Extent and Success of Current Policy Measures to Promote Agroforestry across Europe

Project name	AGFORWARD (613520)
Work-package	8: Agroforestry Policy Development
Deliverable	Deliverable 8.23: Extent and success of current policy measures to promote agroforestry across Europe
Date of report	29 September 2016 (small corrections: 8 December 2016)
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AGFORWARD (Grant Agreement N° 613520) is co-funded by the European Commission, Directorate General for Research and Innovation, within the 7th Framework Programme of RTD. The views and opinions expressed in this report are purely those of the writers and may not in any circumstances be regarded as stating an official position of the European Commission.

1 Context

The AGFORWARD research project (January 2014-December 2017), funded by the European Commission, is promoting agroforestry practices in Europe that will advance sustainable rural development. The project has four objectives:

1. to understand the context and extent of agroforestry in Europe,
2. to identify, develop and field-test innovations (through participatory research) to improve the benefits and viability of agroforestry systems in Europe,
3. to evaluate innovative agroforestry designs and practices at a field-, farm- and landscape scale, and
4. to promote the wider adoption of appropriate agroforestry systems in Europe through policy development and dissemination.

The fourth objective of the project is co-ordinated through policy and dissemination work-packages. This report constitutes the first deliverable of the agroforestry policy work-package and includes an analysis of the periods 2007-2013 and 2014-2020 CAPs.

The report seeks to describe the extent and success of previous and current policy measures to promote agroforestry in Europe. It starts with definitions of agroforestry practices from a policy point of view (Section 2). Section 3 reviews the key global and pan-European policies that affect the Common Agricultural Policy which is a key driver of agricultural land use in Europe. Section 4 describes the key points in the development of the CAP including the development of Pillar I. Section 5 describes the recent implementation of agroforestry measures within Pillar II in the 2007-2013 and the 2014-2020 rural development programmes.

2 Characterising agroforestry in a policy context

2.1 Policy definition of agroforestry

Many papers have been written about the meaning of agroforestry (Nair 1993, McAdam et al. 2009; Mosquera-Losada et al. 2009). They include simple definitions such as from “growing trees on farms” (Young 1997) to more technical definitions. For example, Sommariba (1992) defines agroforestry as a form of multiple cropping which satisfies three basic conditions: 1) there are at least two species that interact biologically, 2) at least one of the species is a woody perennial, and 3) at least one of the plant species is managed for forage, annual or perennial crop.

Within the AGFORWARD project, building on definitions by MacDicken and Vergara (1990), Nair (1993) and Mosquera-Losada et al. (2009) we have defined agroforestry as “the practice of deliberately integrating woody vegetation (trees or shrubs) with crop and/or animal systems to benefit from the resulting ecological and economic interactions” (Burgess et al. 2015). This definition is also similar to the definition used by the European Agroforestry Federation (EURAF 2016) which is that agroforestry is “the integration of woody vegetation, crops and/or livestock in the same area of land. Woody vegetation can be inside parcels or on the boundaries (hedges)”.

The above definitions are useful in an academic and promotional context because they envisage agroforestry as a range of components, there is an emphasis on interactions, and the AGFORWARD definition also implies that there are benefits from the interactions. By contrast, in a policy context the definitions of agroforestry tend to relate more specifically to agroforestry practices and land cover and land use.

Within the European Union (EU), Article 23 of Regulation 1305/2013 defines agroforestry systems as “land use systems in which trees are grown in combination with agriculture on the same land.” The EU currently indicates that arable land, and therefore agroforestry on such land, will not be eligible for direct payments if it has more than 100 trees per hectare (Mosquera-Losada et al. 2016d), but it allows member states to select tree densities if local practices are implemented on permanent grassland. This definition differs from the AGFORWARD project definition, it that it just focuses on trees, rather “trees and shrubs” and secondly it suggests that agroforestry on arable land may be limited by the number of trees per hectare. However, the AGFORWARD project definition is in line with most of the policy definitions across the world (i.e. ICRAF as cited by FAO (1993), FAO (2015), or AFTA (2016) in North America). An argument for a focus on “trees and shrubs” rather than “trees” is that shrubs, because of their woody perennial nature, can provide many of the same productive, environmental or social benefits of trees. Moreover, tree definitions vary across countries and trees can also be cultivated in a shrub shape, while providing the same environment and social benefits (Mosquera-Losada et al. 2016b).

For this policy report, agroforestry is defined as "the integration of woody vegetation (first component) in at least two vertical layers on land, with the bottom layer providing an agricultural product such crops or forage/pasture (second component) which may be consumed by animals (third component). The distribution of the woody vegetation can be uneven or evenly distributed and the woody component can deliver an agronomic product (fruit, forage) and some other ecosystem services".

2.2 European agricultural policy, land cover and land use of Europe

In an agricultural policy context, it is helpful to understand how policies affect land cover change and land use. The evaluation of the impact of policies is needed to obtaining feedback of previous and current policies and to improve future policies. In this context, it can be useful to distinguish between land cover and land use. Land cover has been defined as "the observed physical cover on the earth's surface" whereas land use is "characterized by the arrangements, activities and inputs people undertake in a certain land cover type to produce, change or maintain it" (FAO 2000). Within Europe, the primary dataset used to inform the inventory of land cover and use is the Land Use Cover Aerial Frame Survey (LUCAS) (LUCAS, 2012). Using the LUCAS dataset, the dominant land covers in EU-27 are cropland, grassland, shrubland, and woodland which together comprise about 385 million ha, or about 80% of the total land cover (Table 1). Likewise, using the LUCAS dataset, the dominant land uses are agriculture and forestry, accounting for about 76% of the land area (Table 1). The agriculture land use also includes 1.8 Mha of "kitchen gardens" or "homegardens".

Table 1. Cover and use of land in Europe (LUCAS 2012)

Land cover			Land use		
Category	Area (Mha)	Proportion (%)	Category	Area (Mha)	Proportion (%)
Woodland	159.9	37.1	Agriculture[1]	187.2	43.5
Shrubland	28.6	6.6	Forestry	139.4	32.4
Cropland	106.9	24.8	Fishing	4.2	1.0
Grassland	89.3	20.7	Heavy environmental impact	14.5	3.4
Bareland	7.1	1.7	Services and residential[2]	24.6	5.7
Artificial land	17.8	4.1	Unused and abandoned areas	60.4	14.0
Water	13.7	3.2			
Wetland	7.0	1.6			
Total	430.7	100	Total	430.7	100

[1] Includes fallow land and kitchen gardens (homegardens) [2] Includes residential, commerce, recreation and services

As will be described in Section 3, the Pillar I payments of the Common Agricultural Policy (CAP) is a key policy determining the development of sustainable agriculture in Europe and therefore agroforestry. In Article 4 of EC Regulation 1307/2013, "agricultural area" is defined as "any area taken up by arable land, permanent grassland and permanent pasture, or permanent crops". The term "agricultural activity" is defined in relation to three criteria:

i) production, rearing or growing of agricultural products, including harvesting, milking, breeding animals, and keeping animals for farming purposes, with agricultural products identified in Annex 1 of the treaties (EU 2012).

(ii) maintaining an agricultural area in a state which makes it suitable for grazing or cultivation without preparatory action going beyond usual agricultural methods and machineries, based on criteria established by member states on the basis of a framework established by the Commission, or

(iii) carrying out a minimum activity, defined by member states, on agricultural areas naturally kept in a state suitable for grazing or cultivation.

2.3 Agroforestry practices

Within the AGFORWARD project, agroforestry systems have been classified according to four main farming sectors: (i) livestock farmers, (ii) high value tree farmers, (iii) arable farmers, and (iv) existing agroforestry systems of high nature and cultural value. Such an objective-driven categorisation is useful to facilitate uptake, adoption and engagement of agroforestry by farmers. For example, if the current situation comprises an arable farmer, then the selection and management of trees within that system needs to work around the arable enterprise. However in terms of policy, it may be useful to frame a consideration of agroforestry in terms of practices and land use designation (Table 5). While agroforestry is typically considered by the EU CAP as establishing trees onto agricultural land, it can also describe the introduction of crops and/or livestock into forest land. The LUCAS (2012) data set has been used in this report, to identify the main agroforestry practices across Europe using the methodology detailed by den Herder et al. (2016) at country level but implemented at regional level. However this document also considers those areas having shrubs with crop understories.

Agroforestry links the presence of woody vegetation (trees or shrubs) with an agricultural product obtained from the understory and managed by the farmer (FAO 2015). The 'forestry' component can include shrubs, or fruit/nut trees, as well as timber and biomass trees. The most common spatial agroforestry practices in Europe include silvopasture, homegardens, riparian buffer strips, silvoarable and forest farming (Table 2). Some authors also consider temporal agroforestry practices, such as adding woody vegetation (mainly legumes) to fallow land to improve soil fertility (Mosquera-Losada et al. 2009) for subsequent cropping or animal rearing. This practice is still practised globally and was traditionally used in Europe.

Agroforestry can be applied at plot, farm, and landscape scales. Agroforestry practices are typically implemented at a plot level and can have the woody component spatially (i.e. multipurpose trees in silvopasture or hedgerows) and/or temporally (alternation of silvopasture and silvoarable or including woody vegetation in fallow lands) combined in different farming systems. Agroforestry requires the expertise of woody vegetation specialists/farmers like foresters (to understand and manage long term cropping) and arable and livestock farmers/experts (to understand and manage the short-term crops and/or livestock production). From a policy point of view, agroforestry policies should support and promote the adequate management of woody vegetation at plot level to provide productive and ecological benefits while ensuring more sustainable farming systems (Mosquera-Losada et al. 2016) also considering farm and landscape scales.

Table 2. Spatial agroforestry practices in Europe (Modified from Association for Temperate Agroforestry (AFTA 1997; Alavapati and Nair 2001; Nair 1994, Alavapati et al. 2004; Mosquera-Losada et al. 2009)

Agroforestry practice	Description	
Silvopasture		Combining woody with forage and animal production. It comprises forest or woodland grazing and pastoral land with hedgerows, isolated/scattered trees or trees in lines or belts.
Homegardens or kitchen gardens		Combining trees/shrubs with vegetable production in peri-urban and urban areas, also known as part of "trees outside the forest"
Riparian buffer strips		Strips of perennial vegetation (trees/shrubs) natural or planted between croplands/pastures and water sources such as streams, lakes, wetlands, and ponds to protect water quality. They can be recognized as silvoarable or silvopasture but are signified by its role in preserving water streams.
Silvoarable		Widely spaced woody vegetation inter-cropped with annual or perennial crops. Also known as alley cropping. Trees/shrubs can be distributed following an alley cropping, isolated/scattered trees, hedges and line belts design.
Forest farming		Forested areas used for harvesting of natural standing speciality crops for medicinal, ornamental or culinary uses.

The use of agroforestry practices in Europe can be broadly identified using the Land Use/Cover Area Frame Statistical Survey (LUCAS) (den Herder et al. 2016). In Europe, total agroforestry practices including silvopasture, silvoarable and home garden systems are calculated to occupy about 20 million hectares. This is equivalent to the area of 15.4 million hectares reported by den Herder et al. (2016) but it also includes 2.66 million hectares of grazed shrubland and 1.8 million hectares of home gardens. About 90% of the 20 million hectares is linked to silvopasture practices (including 4.3% where permanent crops or fruit trees form the woody component) (Figure 1). The area occupied by silvopastoral practices with fruit trees (termed multipurpose silvopasture in Figure 1) is about 850,000 ha and they could be easily increased as fruit trees are considered to be permanent crops by the CAP and are therefore fully eligible for Pillar I payments. The second greatest area of agroforestry comprises homegardens representing 8.35% of all land occupied by agroforestry practices in Europe

(1.8 million hectares and less than 1% of the EU territory). Silvoarable practices (e.g. the combination of arable crops with trees) only occupies 360,000 hectares representing less than 1% of the EU land occupied by agroforestry practices, over half of it managed under permanent crops (referred to as "multipurpose silvoarable" in Figure 1). Silvopasture is present on over 15% of the potential land in Europe (Table 3), which is ten times more than that declared by the USA for this practice (USDA 2013); however there remains a large potential for future increase. Multipurpose tree silvopasture and silvopasture practices represent over one million hectares in Europe (4.1% of EU territory). However, silvoarable and multipurpose tree silvoarable is only present in the 0.1% of its potential area, similarly to USA (USDA 2013) with less than 1%. These values indicate that there is high potential for agroforestry practices to be expanded in the EU.

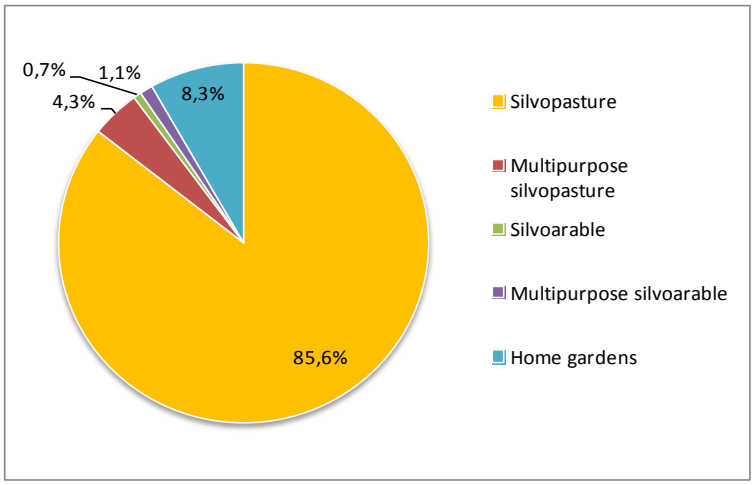

Figure 1. Proportion of agroforestry land in the EU allocated to different agroforestry practices

2.3.1 Silvopasture

Silvopasture is the most widespread agroforestry practice across Europe (Table 3 and Figure 2). It occupies 17.78 million hectares (4.1% of the EU territory) (or 15.11 Mha if shrublands without trees are not included). Silvopasture in woodlands is present in 7.67 million of hectares (1.8% of the EU territory), followed by almost 4.81 million ha of grasslands with sparse trees/shrub cover (1.1% of the EU territory), 2.66 million of shrublands without sparse tree cover (0.61% of the EU territory), and 1.78 million hectares with shrublands with tree cover (0.41%). Multipurpose tree silvopasture practices with permanent crop cover are present in around 0.85 million hectares in Europe.

If the total area of permanent crops, woodlands, shrubland with tree cover, grassland with sparse tree/shrubland cover and shrubland without tree cover is considered, close to 94, 85, 88, 72 and 83% is not grazed respectively, so therefore this areas have the potential of being converted in silvopasture if grazed.

Table 3. Area (Mha: Million hectares) of grazed and ungrazed silvopasture areas across the EU27 as defined by LUCAS land cover types (LUCAS 2012). Proportion of land cover with respect to the total territory of Europe and to the potential area that could theoretically be grazed within each woody vegetation category (potential of land to be used as silvopasture) expressed as percentage and percentage within the European Union land (EU).

Land cover	Silvopasture grazed (Mha)	Not grazed (Mha)	Total (Mha)	Potential land to be used as silvopasture (%)	EU (%)
Permanent crops	0.850	16.242	17.091	94.03	0.19
Woodland	7.668	43.655	51.323	85.06	1.78
Shrubland with tree cover	1.781	13.327	15.108	88.22	0.41
Grassland + sparse tree/shrub cover	4.814	12.668	17.481	72.47	1.11
Sub-total	*15.113*	*85.892*	*101.003*	*85*	*3.51*
Shrubland without sparse tree cover	2.662	12.912	15.574	83	0.61
Total	17.775	98.803	116.578	83.97	4.12

The majority of silvopasture is located in the southern countries of Europe (Figure 2), but this practice also covers many hectares in northern countries. Silvopasture was evaluated as permanent crops (multipurpose silvopasture trees), woodland, shrublands (with and without sparse trees) and grasslands with trees/shrublands (Table 3 and Figure 2). The distribution of silvopasture in woodlands is spread all over Europe, with higher proportions in northern and southern countries than central Europe. Grazed shrublands with and without sparse tree cover represent a low proportion of land use across Europe with a relatively even distribution. Permanent crops linked to grazing are mostly associated with the south of Europe. Grassland with sparse trees is present in large parts of Europe.

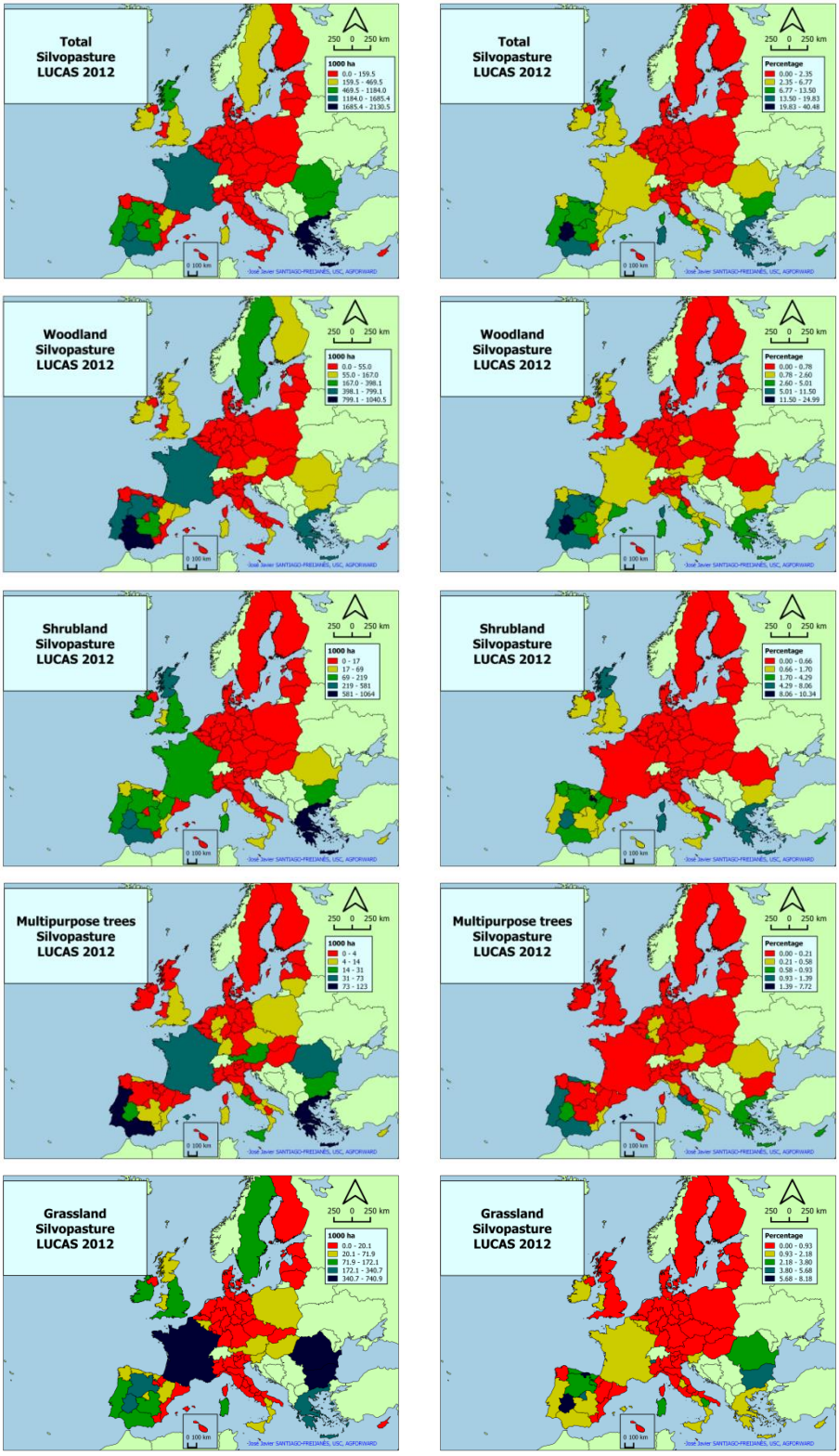

Figure 2. Area (left) and proportion (right) of European land use associated with all silvopasture, woodland silvopasture, shrubland silvopasture (shrubland with and without tree cover), grasslands (with sparse shrub/tree cover) and silvopasture with multipurpose trees (fruit trees).

2.3.2 Home/kitchen gardens

Homegardens or kitchen gardens comprise the multilayer vegetation that surround house plots that supply fruits but also vegetables to owners. The LUCAS 2012 database indicates that they occupy 1.8 million hectares of land in Europe (8.3% of all land occupied by agroforestry practices). The proportion of land allocated to home/kitchen gardens is highest in central and eastern Europe (e.g. the Czech Republic, Slovakia, Romania) and lowest in area such as Spain, the UK, Ireland, the Netherlands, Denmark, Sweden, and Finland (Figure 3). Homegardens are mainly associated with urban or peri-urban areas providing an excellent way of promoting local food as well as creating a link between cities and the countryside. This fit with circular and the bio-economy initiatives and is being promoted in cities like, for example, Gothenburg (Swedish National Agroforestry Association 2015).

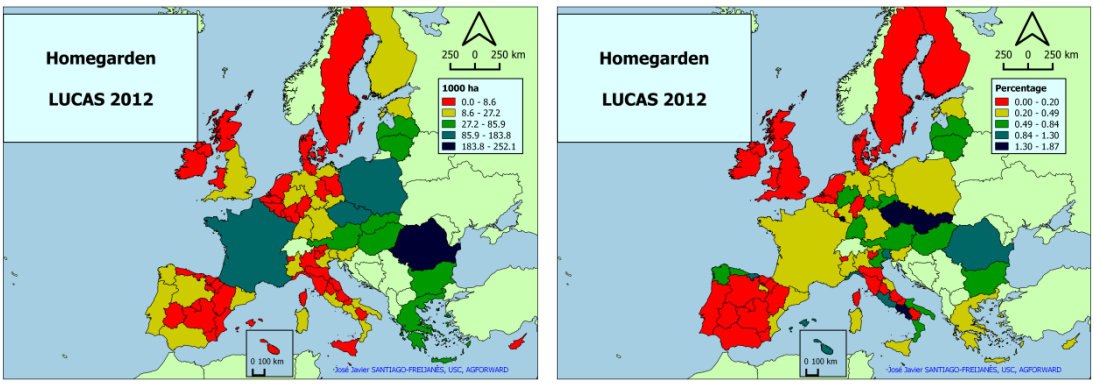

Figure 3. Area (left) and proportion (right) of European land use associated with home gardens

2.3.3 Riparian buffer strips

Riparian buffer strips amount 362 thousand hectares in Europe representing less than 0.08% of the total land of Europe (Figure 4). This type of agroforestry practice can be divided into two subtypes: riparian buffer strips linked to inland running waters and inland riparian buffer strips surrounding water bodies. These two groups occupy 262 and 100 thousand hectares in Europe, respectively. Of the subgroups linked to this type of agroforestry practice (avenue trees, conifer strips, managed and unmanaged hedgerows close to inner waters), there were larger proportions with avenue trees than with unmanaged and managed hedges or conifer strips.

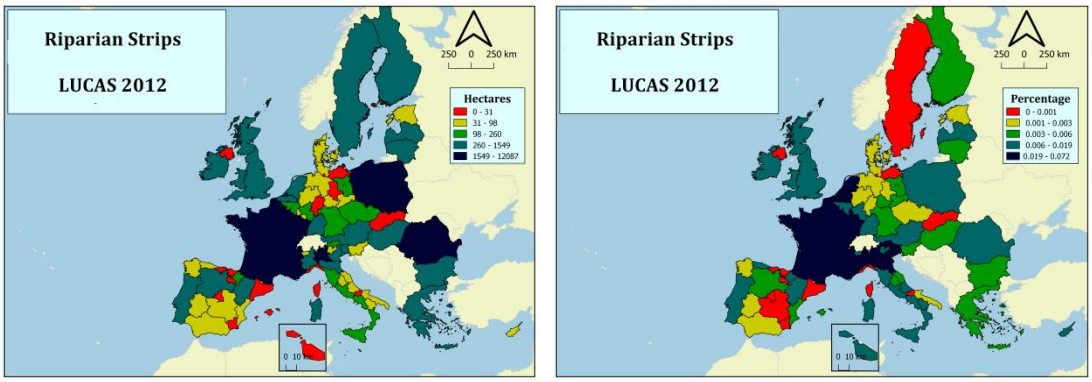

Figure 4. Area (left) and proportion (right) of European land use associated with riparian buffer strips

2.3.4 Silvoarable

Silvoarable practices include the woody component distributed in different forms (borders, hedgerows, windbreaks, scattered trees, lines) deliberately integrated with cropland. Silvoarable practices were estimated by those annual crops intercropped among permanent crops (fruit trees), shrublands with and without sparse tree cover and woodlands. The total area occupied by silvoarable practices in Europe, using the LUCAS database, is around 360 thousand hectares, representing less than 0.08% of total European area (Table 4). By contrast the area that could be potentially used in silvoarable systems is large.

Table 4. Silvoarable practices in Europe (crops) and the potential areas where silvoarable systems could theoretically be practiced. The percentage of cropland areas combined with different land cover including woody component (silvoarable) is given based on the total EU territory land. (LUCAS 2012). Mha: million hectares.

Land cover	Silvoarable (Mha)	Non-silvoarable (Mha)	Total (Mha)	Potential land that could theoretically be used as silvoarable (%)	EU (%)
Permanent crops	0.223	16.594	16.82	98.66	0.04
Woodland	0.133	47.956	48.09	99.72	0.02
Shrubland with sparse tree cover	0.003	14.505	14.51	99.96	<0.01
Shrubland without trees	0.001	14.179	14.18	99.99	0.07
Total	0.360	93.235	93.59	99.62	0.07

Silvoarable practices were mostly linked to permanent crops (fruit trees), summing up 223 thousand hectares. However, the combination of crops with woodlands is also important and covers 133 thousand hectares in Europe, in some cases, linked to stand establishment (Kachova et al. 2016). In contrast, the proportion of silvoarable practices linked to shrubland is very small and amounts to only 4 thousand hectares. Figure 5 describes the proportion and the number of hectares occupied with different silvoarable practices in Europe. The greatest proportional allocation of land to silvoarable practices occurs in southern countries such as Spain, Portugal and Italy.

The proportion of EU land allocated to silvoarable practices is similar to that found in other temperate and developed countries (USDA 2013). However, when considering silvoarable and silvopasture as a plot land cover, the time scale should be taken into account as many plots are alternatively allocated to both silvopasture and silvoarable practices (Moreno et al. 2009). This alternation of practices promotes biodiversity preservation and better nutrient recycling, but it is difficult to quantify and to map them.

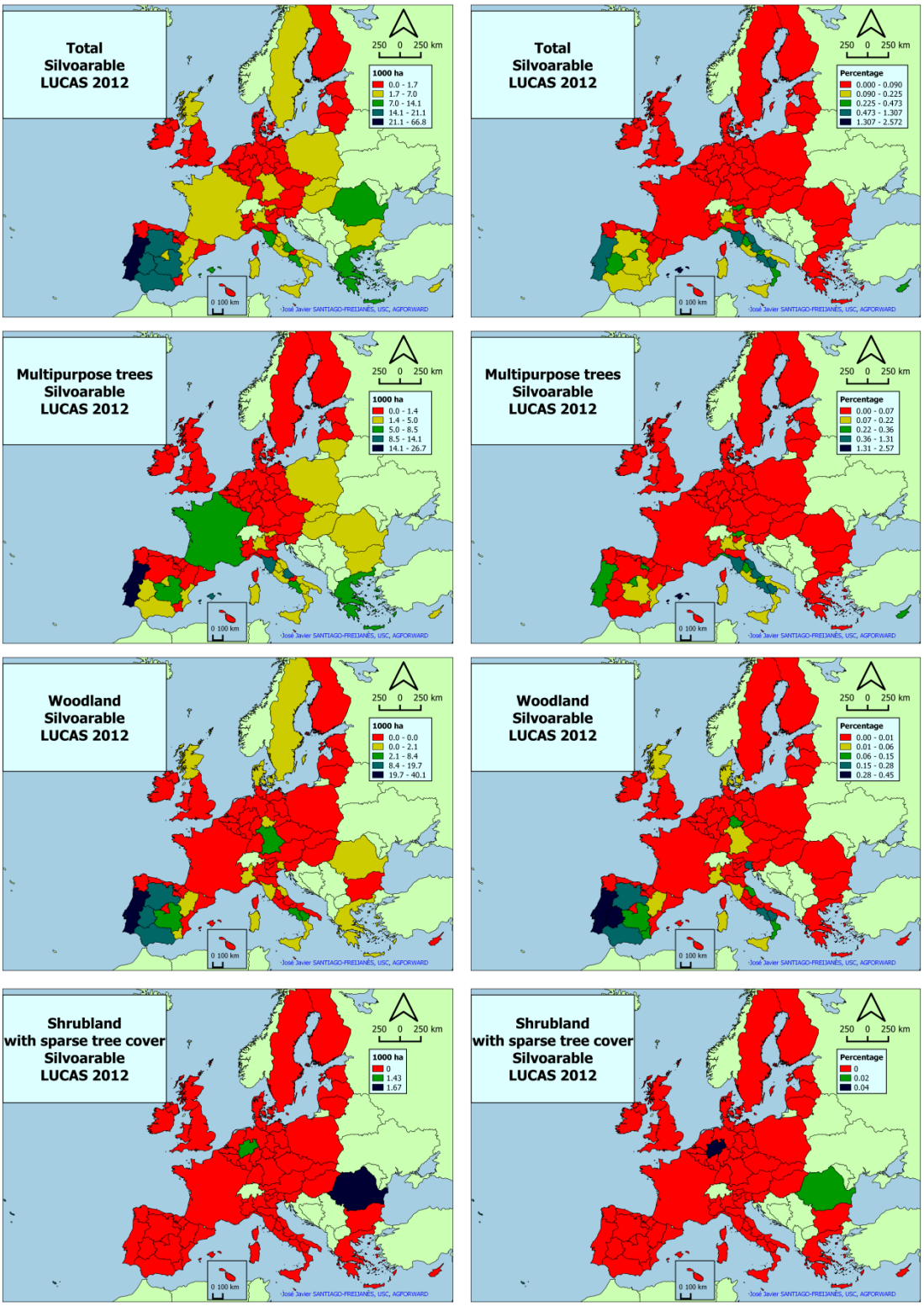

Figure 5. Silvoarable practices linked to permanent crops (top), woodland (medium) and shrubland with sparse tree cover expressed as percentage (left) and hectares (right) per region in Europe

2.3.5 Forest farming

There are no official European statistics linked to the territorial use of forest farming, in spite of the importance of this sector supplying goods and services. FAO summarized the economic value of non-wood forest products (NWFPs) (FAO 2005), but they do not link it to the area of forest that is currently used for non-wood forest products. In the 2015 Ministerial Conference on the Protection of Forests in Europe, the total value of marketed NWFPs was calculated to be 2,300 million Euros, mainly comprising plant products (1,680 million Euros) and animal products (620 million Euros). However, this is not easy to quantify. The distribution and activities of non-wood area where forest products are produced in Europe is not known. Quantitative data related to markets are only available for 27 countries, which provide only information about some of the marketed plant products or raw materials coming from forest farming (Figure 6). This may change in the forthcoming years, due to the use of biomass as a source of renewable energy.

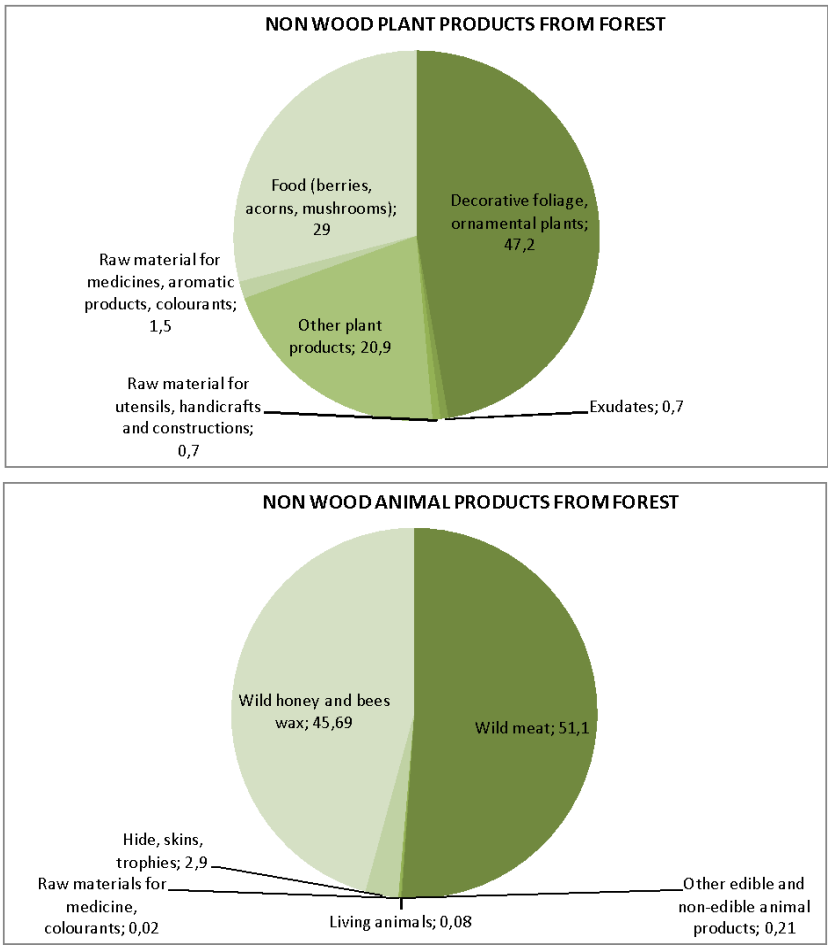

Figure 6. Percentage of profitability obtained by plant (above) and animal (below) products as non-wood products from forests (Ministerial Conference on the Protection of Forests in Europe 2015a)

It is argued that social and cultural dimensions of forest farming should be included within the national forest programmes and other related policies. It is highlighted that new policy objectives comprises, among others, the promotion of entrepreneurship based on ecotourism and business linked to processing of NWFPs, the commercial utilization of the ecosystems services and the facilitation of well-being and recreational values (Ministerial Conference on the Protection of Forests in Europe 2015a). During the Ministerial Conference on the Protection of Forests in Europe, it was

also concluded that the total value of market services for NWFPs is 723 million Euros with 49.8% for social services (i.e. hunting and fishing licenses, renting of huts, sports), 25.0% for other services (for example, licenses for farms, and gravel extraction), 21.2% for biospheric services (i.e. carbon sequestration), 4.9% allocated to social services and 0.03% for amenity services (those related to spiritual, cultural and historical functions).

2.4 Agroforestry practices in farms

The remit of the AGFORWARD project was to focus primarily on agroforestry practices that occur on agricultural land; it does not focus on agroforestry on forest land or on homesteads (Table 5).

Table 5. Agroforestry practices linked to main farm types and land use (agriculture, forest or peri-urban)

Land use and agroforestry practice		Common name	Brief description
AGRICULTURE	Silvopasture	Wood pasture and parkland	Typically areas of widely-spaced trees that are also used for forage and animal production.
		Meadow orchards	This practice includes fruit orchards, shrubs which are grazed or sown with pastures, but also olive groves and vineyards
		Hedgerows and windbreak systems	Here the woody components are planted to provide shelter, shade, or parcel demarcation to a crop and/or livestock production system
	Silvoarable	Alley-cropping systems	Widely spaced woody perennials inter-cropped with annual or perennial crops. It comprises alley cropping, scattered trees and orchards and line belts within the plots. These practices are sometimes found only during the first few years of the plantation
	Riparian buffer strips	Riparian buffer strips	Areas of tree and shrubs allowed to establish croplands/pastures and water sources such as streams, lakes, wetlands, and ponds to protect water quality, can be identified as silvoarable or silvopasture.
FOREST	Silvopasture	Forest grazing	Forested areas with the understory grazed
	Forest farming	Forest farming	Forested areas used for production or harvest of naturally standing speciality crops for medicinal, ornamental or culinary uses
URBAN AND PERIURBAN	Homegardens	Homegardens	Combining trees/shrubs with vegetable production usually associated with peri-urban or urban areas

Agroforestry practices implemented at plot scale can be combined at farm level creating different types of agroforestry systems (Mosquera-Losada et al. 2016). Hence there are thousands of types of agroforestry systems comprising different combinations of woody vegetation, animals and herbaceous components adapted to local conditions (Table 5), that finally configures the landscape.

Silvopasture practice could be carried out in both open (e.g. wood pasture and parkland) or more closed areas (e.g. forest grazing), and with different woody vegetation distribution (e.g. hedgerows and windbreaks). Because arable crop production is generally mechanised, trees have been destroyed and crop varieties adapted to open sites have been selected. By contrast, pasture understories (which are often biodiverse) can usually tolerate greater levels of shade than arable crops and thereby can remain productive in such situations (Pardini et al. 2010). These are some of the reasons why silvoarable practices are not usually associated with "forestland". However there is the potential to identify some better shade- adapted crop species and crop varieties. There are also crops that prefer to have shade conditions instead of being grown in open sites, particularly in southern EU countries where light intensities and temperatures are high.

2.5 Conclusions

Agroforestry concerns the combination of at least two layers of vegetation of which at least one is woody and the lowest layer provides an agricultural product. The major agroforestry practices identified in Europe are silvopasture, silvoarable, riparian buffer strips in agricultural areas, silvopasture and forest farming in forest areas and homegardens in urban and peri-urban areas (Table 5). Silvopasture practices, in particular, are a key land use representing 17.7 million ha which is equivalent to 4.1% of the territorial area of the EU27.

In view of the food, fibre, environmental and social benefits of agroforestry, there is clearly substantial potential to increase the area of agroforestry practices. Agroforestry can be particularly important where the area of woody vegetation is low and the retention or expansion of tree cover needs to be integrated with agricultural production, but also in forest lands that can deliver agricultural products. There is a need of a clear inventory of some agroforestry practices (i.e. forest farming) to determine both the current extent and the potential, and to measure the impact of the different policies to promote agroforestry at local, regional and national levels. In this regard, the landscape scale benefits of agroforestry and woody vegetation can be particularly relevant. The use of woody vegetation at landscape level has been recently discussed within a European Union mixed farming system focus group (Mosquera-Losada et al. 2016a).

3 Global and European policy context for agroforestry

Agroforestry policies can be considered at global, pan-European, and European Union scales (Table 6). Some of the policies are focused on agriculture and others on the environment, forestry or sustainable development.

Table 6. Global, pan-European and EU organizations and agreements delivering policies relevant for agroforestry

Scale	
Global	FAO Sustainable Agricultural and Rural Development Millennium Development Goals Orlando and Lugo Declarations Global Research Alliance Global Alliance for Climate Smart Agriculture
Pan-European	Ministerial Conference 'Environment for Europe' Ministerial Conference 'Forest Europe' (former MCPFE) Pan-European Biodiversity and Landscape Strategy (PEBLDS) European Convention on Landscapes
EU	Seventh Environment Action Programme to 2020 European Biodiversity Strategy to 2020 Natura2000 - Habitats and Birds Directives European Strategy for Sustainable Development´ Bioeconomy European Climate Change Programme (ECCP) European Forest Strategy Cork 1.0 and 2.0 strategy Common Agricultural Policy CAP

3.1 Global policies

Global policies related to agroforestry are considered in terms of the FAO Guidelines for Sustainable Agriculture and Rural Development, the Orlando and Lugo declarations, and the Global Research Alliance, and the Millennium Development Goals. These are considered in turn below.

The FAO (1989) has defined **Sustainable Agriculture and Rural Development** as "the management and conservation of the natural resource base, and the orientation of technological and institutional changes…to ensure the attainment of continued satisfaction of human needs for present and future generations". The same report indicates that sustainable agriculture and rural development requires the conservation of resources such as air, soil and water quality, and a diverse genetic base, whilst ensuring that activities are "environmentally non-degrading, technologically appropriate, economically viable and socially acceptable" (FAO 1988).

In 2014, FAO suggested five principles to guide strategic global development to provide "*a basis for developing national policies, strategies, programmes, regulations and incentives that will guide the transition to an agriculture that is highly productive, economically viable, environmentally sound, and which is based on the principles of equity and social justice*". These principles can be considered in relation to agroforestry.

Principle 1: *Improving efficiency in the use of resources is crucial to sustainable agriculture*. Agroforestry practices commonly enhance resource use in terms of the capture of solar radiation,

water and nutrients at plot level. Hence outputs per unit of land under agroforestry are typically higher than that under a monoculture arable crop or a monoculture tree crop (Figure 7). This is specifically quantified by the concept of the Land Equivalent Ratio (LER): the ratio of the land area of monoculture crop and woodland systems required to achieve the same outputs as the agroforestry system. In deriving the LER it is important to select the appropriate monoculture systems for comparison. Modelled values for the LER for silvoarable agroforestry systems range from 1.0 to 1.8 (Graves et al. 2007; Dupraz and Liagre 2011). This means that one hectare of agroforestry delivers the same products as 1.0 to 1.8 ha of monoculture forestry with monoculture agriculture.

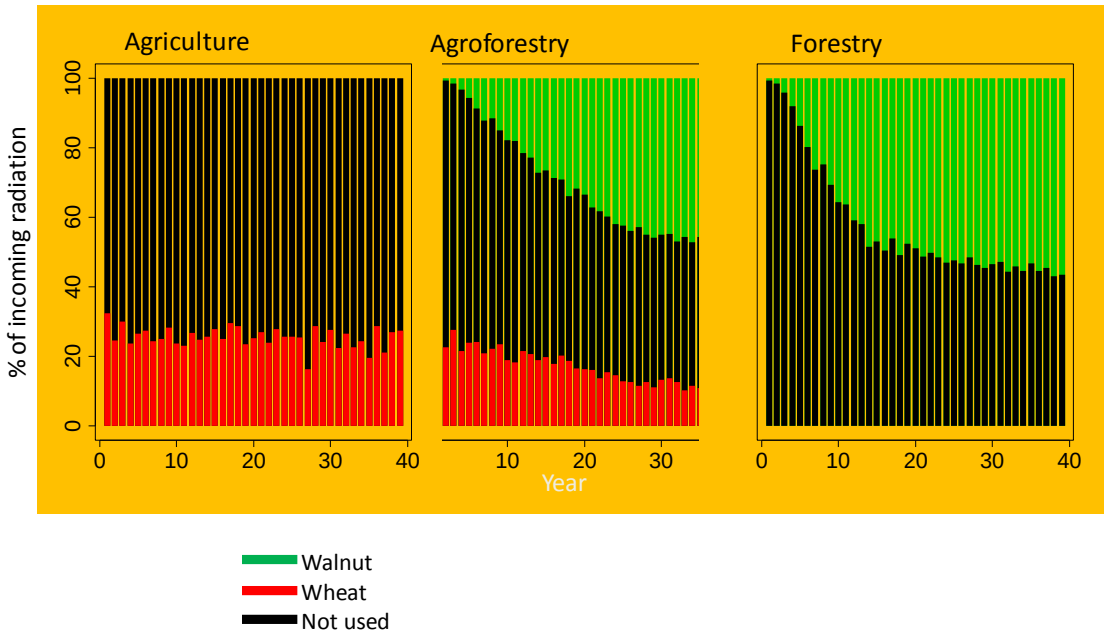

Figure 7. Modelled proportion of solar radiation intercepted by a wheat monoculture, a wheat-walnut agroforestry system, and a walnut forestry system over 40 years (Dupraz and Liagre 2008)

Principle 2: *Sustainability requires direct action to conserve, protect and enhance natural resources*. Agroforestry can help to reduce some of the negative externalities associated with intensive agriculture such as soil organic matter loss and nutrient leaching. Agroforestry also increases some positive externalities, for example planting trees on agricultural land will increase aboveground carbon storage and enhances biodiversity at a range of scales (Rigueiro et al. 2009). The combination of woody vegetation with grass and/or crops can create a wider variety of niches which can support a greater diversity of plants adapted to the different micro-climatic environments (Figure 8), and thereby increases microbial and fauna biodiversity. The combination of woody vegetation with animals (at appropriate stocking rates) also tends to increase biodiversity as 1) animals select some plant species instead of others, and 2) they unevenly fertilize the soil, creating patches of varying fertility which favour different plant species, and 3) animal trampling generates micro perturbations allowing annual species to share the same plot than perennials (Rigueiro et al. 2012). If more than one animal species is allowed to graze, their different behaviour also improves biodiversity because they select different species (i.e. goats feed preferably on woody vegetation) but also because the form of their mouth and grazing action allows some plant species to grow better than others (i.e. *Agrostis* spp. adapted to sheep grazing).

Figure 8. Tree shade effect on below tree vegetation at the end of the growing season in the dehesa, promoting the extension of the growing season to feed animals.

Principle 3: *Sustainable agriculture will protect and improve rural livelihoods and social well-being*. Agroforestry can increase production and thereby the revenue from a given area of land. Higher revenue is linked to higher need of labour and therefore jobs. Some agroforestry practices can provide a basis for eco-tourism, for example many traditional systems have a high cultural value. The diversity of outputs also means that agroforestry can be a more resilient system that helps farmers to counteract shortage periods or unusual catastrophic events (i.e. flooding, heatwaves, and droughts).

Principle 4: *Sustainable agriculture must enhance the resilience of people, communities and ecosystems, especially to climate change and market volatility*. The multipurpose use of land is likely to be more resilient than monoculture systems as a crop failure can be compensated by the sale of the other crop. For example, where oak trees are pruned every two years in ten years in the Mediterranean, they can provide “extra food” during “bad years”. In addition, agroforestry practices such as the grazing of forest understories can reduce forest fire risk. The effects of agroforestry on the vulnerability to climate change has been reviewed by Schoeneberger (2008) and Thorlakson and Neufeldt (2012).

Principle 5: *Good governance is essential for the sustainability of both the natural and human systems.* Agroforestry is a deliberate land use practice that requires good governance, supported where possible by adequate agroforestry policies, such as in India (Indian Government, 2014), the USA (USDA, 2011) and France (French Ministry of Agriculture, 2016) as recommended by the FAO (2015).

Another key concept delivered by FAO is the promotion of “Good Agricultural Practices” which aim to ensure safety and quality of products in the food chain, capture new market advantages by modifying supply chain governance, improving natural resource use, workers health, and working conditions, and/or creating new market opportunities for farmers and exporters (FAO 2015), which all contribute to Sustainable Agriculture and Rural Development (SARD). Sustainability concepts are promoted through different policies and strategies like those shown in this report.

The **United Nations** (UN) has agencies such as FAO focused on agriculture, and programs such as United Nation Development Programme (UNDP) and United Nations Environment Program (UNEP) focused on the environment. The UN has also a specific regional commission in Europe called the UN Economic Commission for Europe (UNECE).

In 1992, the Commission for Sustainable Development of the United Nations organized, the Conference of the United Nations on Environment and Development (UNCED) in Rio de Janeiro, known as the Rio Summit. Several multilateral environmental agreements were signed: Convention on Biological Diversity (CBD), Convention on Climate Change (UNFCCC), Convention to Combat Desertification (UNCCD) and the Rio Declaration on Environment and Development. Agroforestry's role in sustainable development was recognised in the UN Framework Convention on Climate Change (UNFCCC) and the Convention on Biological Diversity (CBD), and within the Forest Principles (not binding) and the action plan 'Agenda 21', which were also developed in the Rio Summit.

Agenda 21 tackles current environmental problems and looks towards the achievement of a world-wide sustainable development. It describes the need to 1) combat deforestation and prevent erosion, 2) combat desertification and drought, 3) support sustainable development in mountainous areas, 4) promote agriculture and sustainable rural development through multidisciplinary research and technology transfer, and 5) to conserve biodiversity. In each of these areas, agroforestry can play a role. Agroforestry can be used to increase vegetation cover to combat desertification, reduce erosion problems and help with land restoration. Agenda 21 also states that measures should be taken to "improve the rate of returns on investments in planted forests, through interplanting and underplanting valuable crops". Again this highlights the important role that agroforestry has to play.

Agenda 21 supports sustainable forestry, the expansion of areas under forest and tree cover, and highlights agroforestry as a sustainable land management practice. Agroforestry, as already described, can help to protect forests by reducing fire risk. It can also provide additional revenue to the private sector and rural communities by allowing the creation of new products or high value services such as ecotourism.

In the Fourth Forum on Forests (United Nations 2004), it was suggested to connect the "**Millennium Development Goals**" (United Nations 2000) with the National Forest Programmes, due to the relationship between sustainable forest management and poverty reduction and at the same time maximize the potential benefits of agroforestry according to a better spatial planning. This can be achieved at different scales: at plot level (woody + annual perennial crops), farm level (strategic use of resources within a year framework) and landscape level (promoting ecosystem services delivery). Such Millennium Goals are a key aspect in the agenda of global development (Garrity 2004), and research and development of agroforestry can contribute to the achievement of many of the objectives including increasing income and improving human wealth, promoting gender equality and environmental sustainability. In fact traditional agroforestry systems are being recognized in tropical areas, and their multifunctional role is also increasingly appreciated in North America and Europe where governments have significant roles in promoting such systems in relation to market access, debt relief programmes, and investments.

The '**Orlando Declaration on Agroforestry Systems**' was made at the First World Agroforestry Congress in the USA in 2004 (First World Congress of Agroforestry 2004). The Declaration declared that agroforestry could address issues of climate change and biodiversity conservation, and increase incomes, promote gender equity, improve health and wellbeing, and promote environmental sustainability. It called for an increase of funding and for agroforestry to be a key component of natural resources management.

The '**Lugo Declaration on Silvopastoral Systems**' was made at the 'Silvopastoralism and Sustainable Management International Congress' in Spain in 2004. It highlighted the economic, ecological and social benefits of silvopastoral agroforestry and its role in rural development, and called for its promotion and research covering topics such as traditional knowledge, management, technology transfer, and capacity-building (Mosquera-Losada et al. 2006 and 2007). Such declarations were agreed by qualified scientists from all over the world highlighting the importance of agroforestry in terms of sustainable land management and the need to include them in the political agenda.

The **Global Research Alliance** (GRA) was created in 2009 at the UN Climate Change Conference in Copenhagen. It seeks to support policies, research collaboration, the exchange of information and technology, and capacity building related to climate change. At the Tampa meeting in 2014, the GRA highlighted the global role of agroforestry to reduce and counteract greenhouse gas emissions. In December 2015, the GRA launched the 4 $^{0}/_{00}$ initiative to counteract the current carbon emissions by storing an additional 0.4% carbon in soils each year. Agroforestry can help to support carbon storage by increasing the above-ground storage of biomass, and in some cases it can increase both the level and resilience of soil C in deeper soil layers than monocrops or herbaceous vegetation. This was also highlighted in the conclusions of the Global Research Alliance meeting held in Rome in July 2016. A specific group on agroforestry has been created within the Global Research Alliance.

The Climate-Smart Agriculture (CSA) concept was promoted at the Hague Conference on Agriculture, Food Security and Climate Change in 2010, through the paper "Climate-Smart Agriculture: Policies, Practices and Financing for Food Security, Adaptation and Mitigation", with a specific chapter on agroforestry (FAO 2010). CSA is an approach to developing the technical, policy and investment conditions to achieve sustainable agricultural development for food security under climate change. CSA specifically mentions that achieving the transformations required for CSA needs an integrated approach that is responsive to specific local conditions. Coordination across agricultural sectors (e.g. crops, livestock, forestry and fisheries) as well as other sectors, such as with energy and water sector development is essential to capitalize on potential synergies, reduce trade-offs and optimize the use of natural resources and ecosystem services. Hence agroforestry is key to this new form of understanding agriculture.

FAO (2013) has also highlighted the importance of agroforestry in "**Smart Climate Agriculture"** (Buttoud 2013). Agroforestry was considered to be a more effective mitigation and adaptation technique to improve food security, than practices such as pasture and grazing management, animal breeding, animal husbandry and health and weather indexed insurance. However the main constraints to the adoption of agroforestry were related to technical and economic issues. In the FAO (2013) book, it is mentioned that "*private actors (i.e. multinational businesses) seeking to offset their carbon footprints by purchasing emission reductions on the carbon markets represent a viable source*

of financing for agricultural climate change mitigation projects, including those that promote agroforestry". The area of agroforestry is seen as an indicator of the Climate Smart Agriculture adoption in farms. For Buttoud (2013), agroforestry promotion should be enacted as a method to: protect and sustain agricultural productive capacity, ensure food diversity and seasonal nutritional security, diversify rural incomes, strengthen resilience to climatic fluctuations and perpetuate local knowledge and social and cultural values.

In 2014, the **Global Alliance for Climate Smart Agriculture** was developed to make it easier to establish the tools needed for climate smart agriculture practices. The current implementation of agricultural activities linked to climate change is based on the **Kyoto protocol** which was adopted at the end of 1997 in Japan, committing industrialized countries to stabilize greenhouse gas emissions based on the principles of the Conventions. It entered into force in 2005, with the intention to reduce an average of the 5% emissions compared with 1990 levels over the five-year old period 2008 to 2012. Later on the Doha Amendment to the Kyoto Protocol was adopted to be implemented from 1 January 2013 until 2020. Parties committed to reduce greenhouse gas (GHG) emissions by at least 18 percent below 1990 levels in the eight-year period from 2013 to 2020, but countries involved are different in the first and second period. The Kyoto Protocol limits the accounting of emissions and removals from Land Use, Land Use Change and Forestry (LULUCF) by Annex I Parties to those activities defined under Article 3, paragraphs 3 and 4. Paragraph 3 is related with human-induced conversion including afforestation and reforestation considered as a whole (AR) and deforestation (D), while paragraph 4 is dealing with those lands that have not undergone conversion since 1990 and are subject to a specific land use. These activities are related to Forest management (FM), Crop management (CM), Grazing land management and Revegetation. Within a commitment period once a land area is classified as AR or D, it cannot be included in paragraph 4. Thus, while it is possible, for example, that AR land is later subject to FM, or that D land is later subject to CM, the land must remain classified under Article 3, paragraph 3, for the entire commitment period. However, a land area can change classification from AR to D if land that was afforested or reforested after 1989 is later deforested prior to the end of the commitment period. The classification of a land area as D is permanent for the commitment period, whenever it happens, highlighting the importance of reducing reforestation. Within the LULUCF activities, the preservation of soil C in the terrestrial ecosystems and the promotion of soil C increase are highly relevant, because 81% of C of terrestrial ecosystems is stored in soils (Karsenty et al. 2003, IPCC 2000). In addition woody vegetation also stores carbon within its biomass on a perennial basis.

3.2 Pan-European policies

The UN Economic Commission for Europe (UNECE) supports the "**Ministerial Conference Environment for Europe**" which provides a high-level platform for stakeholders to discuss, decide and join efforts in addressing environmental priorities across the 56 countries of the UNECE region. It is a regional UN pillar of sustainable development.

In 2003, at the Fifth Conference of Environment for Europe, ministers agreed within the **Kiev Resolution on Biodiversity** to identify the "high nature value" (HNV) farms by 2006 and to adopt necessary conservation measures (UNECE 2003). HNV farms include agroforestry systems such as dehesas and montados. Economic pressures have caused and continue to threaten the abandonment or intensification of large areas of HNV farmland, with irreversible losses of the associated habitats

and species of European importance for biodiversity. HNV farming is essential if the EU is to meet its 2020 biodiversity targets. Many of the HNV areas are included as areas to be paid by different European Rural Development Programmes such as measures supporting less-favoured areas, agri-environment interventions programmes, and organic farming.

The Seventh Conference of Environment for Europe in 2011 focused on sustainable management of water and greening the economy. It highlighted the need to ensure that further economic growth was not associated with environmental degradation, and this could be supported by quantifying externalities, stimulating green investment, supporting policy instruments to promote resource efficiency, and supporting relevant research, innovations, education and training. Agroforestry was identified as a sustainable land use and an eco-intensification tool for the EU, with a particular focus on the use of agroforestry to improve water quality through riparian practices.

The **Ministerial Conference on the Protection of Forests in Europe** (Forest Europe, former MCPFE) is a political platform for promoting European cooperation on the opportunities and threats to the forest sector. It recognises the importance of multifunctional silviculture including both wood and non-wood forest products. The Seventh Ministerial Conference on the Protection of Forests in Europe (2015a and 2015b) was held in Madrid. It highlighted that forests and other wooded land provide a multitude of renewable functions and services such as wood production, the protection of soil and water resources and protection from various hazards, climate regulation, carbon sequestration, recreation, use of non-wood forest products, and maintaining biodiversity. However, there is not a real inventory of non-wood forest products to promote their use.

The **Pan-European 2020 Strategy for Biodiversity** (PESB) was endorsed as the successor of the Pan-European Biological and Landscape Diversity Strategy and Landscape Strategy (PEBLDS 2015), which was set up after adoption of the UN Convention of Biological Diversity in 1992. It aims to provide an innovative and proactive approach to stop and reverse the degradation of biological and landscape diversity in Europe. It has a 20-year vision and framework for Europe to promote a consistent approach to implement the Convention on Biological Diversity. In the Action Plan, the themes include: the consideration of biological and landscape diversity in sectors such as agriculture, conservation of landscapes and forest ecosystems, and action for threatened species. Such themes provide an opportunity for agroforestry. Hence PEBLS is promoting agroforestry through the combination of sectors such as agriculture and forestry at landscape levels. The 2020 Strategy is in line with the Strategic Plan for Biodiversity 2011-2020, the Aichi Biodiversity Targets, and the EU Biodiversity Strategy to 2020.

The aims of the **European Convention on Landscapes** (ECL 2015) are to promote landscape protection, management and planning, and to organize European co-operation on landscape issues fulfilling the sustainability concept of the Rio Summit. This Convention takes a new approach by promoting the cultural significance and social value of all landscapes and expands concerns from simply looking at parts of our heritage, for instance monuments, buildings or species of wildlife, to a concern for the whole landscape. The Convention conveys a strong concern for awareness raising, the exchange of information and expertise. It promotes multi-disciplinary approaches and the need for a clear process of understanding and assessment of the values of landscapes.

The Council of Europe, firstly through PEBLS (Pan-European Biodiversity and Landscape Strategy) and later through the European Convention on Landscapes gave a new dimension to the landscape concept not only as a goal but as a policy means as well. European policies recognize the value of cultural landscapes and the necessity of their creative management, e.g. agroforestry systems (Sioliou and Ispikoudis 2004).

3.3 European Union policies

It was only after the Cardiff Process in June 1998, that environmental concerns were integrated into EU agricultural policies. Within the 6th **Environment Action Programme** (EAP, 2002-2012), environment was integrated into all policies to achieve the mentioned sustainable development goals, following the signature of the previously mentioned global agreements. The 7th EAP will be guiding European environment policy until 2020 under the motto 'Living well, within the limits of our planet'.

The 7th EAP (EU 1386/2013/EU) lists nine priority objectives to be achieved by 2020. The priorities most relevant to agroforestry are: 1) *to protect, conserve and enhance the Union's natural capital*. This includes high value ecosystems such as wood pastures. 2) *to turn the Union into a resource-efficient, green, and competitive low-carbon economy.* Here agroforestry can improve resource capture and efficiency (due to multiple spatial and temporal levels) and as provider of renewable energy. 3) *to safeguard the Union's citizens from environment-related pressures and risks to health and wellbeing*. Here agroforestry can reduce the levels of nitrate leaching, the level of pollutants in the soil and air, and net greenhouse gas emissions (GHG). 4) *to secure investment for environment and climate policy and account for the environmental costs of any societal activities, including expanding markets for environmental goods and services*. The promotion of agroforestry label products would be helpful. 5) *to better integrate environmental concerns into other policy areas and ensure coherence when creating new policy*. As outlined in this report, agroforestry can support a holistic approach at plot, farm and landscape level fulfilling and integrating many policy areas, and 6) *to help the Union address international environmental and climate challenges more effectively, as Sustainable Development Goals*, as explained previously.

The key European policies related to biodiversity are the Pan-European 2020 Strategy, the Strategic Plan for Biodiversity 2011-2020 and the related Aichi Biodiversity Targets, and the **EU Biodiversity Strategy to 2020** (UNEP 2015). The EU Biodiversity Strategy to 2020 aims to halt the deterioration and achieve a measureable improvement in the status of all species and habitats covered by EU nature legislation. The strategy uses targets and actions to improve integration between and positive contributions from the agriculture, forest and fisheries sectors, for example, it is anticipated that instruments within the CAP will contribute to biodiversity targets. The strategy also aims to develop green infrastructure and to improve connectivity between Natura 2000 sites (EC 2014).

The threats to biodiversity include habitat fragmentation, intensive agriculture, land abandonment, climate change, desertification and fires. Even within agriculture, almost half of European livestock breeds are at risk of extinction due to, for example, the industrialization of farming and the global trade in agricultural products and breeding stocks. Agroforestry, which integrates agriculture and forestry and improves water quality, is a useful technology to help preservation and promote biodiversity. Agroforestry enhances biodiversity by creating different ecological niches for

microorganisms, bryophytes, vascular plants, invertebrates and vertebrates. For example Rosa-García et al. (2012) reported that goats and sheep fed on different vegetation types (shrubs and herbaceous) had less health problems than when they only consume herbaceous vegetation and this modified invertebrates biodiversity at plot, farm and landscape levels.

The **Natura 2000** network, created in 1994, included areas associated with the EU Birds Directive (79/409/CEE) on the conservation of wild bird species and the EU Habitats Directive (92/43/CEE) focused on the conservation of natural habitats and the wild flora and fauna. The Birds Directive aims to protect threatened species and habitats where they feed and nest. As most threatened species are associated with specific habitats, measures are needed to preserve selected habitats. Many of these habitats are composed of, at least partially, woody vegetation, and therefore, often include agroforestry practices. Each member state of the EU has to identify the important areas and establish management plans combining long-term conservation and socio-economical activities. Across the EU, the Natura 2000 network accounts for 27,200 protected areas covering more than one hundred million hectares (788,000 ha terrestrial) of the EU territory (18.2%). The network consists of the so called 'special protection areas' (SPA) designated to protect endangered bird species and 'sites of Community importance' (SCI) established for protection of habitat types and species listed in the Habitats Directive. However it is argued that the current implementation will need to be strengthened if the union intends to achieve its 2020 biodiversity targets.

The Birds and Habitat Directives are linked to the "conditionality" or "cross-compliance" mechanism in the CAP Pillar I, supported by the agri-environmental measures within Pillar II, and are very important for protecting agricultural areas of high biodiversity, which are under a constant pressure and include for instance Fennoscandian wooded pastures and meadows, High Nature Value farmland (dehesas, montados) and other extensive systems, and natural and semi-natural grasslands. Key farmland habitats and features that require preservation and maintenance include: hedgerows, copses or small woodlands, single trees and bushes in fields, trees and bushes traditionally used for pollarding and coppicing, large veteran trees in agricultural areas, orchards, olive groves, and nut groves with old mature trees (EC 2014), most of them linked to the presence of woody vegetation and therefore to agroforestry practices. Abandonment of extensive traditional farming practices is the most important pressure on key farmland habitats and species of Community interest, together with the intensification of other practices (EU guidance document Farming for Natura 2000).

The Natura 2000 sites are supported by Pillar I of the CAP (the European Agricultural Guarantee Fund (EAGF)) and Pillar II of the CAP (the European Agricultural Fund for Rural Development (EAFRD)). However the Natura 2000 sites are also supported through the Programme for the Environment and Climate Action (LIFE). Other EU funds available are the European Structural Funds: Regional Development Fund (ERDF), Cohesion Fund (CF) and Social Fund (ESF) that are now integrated. Payments for Ecosystem Services (PES) schemes can also provide an incentive for the conservation and restoration of farmland biodiversity and habitats in order to safeguard (or potentially increase) the provision of the ecosystem services it provides.

Therefore several measures are established such as the development of biodiversity indicators and the promotion of agri-environmental measures within the CAP to establish a system of direct payments for environmental services, e.g. for promotion of grazing with native breeds or establishing

agroforestry systems (measure 222 of CAP period 2007-2013 or measure 8.2 linked to CAP 2014-2020).

The broad objectives of the **European Strategy on Sustainable Development** cut across many sectors including agriculture and forestry. One of the sustainable development objectives is to manage natural resources in a responsible way, to protect habitats and ecosystems, and to halt the loss and then promote biodiversity, all them linked with agroforestry as it was mentioned in previous sections.

The goal of the **European Climate Change Programme** (ECCP), launched in 2000, was to develop an EU strategy to implement the Kyoto Protocol. It comprised policy measures to reduce greenhouse gas emissions and improve energy efficiency. Even though the EU-28 reduced GHG emissions by 24% between 1990 and 2012, new policies are needed to meet the target of a 40% reduction below levels in 1990 by 2030 (EU 2016). Agroforestry can contribute to carbon sequestration, the reduction in the increase in the atmospheric concentration of greenhouse gases, and adaptation to climate change (Sharrow and Ismail 2004; Lal 2004; Mosquera-Losada et al. 2008; Aertsens et al. 2013; Upson et al. 2016). Compared to other agricultural options, agroforestry will generally increase carbon storage per unit of area (Dixon et al. 1994; Nair et al. 2008; Upson et al. 2016). In addition, agroforestry is anticipated to reduce soil erosion (Palma et al. 2007) and reduce the airborne particulate matter in the air to allow a better breathing of healthy air (Silli et al. 2015).

Agroforestry is mentioned several times as an agricultural activity in the last Intergovernmental Panel on Climate Change assessment (Smith et al. 2014), which defines agroforestry as an integrated system together with the mixed systems and explains "AFOLU (agriculture, forestry and other land uses) mitigation measures linked to increases in food production (e. g. agroforestry, or integrated systems) can increase food availability and access especially at the local level". There are several types of agroforestry practices that can contribute to mitigate climate change as recognized land use, land-use change and forestry (LULUCF) activities. The first approach to mitigating climate change is related with Article 3, paragraph 3 of the Kyoto Protocol by strengthening protection against natural disturbances such as fire, pests, and storms, where agroforestry practices are able to reduce the possibility to reclassify areas declared as AR to D that is thereafter permanent for the entire commitment period. Silvopasture in forest lands and silvoarable in arable lands are the best practices to avoid this conversion. Forest grazing is the most sustainable and cheapest tool to clear understory within the forest as the biomass is converted into animal products and at the same time fire risk is reduced (RAPCA 2016). Moreover silvoarable practices, e.g. the combination of annual arable crops during the first years of a tree plantation, when the tree canopy is relatively small, can force trees to develop deeper root systems which makes the trees better anchored and therefore more resilient to natural disturbances like storms, strong winds, flooding or important snow events.

The second approach to mitigating climate change is related with Article 3 paragraph 4. It deals with different land management practices like (1) Forest management (FM: system of practices for stewardship and use of forest land including plantations and natural forests), not including the areas integrated in AR or D, (2) Cropland Management (CM: system of practices on land on which agricultural crops are grown, and on land that is set aside or temporarily not being used for crop production), (3) Grazing land management (GM: system of practices of land used for livestock

production aimed at manipulating the amount and type of vegetation and livestock produced) and (4) Revegetation (RV: is defined as a direct, human-induced activity to increase carbon stocks on sites through the establishment of vegetation that covers a minimum area of 0.05 hectares and does not meet the definitions of afforestation and reforestation). The EU has already determined the activities related with these different lands and the management that should be taken into account (Decision 529/2013/EU) as shown in Table 7.

Table 7. EU indicative measures that may be included in the information on LULUCF actions submitted pursuant to Article 10(2)(d) (Decision 529/2013/EU) that can relate to agroforestry

Measures related to	Examples
Cropland management	• Agroforestry
Grazing management and pasture improvement	• Preventing grassland to cropland conversion to native vegetation • Increasing productivity • Improving nutrient management • Introducing more appropriate species, in particular deep rooted species
Forest activities	• Afforestation and reforestation • Conservation of C in existing forest • Enhancing production in existing forests • Increasing harvested wood products • Enhancing forest management (optimize species composition, tending, thinning and soil conservation)
Preventing deforestation	
Strengthening protection against natural disturbances such as fire, pest and storms	
Substitution GHG intensive energy feedstock and materials with harvested wood products	

Agroforestry has been identified as an indicative measure that may be included in the information on LULUCF actions submitted pursuant to Article 10(2)(d) as part of "Cropland Management" (CM), therefore identifying agroforestry as agricultural land and an agricultural activity (Table 7). Other types of tentative measures included by the EU are those linked to grazing land management and pasture improvement. Grassland management and grassland improvement measures identified by the EU include increasing productivity, nutrient management, the introduction of deep rooted species (also related to agroforestry as productivity and nutrient management is enhanced by the inclusion of deeply-rooted woody vegetation) (Rigueiro et al. 2009). The forest activities promoted by agroforestry practices (Table 7) include those related with soil carbon conservation and the increasing agricultural use of forest land (e.g. increasing harvest wood forests and production in existing forests). Moreover, preventing deforestation and strengthening protection against natural disturbances such as fire, pest and storms can be enhanced by agroforestry. The use of wood products can also be promoted if trees are located on arable land, which links to the bioeconomy if, for example, pruned branches are used for compost production.

The EU **Bioeconomy Strategy** (EC 2012) is described in a document entitled 'Innovating for Sustainable Growth: A Bioeconomy for Europe'. It proposes a comprehensive approach to address the ecological, environmental, energy, food supply and natural resource challenges faced by Europe and the world. It aims to improve the knowledge base and foster innovation to achieve productivity increases, while ensuring sustainable resource use and alleviating stress on the environment. A successful bioeconomy has the potential to create economic growth and jobs, to reduce fossil fuel dependence, and to improve economic and environmental sustainability. A key bioeconomy concept is the circular economy where the "waste" from the creation of one product should be used as raw material for a second product. The strategy will thus support resource efficiency, sustainable use of natural resources, protection of biodiversity and habitats, as well as provision of ecosystem services. Agroforestry can contribute to the circular economy as a primary and renewable source of products including food, wood for timber, and biomass energy. Agroforestry can also support the Bioeconomy Strategy by enabling increased carbon sequestration on agricultural land.

The **European Forestry Strategy** (EU 2013b) aims to ensure that the multifunctional potential of EU forests is managed in a sustainable and balanced way, enabling the "correct" functioning of ecosystem services. It highlights the contribution of forests to employment, well-being, the environment, and rural development. The Forest Strategy from 2013 specifically mentioned agroforestry for the first time. It states: "Member States should use the opportunities given in the new Rural Development Regulation and prioritise investments in: (…) achieving nature and biodiversity objectives; adapting to climate change; conserving genetic resources; forest protection and information; and creating new woodland and agroforestry systems".

A recent development has been an increased awareness of how trees can also contribute to well-being. For example the **Social Farming and Rural Development policy** (ENRD 2010) has highlighted how kitchen gardens (which often include fruit trees) can enhance public health and social inclusion. Again this demonstrates the important role that agroforestry has to play.

In September 2016, twenty years after the 1996 Cork Declaration in relation to the EU and the environment, the "Cork 2.0: European Conference on Rural Development" was held (EU 2016b). This was attended by different policy bodies including the European Agroforestry Federation (EURAF). Discussions led to the development of the Cork Declaration 2.0 which highlights the participation of farmers and foresters as key actors to develop a sustainable agriculture, the recognition of traditional heritage agricultural systems, the inclusion of forestry within the EU agrarian policy, the need of enhancing ecosystem services from agriculture, reducing the impact of climate change (mitigation and adaptation) and the importance of integrated systems such as agroforestry. Agroforestry can contribute to many of the economic, social and environment aspects mentioned in the Cork Declaration.

Conclusions

There is a global and European recognition of the role that agroforestry can play to provide products but also to deliver highly important ecosystem services. However, there is a lack of knowledge transfer and adequate policies that promotes agroforestry at field level, which could be approached by involving stakeholders in the policy development.

4 European Common Agricultural Policy and Pillar I

The Common Agricultural Policy (CAP) has evolved from its initial inception in 1962 when it covered six countries. In 1973, the inclusion of the UK, Ireland, and Denmark increased the total to nine. Following additions were made in 1981 (10), 1986 (12), 1995 (15), 2004 (25) (Figure 9). The inclusion of Romania and Bulgaria in 2007 brought the total to 27, and finally they amounted 28 due to the incorporation of Croatia in 2013. The CAP now has a direct impact on 14 million farmers with a further 4 million people working in the food sector.

The annual CAP expenditure distribution can be seen in Figure 9. CAP expenditure (in current prices) doubled from about 30 billion Euros in 1990 to the current 60 billion Euros. The distribution of the payment to different EU target aims has also changed with coupled payments, exports, refunds and market support measures reduced or removed completely. The “MacSharry” reforms in 1992 started the shift from product support (through prices) to direct payments coupled to specific types of production.

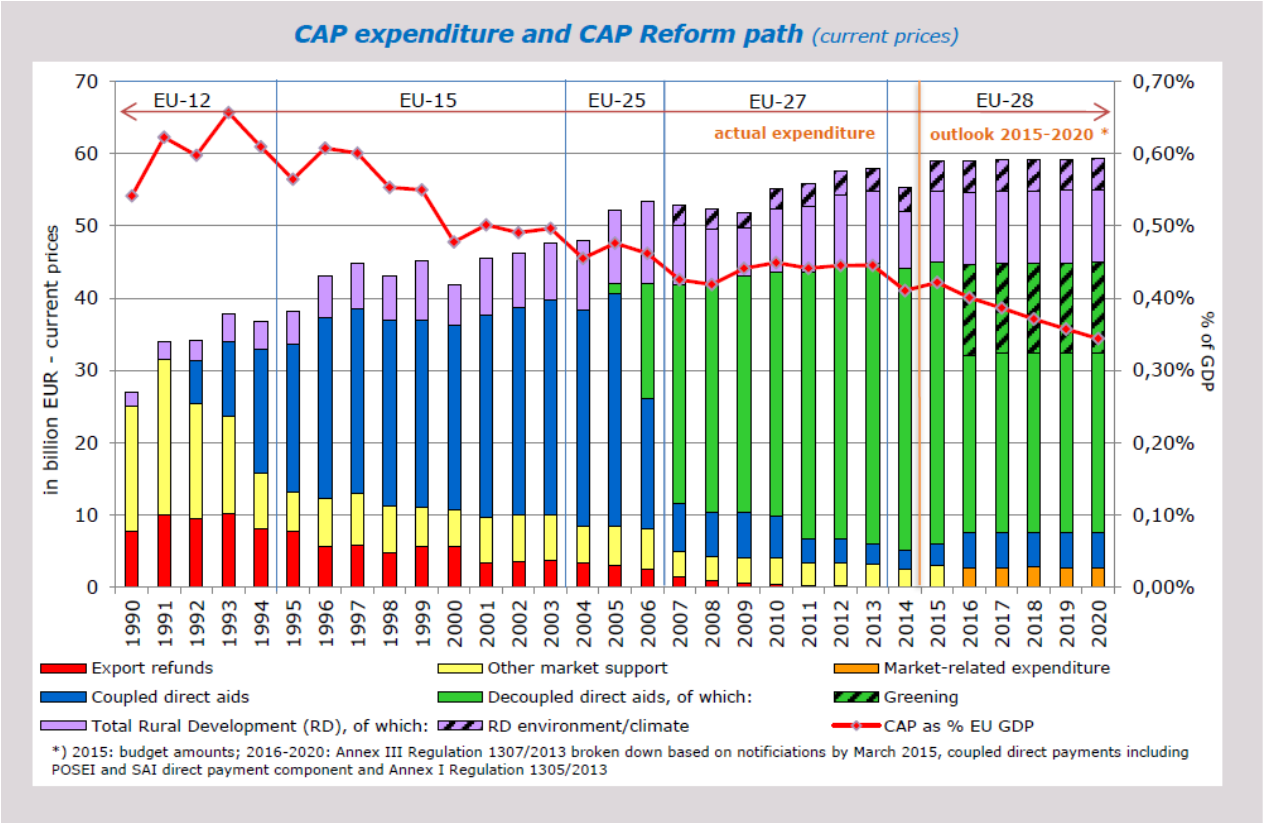

Figure 9. CAP expenditure (1990-2013) and CAP Reform path (in current prices) (European Commission 2016).

The Agenda 2000 reforms, signed in Berlin in 1999, emphasised the division of the Common Agricultural Policy into a “first pillar” (based on single farm payments) and a "second pillar" focused on rural development measures. Payments in Pillar I are completely funded from the European Agricultural Guarantee Fund (EAGF), while Pillar II payments are partly-funded by national governments (between 50 and 85% depending on the country).

Following the CAP reform in 2003, payments were decoupled from the production of a specific product, with farmers instead receiving payments based on a set amount per hectare of agricultural land. The CAP has also aimed to become more environmentally-oriented. For the 2007-2013 period, Pillar I across the EU27 was worth just over three times as much as Pillar II. However there were differences between the CAP budget of the old and new Member States. Whilst the level of expenditure is relatively balanced in the EU-12 (where the level of expenditure on both Pillars is almost the same), the EU-15 receives five times as much for Pillar I as Pillar II. For the 2014-2020 period, rural development and environmental issues account for close to 24% of the total CAP budget.

4.1 Conditionality or Cross-compliance

Those plots receiving CAP funds have to fulfil CAP provisions. Environment preservation is promoted in both Pillars through the "cross-compliance" or "conditionality" concept. Cross-compliance applies to Pillar I but also to most environmental payments forming part of the Rural Development policy (Pillar II) since CAP 2007-2013. From 2008, it applies also for certain wine payments. Farmers receiving these funds have to comply with 13 Statutory Management Requirements (SMR) and standards for maintaining the land in Good Agricultural and Environmental Condition (GAEC). Both, SMR and GAEC, are commonly known as cross-compliance or conditionality.

At present, the European Commission identifies 13 Statutory Management Requirements (SMRs), that build on a number of European directives and regulations (Table 8), after abolishing some from the previous CAP. The SMRs have evolved throughout the years. Current SMRs are related to environment, climate change, and good agricultural condition land linked to (a) water (SMR1: Nitrate Vulnerable Zones), (b) biodiversity (SMR2: wild birds and SMR3: habitats), and (c) public: food and feed law animal, (d) hormones and (e) plant health, as well as to (f) food safety (SMR4: food and feed law; SMR5: hormones; SMR6: pig identification; SMR7: cattle identification; SMR8: sheep and goat identification; SMR9: TSEs and SMR10: plant protection products), and (g) animal welfare (SMR11: welfare of calves, SMR12: welfare of pigs to SMR13: welfare of farmed animals).

As mentioned before, agroforestry will help to fulfil directly the first three SMRs, while improving the quality of feed and food because they are usually linked to sustainable land use practices that deliver high quality products. Silvopasture practices are affected by SMR 6, 7 and 8. SMR 11 and 12 can also be supported by agroforestry practices as trees can provide protection, shade and shelter to animals reared outside.

Table 8. Current Statutory Management Requirements (SMR), former SMR number, Directives and Regulations linked and year of introduction

SMRs	Directives and Regulations that apply	Year of introduction
SMR 1 Protection of water against pollution caused by nitrates	Council Directive 91/676/EEC (Nitrates Directive)	2005
SMR 2 Conservation of wild birds	Directive 2009/147/EC of the European Parliament (Birds Directive)	2005
SMR 3 Conservation of natural habitats and of wild flora and fauna	Council Directive 1992/43/EEC (Habitats Directive)	2005
SMR 4 Food and feed law	Regulation (EC) No 178/2002 of the European Parliament Food Hygiene Regulations (EC) No's 852/2004 and 853/2004 Feed Hygiene Regulation (EC) No 183/2005 Regulation (EEC) No 2377/90 Regulation (EC) No 396/2005 Milk and egg producers have further specific hygiene standards in addition to the general requirements.	2006
SMR 5 Restrictions on the use of substances having hormonal or thyrostatic action and beta -agonists in farm animals	Council Directive 96/22/EC Council Directive 96/23/EC	2006
SMR 6 Pig identification and registration	Council Directive 2008/71/EC	2005
SMR 7 Cattle identification and registration	Regulation (EC) No 1760/2000 of the European Parliament and of the Council	2005
SMR 8 Sheep and goat identification and registration	Council Regulation 21/2004	2005
SMR 9 Prevention and control of transmissible spongiform encephalopathy's (TSEs)	Regulation (EC) No 999/2001 of the European Parliament and of the Council	2006
SMR 10 Plant protection products (PPPs)	Regulation (EC) No 1107/2009 of the European Parliament and of the Council	2006
SMR 11 Minimum Standards for the Protection of Calves	Council Directive 2008/119/EC	2007
SMR 12 Minimum Standards for the Protection of Pigs	Council Directive 2008/120/EC	2007
SMR 13 Protection of Animals kept for Farming Purposes	Council Directive 98/58/EC	2007

In the CAP (2007-2013), each country had to identify its own **Good Agricultural and Environmental Conditions** (GAEC). Some standards were compulsory and some were voluntary. The conditions cover compulsory and voluntary measures to minimise soil erosion (e.g. minimum coverage, minimal management reflecting the specific local conditions, and terraces), maintain soil organic content (e.g. crop rotation, stubble management), maintain soil structure and to ensure minimum levels of maintenance on agricultural land (e.g. minimum livestock density, permanent pasture protection, maintenance of landscape characteristics such as hedges and trees in line, in groups, isolated, field margins, and preventing unwanted scrub encroachment on agricultural land) (Table 9).

Table 9. Good Agricultural and Environmental Conditions in CAP 2007-2013 (Annex 3 Regulation 73/2009)

Issue	Compulsory standards	Optional standards
Soil erosion: protect soil through appropriate measures	• Minimum soil cover • Minimum land management reflecting site-specific conditions	• Retain terraces
Soil organic matter: maintain soil organic matter levels through appropriate practices	• Arable stubble management	• Standards for crop rotations
Soil structure: maintain soil structure through appropriate measures		• Appropriate machinery use
Minimum level of maintenance: ensure a minimum level of maintenance and avoid deterioration of habitats	• Retention of landscape features including, where appropriate, hedges, ponds, ditches, trees in line, in groups, or isolated and field margins • Avoiding the encroachment of unwanted vegetation on agricultural land • Protection of permanent pasture	• Minimum livestock stocking rates and/or appropriate regimes • Establishment and/or retention of habitats • Prohibition of the grubbing up of olive trees • Maintenance of olive groves and vines in good condition
Protection and management of water: protect water against pollution and run-off, and manage the use of water	• Establishment of buffer strips along water courses • Where use of water for irrigation is subject to authorisation, compliance with authorisation procedures	

Within the 2014-2020 CAP, GAEC activities relating to crop rotation or permanent pasture protection are included as a condition in Pillar I as part of the 'greening' payments at farm (crop rotation for those farms with large eligible areas) or at national level (permanent pastures). The retention of landscape features (hedges, trees in line, in group or isolated) has been also included within the Ecological Focus Area of Pillar I as well as buffer strips (Regulation 1307/2013). Therefore, current GAECs (Table 10) are related to environment, climate change, and good agricultural condition land

linked to (a) water (GAEC 1 to GAEC 3), (b) soil and carbon stock (GAEC 4 to GAEC 6) and (c) landscape, minimum level of maintenance (GAEC7).

Table 10. Good Agricultural and Environmental Conditions in the CAP 2014-2020 (Annex 2, Regulation 1306/2013)

Issue	Standards	
Water	GAEC 1	Establishment of buffer strips along water courses
	GAEC 2	Where use of water for irrigation is subject to authorisation, compliance with authorisation procedures
	GAEC 3	Protection of ground water against pollution: prohibition of direct discharge into groundwater and measures to prevent indirect pollution of groundwater through discharge on the ground and percolation through the soil of dangerous substances, as listed in the Annex to Directive 80/68/EEC in its version in force on the last day of its validity, as far as it relates to agricultural activity
Soil and carbon stock	GAEC 4	Minimum soil cover
	GAEC 5	Minimum land management reflecting site specific conditions to limit erosion
	GAEC 6	Maintenance of soil organic matter level through appropriate practices including ban on burning arable stubble, except for plant health reasons
Landscape, minimum level of maintenance Food safety	GAEC 7	Retention of landscape features, including where appropriate, hedges, ponds, ditches, trees in line, in group or isolated, field margins and terraces, and including a ban on cutting hedges and trees during the bird breeding and rearing season and, as an option, measures for avoiding invasive plant species

The presence of woody vegetation is known to help to minimize soil erosion, maintain and even steadily increase the amount of soil organic matter content, improve soil structure (Homar-Sánchez et al. 2014) and maintain the minimum agricultural land (by grazing for example). However agroforestry was rarely mentioned within the 2007-2013 CAP. Instead of including managed woody vegetation with the associated products and services, avoiding encroachment (to maintain GAEC) was usually achieved by ploughing and the destruction of vegetation. Since 2009, activities related to maintenance of landscape characteristics have been compulsory, with specific mentions in Austria, Cyprus, the Czech Republic, Finland, Germany, Hungary, Ireland, Italy, Luxembourg, Malta, Slovakia, Portugal, Slovenia and Spain, but in some cases no increase was allowed (Slovenia). As mentioned before, most of these activities are in line with the use of agroforestry, as it is a demonstrated way to enhance flora and fauna biodiversity, increase resource use efficiency (therefore preventing from nutrient leaching), reduce erosion, increase soil organic matter and reduce encroachment.

In spite of this, cross-compliance conditions for Pillar I have been criticized from both sides, some arguing that they are too lenient, some arguing that that they impose excessive administrative costs. The European Court of Auditors has recently concluded that there are major insufficiencies in cross-compliance conditions that results in rather ineffective conditionality (European Court of Auditors 2009).

The protection of the woody vegetation and therefore agroforestry practices in Europe is currently carried out by the CAP. This protection is mainly linked to some landscape features, which includes

isolated trees but also hedgerows composed of trees/shrubs. Both can be combined with arable and/or grazing lands (Table 5).

4.1.1 Isolated trees

The proportion of land allocated to isolated trees is relatively consistent across Western and Southern Europe, although coverage tends to be lower in North-Eastern and Central Europe (Figure 10). The relative importance of this landscape feature is lower than hedges and multipurpose trees and riparian buffers. The total amount of ha occupied by isolated trees in Europe is equivalent to almost 300,000 hectares i.e. less than hedges and multipurpose trees but similar to riparian buffers.

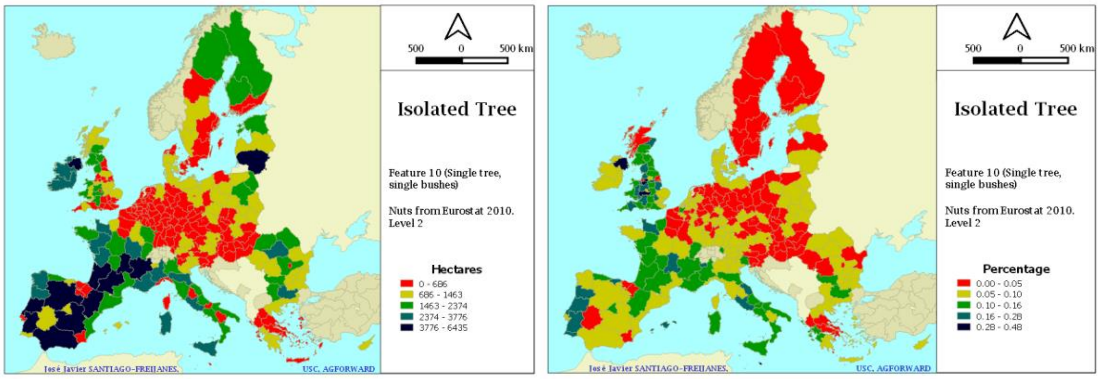

Figure 10. Area (left) and proportion (right) of European land use associated with isolated trees (LUCAS 2012)

4.1.2 Hedgerows

The total area of hedgerows is about 1.78 million hectares representing about 0.42% of the territorial area of the EU (den Herder et al. 2016). The largest areas are found in France, the UK, and Italy, with a high proportional area in Ireland (Figure 11). The distribution of different types of hedgerow (avenue trees, conifer hedges, bush/tree hedges visibly managed and bush/tree hedges not managed from abandonment) are shown in Figure 12. Since 1997 hedgerows have been protected in the UK.

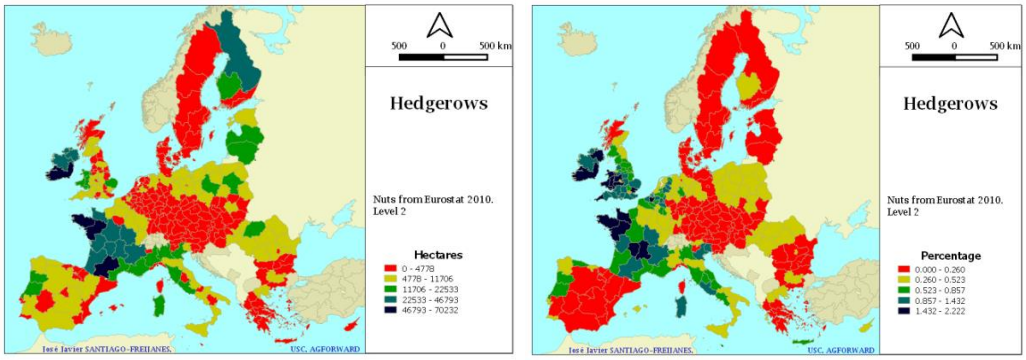

Figure 11. Area (left) and proportion (right) of European land use associated with hedgerows (LUCAS 2012)

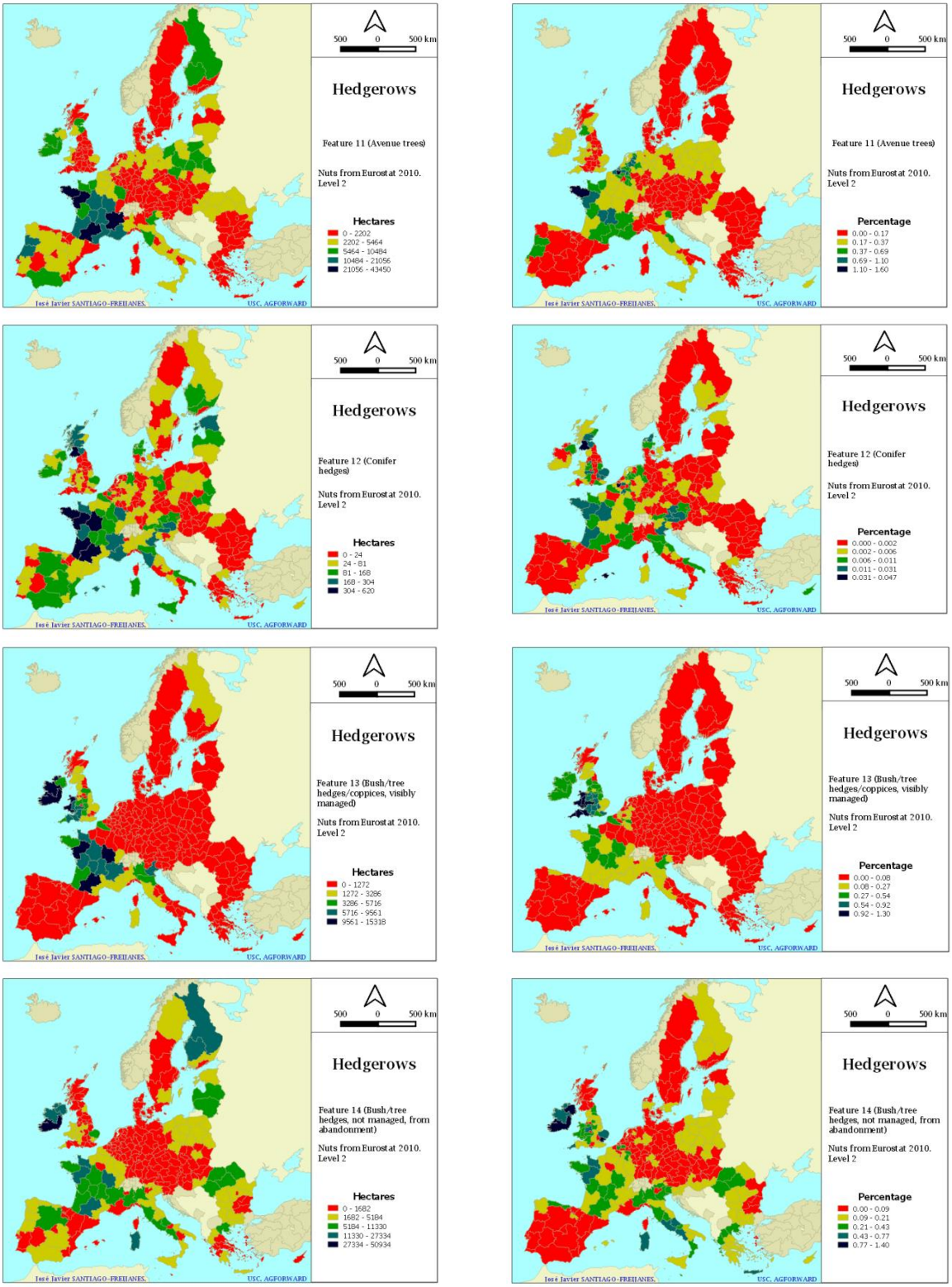

Figure 12. Area (left) and proportion (right) of European land use associated with four hedgerow types: (avenue trees, conifer hedges, bush/tree hedges, visibly managed, bush/tree hedges, not managed, from abandonment) (LUCAS 2012)

4.2 Pillar I: CAP 2007-2013

The **2003** reform of the CAP introduced a new system of direct support to farmers, known as the Single Payment Scheme (SPS). The Single Payment Scheme (hereafter SPS) includes two components: the Single Farm Payment (hereafter SFP) and the Single Area Payment Scheme (hereafter SAPS). The SFP entered into force in 2005 after approval in 2003, and was applied in the 17 oldest Member States (Figure 13). The 10 newest Member States (MS) used a Single Area Payment Scheme (SAPS).

An objective of the 2003 CAP reform was “the farmers should produce what markets demand”. Payments linked to the area of specific crops or per head of livestock were generally transformed into a single payment. The SPS initially allowed several options for the Member States for SPS design and calculation and exceptions from full decoupling. This means that Member States had some flexibility in applying the SPS and that the exact details of implementation vary from one Member State to another, which makes comparisons between countries difficult. The SPS introduced “decoupling” and replaced most previous existing agricultural schemes linked to specific sectors (coupled aid). Payments linked to hectare of a crop or per head were transformed into single payment linked to entitlements based on the value of historical subsidy receipts. Activating an entitlement was based on the ownership or rent of a corresponding number of hectares (Regulation 1782/2003), linked to agriculture activity in an eligible land, but at the same time the farmer had to maintain the land in a good agricultural and environmental condition as explained under “cross-compliance”.

When introducing the SPS in 2005, the 17 oldest Member States (Figure 13) had three main options for calculating the value of payment of their entitlements:

- On the basis of the payments received by the individual farmer during a reference period ("historical model"), resulting in different aid levels per hectare, and associated to the activation of entitlements linked to hectares.
- Taking all payments received in a region and divide them by the number of eligible hectares ("regional model") resulting in a flat rate per region, which is the model that all countries will finally have to adopt under the CAP 2020. Germany adopted it in the period 2014-2020 and countries like Greece, Spain, Finland, Denmark, United Kingdom and France officially recognized the adoption of the regional model in the current CAP period (2014-2020).
- A mixture between these two models ("hybrid model") subsequently applied by most of the countries that can be "static" or "dynamic” (with the latter approximating both elements towards a flatter rate or regional model).

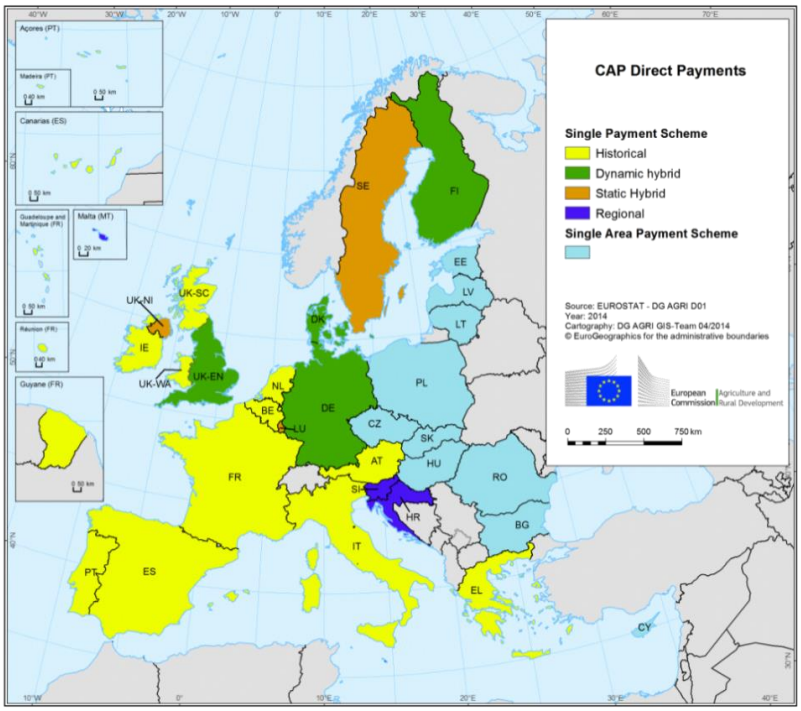

Figure 13. Country selection of direct payments (EC 2014).

4.3 Pillar I: CAP 2014-2020

The Single Area Payment Scheme (SAPS) practiced in the 10 new member states in 2007-2013, was due to expire in 2014-2020 under Regulation (EC) No 73/2009. However, the 2013 reform of the CAP permitted these member states to continue applying SAPS between 2014 and 2020. Hence all new member states (except Slovenia, Malta and Croatia) is using SAPS which calculates payments by dividing the country's annual financial envelope by its respective utilized agricultural area, i.e. there is a constant per hectare payment at a country level.

From 2014 to 2020, the Single Payment Scheme in the CAP has been replaced by three compulsory and four voluntary components. Because different countries have selected different options (Figure 14) it is difficult to interpret the results and the impact of the CAP at field level. The compulsory payment now includes a “greening” component that was intended to guarantee an EU agriculture response to climate change, better water management, biodiversity protection and green energy production.

The three compulsory payments are:

1) a *basic payment* per hectare, which was set at a maximum of 70% of the pillar I money. The mean percentage adopted by the Member States in 2015 was 55%. The basic payment has to be harmonised according to national or regional economic or administrative criteria and subject to an ‘internal’ convergence process within the current CAP.
2) a ‘*greening*’ component which aims to offset the cost of providing environmental public goods not remunerated by the market and linked to an additional payment per hectare for using climate- and environment-friendly farming practices. This component represents 30% of the pillar I funding in each member state.

3) an additional payment for five years for *young farmers*, comprising between 1 and 3% of the pillar I money.

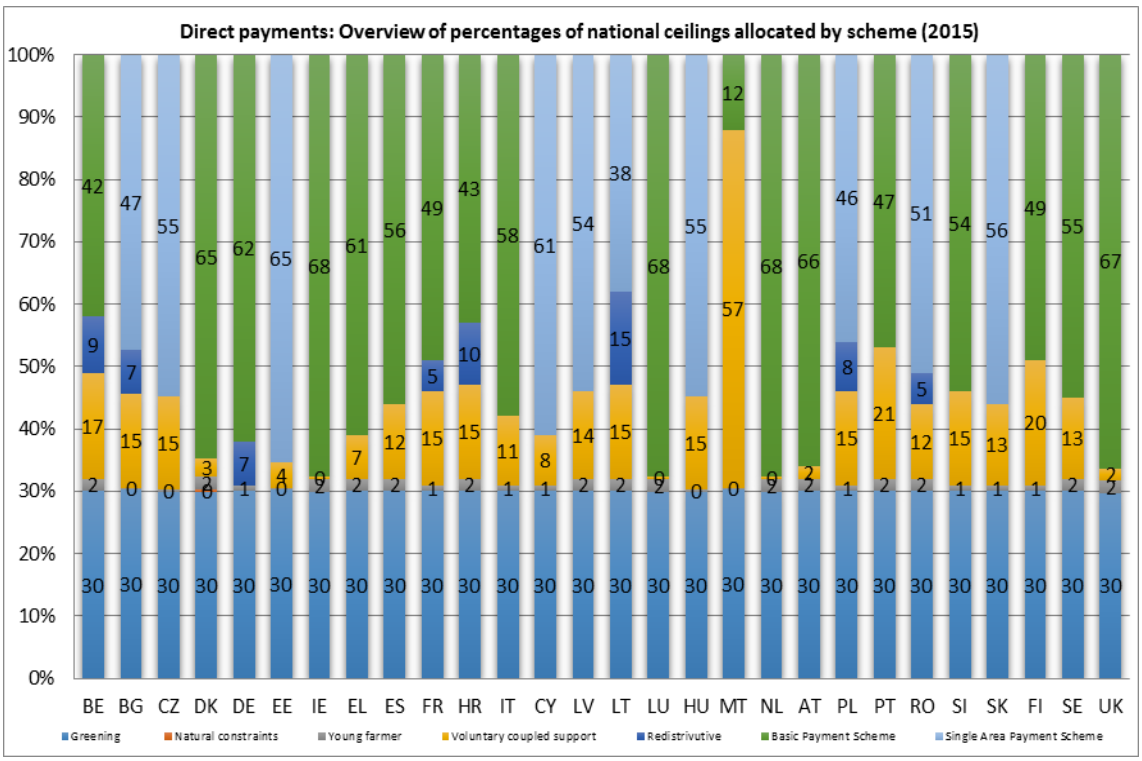

Figure 14. Direct payments: overview allocated per scheme by country across the EU-28 level in 2015 (EC 2015).

The four **voluntary payments** are:

4) additional income support in areas with *specific natural constraints* (ANC). This was only adopted by Denmark
5) a redistributive payment whereby farmers may be granted additional support for the first hectares of farmland. This was only adopted by eight countries (Belgium, Bulgaria, Germany, France, Hungary, Latvia, Poland and Romania)
6) coupled support (VCS) for production, granted in respect of certain areas or types of farming for economic and/or social reasons. VCS is implemented by all member states with the exception of Germany, representing around 10% of the total direct payments envelope for the European Member States. The share of VCS within the countries differs and some of them spent less than 10% of the Direct Payments (Austria, Ireland, Nederland, Luxemburg, United Kingdom, Denmark, Greece, Estonia and Cyprus) and the rest of the member states are above the 10% share for the VCS measure (Belgium, Bulgaria, Czech Republic, Spain, France, Hungary, Italy, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovenia, Slovakia, Finland and Sweden).
7) the last voluntary payment is based on a simplified system for small farmers. This was only implemented by Portugal and Latvia.

4.3.1 Payments and eligibility concept

Eligibility for the Single Farm Payment was primarily linked to areas specified as arable land and grassland. Eligible lands have to fulfil cross-compliance, where the woody component should be protected when selected by member states, as previously mentioned (i.e. landscape feature). However it is noted that a lack of knowledge about the extent of these features in many EU countries makes it difficult to know the real impact and the effectiveness of these measures (European Court of Auditors 2009).

For 2014-2020, an eligible hectare in the CAP is "*any agricultural area of the holding … that is used for an agricultural activity or, where the area is also used for non-agricultural activities, is predominantly used for agricultural activities (can be exercised without being significantly hampered by the intensity, nature, duration and timing of the non-agricultural activities)*" but also "*any area which gave a right to payments in 2008 under SPS or SAPS, and which (i) no longer complies with the definition of 'eligible hectare' as a result of the implementation of "Natura 2000" requirements; or (ii) is afforested pursuant to RD programmes or under a national scheme; or (iii) is set aside pursuant to RD programmes*" (Pagliacci 2015). However, agroforestry established plots, thanks to measure 222 of the CAP 2007-2013, are not mentioned causing incongruence between real agroforestry promotion from Pillar II (measure 222 of CAP 2007-2013) and Pillar I (CAP 2014-2020).

The CAP regulations (1306/2013 and 1307/2013) define an "agricultural area" means any area taken up by arable land, permanent grassland synonymous with permanent pasture, or permanent crops. Therefore an initial division of the territory was carried out, with land classified as permanent grasslands, arable or permanent crops. This approach, however, does not work for those systems that rotate grazing and arable practices in the same unit of land over several years (sometimes over 10 years) in order to improve the soil organic matter (mainly Mediterranean countries). Farmers prefer to declare arable lands instead of permanent pastures, because the former reaches a higher field market value than permanent pastures. It is interesting to highlight that some areas that combine short rotation coppice and arable crops, known as alley cropping and used experimentally in Germany (Böhm et al. 2011) or those areas combining short rotation coppices with tree lines under 100 trees per hectare used experimentally under the AgroCop project (Morhart et al. 2014), are fully eligible.

4.3.1.1 Arable land

Arable land means land cultivated for crop production or areas available for crop production but lying fallow, including areas set aside in accordance with previous regulations (1257/1999, 1698/2005 1305/2013). Once the concept of arable land is defined in 1307/2013, this eligible land has to fulfil the "cross-compliance" which includes maintenance of landscape features such as hedgerows, isolated trees and trees in lines or groups. The maximum density of trees in these arable lands is explained in the Delegate Act 640/2014 describing that for any arable land being eligible, tree density will not be above 100 trees per hectare in CAP 2014-2020 (value risen from 50 trees per ha during the CAP 2007-2013) thanks to the work carried out by the European Agroforestry Federation explaining the ecosystems service benefits that agroforestry provides to officers of the European Commission and members of the European Parliament. Member States could adopt a different maximum tree density but always below the 100 trees per hectare. However, that limit shall not apply in relation to the measures referred in Articles 28 and 30 of Regulation (EU) No 1305/2013,

related to agri-environment and Nature 2000 and water framework directive payments, respectively, and that are linked to Pillar II. This constrains makes it difficult for farmers to include trees on their arable land, particularly when they have small plots.

Isolated trees are defined by the Delegated Act 639/2014 as those trees with a crown diameter of minimum 4 m, which implies a minimum tree cover of 12.56 m^2. This means that a minimum 1256 m^2 of tree cover are allowed in those arable lands so 12.56% of the hectare, but only if tree density is below 100 trees per ha. However, this landscape feature has to be declared and has to have a minimum crown diameter if it should be preserved. Crown diameter above 4 m of diameter can be considered, in most cases, as mature trees. Therefore those isolated trees below this target crown diameter are not protected, and cannot be declared as landscape features, even though they, as young trees, are essential to ensure long term sustainability of isolated trees at least 4 m width. The impact of these figures will depend on the growth rate of the tree species. Another aspect is that CAP does not consider variation between tree species. For example, the selected tree crown diameter size above 4 m could mean a young tree for certain chestnut or oak trees, but for many ancient trees like for example those of Mediterranean cypress (*Cupressus sempervivens*), it is difficult to reach the required size to be protected. Trees below 4 m width may be or may be not considered as a tree depending on the definition of a tree given by the different countries (Table 11) and the category given to the field where the trees are (forestry, agriculture). Different definitions among countries make it difficult to evaluate the results and impact of landscape feature protection across Europe.

Table 11. Minimum values for area size, tree crown cover and tree height as specified by the member state for the definition of forest (Annex 5 of the Decision 529/2013/EU)

Country	Area (ha)	Tree crown cover (%)	Tree height (m)	Country	Area (ha)	Tree crown cover (%)	Tree height (m)
Belgium	0.5	20	5	Luxembourg	0.5	10	5
Bulgaria	0.1	10	5	Hungary	0.5	30	5
Czech rep	0.05	30	2	Malta			
Denmark	0.5	10	5	Netherlands	0.5	20	5
Germany	0.1	10	5	Austria	0.05	30	2
Estonia	0.5	30	2	Poland	0.1	10	2
Ireland	0.1	20	5	Portugal	1	10	5
Greece	0.3	25	2	Romania	0.25	10	5
Spain	1.0	20	3	Slovenia	0.25	30	2
France	0.5	10	5	Slovakia	0.3	20	5
Italy	0.5	10	5	Finland	0.5	10	5
Cyprus				Sweden	0.5	10	5
Latvia	0.1	20	5	UK	0.1	20	2
Lithuania	0.1	30	5				

If trees are grouped, the maximum area allowed for woody vegetation is low as CAP allows just 10% of the hectare (1000 m^2 per hectare). Forest land is not eligible for CAP Pillar I payments, even if there is a profitable agricultural activity (i.e. non-wood products). The most important limitation of

trees in arable lands is linked to the concept that a forest has a tree cover over 10%, and forested land is not able to receive Pillar I payments. However, the concept of a forest varies between countries. For some countries, a forest has a minimum tree cover of 20% and even 30% (Table 11), which makes lands between 10 to 20% even to 10 to 30% without full recognition as agricultural land from a CAP point of view, but not considered as forest in their own countries. This aspect is especially important if we take into account that forest and agricultural areas will be considered in the accountability (LULUCF rules) of GHG emissions and carbon sequestered in the fulfilment of the Kyoto protocol from year 2020 onwards (Decision 529/2013).

Forest is defined within the LULUCF accounting as those areas with minimum values for area size, tree crown cover and tree height. European countries have identified ranges of forestland with a minimum area size between (1) 0.05 and 1 hectare, (2) 10 and 30% of tree crown cover and (3) 2 and 5 m of tree height through Annex 4 of the EU decision 529/2013/EU. This decision shows that more than 50% of the EU countries identifies as forest those lands of at least 20% of tree cover (7, 1 and 6 EU countries indicated that a forest is a land with at least 20, 25 or 30% of tree cover, respectively) and only 11 EU countries identifies forest lands with at least 10% of tree cover (Table 11). This is in contradiction with the maximum number of trees that CAP allows to consider an arable land eligible through the conditionality role of having 100 trees per ha (Act 640/2014 (article 9.3)) with more than 4 m of tree canopy diameter (Act 639/2014 (article 9.3)), which allows 12.5% of tree cover in an arable land.

Regarding hedges or hedgerows, the Regulations protect hedges or wooded strips with a width of up to 10 m (Regulation 639/2014), but only 2 m width can be included as eligible land even if the member state protects wider hedges (Regulation 640/2014). This means that one hectare of arable land surrounded by a hedge with the maximum width of 10 m given by the Regulation 639/2014, the eligible land for the hedge becomes only 784 m^2 (7.2%), on a hectare basis (Regulation 640/2014. This will mean that close to 29% of the arable land will not be eligible under the CAP, so farmers will tend to create 2 m width hedges, in order to maintain the full eligibility and CAP payment. Farmers are also afraid of losing the condition of “arable” of their lands. In some countries, in CAP 2007-2013 permanent grassland was classified as arable land if they were not grazed but harvested to produce hay. In CAP 2014-2020, farmers must intend to plough at least once every five years to maintain the condition of “arable” within the CAP, and therefore provide better market prices for their land.

4.3.1.2 Permanent grassland and permanent pasture

Following the definition given in the Regulation 1307/2013 Permanent grassland and permanent pasture (together referred to as "permanent grassland") means “*land used to grow grasses or other herbaceous forage naturally (self-seeded) or through cultivation (sown) and that has not been included in the crop rotation of the holding for five years or more; it may include other species such as shrubs and/or trees which can be grazed provided that the grasses and other herbaceous forage remain predominant as well as, where Member States so decide, land which can be grazed and which forms part of established local practices where grasses and other herbaceous forage are traditionally not predominant in grazing areas”*. This definition recognizes all types of permanent grasslands across European biogeographic regions better than in the previous CAP. Thanks to the inclusion of the concepts of “self-seeded” (annual herbaceous species) and “grasses and other herbaceous forage are traditionally not predominant in grazing areas” ecological traits linked to a species evolutionary

strategy to surviving seasonal extremes (e.g. summer droughts) or disturbances are included. Therefore, the definition includes those ecosystems with plants that overcome summer droughts through the strategy of becoming a seed but that leaves land without vegetation during the summer time, as well as the “woody” dominated grassland vegetation as an ecological trait to overcome also the long summer period in southern European countries, with the advantage that animals will have farm-produced forage, soils are protected and organic carbon and fertility increased for the forthcoming uses of the land including arable. The “woody” ecological trait is also able to maintain vegetation cover throughout the year as permanent pasture and therefore making the ecosystem more resilient to heavy rains and heat, and avoiding erosion. Both should be recognized as excellent strategies to make the ecosystems more resilient to drought periods, mainly within the global climate change current framework. Both strategies - annual self-seeded species as well as woody vegetation - are of high interest to have farms better adapted to climate change, which will have a higher impact in southern countries.

Declaring the whole area of permanent grassland eligible depends on whether the MS decides to adopt the pro-rata system. When the pro-rata system is not adopted, then the rules linked to woody vegetation previously mentioned for landscape features in arable lands are compulsory in permanent grasslands, unless the area is declared as land which can be grazed and which forms part of “established local practices” (ELP) where grasses and other herbaceous forage are traditionally not predominant in grazing areas, like for example the region of Asturias in Spain.

When a Member State decides to follow a pro-rata system, the choice should apply to all permanent grassland plots of the Member State (EU 2015). This choice means that ineligible areas below 1000 m^2 can be eligible, but unfortunately this is provided at the parcel level and not on a hectare basis, and therefore affecting differently the area eligible of the farm size. However, within the pro-rata system, the areas with scattered trees which can be grazed, known as “grazable trees” are eligible. As indicated by the EU (2015) “grazable" trees on permanent grassland, which are considered as part of the eligible area, should thus not be counted to assess whether the parcel is below or above the maximum tree density. However, the concept of grazable tree for the commission is summarized as those features "which can be grazed" and *should be actually accessible to farm animals for grazing for their full area*. Therefore the concept of grazable tree for the European Commission is linked to the fact that the animal can access food directly from the tree, making ineligible and therefore discounting those trees that provide fruit to animals when fruits fall down to the ground. This is compulsory even if the unique purpose of the tree on that farm is to provide forage. These trees are essential to sustain the livestock in some ecosystems, such as the Dehesas in Spain, but they are discounted if this rule is followed.

Another aspect related to permanent grasslands is that they can still be ploughed and reseeded for conservation purposes that sometimes are broadly used, so losing the meaning of permanent in some cases.

As we mentioned before a key aspect for grassland eligibility is the declaration of “established local practices” (ELP) label mentioned in the EU Regulation 1307/2013. ELPs are defined as any of, or a combination of, the following practices: (a) practices for areas for livestock grazing which are traditional in character and are commonly applied on the areas concerned and (b) practices which

are important for the conservation of habitats listed in Annex I to Council Directive 92/43/EEC and of biotopes and habitats covered by Directive 2009/147/EC of the European Parliament and of the Council as defined by the Regulation 639/2014. The ELP meaning that permanent grasslands may include in their definition "grasses and other herbaceous forage are traditionally not predominant in grazing areas" should be activated by the Member States. Three countries have activated both options (a and b) within their definition of permanent pasture, favouring therefore the existence of woody vegetation; they are Germany, Spain and Sweden and option (a) of ELP has been activated by Greece, France, Hungary, Italy, Cyprus, Portugal and the United Kingdom.

4.3.1.3 Permanent crops

Permanent crops are defined by the Commission as non-rotational crops other than permanent grassland or permanent pasture that occupy the land for five years or more and yield repeated harvests, including nurseries and short rotation coppice. For permanent crops, the tree densities given for arable land eligibility did not apply and combinations with crops or grasslands are allowed. If fruit trees are combined with grazing, this type of land use falls within the permanent crop concept and again no restrictions of fruit tree density are included. They include apple, pear, apricot, peach, nectarines, orange, small citrus, lemon and olive trees as well as vineyards for table production. These types of trees should be included in the information that countries should provide to EU for statistics (EU Regulation 1337/2011) but not those related with cherry, plum or berries. Permanent crops are those linked to multipurpose tree silvoarable and multipurpose tree silvopasture agroforestry practices. Permanent crops linked to silvoarable and silvopasture practices occupy 223,000 and 850,000 ha with a theoretical potential area of 16.820 million ha (Table 4) and 17.091 million ha respectively (Table 3).

4.3.2 Greening

Besides the basic payments, the other compulsory multipurpose payment established within the direct payments in the 2014-2020 period is the "Payment for agricultural practices beneficial for the climate and the environment" or the so called "greening". It represents 30% of the payments in a compulsory way and is paid ipso facto to the organic farmers. Greening is not compulsory in those holdings a) where more than 75% of the arable land is used for the production of grasses or other herbaceous forage (selected by the MS), is land lying fallow, or is subject to a combination of these uses, provided that the arable area not covered by these uses does not exceed 30 hectares; (b) where more than 75% of the eligible agricultural area of a holding is permanent grassland, is used for the production of grasses or other herbaceous forage or for the cultivation of crops under water for a significant part of the year or for a significant part of the crop cycle, or is subject to a combination of these uses, provided that the arable area not covered by these uses does not exceed 30 hectares; (c) where more than 50% of the areas of arable land declared were not declared by the farmer in his aid application of the previous year and, where based on a comparison of the geospatial aid applications, all arable land is being cultivated with a different crop compared to that of the previous calendar year and (d) that are situated in areas north of 62nd parallel or certain adjacent areas. Where the arable land of such holdings covers more than 10 hectares, there shall be at least two crops on the arable land, and none of these crops shall cover more than 75% of the arable land, unless the main crop is grasses or other herbaceous forage, or land lying fallow. As mentioned, the greening measures push forward the cross-compliance concept through the protection of already existing elements (rather than promoting them), with 5% of the eligible land allocated to the so-

called Ecological Focus Area (EFA), preservation of permanent pasture, usually linked to woody vegetation, and crop diversification. Recognition of the role of woody vegetation is mainly related to two of the three main components of the greening: permanent pasture conservation and the designation of several of the measures of the EFA. But crop diversification may include fallow land, that if uses woody vegetation, can also be considered an agroforestry practice.

The three basic measures foreseen within the greening are:
Crop diversification: a farmer must cultivate at least two crops when his arable land exceeds 10 hectares and at least three crops when his arable land exceeds 30 hectares. The main crop should not cover more than 75% of arable land in the first case, while in the second the main crop shall not cover more than 75% of that arable land and the two main crops together shall not cover more than 95% of that arable land. For the crop diversification measure, a crop is identified as a culture of any of the different genera defined in (a) the botanical classification of crops; (b) a culture of any of the species in the case of Brassicaceae, Solanaceae, and Cucurbitaceae; (c) land lying fallow; (d) grasses or other herbaceous forage. Some exceptions to these general rules occur when the land lying fallow or forage is part of the arable land. Permanent crops are not considered crops in the definition as EU links the concept to “arable land”.

Permanent grassland: this measure establishes that Member States shall ensure that the ratio of areas of permanent grassland to the total agricultural area declared by the farmers will not decrease by more than 5% compared to a reference ratio established by Member States in 2015. This ratio may be applied at national or regional level, with most countries selecting the national level with the exception of Belgium, France, Germany and UK, which will ensure a better fulfilment at regional level. Up to now, nine MS designated all grassland in Natura 2000, but five and nine different MS designated the grassland between 50 and 100% and less than 50% of the grassland they have as part of in Natura 2000, respectively. Member States shall designate permanent grasslands which are in environmentally sensitive areas (Environmentally Sensitive Permanent Grasslands) covered by Directives 92/43/EEC or 2009/147/EC, including in peat and wetlands, and which need strict protection in order to meet the objectives of those Directives but also go beyond these areas. ESPG was also designated outside Natura 2000 (Czech Republic, Latvia, Luxembourg and Wales (UK)). Malta did not declare permanent grasslands. Due to the large area of permanent grasslands of Europe with woody vegetation, this measure is highly relevant for AF, protecting the already existing agroforestry systems linked to silvopasture practices in both the south (i.e. dehesa) and the north (i.e. grazed orchards). However, this measure could include ploughing and reseeding, necessary for the correct maintenance of some permanent grassland, but that may be extensive to those where this maintenance is not needed. Therefore, this measure may degrade permanent grasslands and not fulfil the concept of permanent pasture, which is the pasture has not been included in the crop rotation of the holding for five years or more.

Ecological focus area (EFA) should be established occupying at least 5% of the arable area of the farms with a farm area larger than 15 hectares (excluding permanent grassland). Ecological focus areas are identified with field margins, hedges, trees, fallow land, landscape features, biotopes, buffer strips, afforested areas, agroforestry, green cover and catch crops, among others. Ecological focus areas will be raised to 7% after a Commission report in 2017 and a legislative proposal. This

role should be fulfilled at an individual level in all countries, with the exception of the Netherlands and Poland.

Some states may decide not to implement EFA when they have above 50% of their land allocated to forestland, which recognizes the importance of the agroforestry landscapes. The Forest exemption has been activated by Finland, Latvia, Estonia and Sweden. Implementing the greening starts by the states choice of one or more of the following EFA measures:

a. land lying fallow
b. terraces
c. landscape features
d. buffer strips, including buffer strips covered by permanent grassland, provided that these are distinct from adjacent eligible agricultural area
e. hectares of agroforestry that receive, or have received, support under Article 44 of Regulation (EC) No 1698/2005 and/or Article 23 of Regulation (EU) No 1305/2013
f. strips of eligible hectares along forest edges
g. areas with short rotation coppice with no use of mineral fertiliser and/or plant protection products
h. afforested areas referred to in point (b)(ii) of Article 32(2) of this Regulation
i. areas with catch crops, or green cover established by the planting and germination of seeds, subject to the application of weighting factors referred to in paragraph 3 of this Article
j. areas with nitrogen-fixing crops.

With the exception of the areas of the holding referred to in points (g) and (h), the EFA shall be located on the arable land of the holding. In the case of areas mentioned in points (c) and (d), the EFA may also be adjacent to the arable land of the holding.

As shown, agroforestry is one of the choices for fulfilling the EFA, but it is restricted only to those agroforestry practices carried out within the Rural Development measure 222 of the previous period (article 44 of the Regulation 1698/2005) and the Rural Development measure (8.2) described in article 23 both dealing with the establishment of agroforestry systems. This means that those agroforestry systems already existing and established outside of these measures will not be recognized as EFA. Besides this, activities linked to landscape features, buffer strips, strips of eligible hectares along forest hedges, areas with short rotation coppice with no use of mineral fertiliser and/or plant protection products and afforested areas can be considered as part of plot, farm or landscape level agroforestry systems. More information can be seen in the delegated act 1307/2013 (EU 2015b).

Most of the countries selected less than 10 EFA categories. Finland, Lithuania, the Netherlands, Slovenia and Spain selected between 2 and 4, Denmark, Estonia, Greece, Latvia, Malta, Portugal and United Kingdom between 5 and 9, while 14 member states selected over 10 EFA (Austria, Belgium, Bulgaria, the Czech Republic, France, Denmark, Hungary, Ireland, Italy, Luxembourg, Poland, Romania and Slovakia). EU information about categories highlighted that the most popular measure was “nitrogen fixing crops” (27 MS) followed by “lying fallow” (26 MS), “landscape feature” (at least one) (24 MS), “short rotation coppice” (20 MS), “catch crops” (19 MS), “buffer strips” (17 MS), “afforested areas” (14 MS), and “agroforestry” (11 MS). Less popular were “strips along forest edges”, “with production “(7 MS) and “without production” (9 MS) and “terraces” (8 MS). The selection within the

landscape features included “trees in groups” (17 MS), “field margins” (16 MS), “trees in line” (16 MS), “ditches” (15 MS), “hedges” (13 MS), “isolated trees” (13 MS), “ponds” (12 MS), “traditional stone walls” (7 MS) and “other landscape features” (12 MS). Only 3% of the MS chose nine landscape features, 29% selected between one and three, 29% selected between four and six, and 16% chose between seven and eight landscape features. The most popular species under the “Short Rotation Coppice” were willow (20 MS), poplar (17MS), alder (14MS), birch (11 MS) and ash (11 MS).

4.4 Conclusions Pillar I

There is a lack of knowledge of the real extent of agroforestry in Europe and the real extent of agroforestry land funded by Pillar I. This makes difficult to evaluate the impact of Pillar I on agroforestry in Europe. The first step to improve agroforestry policy in Europe is to identify the land where it is applied, the potential area where it could be applied and how current policy modifies the implementation. As mentioned, there is a huge potential to increase agroforestry practices across Europe to help fulfil the sustainable goals set by the EU.

The 2007-2013 CAP had two aspects that encouraged farmers to remove woody vegetation from farmland to ensure eligibility for the single payment scheme. First there was the limit of having more than 50 trees per hectare. Secondly, the definition of the permanent pasture only considered pastures with a dominant herbaceous component. Both aspects caused the removal of trees and shrubs from agricultural land across Europe by farmers that wished to receive the CAP funds in spite of the benefits demonstrated by agroforestry practices, from a productive and ecosystem services point of view. Thanks to the work of different NGOs and the advisory and civil dialogue groups in Europe, the new and more sustainable CAP concept recognized the value of the woody vegetation in Europe, but there is still a long way to go to really preserve and promote them, as discussed below.

Cross-compliance deals with measures of already existing woody component on arable and pasture land, but does not have the aim to increase them. The increase of agroforestry practices should be based on a more flexible strategy to obtain products from woody vegetation while implementing sustainable practices, within a circular economy global concept. In general, no more than a 10% of the arable land is allowed to have an existing woody component, which has improved from the last CAP (5%), but is still not enough to improve productivity and resilience of many European arable systems. This causes again destruction of trees, mostly in those small plots of farms and small farms. Hedgerows wider than 2 m are not considered eligible, even if they are protected, which makes farmers relate them with a reduction of CAP funds instead of the ecosystem services they deliver. However, alley cropping systems with short rotation coppices are allowed and are fully eligible in the current CAP, but they are not promoted or even specifically mentioned by the CAP. The woody vegetation of permanent pasture has been protected at some extent by those countries where Local Practices are claimed. However, there are still regions and countries that decided not to make eligible pastures that are dominated by woody vegetation in spite of delivering agricultural products derived from livestock that use woody vegetation as part of the feed strategy of the farm. Cross-compliance conditions for the Pillar I are criticized from both side, some arguing that they are too lenient, some arguing that that they impose excessive administrative costs. For example, the European Court of Auditors (2009) concluded that there are major insufficiencies in cross-compliance conditions that made the whole SPS conditionality rather ineffective.

CAP and Direct payments have been modified to fulfil sustainable agriculture concepts. Promoting agroforestry, as woody vegetation, has been increasingly considered since CAP was established. However, there are still several steps that prevent implementation of agroforestry practices by farmers. Considering the different farmers groups delineated by the AGFORWARD project:

High Nature Value farming. Conditionality makes it compulsory to fulfil the Statutory Management Requirements linked to birds (SMR2) and habitat directive (SMR3) included in the Nature 2000 Network. Pillar I protects those Natura 2000 grassland pastures, as all of them are prevented from being destroyed with the specific category of environmentally sensitive grasslands. All HNV farms are able to receive payments linked to the basic payment scheme and greening, and should be protected through the implementation of the "Local Practice" label under the definition of the Regulation 1307/2013, that allows no herbaceous predominant pastures to be eligible and therefore protecting sustainable farming.

For the High value tree farmers group of the AGFORWARD project, tree density is not a problem to develop agroforestry practices if permanent crops (fruit trees) are considered. But if timber trees are involved, they will have to meet the eligibility requirements of arable or permanent grasslands which are much more restrictive. However, the promotion of agroforestry with permanent crops should be pursued and it does not seem to be specially promoted, but protected when grazing orchards are considered under the permanent pastures greening measure.

Within the silvoarable agroforestry group, the limitation of less than 1000 m^2 per hectare is clearly dealing with the maximum surface allowed for landscape features without taking into account that tree distribution and tree age may play a strong role in the reduction or increase of understory production, therefore, limiting the possible benefits of agroforestry implementation. In this case, it is highly relevant that it deals with the protection of already existing woody vegetation, but not with the promotion of woody vegetation in those places were woody vegetation has been completely destroyed. This promotion should be carried out through the implementation of Pillar II, mainly linked with agroforestry and agri-environment measures which on the other hand, may convert the land as ineligible for Pillar I payments. Moreover, the CAP does not consider the promotion or the use of branches of these trees as a renewable source of energy.

Within the silvopasture agroforestry linked to the livestock AGFORWARD group, the definition falls within the permanent grasslands. Again, the inclusion of trees is not pursued within the Pillar I, and they should be protected within the permanent grassland greening measure. They are eligible in both cases when herbaceous vegetation is dominant and if considered a local practice when the herbaceous vegetation is not dominant. Besides that, some animal products in some countries still get some funds from coupled payments. From those, goat animals are usually linked to the woody vegetation consumption and therefore could support agroforestry at some extent.

However difficulties in promoting agroforestry practices at a European scale remain. There is a difficulty to clearly identify the different types of agroforestry practices within the Pillar I Regulation description, being named in several aspects (e.g. grazed orchards, article 44 dealing with the previous agroforestry establishment, landscape features related to buffer strips, isolated trees, and hedges) but not clearly identified as agroforestry. Even though there is a clear recognition of the role

of woody vegetation delivering ecosystem services, it is not clear how this vegetation fits in the whole CAP (landscape features linked to conditionality but also to greening and Pillar II). Simplification should be applied in a consistent way to allow woody vegetation to play the important role it has to play from an environment but also a productive point of view.

5 European Common Agricultural Policy and Pillar II

5.1 Pillar II: CAP 2007-2013

The Rural Development Program (RDP) 2007-2013 was composed of 44 measures, of which 18 dealt with the first axis (improving the competitiveness of the agricultural and forestry sector), 13 with the second axis (improving the environment and the countryside), while only eight and five are related to the third (quality of life in rural areas and diversification of the rural economy) and fourth (implementation of the Leader approach) axes respectively (Table 12). Agroforestry promotion was primarily linked to Axis 2, even though some measures related with the improvement of quality of life in rural areas and diversification of the rural economy are in some cases linked with the infrastructures needed for and the products delivered from agroforestry practices. Similarly, local development groups and LEADER projects could be related to agroforestry.

Before describing the most relevant policies linked to agroforestry within the different axis of the RDP of 2007-2013, it is important to provide a general overview of the RDPs. Axis 2 is the most important, firstly from a budget point of view, as it received 45% of the budget, followed by Axis 1 (33%), Axis 3 (13%) and Axis 4 (6%). However there are country differences: Axis 1 was relatively important in Belgium, Spain, Poland, Portugal, Hungary, Cyprus and Latvia with shares over 40%; by contrast Ireland (over 80%), the UK and Austria allocated resources mainly to Axis 2. Axis 3 was relatively highly represented in Bulgaria, Malta, the Netherlands and Germany. As can be seen in Figure 15, there were differences in the number of measures implemented per country. There are some regions or countries like Ireland that activate a small number of measures and there are others like France that activated a large number of measures.

In some countries, the 2007-2013 RDP was implemented at a regional level (e.g. Germany and Spain) and in some countries (e.g. France) the RDP was established for the whole country. The 17 RDPS in Spain potentially allow the application of the most relevant measures to the different environments of the Spanish regions, whilst a single RDP (such as in France) makes the implementation and evaluation of the impact of the different measures at national level easier (France subsequently developed several RDPs within the 2014-2020 CAP). The different measures involved as well as the implementation of them at different territorial scales make it difficult to evaluate the RDPs when a focus on the use of land and specially agroforestry is intended. Moreover, the differences in the EU territory also makes it difficult to carry out the evaluation at a European level, because the same measure may have a different impact depending on the biogeographic and social conditions of the area, where each specific measure is implemented. Socio-economic aspects of the different RDP regions of Europe have been summarized by the EU (2013). The evaluation of the RDP is also difficult because countries may intend to apply measures that are eventually not used or supported at a lower level than initially intended. Moreover, during the 2014-2020 CAP, measures can be open yearly.

Within the 2007-2013 CAP, the most popular measure of the four axes was the Measure 214 (agri-environment payments, 24%), followed by Measures 121 (modernisation of agricultural holdings, 12.1%), 212 (payments to farmers in areas with handicaps other than mountain areas, 6.9%) and 211 (natural handicap payments other than mountain areas, 6.9%).

Table 12. Measures of the Rural Development Programme Period 2007-2013. Measures indicated in **bold** are those related to agroforestry.

Axis	Cluster	Measures
1. Improving the competitiveness of the agricultural and forestry sector	1.1. Measures aimed at promoting knowledge and improving human potential	**111. Vocational training and information actions, including diffusion of scientific knowledge and innovative practices, for persons engaged in the agricultural, food and forestry sectors** **112 Setting up of young farmers** 113. Early retirement of farmers and farm workers **114. Use of farm and forestry advisory services** 115. Setting up of management, relief and advisory services
	1.2. Measures aimed at restructuring and developing physical potential and promoting innovation	**121. Modernisation of agricultural holdings** **122. Improving the economic value of forests** **123. Adding value to agricultural and forestry products** 124. Cooperation for development of new products, processes and technologies in the agriculture and food sector and in the forestry sector **125. Infrastructure related to the development and adaptation of agriculture and forestry** **126. Restoring agricultural production potential damaged by natural disasters and introducing appropriate prevention actions**
	1.3. Measures aimed at improving the quality of agricultural production and products	131. Meeting standards based on Community legislation **132. Participation of farmers in food quality schemes** **133. Information and promotion activities**
	1.4. Transitional measures for the Czech Republic, Estonia, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Slovenia and Slovakia	141. Supporting semi-subsistence agricultural holdings undergoing restructuring 142. Setting up of producer groups
2. Improving the environment and the countryside	2.1. Measures targeting the sustainable use of agricultural land	**211. Natural handicap payments to farmers in mountain areas** **212. Payments to farmers in areas with handicaps, other than mountain areas** **213. Natura 2000 payments and payments linked to Directive 2000/60/EC** **214. Agri-environment payments** **215. Animal welfare payments** **216. Support for non-productive investments**
	2.2. Measures targeting the sustainable use of forestry land	**221. First afforestation of agricultural land** **222. First establishment of agroforestry systems on agricultural land** **223. First afforestation of non-agricultural land** 224. Natura 2000 Payments **225. Forest-environment payments** **226. Restoring forestry potential and introducing prevention actions** **227. Support for non-productive investments**
3. Quality of life in rural areas and diversification of the rural economy	3.1. Measures to diversify the rural economy	**311. Diversification into non-agricultural activities** **312. Support for the creation and development of micro-enterprises** 313. Encouragement of tourism activities
	3.2. Measures to improve the quality of life in rural areas	321. Basic services for the economy and rural population **322. Village renewal and development** **323. Conservation and upgrading of the rural heritage**
	3.3. Training and information	331 Training and information for economic actors operating in the field covered by Axis 3
	3.4. Skill acquisition, animation and implementation	341 Skills acquisition and animation with a view to preparing and implementing a local development strategy
4. Implementation of the Leader approach	4.1. Local development strategies	411 Local development strategies. Competitiveness. **412 Local development strategies. Environment/land management**. 413 Local development strategies. Quality of life/diversification.
	4.2. Inter-territorial and transnational cooperation	421 Transnational and inter-regional cooperation
	4.3. Running the local action group, acquiring skills and animating the territory	431 Running the local action group, skills acquisition, animation

In 2007-2013, overall 37% of Axis 1 funding was allocated to Measure 121 (farm modernization), followed by 18% and 15% allocation to Measures 123 (adding value to agricultural and forestry products) and 125 (improving and developing infrastructure related to the development and adaptation of agriculture and forestry) respectively. In Axis 2, 53% of the money was allocated to Measure 214 (agri-environment) followed by Measures 212 (payments to farmers in areas with handicaps, other than mountain areas, 17%) and 211 (natural handicap payments to farmers in mountain areas, 15%). The allocation of money in Axis 3 is more evenly allocated with 28, 26, 16 and 10% allocated to Measures 321 (basic services for the economy and rural population), 322 (village renewals and development), 313 (encouragement of tourism activities) and 323 (conservation and upgrading of the rural heritage), respectively. In Axis 4, 67% of the budget was allocated to Measure 413 (local development strategies. Quality of life/diversification) followed by Measure 431 (running the local action group, skill acquisition, animation) with 17% of the share.

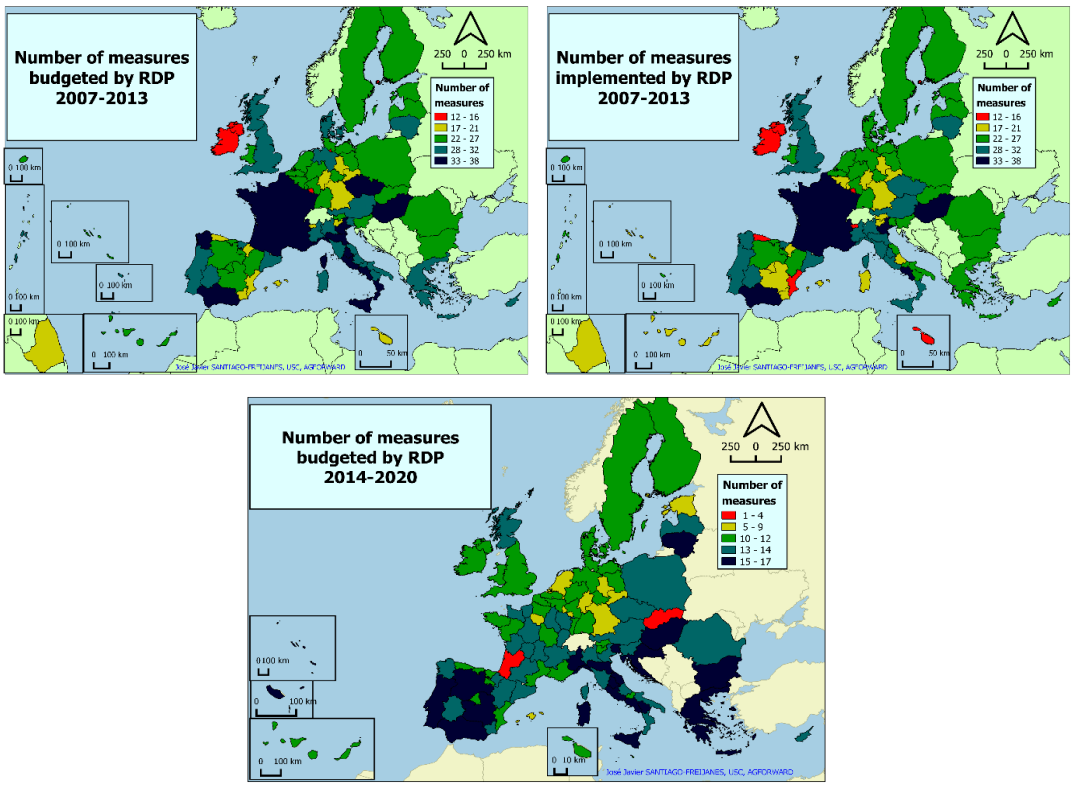

Figure 15. Number of measures budgeted and implemented in the 2007-2013 RDP and the number of measures budgeted in the 2014-2020 RDP

The maximum numbers of measures budgeted and implemented in an individual region or country in 2007-2013 were 37 and 38 respectively (Figure 15). In 2007-2013, Ireland budgeted and the lowest number of measures. France as well as Galicia, Andalucía, Hungary, the Czech Republic, Malta, Sicily, Calabria, Campania, Lazio, Umbria, Veneto and Emilia Romagna budgeted for the largest number of measures. Some regions, like Abruzzo, budgeted for a large number of measures but only eventually a few.

5.2 Pillar II: CAP 2014-2020

In 2014-2020, the structure of the RDPs is different from the previous period as it is divided in measures and sub-measures that are split in more clearly defined operations (Table 13). The understanding about how the operations are linked to land use has been improved. The number of measures has been reduced by half and in some cases previous measures i.e. afforestation and reforestation and agroforestry establishment are grouped in one unique measure in RDP 2014-2020 when previously they had two measures. Table 14 describes the sub-measures selected by countries to promote agroforestry in the first year of implementation of PDR 2014-2020, that will be further detailed.

5.3 Basis of our analysis of Pillar II in relation to agroforestry

For this paper, 88 RDPs in CAP 2007-2013 and 90 (out of 118 and including western EU countries) in the 2014-2020 CAP were reviewed. However we found it very difficult to make an analysis of the promotion of agroforestry by focusing only on the specific agroforestry measure (222) due to the relative failure of this measure and because, in fact, woody vegetation combined with agriculture is promoted in a number of different measures. So all 88 (2007-2013) and 90 (2014-2020) RDPs of CAP implemented in Europe were evaluated in this study, and their measures organized based on the activities linked to the agroforestry practices they promote. Once EU Rural Development Programmes are published by each region, they include the list of measures they choose form the EU measure list, but this election can be modified; **the evaluation of the 2014-2020 period of this report is based on the first election of the measures of the regional RDP.** The RDP that have not been evaluated in the present report include Greece and Cyprus.

The main agroforestry practices included in the RDP CAP 2007-2013 activities can be associated to forest farming through the promotion of agricultural use that does not come exclusively from the tree (fruit), silvoarable promoting the increase of woody vegetation across agricultural lands of Europe (forest strips and small stands, hedgerows, isolated trees), and finally those related to silvopasture (forest understory grazing and meadow orchards as a multipurpose tree silvopasture), including also mountain pastoralism as the woody component is present elsewhere in mountain areas.

Multipurpose tree silvopasture (meadow orchard) was treated separately due to the different eligibility rules they have (they fall in the category of permanent crops of the Pillar I) and because there are specific measures dealing with them. From the analysis carried out in the CAP 2007-2013, it is not easy to identify a unique European measure of the RDPs associated to any of these agroforestry practices. On the contrary, each agroforestry practice is promoted by different measures depending on the regional RDP, and even by several measures and sub-measures within the same RDP. This makes it difficult to specifically analyze the measures and amount of money of each RDP linked to the promotion of agroforestry practices. Finally, we will not deal with some agroforestry activities promoted at the landscape scale. A final section in this chapter deals with the evaluation of Measure 222 (linked to agroforestry establishment) in the RDP 2007-2013 and their respective Measures 8.2 and 8.1 in the 2014-2020 RDP.

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Table 13. Measures of the Rural Development Programme Period 2014-2020

Measure	Description	Article	Description
M01	Knowledge transfer and information actions	**article 14**	Knowledge transfer and information actions
M02	Advisory services, farm management and farm relief services	**article 15**	Advisory services, farm management and farm relief services
M03	Quality schemes for agricultural products, and foodstuffs	**article 16**	Quality schemes for agricultural products, and foodstuffs
M04	Investments in physical assets	**Article 17**	Investments in physical assets
M05	Restoring agricultural production potential damaged by natural disasters and catastrophic events and introduction of appropriates prevention actions	**article 18**	Restoring agricultural production potential damaged by natural disasters and catastrophic events and introduction of appropriate prevention actions
M06	Farm and business development	**article 19**	Farm and business development
M07	Basic services and village renewal in rural areas	**article 20**	Basic services and village renewal in rural areas
M08	Investments in forest area development and improvement of the viability of forests	**article 21**	Investments in forest area development and improvement of the viability of forests
		article 22	Afforestation and creation of woodland
		article 23	Establishment of agroforestry systems
		article 24	Prevention and restoration of damage to forests from forest fires and natural disasters and catastrophic events
		article 25	Investments improving the resilience and environmental value of forest ecosystems
		article 26	Investments in forestry technologies and in processing, in mobilising and in the marketing of forest products
M09	Setting -up of producer groups and organisations	**article 27**	Setting -up of producer groups and organisations
M10	Agri-environment-climate	**article 28**	Agri-environment-climate
M11	Organic farming	**article 29**	Organic farming
M12	Natura 2000 and Water Framework Directive payments	**article 30**	Natura 2000 and Water Framework Directive payments
M13	Payments to areas facing natural or other specific constraints	**article 31**	Payments to areas facing natural or other specific constraints
		article 32	Designation of areas facing natural and other specific constraints
M14	Animal welfare	**article 33**	Animal welfare
M15	Forest-environmental and climate services and forest conservation	**article 34**	Forest-environmental and climate services and forest conservation
M16	Co-operation	**article 35**	Co-operation
M17	Risk management	**article 36**	Risk management
M18	Crop, animal, and plant insurance	**article 37**	Crop, animal, and plant insurance
M19	Mutual funds for adverse climatic events, animal and plant diseases, pest infestations and environmental incidents	**article 38**	Mutual funds for adverse climatic events, animal and plant diseases, pest infestations and environmental incidents
		article 39	Income stabilisation tool
		article 40	Financing of complementary national direct payments for Croatia
		article 41	Rules on the implementation of the measures
		article 42	LEADER local action groups
		article 43	LEADER start-up kit
		article 44	LEADER co-operation activities
		article 45	Investments
		article 46	Investments in irrigation
		article 47	Rules for area related payments
		article 48	Revision clause
		article 49	Selection of operations
		article 50	Rural area definition
		article 51	Funding technical assistance
		article 52	European network for rural development
		article 53	European Innovation Partnership network
		article 54	National rural network

Table 14. Summary of selected measures to promote agroforestry by countries within the Rural Development Programme (2014-2020)

Measure code and name, and associated article	Name of sub-measure
1: Knowledge transfer and information actions	1.1 - Support for vocational training and skill acquisition actions
	1.2 - Support for demonstration activities and information actions
2. Advisory services, farm management and farm relief services	2.1 - Support to help benefiting from the use of advisory services
	2.3 - Support for training of advisors
4. Investment in physical assets	4.1 - Support for investments in agricultural holdings
	4.2 - Support for investments in processing/marketing and/or development of agricultural products
	4.3 - Support for investments in infrastructure related to development, modernisation or adaptation of agriculture and forestry
	4.4 - Support for non-productive investments linked to the achievement of agri-environment-climate
5. Restoring agricultural production potential…and introduction of prevention actions	5.1 - Support for investments in preventive actions aimed at reducing the consequences of probable natural disasters, adverse climatic events and catastrophic events
6. Farm and business Development	6.1 - Business start up aid for young farmers
	6.3 - Business start-up aid for development of small farms
7. Basic services and village renewal in rural areas	7.4 - Support for investments in the setting-up, improvement or expansion of local basic services for the rural population including leisure and culture, and the related infrastructure
	7.6 - Support for studies/investments associated with the maintenance, restoration and upgrading of the cultural and natural heritage of villages, rural landscapes and high nature value sites including related socio-economic aspects, as well as environmental awareness actions
8. Investments in forest area development and improvements of the viability of forests	8.1 - Support for afforestation/creation of woodland
	8.2 - Support for establishment and maintenance of agroforestry systems
	8.3 - Support for prevention of damage to forests from forest fires and natural disasters and catastrophic events
	8.4 - Support for restoration of damage to forests from forest fires and natural disasters and catastrophic events
	8.5 - Support for investments improving the resilience and environmental value of forest ecosystems
	8.6 - Support for investments in forestry technologies and in processing, mobilising and marketing of forest products
9. Setting up of producer groups and organisations	9.1 – Setting up of producer groups and organisations in the agriculture and forestry sectors
10. Agri-environment climate	10.1 - Payment for agri-environment-climate commitments
11. Organic farming	11.1 - Payment to convert to organic farming practices and methods
	11.2 - Payment to maintain organic farming practices and methods
12. Natura 2000 and Water Framework Directive Payments	12.1 - Compensatory payments for the arable land in NATURA 2000
13. Payments to areas facing natural or other specific constraints	13.2 – Compensation payment for other areas facing significant constraints
15. Forest-environmental and climate services and forest conservation	15.1 - Payment for forest -environmental and climate commitments
16. Co-operation	16.5 - Support for joint action undertaken with a view to mitigating or adapting to climate change, and for joint approaches to environmental projects and ongoing environmental practices

5.4 Pillar II: Promotion of agroforestry practices

5.4.1 Forest farming

Forest farming includes agricultural activities linked to woodland or forestland such as the production of mushrooms, medicinal and aromatic plants, and honey. The analysis of the Rural Development Programs suggests that honey production is the principal forest farming activity supported through the 2007-2013 (Table 15) and 2014-2020 RDP (Table 16). However understorey production activities such as mushroom have also been encouraged (Table 17 and Table 18).

Apiculture (the maintenance of honey bee colonies) may or may not be linked to agroforestry, depending on the use or not of woody vegetation by bees, but, as highlighted by Nieto et al. (2014) the use of woody vegetation can maintain bee activity and pollination for longer periods than systems without woody vegetation. For this reason, apiculture is included in this report. Europe is the second largest producer of honey in the world, with almost 14 million hives. This activity is promoted across Europe by (a) National Apiculture Programs and by the (b) RDPs. National Programs are 50% financed by the European Commission through a specific budget. They should be established every three years and include technical assistance, control of varroasis, rationalization of transhumance, management of the restocking of hives in the Community, cooperation on research programs on beekeeping and apiculture products with a view to improve production conditions and marketing (Council Regulation 1234/2007 repealed by 1308/2013). They are funded through the European Agricultural Guarantee Fund (EAGF), which also funds CAP (Figure 16).

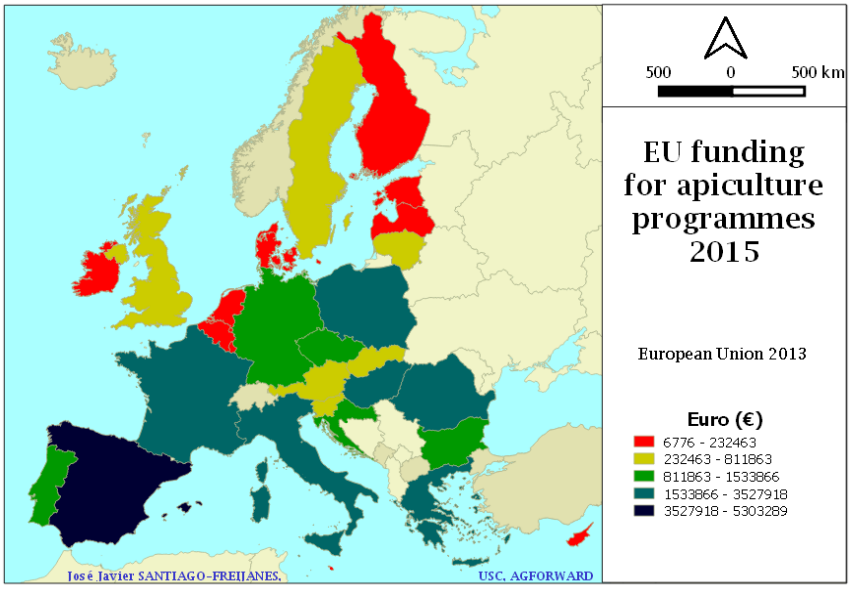


Figure 16. EU Fund allocation within the RDP for national apiculture programs in 2015

The number of measures related to apiculture per RDP ranges from zero to three (Figure 17), with countries in Eastern and Southern Europe most likely to adopt a measure. Spain, Romania, Poland and Sweden were some of the regions adopting the most measures in 2007-2013.

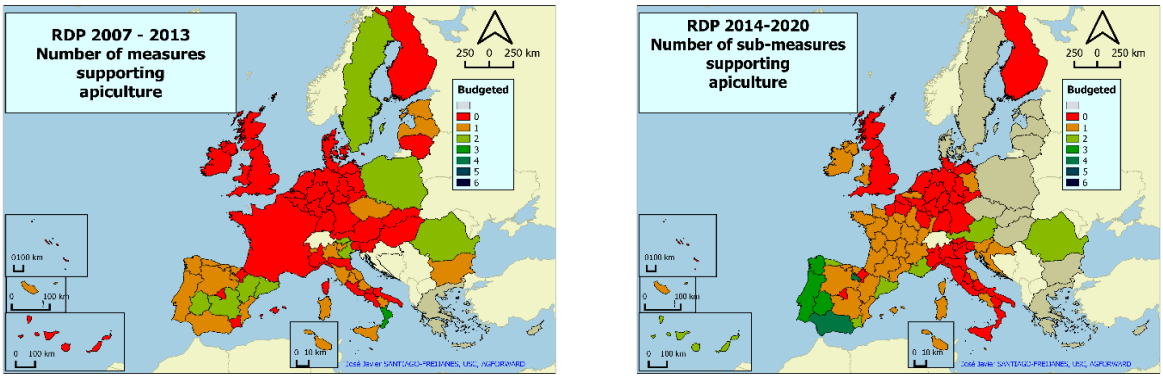


Figure 17. Number of measures in RDP 2007-2013 and 2014-2020 supporting apiculture

In 2007-2013, apiculture was promoted under Axis 1 within eight different measures (Table 15), the most popular being Measure 121 (farm modernization). In Axis 2, the most popular measure to enhance apiculture was 214 (agri-environmental payments) in 17 RDPs, followed by the measures 215 (animal welfare payments) and 216 (support for non-productive investments). Axis 3 was only activated by Lombardy with the measure 323 (conservation and upgrading of the rural heritage).

In 2007-2013, apiculture was promoted in 36 out of 88 regions of Europe (41%), with Measure 121 (mainly linked to modernization in Italy) and 214 (being apiculture connected to organic farming and biodiversity maintenance in Spain) used by 80% of the RDP funding for apiculture. Apiculture RDP measures were always connected to EU-National programs to avoid double funding for the same activity. Measure 121 mainly encouraged processing, and marketing activities which can be linked with supporting agroforestry practices though the promotion of forest, but also purchase of hives. In some areas like Portugal, Measure 121 was used to enhance other forest farming activities (mushroom) together with Measure 122 (improving the economic value of forests).

In 2014-2020, there is a greater connection of Rural Development with forest farming with measures adopted in 48 RDPs. Again one of the most used apiculture promotion measure is the agri-environment measure (10.1) included in 34 RDPs out of 90 (Table 16). As beekeeping helps enhance biodiversity, some RDPs, like Northern Ireland, support the creation of pollinator margins. This is a key aspect because flowering is lengthened if woody vegetation is included (Nieto et al. 2014). The rest of the measures includes knowledge transfer (Measure 1) about beekeeping practices, purchase of infrastructures (Measure 4), improvement of farm (Measure 6) and promotion and maintenance of apiculture (Measure 11), as well as Measures 2 (advisory services) and 8 (forest area development).

Table 15. Apiculture measures linked to Rural Development Programs in the period 2007-2013. Measures indicated in green for a specific region or country were promoted.

RDP	Country	Measure related to apiculture											
		111	112	114	121	122	123	132	133	214	215	216	323
BG	Bulgaria									■			
CZ	Česká Republika		■										
EE	Eesti				■								
ES11	Galicia									■			
ES12	Asturias									■			
ES13	Cantabria									■			
ES21	Euskadi									■			
ES23	La Rioja									■			
ES24	Aragón				■					■			
ES41	Castilla y León									■			
ES42	Castilla-La Mancha				■					■			
ES43	Extremadura				■					■			
ES51	Catalunya									■	■		
ES52	València									■			
ES61	Andalucía									■			
FI2	Åland				■								
ITC2	Valle d'Aosta									■			
ITC4	Lombardia												■
ITF1	Abruzzo				■								
ITF5	Basilicata						■						
ITF6	Calabria	■		■	■								
ITG1	Sicilia				■								
ITG2	Sardegna				■								
ITH1	Bolzano/Bozen							■	■				
ITH2	Trento				■								
ITH3	Veneto	■			■								
ITI1	Toscana				■								
ITI2	Umbria				■								
ITI3	Marche				■								
LV	Latvija									■			
MT	Malta									■			
PL	Poland				■		■						
PT1	Continente					■							
PT3	Madeira					■							
RO	România				■		■						
SE	Sverige									■		■	

Table 16. Apiculture measures linked to Rural Development Programmes in the period 2014-2020. Measures indicated in green for a specific region or country are budgeted.

RDP	Country or region	Measure related to apiculture									
		1.2	2.1	4.1	4.2	6.1	6.3	8.6	10.1	11.1	11.2
AT	Österreich			■							■
BE2	Vlaams								■		
DE3_4	Berlin und Brandenburg			■							
ES11	Galicia								■	■	■
ES12	Asturias									■	■
ES13	Cantabria									■	
ES21	Euskadi								■		
ES23	La Rioja							■	■	■	■
ES24	Aragón								■		
ES41	Castilla y León								■		
ES42	Castilla-La Mancha								■		
ES43	Extremadura								■	■	■
ES51	Catalunya								■	■	
ES52	València							■			
ES53	Illes Balears	■									
ES61	Andalucía							■	■	■	■
ES62	Murcia			■					■		
ES70	Canarias								■	■	
FR10	Ile-de-France								■		
FR21	Champagne-Ardennes								■		
FR24	Centre-Val de Loire								■		
FR25	Basse-Normandie								■		
FR26	Bourgogne								■		
FR42	Alsace								■		
FR43	Franche-Comte								■		
FR51	Pays de La Loire								■		
FR52	Bretagne								■		
FR53	Poitou-Charentes								■		
FR61	Aquitaine								■		
FR62	Midi-Pyrénées								■		
FR63	Limousin								■		
FR71	Rhône-Alpes								■		
FR72	Auverne								■		
FR81	Languedoc-Roussillon								■		
FR82	Provence-Alpes-Cote Azur					■			■		
FR83	Corse								■		
HR	Hrvatska				■						
IE	Ireland								■		
ITF3	Campania			■							
ITG2	Sardegna			■							
ITI3	Marche			■							
MT	Malta								■		
PT1	Continente				■			■	■		
PT3	Madeira							■			
RO	Romenia					■	■				
SI	Slovenija			■							
UKL	Wales		■								
UKN	Northern Ireland								■		

While apiculture is the main forest farming activity addressed in the RDP of 2007-2013 and 2014-2020, there has been support for other forest farming activities. The evaluation of the possible promotion of forest farming activities linked to aromatic plants, medicinal and even mushrooms as agricultural products delivered from woodlands and forestlands is not easily identified as sometimes they are linked to intensive (greenhouse) practices that are not distinguished from real forest farming activities. However the promotion of these activities as agroforestry is possible.

In 2007-2013, measures supporting forest farming activities excluding apiculture were only linked to Axes 1 and 2 (Table 17). In Axis 1, Measure 121 (which is connected to transformation) included truffle cultivation as eligible in Estonia, Italy (Abruzzo and Sardegna) and in Spain (Castilla-La Mancha). Measure 122 was the most widely-adopted measure promoting forest farming and could be used to encourage the exploitation of non-timber forest products. Italy (Toscana and Umbria), Estonia and Romania also used Measure 123 to promote processing and marketing of non-timber forest products. In Axis 2, measure 221 was used to promote the use of inoculated trees to produce mushrooms in agricultural lands in Abruzzo (Italy) and the Basque Country (Spain), while in Abruzzo and Molise-Italy this activity was enhanced in non-agricultural land with Measure 223. Measure 227, implemented in Spain (Andalucía), deals with the control of hunting intensity related to truffles.

Table 17. Forest farming measures (excluding apiculture) linked to Rural Development Programs in the period 2007-2013. Measures indicated in green for a specific region or country were promoted.

RDP	Country or region	Measure related to forest farming					
		121	122	123	221	223	227
DEG	Thüringen			■			
EE	Eesti	■		■			
ES11	Galicia		■				
ES21	Euskadi				■		
ES22	Navarra		■				
ES42	Castilla-La Mancha	■					
ES61	Andalucía						■
ITF1	Abruzzo	■			■	■	
ITF2	Molise					■	
ITF5	Basilicata			■			
ITG2	Sardegna	■					
ITI1	Toscana		■	■			
ITI2	Umbria		■	■			
PT1	Continente		■				
PT3	Madeira		■				
RO	România		■	■			

In 2014-2020, Measure 4 deals with investments employed to increase the production of agrarian products in forests (wild mushrooms in agroforestry but also cork, pine cone and pine nuts usually linked to grazing). Measure 8 deals with the promotion of mycorrhizal-innoculated plants to produce mushrooms, or activities like enhancing processing, mobilising and marketing of forest products in order to increase the value of non-timber forest products. Measure 9 enhances the cooperation among farmers to improve the production of mushrooms, truffles, wild fruits and plants (Table 18).

Andalucía in Spain is also using Measure 1 for knowledge transfer and Wales is promoting Measure 2 to support specific projects to protect game birds.

Table 18. Forest farming measures (excluding apiculture) linked to Rural Development Programmes in the period 2014-2020. Measures indicated in green for a specific region or country are budgeted.

RDP	Country or region	Measure related to forest farming							
		1.2	2.1	4.1	4.2	4.4	8.1	8.6	9.1
ES61	Andalucía	■						■	
HR	Hrvatska				■			■	
ES23	La Rioja							■	
ES42	Castilla-La Mancha								■
ES43	Extremadura							■	
ES52	València							■	
ITF1	Abruzzo							■	
ITF3	Campania			■					
ITG2	Sardegna							■	
ITH2	Trento					■			
ITH5	Emilia-Romagna							■	
ITI1	Toscana							■	
ITI2	Umbria							■	
ITI3	Marche						■		
PT1	Continente							■	
PT3	Madeira							■	
UKL	Wales		■						

In terms of forest farming, there are no clear statistics about the extent of such agroforestry practices nor clear links of the policy promotion of these activities through specific measures. Apiculture is the most obviously supported forest farming activity; it was mainly promoted by Measures 121 and 214 in 2007-2013 and is being promoted by sub-measure 10.1 in 2014-2020. Most of measures supporting forest farming excluding apiculture activity are those related to processing and marketing to add value to agroforestry products from forests but also to use inoculated trees in forestlands to enhance mushrooms production. The key measures were 122 and 123 in 2007-2013 and sub-measure 8.6 in 2014-2020 related with the investments in forest area development and improvement of the viability of forests.

5.4.2 Silvoarable

Silvoarable practices can be enhanced by measures linked to the promotion of "forest strips and small stands", "isolated trees" and "hedgerows" on arable land. The current extent of these landscape features can be seen in sections 4.1.1. and 4.2.2 of this report. In a similar way, silvopastoral practices can be promoted by the same measures on grassland. Moreover, the land use of a plot may vary in a rotational way, so that the same land can be classified as arable land one year and as pastureland in five years, while the persistence of the woody component as part of the plot does not vary at all.

5.4.2.1 Forest strips and small stands

In 2007-2013, forest strips and small stands were only promoted in 39 RDPs (Table 19), with a wide range of measures being used in Italy. Measure 214 was the most widely adopted measure to promote forest strips and small stands (in 22 RDPs), followed by Measure 216 (in 17 RDPs). In total 79% of the RDPs used these two measures to promote this activity during 2007-2013. Measure 214 was concerned with maintenance of these features in most of the RDPs, while Measure 216 usually supported establishment.

During 2007-2013, support for forest strips and small stands was also linked to Measure 126 (restoring agricultural production potential damaged by natural disasters and introducing appropriate prevention actions) as a means of flood control using copses as protection plantations against soil losses (Berlin und Brandenburg RDP) (Table 19). In addition, the Azores Islands (Portugal) used Measure 227 (support for non-productive investments) for establishing and improving this activity. Measure 323 (conservation and upgrading of the rural heritage) was used to promote the restoration of copses and other landscape elements. Measure 225 was used to maintain and preserve small stands in the Basque Country and Portugal (Continental) while Measures 221, 222 and 223 are related to the plantations of forestry including small stands.

During the period 2014-2020 (Table 20), forest strips and small stands measures are being promoted by 52 RDPs out of the 90 RDPs analyzed, including 19 regions in France. Around 80% of the promotion of these activities is linked to RDP Measures 4 and 10. Measure 4 intends to enhance the maintenance and restoration of the grove networking through sub-measure 4.4 (support for non-productive investments linked to the achievement of agri-environment-climate objectives), while Measure 10 through the sub-measure 10.1 (payment for agri-environment-climate commitments) intends to promote the conservation and management of copses. Establishment and improvement of copses are promoted in Portugal through sub-measure 7.4 as well as in Austria, three German RDPs and 4 French RDPs through sub-measure 7.6. All German RDPs together with Alsace in France also included conservation as part of sub-measure 7.6, while in Sicily conservation was included through sub-measure 12.1 (Table 20). Similar activities are enhanced through sub-measure 8.5 (support for investments improving the resilience and environmental value of forest ecosystems) to restore forest strips, sub-measure 8.6 (support for investments in forestry technologies and in processing, mobilising and marketing of forest products) and sub-measure 15.1 (payment for forest-environmental and climate commitments) to enhance diversification by copses promotion. Wallonia is using measure 13.2 to maintain group of trees to conserve traditional landscapes, while Trento in Italy is using sub-measure 16.5 to develop, manage and recover elements like small stands to favour functional landscape.

Table 19. Forest strips and small stand measures linked to Rural Development Programs in the period 2007-2013. Measures indicated in green for a specific region or country were promoted.

RDP	Country or region	Measure related to forest strips and small stands								
		126	214	216	221	222	223	225	227	323
AT	Österreich									■
BE2	Vlaams		■							
BE3	Wallonie		■							
DE2	Bayern			■						■
DE3_4	Berlin und Brandenburg	■								
DE8	Mecklenburg-Vorpommern		■							
DED	Sachsen									■
DEG	Thüringen		■							
EE	Eesti				■					
ES21	Euskadi							■		
ES22	Navarra		■							
ES61	Andalucía			■						
ES62	Murcia			■						
FI1	Mainland		■							
FR00	Hexagone									■
ITC1	Piemonte		■	■						
ITC3	Liguria		■							
ITF1	Abruzzo			■						
ITF2	Molise			■						
ITF3	Campania			■						
ITF4	Puglia			■						
ITF5	Basilicata		■	■						
ITF6	Calabria		■	■						
ITG1	Sicilia			■		■				
ITG2	Sardegna		■							
ITH2	Trento		■							
ITH3	Veneto		■	■						
ITH4	Friuli-Venezia Giulia		■	■						
ITH5	Emilia-Romagna		■	■						
ITI1	Toscana		■		■		■			
ITI2	Umbria		■	■						
ITI3	Marche			■		■				
ITI4	Lazio		■	■						
LU	Luxembourg		■							■
NL	Nederland		■							
PT1	Continente							■		
PT2	Açores								■	
UKL	Wales		■							
UKN	Northern Ireland		■							

Table 20. Forest strips and small stand measures adopted in 2014-2020 Rural Development Programs. Measures indicated in green for specific regions or countries were measures are budgeted.

RDP	Country or region	Measure related to forest strips and small stands										
		4.4	7.4	7.6	8.2	8.5	8.6	10.1	12.1	13.2	15.1	16.5
AT	Österreich			■								
BE2	Vlaams							■				
BE3	Wallonie							■		■		
DE1	Baden-Wurttemberg	■						■				
DE2	Bayern	■										
DE3_4	Berlin und Brandenburg			■								
DE5_9	Bremen und Niedersachsen			■				■				
DEB	Rheinland-Pfalz			■								
DEE	Sachsen-Anhalt	■										
DEG	Thuringia							■				
ES42	Castilla-La Mancha							■				
FR10	Ile-de-France	■		■				■				
FR21	Champagn-Ardennes							■				
FR22	Picardie							■				
FR23	Haute Normandie							■				
FR24	Centre-Val de Loire							■				
FR25	Basse-Normandie	■		■				■				
FR26	Bourgogne	■						■				
FR30	Nord-Pas-de-Calais							■				
FR41	Lorraine			■				■				
FR42	Alsace			■				■				
FR43	Franche-Comte							■				
FR51	Pays de La Loire	■						■				
FR53	Poitou-Charentes							■				
FR62	Midi-Pyrénées							■				
FR63	Limousin							■				
FR71	Rhône-Alpes							■				
FR72	Auverne							■				
FR81	Languedoc-Roussillon							■				
FR82	Provence-Alpes-Cote Azur							■				
IE	Ireland	■						■				
ITC1	Piemonte	■						■				
ITC3	Liguria	■										
ITF1	Abruzzo	■										
ITF2	Molise	■						■				
ITF3	Campania	■						■				
ITF6	Calabria	■										
ITG1	Sicilia	■							■			
ITG2	Sardegna										■	
ITH1	Bolzano/Bozen					■						
ITH2	Trento											■
ITH3	Veneto	■						■				
ITH4	Friuli-Venezia-Giulia							■				
ITH5	Emilia-Romagna	■						■				
ITI1	Toscana					■						
ITI2	Umbria	■				■	■				■	
ITI4	Lazio					■						
PT1	Continente		■		■							
PT3	Madeira					■						
UK0	England	■						■				
UKL	Wales	■										
UKM	Scotland							■				

Figure 18 shows the number of measures linked to the promotion of forest strips and small stands in the RDPs of 2007-2013 and 2014-2020. The number of regions including these measures increased from 2007-2013 to 2014-2020, particularly in central Europe. Forest strips and small stands are promoted through the maintenance (mostly through Measures 214 and 10.1) and establishment (mainly through Measures 216 and 4.4) in Europe thanks to the recognition they have to increase farming systems resilience (i.e. floods, erosion) and preserve and enhance biodiversity (Table 20).

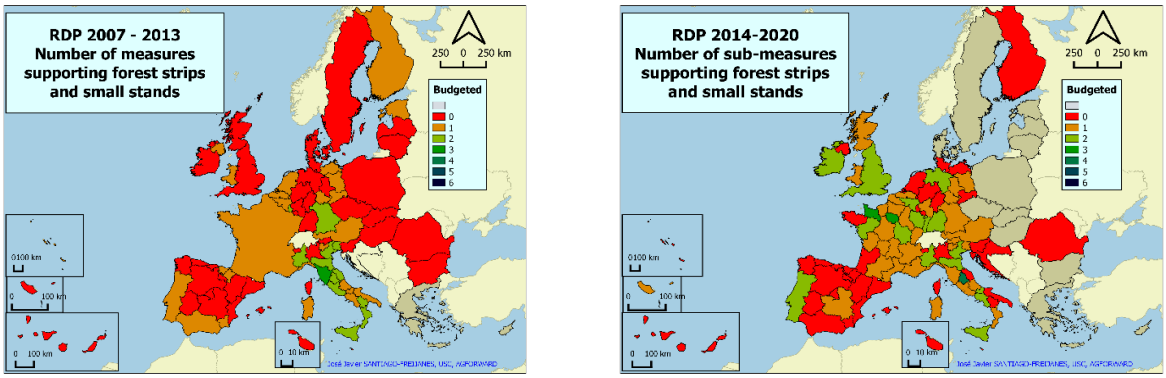


Figure 18. Number of measures promoting the introduction or maintenance of forest strips and small stands

5.4.2.2 Hedgerows

During 2007-2013, hedgerows were promoted through the RDP (Table 21). Hedgerows were enhanced by 13 measures with two in the Axis 1, six in the Axis 2, four in Axis 3 and one in Axis 4. Again, Measure 214 (39 RDPs) and 216 (30 RDPs) were used by 80% of RDPs to promote agroforestry through hedgerow enhancement. As happened with the forest strips and small stands, Measure 214 was mainly related with maintenance while Measure 216 was usually linked to establishment. The main aims of the promotion of the hedgerows were usually linked to the enhancement of their ecosystem services. For example, Measure 121 (modernization of agricultural holdings) was used to plant vegetation structures in sensitive areas in France and to protect water and recover landscape in Sardinia. Measure 213 guaranteed Natura 2000 payments and payments linked to Directive 2000/60/EC that in some RDP required commitments to prohibit the elimination of existing hedgerows, while the RDP of Marche (Italy) included payments for the creation of hedgerow as a means of bird conservation.

Table 21. Hedgerow measures linked to Rural Development Programmes in the period 2007-2013

RDP	Country or region	Measure related to hedgerows												
		121	122	213	214	216	221	222	227	311	312	322	323	412
AT	Österreich												■	
BE2	Vlaams				■									
BE3	Wallonie				■									
CZ	Česká Republika				■									
DE1	Baden- Württemberg												■	
DE2	Bayern				■	■							■	
DE3_4	Berlin und Brandenburg												■	
DE5_9	Bremen und Niedersachsen												■	
DE6	Hamburg					■								
DE7	Hessen				■									
DE8	Mecklenburg- Vorpommern				■								■	
DEA	Nordrhein- Westfalen				■									
DED	Sachsen												■	
DEF	Schleswig- Holstein and Hamburg												■	
DEG	Thüringen				■									
DK	Danmark					■						■		
EE	Eesti					■								
ES11	Galicia					■								
ES21	Euskadi				■									
ES23	La Rioja													■
ES24	Aragón				■									
ES41	Castilla y León				■									
ES43	Extremadura					■								
ES52	València				■									
ES53	Illes Balears								■					
ES61	Andalucía					■			■					
ES62	Murcia					■								
ES70	Canarias				■									
FR00	Hexagone	■			■	■							■	
FR83	Corse				■									
HU	Magyarország					■								
IE	Ireland				■	■								
ITC1	Piemonte				■	■								
ITC2	Valle d'Aosta			■										
ITC3	Liguria					■								
ITC4	Lombardia				■	■					■			
ITF1	Abruzzo					■								
ITF2	Molise				■	■								
ITF3	Campania					■								
ITF4	Puglia					■	■							
ITF5	Basilicata				■	■								
ITG1	Sicilia				■	■		■					■	
ITG2	Sardegna	■			■									
ITH1	Bolzano/Bozen				■								■	
ITH2	Trento				■									
ITH3	Veneto				■	■			■					
ITH4	Friuli-Venezia Giulia				■	■								
ITH5	Emilia-Romagna				■	■								
ITI1	Toscana				■	■			■					
ITI2	Umbria				■	■								
ITI3	Marche			■	■	■		■		■				
ITI4	Lazio			■										
LT	Lietuva				■									
LU	Luxembourg				■								■	
NL	Nederland				■									
PT1	Continente					■								
PT2	Açores				■								■	
PT3	Madeira		■											
RO	România						■							
SI	Slovenija				■									
UK0	England				■	■								
UKL	Wales				■	■								
UKM	Scotland				■									
UKN	Northern Ireland				■	■								

Hedgerows, linked in some cases to water courses, are promoted in different RDPs with different measures related to riparian buffer strips. The establishment of wooded hedges was explicitly eligible by using Measure 221 in Romania and Puglia (Italy), provided they were at least 20 m wide and identified as forest belts. In Italy, Sicily and Marche allowed hedgerows explicitly as eligible for Measure 222. Some RDPs (4) included hedgerow improvement within the support of non-productive investments (Measure 227). Hedgerows were also seen as a way to improve the economic value of forests, like in the RDP of Madeira (Portugal), which used Measure 122 to promote the installation of discontinuous elements (including hedgerows). Rural activity diversification and infrastructure purchase, including hedgerows promotion, were also promoted in Axis 3. The RDP of Marche promoted the inclusion of hedgerows in open spaces neighbouring properties used for farm tourism through the Measure 311 (diversification into non-agricultural activities). With Measure 312 (support for the creation and development of micro-enterprises), Lombardia (Italy) supported, among other activities, the adaptation, construction and the purchase of equipment and machinery needed for the "implementation of hedgerow pruning". Denmark used Measure 322 (village renewal and development) to promote hedgerows.

Thirteen RDPs used Measure 323 (Conservation and upgrading of the rural heritage) to promote hedgerows (Table 21), almost always supporting restoration or improvement, but in some cases, such as in the French RDPs, included the creation in the support. La Rioja (Spain) used measure 412 (Local development strategies and Environment / land management) of Axis 4 to promote hedgerows, by funding non-productive investments such as the recovery of hedgerows and borders among farms.

Within the 2014-2020 RDP, 75 RDPs promoted hedgerows (Table 22), with about 93% using Measures 10.1 and 4.4 (in a similar way to the support for forest strips and small stands). Measure 10.1 (agri-environment) is being used in 70% of the RDPs evaluated to promote the maintenance and conservation of hedgerows. Northern Ireland presents five operations within Measure 10.1 for the creation and restoration of hedgerows, but not conservation. Regions are also using Measure 4.4 (investments in physical assets) to supporting non-productive investments linked to the achievement of agri-environment-climate objectives to plant and/or restore, but Toscana (Italy) describes a second operation to promote the conservation. Bretagne (France) also uses sub-measure 4.3 (support for investments in infrastructure related to development, modernisation or adaptation of agriculture and forestry) sub-measure to improve existing hedgerows. Training to evaluate hedgerows is linked to sub-measure 1.1 while demonstration activities and information actions are enhanced by sub-measure 1.2 in Basse-Normadie. Advisory services are targeted in Basse-Normandie to evaluate hedgerows as an item with two operations from the sub-measures 2.1 (support to help benefiting from the use of advisory services) and 2.3 (support for training of advisors).

Table 22 (part 1). Hedgerow measures linked to Rural Development Programs in the period 2014-2020. Measures indicated in green show specific regions or countries where measures are budgeted.

RDP	Country or region	Measure related to hedgerows																
		1.1	1.2	2.1	2.3	4.3	4.4	5.1	7.4	7.6	8.2	8.5	10.1	11.1	11.2	12.1	13.2	16.5
BE2	Vlaams						■						■					
BE3	Wallonie												■				■	
DE1	Baden-Wurttemberg						■						■					
DE2	Bayern						■											
DE3_4	Berlin und Brandenburg									■								
DE5_9	Bremen und Niedersachsen						■			■			■					
DE8	Mecklenburg-Vorpommern						■											
DEA	North Rhine-Westphalia												■					
DEB	Rheinland-Pfalz									■								
DEE	Sachsen-Anhalt						■											
DEG	Thuringia												■					
ES11	Galicia						■											
ES12	Asturias						■											
ES21	Euskadi												■					
ES22	Navarra											■						
ES41	Castilla y León												■					
ES42	Castilla-La Mancha												■					
ES43	Extremadura						■											
ES51	Catalunya												■					
ES61	Andalucía						■					■	■					
ES62	Murcia						■											
ES70	Canarias												■					
FI1	Mainland												■					
FR10	Ile-de-France						■			■			■					
FR21	Champagne-Ardennes												■					
FR22	Picardie												■					
FR23	Haute Normandie												■					
FR24	Centre - Val de Loire												■					
FR25	Basse-Normandie	■	■	■	■					■			■					
FR26	Bourgogne						■						■					
FR30	Nord-Pas-de-Calais												■					
FR41	Lorraine									■			■					
FR42	Alsace						■			■			■					
FR43	Franche-Comte												■					
FR51	Pays de La Loire						■						■					
FR52	Bretagne					■	■						■					
FR53	Poitou-Charentes												■					
FR61	Aquitaine												■					
FR62	Midi-Pyrénées												■					
FR63	Limousin												■					
FR71	Rhône-Alpes						■						■					
FR72	Auverne						■						■			■		
FR81	Languedoc-Roussillon												■					
FR82	Provence-Alpes-Cote Azur												■					
FR83	Corse												■					
HR	Hrvatska						■											
IE	Ireland						■						■					
ITC1	Piemonte						■						■					
ITC3	Liguria						■											
ITC4	Lombardia						■						■					
ITF1	Abruzzo						■											
ITF2	Molise						■						■	■	■			
ITF3	Campania						■						■					
ITF4	Puglia						■											
ITF5	Basilicata						■						■					
ITF6	Calabria						■											

Table 22 continued. Hedgerow measures linked to Rural Development Programs in the period 2014-2020. Measures indicated in green for a specific region or country are budgeted

RDP	Hedgerows	1.1	1.2	2.1	2.3	4.3	4.4	5.1	7.4	7.6	8.2	8.5	10.1	11.1	11.2	12.1	13.2	16.5
ITG1	Sicilia																	
ITH1	Bolzano/Bozen																	
ITH2	Trento																	
ITH3	Veneto																	
ITH4	Friuli-Venezia-Giulia																	
ITH5	Emilia-Romagna																	
ITI1	Toscana																	
ITI2	Umbria																	
ITI3	Marche																	
ITI4	Lazio																	
MT	Malta																	
PT1	Continente																	
PT2	Açores																	
PT3	Madeira																	
SI	Slovenija																	
UK0	England																	
UKL	Wales																	
UKM	Scotland																	
UKN	Northern Ireland																	

The Azores (Portugal) RDP is using sub-measure 5.1 to support investments in preventive actions aimed at reducing the consequences of probable natural disasters, adverse climatic events and catastrophic events with hedgerows, as well as to prevent natural disasters protecting crops from wind and rain and consolidate the soil to avoid erosion. This region also promotes the installation of shelterbelts of trees for pasture and animal protection as one of the eligible operations of the agroforestry measure (sub-measure 8.2). Sub-measure 7.4 also supports hedgerows in mainland Portugal, while by using the sub-measure 7.6 (support for studies/investments associated with the maintenance, restoration and upgrading of the cultural and natural heritage of villages, rural landscapes and high nature value sites including related socioeconomic aspects, as well as environmental) the creation and enhancement of hedgerows is promoted in seven RDPs (three from Germany, and four from France). Three RDPs from Germany and Alsace also promote the conservation within the sub-measure 7.6. Through the sub-measure 8.5 (support for investments improving the resilience and environmental value of forest ecosystems), hedgerows are promoted in Navarra and Andalucía (Spain) and Madeira (Portugal).

Molise (Italy) includes hedgerows in the list of operations within organic farming (Measure 11), both for converting (11.1) and maintaining organic farming (11.2), while Friuli-Venezia-Giulia (Italy) pays for the obligation of "bands buffer maintenance" from Measure 12 (sub-measure 12.1: compensation payment for Natura 2000 agricultural areas). Sub-measure 12.1 is also employed in Auverne (France) for promoting the hedgerows as a source of economic activity and biodiversity conservation, and in Sicily (Italy) to improve the retention of landscape features, including, where appropriate, hedges, ponds, ditches, trees in line, in group or isolated. Wallonia (Belgium) by Measure 13.2, aims at maintaining holdings with favourable agricultural activities and the environment required for the conservation of landscape features including hedgerows which are traditional in these areas. Finally, sub-measure 16.5 (support for joint action undertaken with a view to mitigating or adapting to climate change and for joint approaches to environmental projects and ongoing environmental practices) employed in Trento (Italy) supports the development,

management and recovery of functional articulation elements of agro-ecosystems such as hedgerows and other natural elements of the agricultural landscape.

Figure 19 shows the distribution of the number of measures and sub-measures supporting hedgerows in 2007-2013 and 2014-2020. Most of the countries have increased the number of sub-measures allocated to hedgerow promotion. The enhancement of the hedgerows is mostly linked to those areas where they are really relevant (e.g. France, UK and Denmark) and funded by several measures.

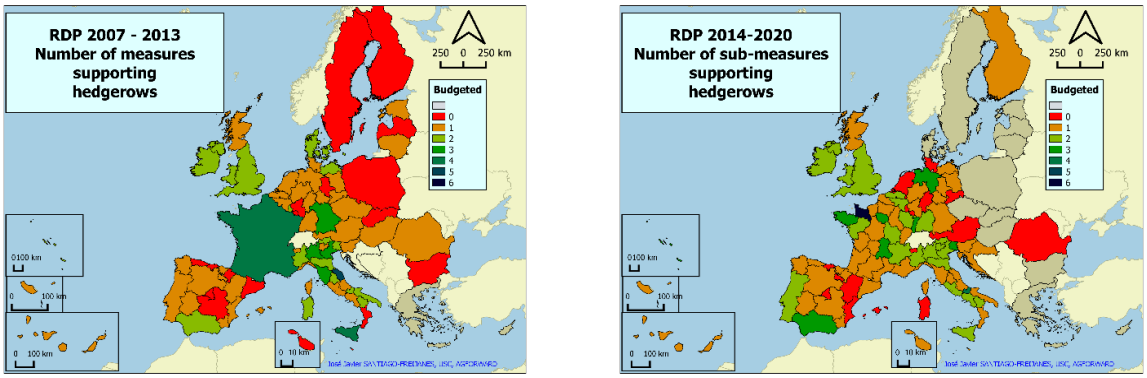


Figure 19. Number of measures promoting hedgerows in the 2007-2013 RDP and the 2014-2020 RDP

As with forest strips and small stands, activities related with the establishment, maintenance and management of hedgerows were mainly linked to Measures 214 and 216 of 2007-2013 RDP and with 4.4 and 10.1 in the 2014-2020 RDP. The recognition of the ecosystem services provided by the woody vegetation related with biodiversity promotion as well as resilience of the systems is highlighted when the hedgerows are considered.

5.4.2.3 Isolated trees

In 2007-2013, two RDP measures were employed in 86% of the countries that promoted isolated trees (Table 23): Measures 214 (20 RDPs) and 216 (12 RDPs). Measure 214 was used to preserve and maintain this landscape feature, while Measure 216 was oriented to the planting of trees. Italy, Sicily and Marche promoted planting of isolated trees with the agroforestry measure 222. Three RDPs included isolated tree management through the support for non-productive investments (Measure 227), while Toscana also report its use for plantation and enhancement. From Axis 3, only four RDPs used Measure 323 (conservation and upgrading of the rural heritage) to promote isolated trees mainly supporting the tree management and considering the cultural value of the trees.

Table 23. Isolated tree measures linked to Rural Development Programmes in the period 2007-2013. Specific regions or countries where measures were promoted are indicated in green.

RDP	Country or region	Measure related to isolated trees				
		214	216	222	227	323
AT	Österreich					■
BE3	Wallonie	■				
DE2	Bayern					■
DE6	Hamburg		■			
DE8	Mecklenburg- Vorpommern		■			
DEA	Nordrhein- Westfalen	■				
DED	Sachsen					■
ES13	Cantabria	■				
ES21	Euskadi	■				
ES23	La Rioja				■	
ES24	Aragón	■				■
ES43	Extremadura		■			
ES51	Catalunya	■	■			
ES53	Illes Balears	■			■	
ES61	Andalucía		■			
ES62	Murcia		■			
FI1	Mainland	■				
FR00	Hexagone	■	■			
FR83	Corse	■				
IE	Ireland		■			
ITC1	Piemonte	■	■			
ITG1	Sicilia		■	■		
ITG2	Sardegna	■				
ITH2	Trento	■				
ITH5	Emilia-Romagna	■				
ITI1	Toscana				■	
ITI2	Umbria	■	■			
ITI3	Marche			■		
ITI4	Lazio	■				
LU	Luxembourg	■				
PT1	Continente	■				
UK0	England	■				
UKL	Wales	■				
UKN	Northern Ireland		■			

Within the 2014-2020 RDPs (Table 24), over 90% of the analyzed RDPs (33) currently use Measure 10.1 (agri-environment) to promote isolated trees. Many of the RDPs are using sub-measure 10.1 to maintain isolated trees while Bremen und Niedersachse (Germany), Wales (UK) and Malta also aim to create such landscapes elements. In total, 37% of the RDPs selected sub-measure 4.4 to promote isolated trees. Sub-measure 7.6 (support for studies/investments associated with the maintenance, restoration and upgrading of the cultural and natural heritage of villages, rural landscapes and high nature value sites including related socioeconomic aspects, as well as environmental) is being used to support isolated trees in the Berlin und Brandenburg RDP (promotion of isolated trees) and four French RDPs (maintenance of isolated trees). On the other hand, Measure 12 is related with the maintenance of isolated trees in Champagne–Ardennes, Auverne and Lorraine (France) and Sicily,

through sub-measure 12.1 (compensation payment for Natura 2000 agricultural areas) while sub-measure 8.5 aims at enhancing and restoring isolated trees in Andalucia.

Table 24. Isolated tree measures linked to Rural Development Programmes in the period 2014-2020. Specific regions or countries where measures are budgeted are indicated in green.

RDP	Country or region	Measure related to isolated trees						
		4.4	7.6	8.5	10.1	12.1	13.2	16.5
BE3	Wallonie							
DE3_4	Berlin und Brandenburg							
DE5_9	Bremen und Niedersachsen							
DE8	Mecklenburg-Vorpommern							
ES42	Castilla-La Mancha							
ES51	Catalunya							
ES61	Andalucía							
ES70	Canarias							
FR10	Ile-de-France							
FR21	Champagne - Ardennes							
FR22	Picardie							
FR23	Haute Normandie							
FR24	Centre - Val de Loire							
FR25	Basse-Normandie							
FR26	Bourgogne							
FR30	Nord-Pas-de-Calais							
FR41	Lorraine							
FR42	Alsace							
FR43	Franche-Comte							
FR51	Pays de La Loire							
FR52	Bretagne							
FR53	Poitou-Charentes							
FR61	Aquitaine							
FR62	Midi-Pyrénées							
FR63	Limousin							
FR71	Rhône-Alpes							
FR72	Auverne							
FR81	Languedoc-Roussillon							
FR82	Provence-Alpes-Cote Azur							
ITC1	Piemonte							
ITC3	Liguria							
ITG1	Sicilia							
ITH1	Bolzano/Bozen							
ITH2	Trento							
ITH3	Veneto							
ITH5	Emilia-Romagna							
ITI2	Umbria							
ITI4	Lazio							
MT	Malta							
UK0	England							
UKL	Wales							
UKM	Scotland							
UKN	Northern Ireland							

Sub-measure 13.2 is used in Wallonia (Belgium) to maintain holdings with favourable agricultural activities and the environment required for the conservation of landscape features (individual trees) as traditional of these areas (Table 24). Finally, Trento (Italy) uses Measure 16 (cooperation) through sub-measure 16.5 (support for joint action undertaken with a view to mitigating or adapting to climate change and for joint approaches to environmental projects and ongoing environmental practices) to support development, management and recovery of functional articulation elements of agro ecosystems such as isolated trees plantation and other natural elements of the agricultural landscape.

Figure 20 shows the distribution of the number of measures and sub-measures supporting isolated trees in the RDP 2007-2013 and 2014-2020. Isolated trees are promoted in most of the RDP 2007-2013 of EU western countries, but not in eastern Europe. The number of regions promoting isolated trees increased from 2007-2013 to 2014-2020.

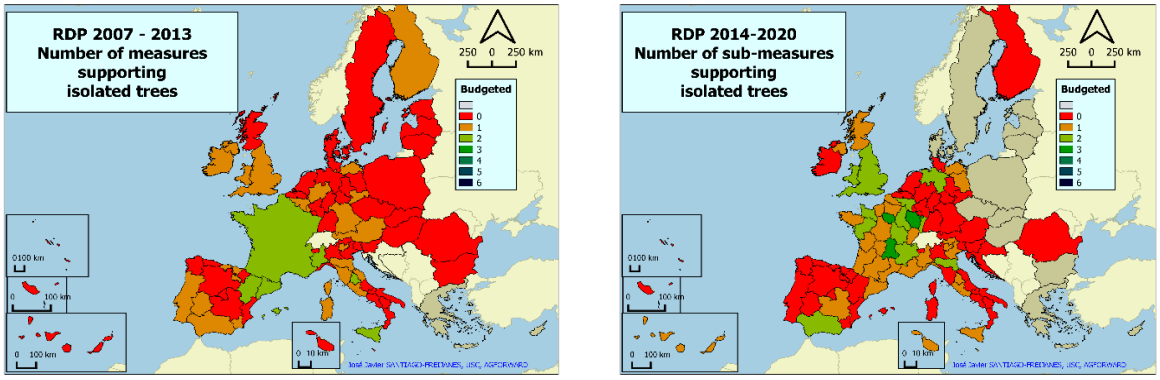


Figure 20. Number of measures promoting the introduction or maintenance isolated trees in the 2007-2013 RDP and the 2014-2020 RDP

In conclusion, isolated trees are mainly promoted through maintaining (Measure 214 and sub-measure 10.1) and establishing (Measure 216 and sub-measure 4.4) measures in the RDP 2007-2013 and 2014-2020, respectively. These measures recognize the cultural value of isolated trees. There are also a small number of RDPs directly promoted cropping under trees usually linked to the dehesa system. For example Measure 214 in the Castilla-La Mancha, Extremadura and Andalucía regions of Spain was used to enhance dehesa management and conservation and Measure 221 (first afforestation of agricultural land) was used in the Comunidad de Madrid region.

The promotion of forest strips and small stands, hedgerows, and isolated trees that are mainly linked to silvoarable agroforestry practices considers the ecosystem services (water protection, biodiversity) and resilience (climate change) they provide, so agroforestry practice benefits are recognized. Measure 214 (succeeded largely by sub-measure 10.1) was the most commonly adopted measure to maintain these practices while Measure 216 (currently linked to sub-measure 4.4) is usually related with establishment. However, other measures are used in selected regions due to the specific regional reasons for promoting these landscape features.

5.4.3 Silvopasture

Silvopasture activities are supported by measures in the 2007-2013 and 2014-2020 RDPs that address forest understory grazing and with pasture establishment or grazing under permanent crops (multipurpose or fruit trees). The current extent of silvopasture practice in Europe was reported in Section 2.3.1 of this report. However there are also some measures that support mountain pastoralism and such systems usually contain woody vegetation as part of their grazing systems.

5.4.3.1 Forest understory grazing

In 2007-2013, forest understory grazing was enhanced within Axis 2 of the RDP in measures linked to forestland (e.g. 225, 226 and 227) and agricultural land (e.g. 214 and 216). Forest understory grazing was promoted in 30% of the 2007-2013 RDPs (Table 25), with Measure 214 being the most commonly adopted. Measure 214 was employed to conserve and manage forestland in most of the RDPs where it was implemented, but also to enhance the establishment of forest grazing (e.g. in Puglia, Italy) and to restore and enhance areas using forest grazing (e.g. in mainland Portugal and Northern Ireland). Measure 216 was applied in Sweden, the Aland Islands, and Northern Ireland to promote restoration or establishment of forest understory grazing, while Measure 225 (forest-environment payments) was used to encourage both establishment and maintenance. There were three Spanish RDPs that employed measure 226 (restoring forestry potential and introducing prevention actions) to support enhancement of this agroforestry practice in forest lands. Measure 227 (Support for non-productive investments) was used in Denmark and Trento (Italy) to prepare areas for forest grazing, while Measures 225 and 323 were used to establish and manage forest grazing.

In the 2014-2020 RDP, the measures promoting forest grazing vary with country (Figure 21 and Table 26). For example, Spain is using sub-measure 8.3, while Italy and UK is using sub-measure 10.1 (agri-environment-climate sub-measure). Measure 8 can be used to promote forest understory grazing through different sub-measures. Aragon (Spain) includes the development and implementation of management silvopastoral plans, as well as the costs linked to afforestation (sub-measure 8.1: support for afforestation/creation of woodland) and restoration (sub-measure 8.4: support for restoration of damage to forests from forest fires and natural disasters and catastrophic events). In Veneto and Umbria (Italy) and mainland Portugal silvopastoral practices are eligible for funding from sub-measure 8.2 (support for establishment and maintenance of agroforestry systems). Thirteen RDPs (ten of them Spanish) support plans and works favouring grazing as preventive action against wildfires using sub-measure 8.3 (support for prevention of damage to forests from forest fires and natural disasters and catastrophic events). Lastly, Basilicata (Italy) and Scotland (UK) promote the maintenance of silvopasture by the sub-measure 8.5 to improve the resilience and environmental value of forest ecosystems. Agroforestry includes silvopasture practices, but because there is a specific measure to help prevent forest fires in forestlands through grazing, countries with a high prevalence of this risk select this activity in Measure 8.3 instead of Measure 8.2. However some countries are making use of sub-measures 10.1 and 4.3. For example, Italy uses sub-measure 10.1 for promoting silvopasture because the main aim is to introduce pasture to maintain soil cover and preserve organic matter. Sub-measure 10.1 is also used to establish pasture under trees in Corse (France), Liguria (Italy), and Wales (UK). Finally, sub-measure 4.3 (support for investments in infrastructure related to development, modernisation or adaptation of agriculture and forestry),

promotes the creation of infrastructures facilitating access and pasture production under trees in Castilla-La Mancha (Spain), and Lombardia (Italy).

Table 25. Forest understory grazing measures linked to Rural Development Programs in the period 2007-2013. Measures indicated in green are for specific regions or countries where the measures were promoted.

RDP	Country or region	Measure related to forest understory grazing					
		214	216	225	226	227	323
AT	Österreich			■			
DE1	Baden- Württemberg	■					
DE2	Bayern	■					
DE3_4	Berlin und Brandenburg	■					
DE5_9	Niedersachsen und Bremen						■
DE8	Mecklenburg- Vorpommern			■			
DEF	Schleswig- Holstein & Hamburg	■					
DK	Danmark			■		■	
ES24	Aragón				■		
ES43	Extremadura	■					
ES53	Illes Balears				■		
ES70	Canarias				■		
FI2	Åland	■	■				
FR00	Hexagone	■					
FR83	Corse	■					
ITF2	Molise	■					
ITF4	Puglia	■					
ITH1	Bolzano/Bozen	■					
ITH2	Trento					■	
ITI4	Lazio	■					
PT1	Continente	■		■			
SE	Sverige	■	■				
SI	Slovenija	■					
UK0	England	■					
UKL	Wales	■					
UKM	Scotland	■		■			
UKN	Northern Ireland	■	■				

Table 26. Forest understory grazing measures linked to Rural Development Programs in the period 2014-2020. Measures indicated in green are for specific regions or countries where the measures are budgeted.

RDP	Country or region	Measure related to forest understory grazing						
		4.3	8.1	8.2	8.3	8.4	8.5	10.1
ES11	Galicia				■			
ES12	Asturias				■			
ES22	Navarra				■			
ES24	Aragón		■		■	■		
ES30	Madrid				■			
ES41	Castilla y León				■			
ES42	Castilla-La Mancha	■						
ES51	Catalunya				■			
ES53	Illes Balears				■			
ES61	Andalucía				■			
ES62	Murcia				■			
FR42	Alsace							■
FR83	Corse							■
ITC3	Liguria							■
ITC4	Lombardia	■						
ITF5	Basilicata						■	
ITF6	Calabria				■			■
ITG1	Sicilia							■
ITG2	Sardegna							■
ITH1	Bolzano/Bozen							■
ITH3	Veneto			■				
ITI1	Toscana							■
ITI2	Umbria			■				
ITI4	Lazio							■
PT1	Continente			■	■			■
UK0	England							■
UKL	Wales							■
UKM	Scotland				■		■	■
UKN	Northern Ireland							■

Forest understory grazing is usually linked to the maintenance or establishment of pasture under forest or woodlands mainly through measure 214 in the previous RDP. Silvopasture is mainly related to 8.3 in Spanish regions to reduce fire risk and to 10.1 in areas like Italy to maintain or establish pasture under trees to maintain soil cover in most cases. Although measure 222 was not previously implemented to promote silvopasture practices, in the 2014-2020 it is currently being used to support forest grazing establishment. The geographical extent of the adoption of measures to support forest grazing is variable across Europe (Figure 21). In the 2014-2020 RDP, support for forest grazing was not yet been adopted in France or Germany, although there were options in the 2007-2013 RDP. By contrast, Spain has increased the number of regions activating this activity.

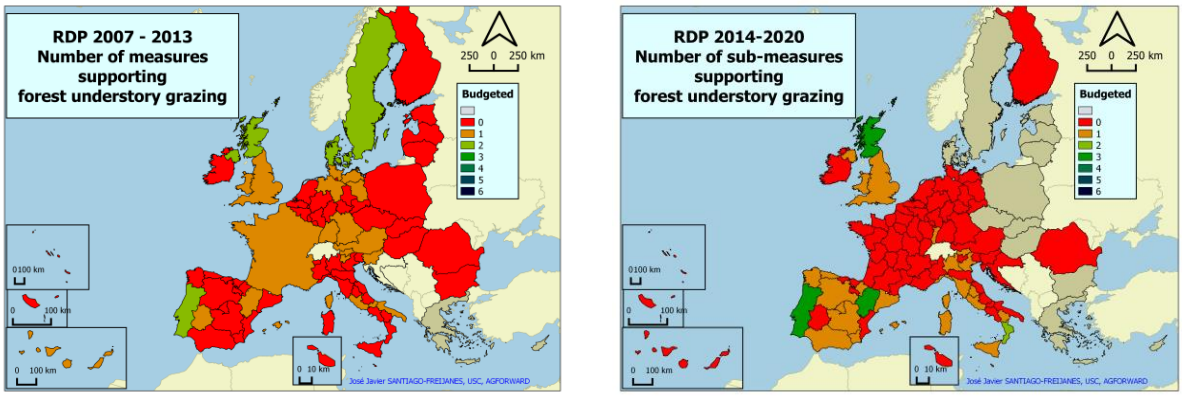


Figure 21. Number of measures promoting the introduction or maintenance forest understory grazing in the 2007-2013 RDP and the 2014-2020 RDP.

5.4.3.2 Silvopasture with permanent crops

Support for agroforestry with permanent crops is mainly linked to support for meadow orchards. During 2007-2013, meadow orchards were funded in 52% of the RDPs (Table 27), out of which 49% used Measure 214 to promote, on one hand, the creation (grass sowing, usually on slopes to combat erosion) and, on the other hand, the conservation and restoration of traditional orchards.

The other measures used in the 2007-2013 RDP to support meadow orchards were Measures 121, 216 and 323. Measure 121 (modernisation of agricultural holdings) enhanced both meadow orchards and other permanent cultures and Measure 216 dealt with the restoration of traditional orchards. In some cases, such as Murcia (Spain), Measure 216 promoted grass planting in orchards on sloping land. Finally, Measure 323 (conservation and upgrading of the rural heritage) promoted meadow orchards through the support of their management and conservation.

In 2014-2020, out of 90 RDPs evaluated, 56 RDPs and 96 operations have been adopted to support meadow orchards (Table 28). Out of them, sub-measure 10.1 (agri-environment-climate) is the most employed measure (similar to Measure 214 in 2007-2013) being used by 52 RDPs. Sub-measure 10.1 promotes meadow orchards with 76 operations. Most RDPs aim to conserve and maintain orchards and highlight the maintenance of a grass cover, at least in autumn and winter, to prevent soil erosion. The UK RDPs support the creation of grazing orchards under sub-measure 10.1.

Measure 4 supports meadow orchards in nine RDPs, through twelve operations. Andalucia (Spain), Slovenia, and Austria do so through the sub-measure 4.1 (support for investments in agricultural holdings), while sub-measure 4.3 (support for investments in infrastructure related to development, modernisation or adaptation of agriculture and forestry) has the objective of promoting infrastructures in Extremadura (Spain), and purchase of technology and equipment in Sachsen (Germany) to maintain meadow orchards. Finally, sub-measure 4.4 (support for non-productive investments linked to the achievement of agri-environment-climate objectives) is used to improve meadow orchards in Andalucia and Extremadura (Spain), and Austria, and to create meadow orchards in Ireland, and England and Wales (UK) or to develop both activities in Niedersachsen und Bremen (Germany).

Table 27. Meadow orchards measures linked to Rural Development Programs in the period 2007-2013. Specific regions or countries where measures were promoted are indicated in green.

RDP	Country or region	Measure related to meadow orchards			
		121	214	216	323
AT	Österreich				
BE3	Wallonie				
BG	Bulgaria				
DE1	Baden- Württemberg				
DE2	Bayern				
DE3_4	Berlin und Brandenburg				
DE5_9	Bremen und Niedersachsen				
DE6	Hamburg				
DE7	Hessen				
DEA	Nordrhein- Westfalen				
DEB	Rheinland- Pfalz				
DEC	Saarland				
DED	Sachsen				
DEE	Sachsen- Anhalt				
DEG	Thüringen				
ES11	Galicia				
ES21	Euskadi				
ES23	La Rioja				
ES24	Aragón				
ES42	Castilla-La Mancha				
ES43	Extremadura				
ES52	València				
ES53	Illes Balears				
ES61	Andalucía				
ES62	Murcia				
ES70	Canarias				
FR00	Hexagone				
FR83	Corse				
HU	Magyarország				
ITC1	Piemonte				
ITF2	Molise				
ITF3	Campania				
ITF6	Calabria				
ITH1	Bolzano/Bozen				
ITH4	Friuli-Venezia Giulia				
ITH5	Emilia-Romagna				
ITI1	Toscana				
ITI3	Marche				
LU	Luxembourg				
NL	Nederland				
PL	Poland				
PT2	Açores				
SI	Slovenija				
UK0	England				
UKL	Wales				
UKN	Northern Ireland				

Measure 7 supports the creation and enhancement of meadow orchards in Lorraine (France), Austria, and “Berlin und Brandenburg”, and “Niedersachsen und Bremen” in Germany, through sub-measure 7.6 (support for studies/investments associated with the maintenance, restoration and upgrading of the cultural and natural heritage of villages, rural landscapes and high nature value sites including related socioeconomic aspects, as well as environmental aspects). The two German RDPs

also support maintenance by using this sub-measure. Finally, sub-measure 11 is used in Sicily (Italy) to sow herbaceous species between rows of fruit trees or vines to support the conversion to organic farming with the sub-measure 11.1.

It can be seen that UK, Ireland, Spain and Germany have increased the number of measures allocated to promote meadow orchard. However, Italy reduced the number of RDPs enhancing meadow orchards while France maintained a similar number. Meadow orchards are mainly linked to measures related to the agri-environment (Measure 214 in 2007-2013 and sub-measure 10.1 in 2014-2020), that can promote both establishment and maintenance. Erosion control, soil protection or conversion to organic farming are the main justification to establish meadow orchards through the sowing of pasture among fruit tree rows, but there is also an interest in restoring this type of traditional farm system. However, it has to be highlighted the role that grazing animals play in improvement of resource efficiency in the nutrient recycling, the reduction of non-desirable, low quality vegetation, the connection between forest and no forest lands, besides the before mentioned reason argued by the RDP.

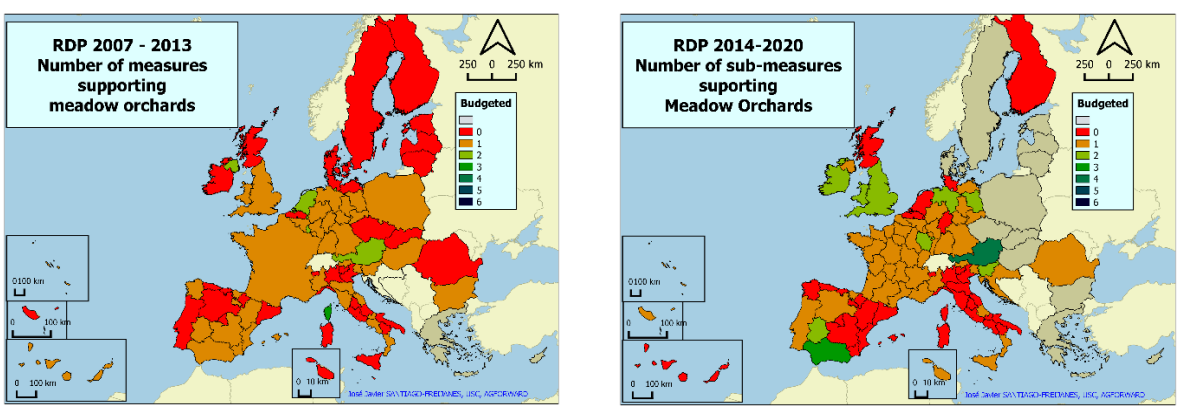


Figure 22. Number of measures promoting the introduction or maintenance meadow orchards in the 2007-2013 RDP and the 2014-2020 RDP

Table 28. Meadow orchards measures linked to Rural Development Programs in the period 2014-2020. Measures indicated in green show specific regions or countries where measures are budgeted.

RDP	Country or region	Measures related to meadow orchards					
		4.1	4.3	4.4	7.6	10.1	11.1
AT	Österreich						
BE3	Wallonie						
DE1	Baden-Wurttemberg						
DE2	Bayern						
DE3_4	Berlin und Brandenburg						
DE5_9	Bremen und Niedersachsen						
DE8	Mecklenburg-Vorpommern						
DEA	North Rhine-Westphalia						
DEB	Rheinland-Pfalz						
DEC	Saarland						
DED	Sachsen						
DEE	Sachsen-Anhalt						
DEG	Thuringia						
ES21	Euskadi						
ES41	Castilla y León						
ES43	Extremadura						
ES61	Andalucía						
FR10	Ile-de-France						
FR21	Champagne - Ardennes						
FR22	Picardie						
FR23	Haute Normandie						
FR24	Centre - Val de Loire						
FR25	Basse-Normandie						
FR26	Bourgogne						
FR30	Nord-Pas-de-Calais						
FR41	Lorraine						
FR42	Alsace						
FR43	Franche-Comte						
FR51	Pays de La Loire						
FR52	Bretagne						
FR53	Poitou-Charentes						
FR61	Aquitaine						
FR62	Midi-Pyrénées						
FR63	Limousin						
FR71	Rhône-Alpes						
FR72	Auverne						
FR81	Languedoc-Roussillon						
FR82	Provence-Alpes-Cote Azur						
HR	Hrvatska						
IE	Ireland						
ITC1	Piemonte						
ITF1	Abruzzo						
ITF6	Calabria						
ITG1	Sicilia						
ITH1	Bolzano/Bozen						
ITH4	Friuli-Venezia-Giulia						
LU	Luxembourg						
MT	Malta						
PT1	Continente						
PT2	Açores						
PT3	Madeira						
RO	Romenia						
SI	Slovenija						
UK0	England						
UKL	Wales						
UKN	Northern Ireland						

5.4.4 Mountain pastoralism

Policy dealing with mountain pastoralism associated with transhumance or summer pastures can be considered as part of silvopasture because they are usually linked to forest or woodland grazed areas. However because of its specific features, it is considered in a separate section.

In 2007-2013, there were 21 RDPs supporting mountain pastoralism with 12 different measures; three within Axis 1, eight in Axis 2 and one with Axis 3 (Table 29). Galicia (Spain) included support for demonstration projects dealing with multifunctional forest use, especially with Measure 111 (vocational training and information actions, treats including diffusion of scientific knowledge and innovative practices, for persons engaged in the agricultural, food and forestry sectors) to improve silvopasture use and dissemination activities of the research results. Madeira (Portugal) and Galicia budgeted Measure 122 (improving the economic value of forests) to activate mountain pastoralism. Galicia aimed to create and improve the infrastructure and service facilities in forestry (including silvopasture), while Madeira aimed to improve mountain pastoralism with the installation of elements of discontinuity in the forest, for example meadows, by promoting silvopastoral practices among others.

Table 29. Mountain pastoralism measures linked to Rural Development Programs in the period 2007-2013. Specific regions or countries where measures were promoted are indicated in green.

RDP	Country or region	Measure related to mountain pastoralism											
		111	122	125	211	212	213	214	216	225	226	227	323
BG	Bulgaria							■					
ES11	Galicia	■	■										■
ES12	Asturias							■					
ES13	Cantabria			■				■					
ES22	Navarra						■						
ES23	La Rioja							■					
ES41	Castilla y León							■					
ES52	València										■		
ES61	Andalucía							■			■		
ES62	Murcia				■	■							
ES70	Canarias							■					
ITC1	Piemonte			■				■					
ITC2	Valle d'Aosta							■					
ITC4	Lombardia							■					■
Aa8ITH1	Bolzano/Bozen							■					
ITH2	Trento							■					■
ITH3	Veneto			■				■					■
ITI3	Marche							■					
PT1	Continente							■	■	■		■	■
PT3	Madeira		■										
SE	Sverige							■	■				

Cantabria (Spain), Piemonte and Veneto (Italy) employed Measure 125 (infrastructure related to the development and adaptation of agriculture and forestry) to improve infrastructures related with mountain pastoralism; in both communal (Cantabria) or public pastures (Piemonte) and in alpine traditional farms of Malga (Veneto). Natural handicap payments to farmers were used in mountain areas (Measure 211) and other lands (Measure 212) in Murcia (Spain), that made payments to

support areas for livestock feeding, including, among other, forests. As Natura 2000 payments and payments linked to Directive 2000/60/EC, Navarra (Spain) included mountain grazing in the Natura 2000 network. Sixteen RDPs used the Measure 214 to support landscape management with silvopasture practices including transhumance between lowlands and highlands.

Mainland Portugal put into practice several territorially integrated interventions by joining several measures. Besides Measure 214, they also activated Measures 216, 225, 227, and 323 to improve mountain pastoralism management. Sweden also used Measure 216 to promote management practices related to mountain pastoralism. Valencia and Andalucía (Spain) explored the 226 Measure (restoring forestry potential and introducing prevention actions) to prevent wildfire by pastoral practices in the forest, both firewall and understory. Five RDPs, including the before mentioned mainland Portugal, supported grazing mountain with Measure 323. Trento and Veneto (Italy) promoted investments to restore traditional alpine farms ("Malga"). Lombardia also supported this type of farm, but only grazing management ("Alpegio"). Galicia (Spain) funded communal pastoralism in forests.

In 2014-2020, only 26% of RDPs favoured mountain pastoralism (Table 30), of which 74% selected the sub-measure 10.1 to support this activity. Sub-measure 10.1 aims to preserve different types of mountain pastoralism, such as the *alpeggio*. Franche-Comte (France), Piemonte, and Valle d'Aosta (Italy) and Austria use sub-measure 7.6 (support for studies/investments associated with the maintenance, restoration and upgrading of the cultural and natural heritage of villages, rural landscapes and high nature value sites including related socioeconomic aspects, as well as environmental aspects) to restore mountain pastures. Also for maintaining the *alpeggio* with organic livestock, Valle d'Aosta (Italy) employed sub-measure 11.1 (payment to convert to organic farming practices and methods). Measure 4 promotes mountain pastoralism in 12 RDPs with 14 operations. Cantabria (Spain), Veneto (Italy), and Austria enhances its improvement by employing sub-measure 4.1 (support for investments in agricultural holdings). By using the sub-measure 4.3 (support for investments in infrastructure related to development, modernisation or adaptation of agri culture and forestry), Navarra (Spain), and Piemonte, Lombardia, Abruzzo, Veneto, and Friuli-Venezia-Giulia (Italy) support investments to improve the mountain pastoralism, while Lombardia supports its maintenance. Sub-measure 4.4 (support for non-productive investments linked to the achievement of agri-environment-climate objectives) aims to improve mountain pastures for the four RDPs that implement this sub-measure, but also their creation (Friuli-Venezia-Giulia) and conservation (Trento).

Table 30. Mountain pastoralism measures linked to Rural Development Programs in the period 2014-2020. Specific regions or countries where measures are budgeted are indicated in green.

RDP	Country or region	Measure related to mountain pastoralism					
		4.1	4.3	4.4	7.6	10.1	11.1
AT	Österreich						
DE2	Bayern						
DE5_9	Bremen und Niedersachsen						
ES12	Asturias						
ES13	Cantabria						
ES21	Euskadi						
ES22	Navarra						
ES23	La Rioja						
ES30	Madrid						
ES41	Castilla y León						
ES70	Canarias						
FR43	Franche-Comte						
HR	Hrvatska						
ITC1	Piemonte						
ITC2	Valle d'Aosta						
ITC4	Lombardia						
ITF1	Abruzzo						
ITH1	Bolzano/Bozen						
ITH2	Trento						
ITH3	Veneto						
ITH4	Friuli-Venezia-Giulia						
PT1	Continente						
SI	Slovenija						

The adoption of measures to support mountain pastoralism appear to have been reduced from 2007-2013 to 2014-2020 in most of Europe (Figure 23), probably due to the selection of other sub-measures with a similar aim. Support for mountain silvopastoralism was related with demonstration of silvopasture, improving infrastructure, establishment and management of silvopasture but also to promote transhumance and to reduce fire risk in forest areas with Measure 214 in 2007-2013. The parallel measure 10.1 (agri-environment) is being employed in 2014-2020 RDPs to enhance mountain pastoralism through activities of preservation, restoration, improvement, conservation and creation of areas linked to the maintenance of cultural value, traditional systems and high nature value areas.

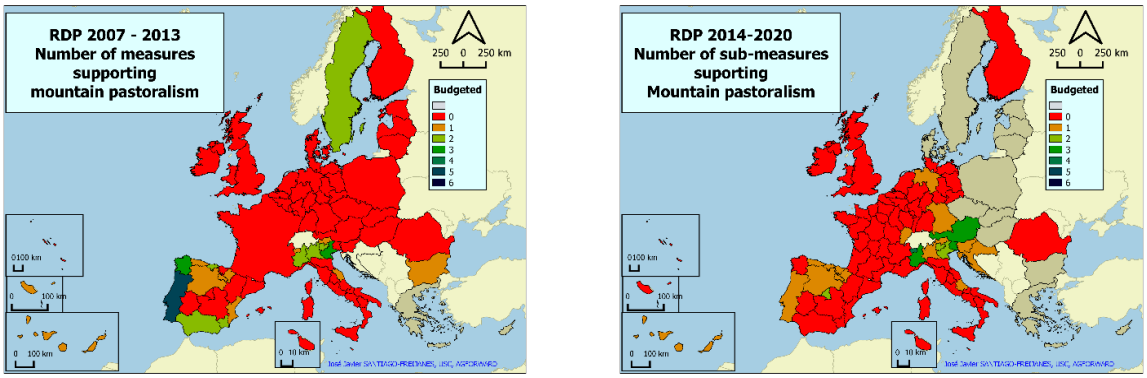


Figure 23. Number of measures promoting mountain pastoralism in the 2007-2013 RDP and the 2014-2020 RDP

5.4.5 Agroforestry measures 222 and 8.2

Tree planting within the 2007-2013 CAP was promoted by Measures 221, 222 and 223 within Axis 2 which focuses on "Improving the environment and the countryside". The measures were regulated by the article 36 (b) of the Regulation (EC) 1698/2005 aimed at promoting the sustainable use of forest land, the expansion of forest resources in agricultural or not agricultural land and finally the promotion of the combination of extensive agriculture and forestry systems. These measures had different payments (Table 31) and sought to achieve different positive impacts such as climate change mitigation, soil preservation, water protection and biodiversity and landscape enhancement. Measure 221 was allocated to first afforestation of agricultural land, measure 222 to agroforestry establishment while measure 223 was connected to the first afforestation of non-agricultural land. Measures 221 and 223 involved both (a) expenditure related to the expansion of areas with trees and (b) the maintenance costs associated with afforestation and reforestation in previous periods, while in some RDPs, measure 222 was only related with tree establishment before RDP 2014-2020.

Table 31. Characterization of measures 221, 222 and 223 according to the Reg. (EC) 1698/2005

Measure code	Measure title	Subsides	Impact
221	First afforestation of agricultural land	Establishment cost; maintenance costs; compensation for loss of income	Biodiversity; soil; climate change; water
222	First establishment of agroforestry systems on agricultural land	Establishment costs	Biodiversity; landscape; water, climate change
223	First afforestation of non-agricultural land	Establishment costs; maintenance costs	Landscape; biodiversity; water, climate change

In 1992, Regulation 2080/92 supported the afforestation of agricultural land and was associated with the planting of about 1 million hectares of trees between 1994 and 1999 (European Communities 2003). The level of afforestation was reduced in the next CAP period from 2000 to 2006 where Regulation 1257/1999 promoted reforestation on agricultural (measure 221) and non-agricultural land (measure 223). The total land afforested and reforested during 2000-2006 was only 79,941 hectares with the largest areas in Spain (26,853 ha) the UK (25,532 ha) and Lithuania (12,723 ha). In the same period, between 1800 and 2500 hectares were afforested in Portugal, Poland and Italy.

Between 2007 and 2013, the implementation of the measure 221 supported the afforestation and reforestation of 260,579 hectares in Europe (EU 2016) with the main area occurring in the UK (143,635 ha). There were also significant areas in Spain (35,050 ha), Hungary (25,900 ha), Poland (25,296ha) and Italy (12,472). Between 1000 and 5000 hectares were forested using measure 221 in Lithuania, Portugal, Denmark, Germany and the Czech Republic. Measures 221 and 223 (Table 31) aimed to promote forest product supplies and to contribute to the protection of the environment, the prevention of extreme natural hazards, and the mitigation of climate change. It should be noted that part of the money allocated to 221 was to fulfil existing payments commitments agreed within previous periods (i.e. Regulations 2080/92, 1257/1999 (article 31) and 1698/2005 (article 43(b)(i)). Hence some regions, such as Galicia, Cantabria, Cataluña, Valencia, Baleares Islands in Spain, Liguria and Sardegna in Italy, Nordrhein-Westfalen in Germany and Finland Mainland, although implementing the measure within the 2007-2013 RDP, did not increase the area of trees. Payments

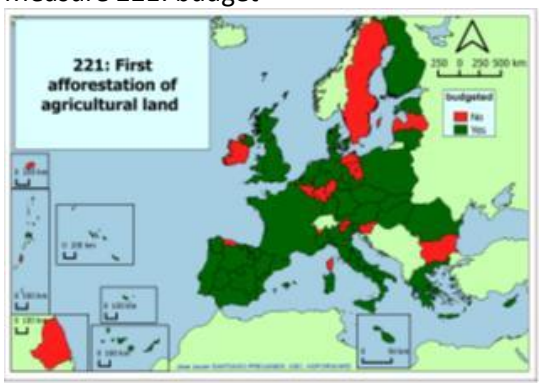
were used to cover the loss of income resulting from afforestation but not from reforestation. No payments were provided within measures 221 and 223 to promote the use of the land to generate any agricultural activity after trees were planted. Moreover, the under-utilisation of these lands was promoted as payments were linked to compensations because of the reduction of previous productivity. This created significant problems because in some case it restricted the management of the land after establishment and operations such as thinning and pruning were not carried out. Increasing the income from these areas through the promotion of agroforestry (i.e. forest farming, silvopasture) with sustainable management is an effective way to promote biodiversity and to reduce forest fire risks, while reducing in a more appropriate way the income losses. Agroforestry would benefit from additional funds to support management as the investments needed to establish agroforestry practices are higher than with exclusive forest land use. In the 2014-2020 RDP, measures 221 and 223 have been replaced by sub-measure 8.1 “Support for afforestation/creation of woodland”. So, it would have been advisable to support agricultural activities in those new forest lands to increase income and to help to reduce costs of the adequate management of the recently established forest lands.

Measure 222 was focussed on establishing trees on arable land and seen as a way to promote agroforestry practices in agricultural lands due the high ecological and social value of the system and the potential to produce high-quality wood while maintaining the production of agricultural products. In France, measure 222 mainly promoted silvoarable practices but not silvopasture, but the opposite happened in Hungary. Most of the beneficiaries established agroforestry practices on grassland (99 beneficiaries from 120), especially in Hungary; and broadleaves were the most utilised tree species (in 1196 out of 1212 ha). Although there was no maintenance payment associated with agroforestry under measure 222 during 2007-2013, they should have been made available to cover costs of appropriate management of the trees to make it more compatible with the agricultural understory production to promote high value tree timber production at short, medium and long term and to cover the loss of income that the farmer has in the strips of lands where trees are planted within an specific plot. Whilst mature trees may result in marketable products (e.g. fruit), this may not be the case with young trees and in some cases there is a need to market new tree products. It is possible that an increased interest in the use of bioenergy (within a circular economy) or improved markets for tree products (e.g. branches or fruits for animal or human consumption) will result in more profitable agroforestry systems in the future. An excellent example is to the Ecocitric life project (Ecocitric 2016) which converts pruning residues in high value products from farms.

In the new CAP 2014-2020, agroforestry is promoted through Article 23 of the new Rural Development Regulation 1305/2013 identified with the sub-measure 8.2, which is devoted to the establishment and maintenance of agroforestry systems. For the purposes of these two measures (222 and 8.2), agroforestry is defined *as "land use system in which trees are grown in combination with agriculture on the same land”*. This definition does not consider other woody vegetation which may be addressed by other agri-environment measures (i.e. woody hedges promotion). A key difference between the 2014-2020 RDP, compared to 2007-2013, is that 222 (in 2007-2013) was only allocated to the establishment of agroforestry systems, while sub-measure 8.2 includes maintenance for a period of five years of new agroforestry practices in addition to establishment. This five year period for maintenance may not be enough if the tree requires a longer period before it produces saleable products, but also to ensure adequate tree management to enhance the understory

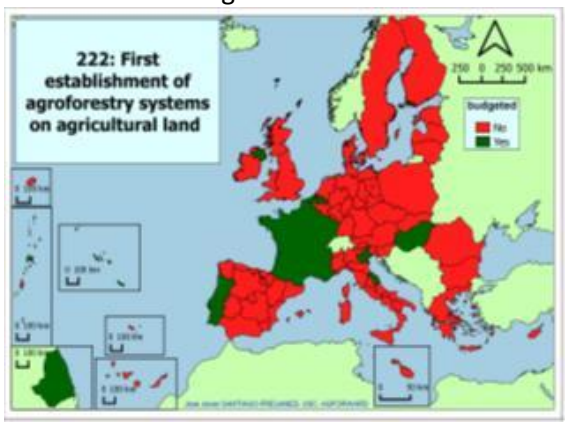
agricultural production. This main be the case when, for example, legumes (which do not provide a direct return) are used as an understorey to improve tree growth. Improved protocols on which combinations of trees and understory crops can achieve early returns would be helpful.

Measure 221: budget

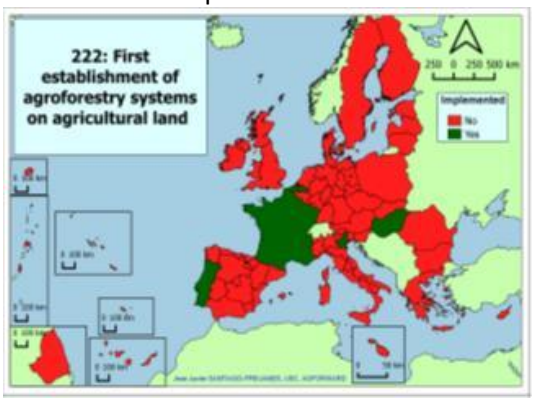


Measure 221: implemented

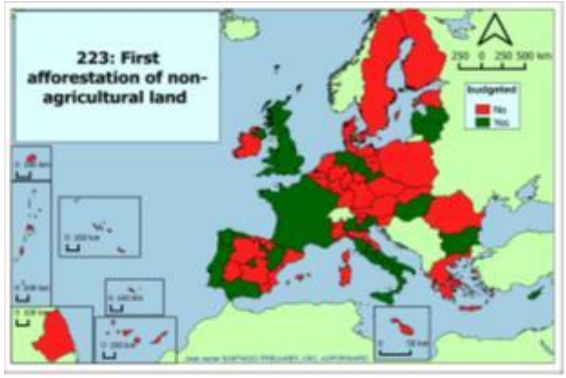
Measure 222: budget



Measure 222: implemented



Measure 223: budget



Measure 223: implemented

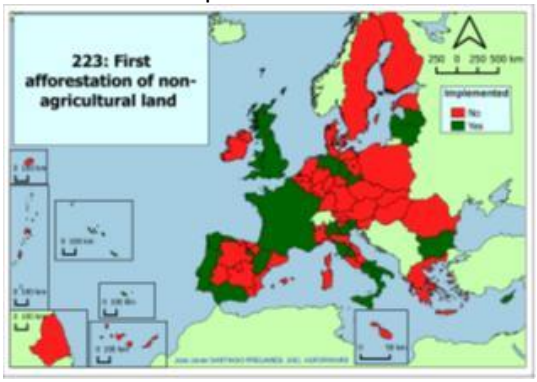


Figure 24. EU Regions that allocated resources (on the left) and implemented (on the right) measure 221, 222 and 223 in 2007-2013

Once EU regulations are published, they have to be activated by member states. Comparisons between the two CAP (periods 2007-2013 and 2014-2020) have to consider that the global number of RDPs have changed (the number of CAP RDP programmes went from 88 in 2007-2013 to 118 in 2014-2020). This was associated with the regionalization of the RDP in France, the lack of RDP in Hamburg as it is currently considered an urban region and because the integration of new EU countries (EU countries were 15, 25 and 27 since 1995, 2004 and 2007). Table 32 shows the regions

where agroforestry has been budgeted and activated in RDPs 2007-2013 and initially activated in RDPs 2014-2020.

Table 32. Amount of money budgeted and spent (implemented) in measures 221, 222 and 223 in the 2007-2013 RDPs and budgeted for measure 8.1 and 8.2 in the 2014-2020 RDP

RDP	Name	221 BUDGETED	223 BUDGETED	221 IMPLEMENTED	223 IMPLEMENTED	8.1 BUDGETED	222 BUDGETED	222 IMPLEMENTED	8.2 BUDGETED
AT	Austria	1.620		1.355					
BE2	Belgium - Flanders	2.714		1.731		7.600	500	12	500
BG	Bulgaria		40.424		2.826	9.218			
CY	Cyprus	698	485	337	226	1.000			
CZ	Czech Republic	18.850		16.947		10.376			
DE1	Baden-Württemberg	2		2					
DE2	Bavaria	1.440		1.432					
DE59	Lower Saxony + Bremen	4.475	119	3.269	100				
DEA	North Rhine-Westphalia	3.251		2.860					
DED	Saxony	12.275	56	9.860	31				
DEE	Saxony-Anhalt	1.991	8	1.992	7				
DEF	Schleswig-Holstein	5.854		5.592		1.855			
DEG	Thuringia	5.308		3.538					
DK	Denmark	57.068		34.395		37.815			
EE	Estonia	4.281		303					
EL	Greece	108.003		92.326		119.333			21.333
ES11	Galicia	5.931	73.947	5.938	38.634	49.320			7.640
ES12	Principado de Asturias		13.400		10.937	18.333			18.333
ES13	Cantabria	286		222					
ES21	País Vasco	49		43		12.502			1.418
ES22	Navarra	6.466		5.589		4.900			
ES23	La Rioja	2.430	2.624	2.493	2.741	6.000			
ES24	Aragón	27.569	3.030	22.478	1.497	10.500			
ES30	Madrid	9.046		6.813		2.500			
ES41	Castilla y Leon	135.313		143.048		121.296			
ES42	Castilla la Mancha	138.852		139.114		557			
ES43	Extremadura	126.964		100.160		47.744			
ES51	Cataluña	1.048		808					
ES52	Comunidad Valenciana	3.800		3.036					1.300
ES53	Balearic Islands	1.214		776		530			
ES61	Andalucia	149.147	7.275	108.726	4.276	51.238			26
ES62	Murcia	9.046		6.813		2.630			
FI1	Mainland Finland	8.514		7.704					
FR00	Hexagone	24.533	1.654	18.032	1.613	12.958	2.852	101	3.105
FR91	Guadeloupe	200				294	326		362
FR92	Martinique								118
FR93	Guyane						50		730
FRA5	Mayotte					1.000			200
HU	Hungary	244.079	1.952	142.314		78.187	2.814	721	7.272
ITC1	Piemonte	25.709		16.453		12.000			
ITC3	Liguria	341		65					
ITC4	Lombardia	73.080	617	66.443	301	62.250			
ITF1	Abruzzo	21.014	4.203	6.940		6.000			
ITF2	Molise	12.442	1.000	9.532	469				
ITF3	Campania	38.979	3.968	24.959	1.200	35.000			
ITF4	Puglia	23.550	20.000	6.668	133	20.000			5.000
ITF5	Basilicata	19.548	675	11.670	104	6.612			826
ITF6	Calabria	36.077	5.917	20.079	1.620	23.187			
ITG1	Sicily	63.793	9.184	61.036	4.135	70.000			
ITG2	Sardegna	33.290		30.497		20.000			
ITH3	Veneto	17.036	1.100	14.355	778	9.045	30	10	232
ITH4	Friuli-Venezia-Giulia	16.760	1.796	11.752	1.001	16.000			
ITH5	Emilia-Romagna	22.020		19.161		20.297			
ITI1	Toscana	38.343	2.800	27.082	91	14.000			
ITI2	Umbria	33.589	760	19.756	19	16.000			1.000
ITI3	Marche	20.550		16.401			1.270		
ITI4	Lazio	15.178	50	10.242		4.081			
LT	Lithuania	50.096	54.998	26.294	35.559	88.626			
LV	Latvia		17.222		14.279	9.960			
NL	Netherlands	10.980		9.814					
PL	Poland	294.502		196.685		300.997			
PT1	Continental Portugal	288.158	20.551	272.691	11.534	206.673	6.645	103	2.586
PT2	Azores	8.988	309	6.612	2	10.588	160		941
PT3	Madeira	2.000	5.000	1.905	1.811	12.625			900
RO	Romania	3.254		185		124.513			
UK0	England	154.665	4.824	120.491	4.865	141.187			
UKL	Wales	25.261	2.962	11.202	692	22.529			1.000
UKM	Scotland	94.168	94.168	132.121	50.092	260.600			1.200
UKN	Northern Ireland	9.178	386	10.653		20.378	97		

In 2007-2013, while measures 221 and 223 were broadly adopted measure 222 had a quite limited adoption across EU. Measure 221 was budgeted in 63 RDPs across European regions, measure 222 in 10 RDPs and measure 223 in 34 RDPs (Table 32; Figure 24). Although there was a budget, not all regions effectively opened the calls to apply for grants: measures 221 was implemented in 62 regions, measure 222 in 5 regions and measure 223 in 29 regions. Hence the budgeting and implementation related to measure 222 in 2007-2013 was very low (Figure 24).

In 2014-2020, the number of current EU RDPs including sub-measure 8.1 is 46 and 50 while measure 8.2 is budgeted in 12 and 22 RDPs, considering France as a whole or regionalized country respectively (Figure 25). Therefore the number of regions budgeting measures related to afforestation and reforestation have declined from 2007-2013 to 2014-2020 (from 63 to 48, if France is not regionalized). By contrast the number of regions budgeting agroforestry measure 222 or 8.2 has increased from 10 to 18 (if France is not regionalized), considering that these figures may be modified by member states through their opening during the period 2014-2020.

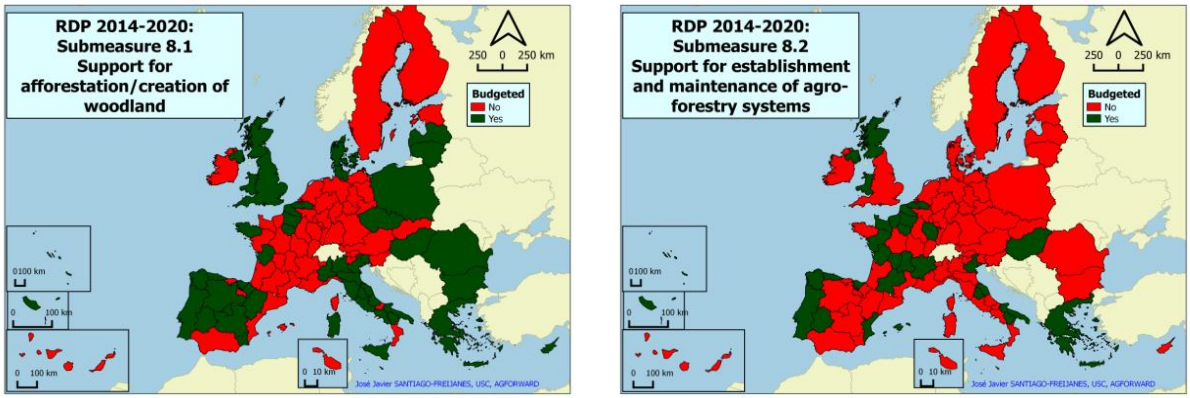


Figure 25. EU Regions that have allocated resources to measure 8.1 and 8.2 in the 2014-2020 RDP

Some of the agroforestry practices linked to measures 221, 222 and 223 of RDP 2007-2013 and 8.1 and 8.2 of RDP 2014-2020 are shown for selected regions in Table 33. Measure 221 was used to promote agroforestry practices such as forest farming, forest strips and small stands and hedgerows, and measure 223 was employed in Toscana to establish forest strips and small stands. In 2007-2013, forest grazing was not promoted by 221, 222 or 223. Although France activated measures 221, 222 and 223, the activities linked to them were not easily implemented.

In the first year of 2014-2020 CAP, although 22 regions and 8 countries have decided to activate sub-measure 8.2, only five have effectively implemented it with different purposes. In the first year of the development, Marché in Italy is using measure 8.1 to carry out forest farming only, whilst continental Portugal is using measure 8.2 to promote forest strips and small stands and forest grazing. Measure 8.2 is also being used by the continental Portugal and the Azores to promote hedgerows.

Measures 221, 222 and 223 and measures 8.1 and 8.2 were not used to promote silvopasture combined with fruit trees (so called permanent crops) or mountain pastoralism (Table 33). These two agroforestry activities were mainly linked to measures 214 and 10.1 in the Rural Development

Programmes of 2007-2013 and 2014-2020 respectively, where the focus was on the delivery of ecosystem services rather than the agroforestry activity itself.

Table 33. Summary of the regions where agroforestry practices were specifically promoted through measures 221, 222, 223 (RDP 2007-2013) and an initial assessment of the implementation of 8.1 and 8.2 (RDP 2014-2020) to support agroforestry in the first year of programming (2016)

Agroforestry practice	RDP code	RDP	RDP 2007-2013			RDP 2014-2020	
			221	222	223	8.1	8.2
Forest farming	ES21	Euskadi	■				
	ITF1	Abruzzo	■				
	ITF2	Molise					
	ITI3	Marche				■	
Forest strips and small stands	PT1	Continente					■
	EE	Eesti	■				
	ITG1	Sicilia		■			
	ITI1	Toscana	■		■		
	ITI3	Marche		■			
Hedgerow	ITG1	Sicilia		■			
	ITF4	Puglia	■				
	ITI3	Marche		■			
	RO	România	■				
	PT1	Continente					■
	PT2	Azores					■
Isolated trees	ITG1	Sicilia		■			
	ITI3	Marche		■			
Forest grazing	ES24	Aragón				■	
	ITH3	Veneto					
	ITI2	Umbria					
	PT1	Continente					■

5.5 Conclusions Pillar II

In 2007-2013, the most popular measure to promote agroforestry practices was measure 214 (Agri-environmental payments), and in 2014-2020 this has continued with sub-measure 10.1 (Agri-environment climate). They were followed by measure 216 (support for non-productive investments) in 2007-2013 and 4.4 (related to investments in physical assets) in 2014-2020. It is difficult to evaluate the impact of these measures on agroforestry because the reported budget distributions are linked to the whole measure (i.e. 214) and not to specific activities. The lack of information about the specific land use affected also makes it difficult to determine the socio-economic and environment effect of such measures. At present there are no available data to describe the use of resources and the effect of activities related to a specific land use practice (such as agroforestry) at an EU scale.

The main objectives of the before mentioned measures, used to establish or maintain different agroforestry practices, relate to improved resilience to climate change (e.g. addressing flooding and extreme heat), the enhancement of ecosystem services (e.g. biodiversity, erosion control, water protection, and fire prevention) and increased carbon sequestration. Hence the role of agroforestry

in improving environmental sustainability appears to be recognized in most of the rural development programmes. However some of the measures, e.g. the use of agroforestry in organic systems, also recognises improvements in sustainable productivity. Socio-economic aspects are also recognized, as the cultural value agroforestry practices provide links to traditional farming systems, and are specifically promoted.

Although agroforestry on forest land is not specifically within the remit of the AGFORWARD project, this report has considered this aspects as the EU Forest Strategy indicates that agroforestry should be enhanced on forest land. Hence in this report, we have not focused on whether the land was considered as "forestry" or "agriculture". However this division is apparent in some measures. For example in the 2007-2013 RDP, in axis two there is a split between forest measures (from 221 to 227 in the RDP 2007-2013) and agriculture measures (from 211 to 216 in the RDP 2007-2013). However, this division is unclear in other axis within the 2007-2013 programmes and in the RDP 2014-2020 framework, as it depends on each country or regional RDP.

The development of guidance on future agroforestry policy support will be considered in a later AGFORWARD report. However this report highlights five existing types of support for agroforestry on farms.

- Firstly there are measures promoting silvoarable practices on farms such as hedgerows, isolated trees and forest strips and small stands,
- There is support for silvopasture farms dealing with forest and permanent crops (fruit trees, orchards) understory grazing,
- There is support for farms with high value trees related with meadow or grazed orchards,
- There is support for high nature value farms related with mountain pastoralism, and
- Forest farming activities include a special type of agroforestry practices that can be considered as a complementary agricultural activity related with most of the previous farms including interactions between forest and agricultural lands (i.e. apiculture) or mainly linked to forest lands (i.e. forest farming activities not including apiculture).

On silvoarable farms, the promotion of hedgerows, forest strips and small stands and isolated trees was promoted by more than 80% of the 2007-2013 RDPs and was primarily linked to measures 214 and 216. Agroforestry activities were included as they could improve system resilience, cultural value (including restoration of traditional practices), economic value, and environmental benefits such as water protection and bird conservation. In the 2007-2013 RDP framework nine measures were used to support forest strips and small stands, 13 to support hedgerows and four to support isolated trees. Within the 2014-2020 RDP, 21 measures (out of the 90 RDPs evaluated) were used to promote all these landscape characteristics (11 related to forest strips and small stands, 17 with hedgerows, and 7 with isolated trees). If the focus of these measures is to promote a particular landscape feature through policy, it could be desirable to simplify the measures allocated to these activities in order to better evaluate the impact across the regions and to simplify administrative burdens at national and European levels. This simplification could allow national governments and the Commission to better focus the available resources on the control and evaluation of the measures to promote them from a land use point of view.

Silvopasture farms comprise land with woody vegetation with sown pasture or animals. In the 2007-2013 RDP, 5 measures were related to this activity all of them included in axis 2. In 2007-2013, 27 out of 88 RDPs included this activity mainly (21 out of 27) related to measure 214 (Agri-environmental payments). In 2014-2020, 7 measures are being used to promote forest understory grazing, linked to measures 4 (one operation), 8 (five operations) and 10 (one operation). The activities linked to silvopasture were differently allocated to different measures by different countries depending on the aim of the activity. For example, Spain selected measure 8.3 to reduce forest fire risk, while Italy selected measure 10.1 to maintain annual soil cover and organic matter in forests and woodland. Further information is needed to understand the benefits of these measures, for example in terms of carbon storage following land use change.

Agroforestry on high value tree farms was promoted by six measures in 2007-2013 and is being promoted by four measures in the 2014-2020 RDP. The principal measures relate to the agri-environment (214 in 2007-2013 and the parallel 10.1 in 2014-2020); these measures were used in more than 90% of the RDP analyzed. Meadow orchards were supported by more of 50% of the RDP of Europe to promote creation, restoration, erosion control, and soil protection. They are linked in some cases to traditional farming systems. However, a lack of information regarding the management and the characteristics of the farms where funds were destined makes it difficult to evaluate the success of these measures.

The analysis also considered agroforestry linked to mountain areas. These farms are usually farmed at a low intensity; contain a significant level of semi-natural (usually woody) vegetation, and a high diversity of land cover (European Evaluation Helpdesk for Rural Development, 2016). These farms were promoted by 12 measures in RDP 2007-2013. In 2014-2020, such systems were supported by three sub-measures of measure 4 and one sub-measure of measure 7, 10 and 11. Again more than 90% of the RDP were linked to measures 214 and 10.1 for both RDP periods. The number of regions claiming this option was relatively low compared with other agroforestry activities. Transhumance and landscape were highly relevant to these farms, but again a lack of knowledge of how were the different measures implemented limits the evaluation.

6 Acknowledgements

The AGFORWARD project (Grant Agreement N° 613520) is co-funded by the European Commission, Directorate General for Research & Innovation, within the 7th Framework Programme of RTD, Theme 2 - Biotechnologies, Agriculture & Food. The views and opinions expressed in this report are purely those of the writers and may not in any circumstances be regarded as stating an official position of the European Commission.

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