A comparative review of agroforestry legal frameworks in France, the United Kingdom, Germany, and Ireland.

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List of Abbreviations

AEFS	Agro-Ecological Farming Systems
AFS	Agroforestry systems
CAP	Common Agricultural Policy
DAFM	Department of Agriculture, Food, and the Marine (Ireland)
DAERA	Department of Agriculture, Environment and Rural Affairs (Northern Ireland)
DE	Germany
EFA	Ecological Focus Area
ES	Ecosystem Services
EU	European Union
GAEC	Good Agricultural and Environmental Condition
GIEE	Economic and Environmental Interest Groupings (Groupements d'Intérêt Economique et Environnemental)
IE	Ireland
LUCAS	Land Use and Land Cover survey
LULUCF	Land use, land-use change and forestry
MAA	French Ministry for Agriculture and Food
RDP	Rural Development Programme
UK-E	England
UK-NI	Northern Ireland
UK-S	Scotland
UK-W	Wales
UAA	Utilised Agricultural Area

Abstract

Agroforestry is a multifunctional land used system combining trees and shrubs with crops and/or animals on the same land management unit for optimising environmental, social, and productive benefits. The system is gaining recognition in the European Union (EU) as part of the solution to addressing the sustainability challenges of modern intensive agriculture and food production. This work conducts analysis of literature and expert interviews to provide a comparative perspective of the legal frameworks, economic incentives and legal barriers directed towards agroforestry in France, Ireland, Germany, and the United Kingdom (UK). Analysis of seventeen enabling policies shows that France is leading in promoting the mainstream application of agroforestry into farming practice. A recent momentum in economic support for agroforestry establishment and maintenance in France, Ireland, and parts of the UK is emerging. Despite the existence of enabling measures and subsidies in these countries, farmers wanting to implement agroforestry across the study region face various legal obstacles, mainly inadequate economic support, lack of administrative support, and poorly adapted and coordinated policies. To overcome these constraints, solutions will come from many actions such as improved national support for agroforestry research, better legal recognition, flexible incentive conditions based on improved economic evaluations of the public benefits of agroforestry systems, wider policy framing coordinated at the local, national, and international scales, with multi-actor involvement and a focus on agroforestry system interactions and connections rather than boundaries.

1. Introduction

1.1. Agricultural pressures and trends

An IPCC Special Report on Climate Change and Land confirms that agricultural and forestry expansion has "contributed to increasing net GHG emissions (very high confidence), loss of natural ecosystems (e.g., forests, savannahs, natural grasslands and wetlands) and declining biodiversity (high confidence)" (IPCC, 2019,p.7).

Rockström *et al*. 2009 identified nine critical Earth System processes and quantified their boundaries, which define the "safe operating space for humanity" for minimising the risk of crossing critical thresholds including land-system change which is driven primarily from agricultural expansion and intensification (Rockström *et al.*, 2009). The Sustainable Development Goals (SDGs) represent humanity's social boundaries and between these "social and physical boundaries exists a safe and just space for humanity to thrive" (Raworth, 2017).

Table 1 presents a mixed picture of the recent trends and environmental performance of agriculture in Europe. Agriculture is responsible for around 10% of Europe's total greenhouse gas emissions (MtCO2eq) with no improving trend. At the EU level, there has been a decrease in the agricultural nitrogen balance between 2000 and 2015 (EEA, 2019). Despite regional differences, the EU still has an "unacceptable" surplus of nitrogen in agricultural land, with all Member States exhibiting a positive nitrogen balance or surplus and nutrient run-off from agriculture continuing to be one of the biggest pressures on the aquatic environment (EEA, 2018).

Soil formation and protection is one of the ecosystem services known to be declining in Europe, according to a recent IPBES assessment (IPBES, 2018). Soil compaction from agriculture is increasing and may cause loss of soil fertility and reduce its capacity to store water and carbon with 23% of soils found to have a critically high density of subsoils (EEA, 2019). Long term monitoring shows "significant downward trends in common farmland birds and in grassland butterfly population numbers, with no signs of recovery" because of habitat loss, fragmentation and degradation with agricultural intensification one of the main causes (EEA, 2020).

Table 1: Agriculture and the environment: pressures and recent trends at the overall European Union level. **Data sources:** Adapted from The European environment – state and outlook 2020 report, Chapter 13 (EEA, 2019); the Eurostat agri-environmental indicators (EC, 2020d); and the European Environment Agency indicators (abundance and distribution of selected European species) (EEA, 2020). Note that regional differences in trends exist between Member States.

Pressures and impacts	***EU level***
Livestock density(2013-2016)[i]	↑
Antibiotic use (2011-2016)[ii]	↓
Mineral fertiliser consumption[iii]	N ↑ P ↓
N & P Surplus[iv]	↓
Pesticide use[v]	→
Greenhouse gas emissions[vi]	→
Ammonia emissions (2013-2017)[vii]	↑
Biodiversity[viii]	↓
Nitrates in rivers, groundwater[ix]	→
Soil compaction[x]	↑

[i] In 2016, livestock density in the EU-28 was slightly higher than in 2013. Livestock numbers remained stable between the 2013-2016 period. In absolute terms, France, Germany, Spain and the UK had the highest number of livestock units (EC, 2020b).
[ii] Chapter 13, (EEA, 2019).
[iii] Estimated mineral fertiliser consumption by agriculture, EU-27, 2008-2018 (EC, 2020b).
[iv] N averaged. 2013-15; P averaged. 2010-14, Chapter 13 (EEA, 2019).
[v] "Over the period 2011-2018, the sales of pesticides remained more or less stable at around 360 000 tonnes per year in the EU" (EC, 2020).
[vi] Chapter 13 (EC, 2020b)
[vii] Ammonia emissions from agriculture decreased in the period 1990-2010 but remain high and increased by approximately 3% from 2013-2017, primarily due to livestock production (EEA, 2019).
[viii] Population trends of farmland birds and grassland butterflies 1990-2017 (EEA, 2020).
[ix] Rivers nitrate 2000-2017 (EEA, 2020).
[x] Chapter 13 (EC, 2020).

1.2. Overview of agroforestry and the benefits and challenges

Agroforestry is a collective term for land use systems consisting of diverse, ecologically based production models that integrate woody perennials with animals and/or crops in the same land-management unit (in various spatial arrangements and temporal sequences) (FAO, 2015). The multi-country AGFORWARD project further clarifies agroforestry in the European context 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'' (Mosquera-Losada *et al.*, 2016).

Agroforestry entails a diverse field of applications, of both traditional systems (often in decline) (e.g. the traditional orchard meadows called Streuobst in Germany (Plieninger *et al.*, 2015) or Bocage systems in France) and emerging modern sustainable intensification models (Smith, Pearce and Wolfe, 2012; FAO, 2015; Nerlich, Graeff-Honninger and Claupein, 2013). The premise of the underpinning science is that more structurally and functionally complex integrative land use systems when compared to monoculture production have greater resource

use efficiency (nutrients, light, water), better nutrient cycles, and improved soil retention and biodiversity, leading to sustainability and resilience at the farm scale, while maintaining or improving productivity (Nair, 2007).

There are three general groups according to their structural components. Silvoarable systems (trees + crops), silvopastoral systems (trees + pastures and/ or animals) and agrosilvopastoral systems (trees + crops + pastures and/ or animals) (Nair, Kumar and Nair, 2009). The AGFORWARD project classified five main types of agroforestry practices in Europe (silvopasture, silvoarable, hedge, forest farming and homegardens) (Mosquera-Losada *et al.*, 2018c; Burgess and Rosati, 2018).

Agroforestry can deliver a variety of environmental (including climate mitigation and adaptation), cultural, social, and economic benefits and also present some challenges, with its level of impact depending on the mode of implementation, management of the system and the local conditions (Hernandez-Morcillo *et al.*, 2018; Smith et al., 2012; Kay *et al.*, 2019b; IPCC, 2019). A range of ecosystem services can be delivered such as the regulation of nutrients and water in soils, increased biodiversity, and sequestration of atmospheric CO_2 (Torralba *et al.*, 2016; Tsonkova *et al.*, 2014; Fagerholm *et al.*, 2016; Beckert *et al.*, 2016; Fornara *et al.*, 2018).

Despite its potential as a sustainable land use and in particular as an alternative that reconciles the competing demands for land between conventional agriculture and forestry, implementation of agroforestry remains at the small scale (IPCC, 2019). Some of the challenges faced by farmers in implementing agroforestry are the high expertise needed to deal with complex management the lack of reliable advice and unsupportive governance such as low levels of financial support (Hernandez-Morcillo et al., 2018; García de Jalón *et al.*, 2018). Planting locations also need to be appropriately sited, and soil conditions considered to avoid creating a carbon source rather than a sink (Friggens *et al.*, 2020).

1.3. Extent of agroforestry in France, Germany, Ireland, and the UK

A mapping study using 2012 LUCAS Land use/Cover area frame survey conducted as part of the AGFORWARD project found that agroforestry is a significant agricultural land use in the EU-27, covering about 15.4 million hectares or 3.6% of the territorial area and 8.8% of the utilised agricultural area (UAA) (den Herder *et al.*, 2017). The results relevant to the case study countries for this review are summarised in Table 2 which shows that silvopastoral is the predominant agroforestry system in the countries selected for this review and the EU-27.

Table 2: Extent of agroforestry in selected study countries (2017). **Data source:** Adapted from (den Herder et al., 2017).

Country	Arable agroforestry	Livestock agroforestry	High value tree agroforestry	All agroforestry	Estimated proportion of UAA
	(1000 ha)	(1000 ha)	(1000 ha)	(1000 ha)	(%)
France	5.7	1557.9	58.2	1562.2	5.6
Germany	5.7	257.7	35.8	263.5	1.6
Ireland	0.0	224.4	0.0	224.4	4.5
United Kingdom	2.0	547.6	14.2	551.7	3.3
EU-27 Total	358	15102	1050	15421	8.8

Lack of adequate policy support and legal uncertainty are mentioned in the literature as barriers to practicing agroforestry in the EU (Smith et al., 2012; Mosquera-Losada et al., 2018c; Tsonkova *et al.*, 2018; Rois-Díaz *et al.*, 2018). A recent evaluation on key agricultural policy at the EU level was documented by the EU-sponsored AGFORWARD project. The project highlighted that agroforestry is a sustainable land use that can contribute benefits which align with many EU societal and environmental goals. However, it is constrained by its minimal recognition in the existing policy regime, lack of a harmonised definition, and the complex, overly prescriptive conditions, within the Common Agricultural Policy (CAP) which is the main policy for EU level farm support (Mosquera-Losada *et al.*, 2018b; Burgess and Rosati, 2018).

There are few published studies analysing agroforestry legal frameworks, enabling policies and constraints at the EU country or regional level (Borremans *et al.*, 2018; Tsonkova et al., 2018). Further insights at these scales would add to the body of knowledge that is developing on the agroforestry legal landscape within the EU. A comparison of the UK and France with Ireland and Germany is useful for a few reasons. Both France and the UK have activated the agroforestry sub-measure 8.2 in their Regional Rural Development Programmes (RDPs) therefore it may be instructive to analyse the policy support measures they have implemented in advance of Ireland and Germany within the constraints of the EU agricultural financial aid rules. Recent evidence shows that France is in the top five countries when it comes to total extent of agroforestry and is an example of a temperate, European country making a visible effort to transform its agricultural sector towards more agroecological practices with policies that go beyond RDPs (Mottershead and Maréchal, 2017; Liagre, Santi and Vert, 2012; den Herder et al., 2017).

The aim of this research is to review and synthesise the literature on policy frameworks, incentives and the institutional barriers that may promote or hinder, respectively, the establishment or maintenance of agroforestry practices. This will provide a comparative perspective on the types of different innovative schemes, and economic incentives. This dissertation will contribute to socioeconomic discourses in agroforestry and fill a gap by focussing at the country level on holistic incentive support for establishing general agroforestry rather than for restricted activities and specific agroforestry types. It relates to themes of socio-ecological systems, agroecology, and public policy.

1.4. Research objectives and questions

The core questions of this research regarding agroforestry legal frameworks are:

1. How is agroforestry defined within the legal frameworks of France, UK, Ireland, and Germany?
2. What are the enabling policies, economic incentives, and legal constraints for agroforestry systems in these regions?
3. What are the policy relevant insights and recommendations?

It is hypothesised that:

- There are lessons from policy advances made in Atlantic/temperate agroforestry countries such as France and the UK, that recognise agroforestry in their Rural Development Programmes (RDPs) that would assist with understanding barriers to greater utilisation of agroforestry systems in Ireland and Germany.

- Ireland and Germany are less advanced regarding agroforestry policy.
- The legal framework restricts the recognition and installation of agroforestry systems in Ireland and Germany.

2. Methodology

2.1. Literature review

There are two key objectives of the literature review. The first is to provide an overview of the agroforestry legal framework in the selected countries, capturing the whole diversity of instruments that exist. The second is to collate and synthesise information on agroforestry subsides and obstacles to agroforestry implementation. Specifically, the review identified for France, the UK, Ireland, and Germany:

- current or soon to be implemented national level policies, instruments, legal definitions, grant criteria and planting targets and budgets, that enable the implementation of agroforestry.
- the legal framework obstacles identified as salient to agroforestry through the lens of regional level studies and reports; and
- important conclusions.

The literature review was modelled on the PRISMA checklist (see Figure 1).

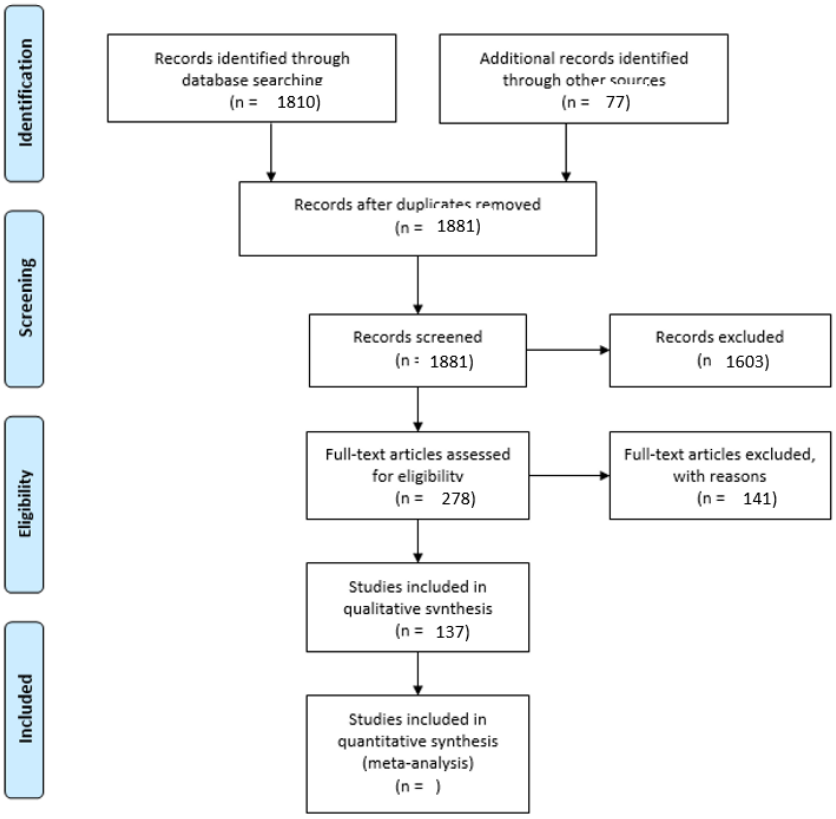

Figure 1: PRISMA 2009 Flow diagram. **Source:** http://prisma-statement.org/

Peer-reviewed literature was sourced using the 'Advanced Search' function in Web of Science and Scopus. The search string design is a modified version from (Brown *et al.*, 2018), adjusted to include specific terms found during the preliminary reading phase and to specify the study

designs/outcomes and locations for this research and is presented in Table 3. Policy literature older than 10 years was one of the main ineligibility criteria used for the screening.

Table 3: The search string used to find primary literature in Web of Science and Scopus. **Reference:** adapted from (Brown et al., 2018).

CATEGORY	TERMS FOR TOPIC SEARCH, TS=
PRACTICES:	((agr$forest* OR agr$-forest* OR agr$silvicultur* OR agr$-silvicultur* OR silv$arable OR windbreak* OR wind-break* OR shelterbelt* OR hedgerow* OR living-snow-fence OR riparian-buffer* OR *silv$pasture* OR *silv$pastoral* OR wood-pasture* OR (woodland* NEAR/5 pasture*) OR (woodland* NEAR/5 crop*) OR alley-crop* OR silvoarable OR "forest farm*" OR "farm forest*" OR "forest grazing" OR (multi-stor$y NEAR/1 (farm* OR system*)) OR (multi-strata NEAR/1 (farm* OR system*)) OR home$garden* OR "kitchen garden*" OR "improved fallow*" OR "shade tree*" OR "rotational tree fallow*" OR "multipurpose tree*" OR "tree garden*" OR "forest garden*" OR shifting-cultivation OR "natural vegetation strip*" OR hedge-crop* OR hedgerow* OR hedge-row* OR fodder-tree* OR fodder-shrub* OR "living fence*" OR ("integrated production" NEAR/3 (tree* OR wood*)) OR (apiculture AND tree$) OR entomoforestry OR entomo-forestry OR aquasilvofisher* OR aqua-silvo-fisher* OR aqua-silvofisher* OR "agroecolog*" OR "multi-purpose tree lot*" OR "fertili$er tree*" OR shade-grown OR "tree-based system*" OR "tree fallow*" OR "planted fallow*" OR (woodlot* NEAR/5 pasture*) OR "agricultural innovation system*" OR "boundary planting" OR "mixed trees and crops" OR ("conservation agriculture" AND trees) OR "farmer managed natural regeneration" OR "nitrogen fixing trees" OR "multifunctionality" OR "agforward" OR "biodiversity-based agriculture" OR "mixed farming" OR "diversified farming systems" OR "climate-smart agriculture") AND
STUDY DESIGNS OR OUTCOMES:	("legal" OR "policy" OR "intervention" OR "barrier*" OR "framework" OR "evaluation" OR "assessment" OR "*effectiveness" OR "cost–benefit" OR "regulation" OR "constraint*" OR "incentiv*" OR "institutional" OR "develop*" OR "promot*" OR "subsid*") AND
STUDY LOCATIONS:	(France OR Germany OR "United Kingdom" OR UK OR Britain OR England OR Scotland OR Wales OR "Northern Ireland" OR Germany OR Ireland OR "Europe*" OR temperate))

Additionally, to identify any grey literature the websites listed in Table 4 were searched for relevant publications.

Table 4: List of websites searched as part of this review.

Organisation	Website
L'AFAC Agroforesteries	https://afac-agroforesteries.fr
AFAF – French Agroforestry Association	https://www.agroforesterie.fr/agroforestry-in-france.php
AFINET – Agroforestry Innovation Networks (Knowledge Cloud)	https://euraf.isa.utl.pt/afinet
AGFORWARD	https://www.agforward.eu/index.php/en/
Chamber of Agriculture, France	https://chambres-agriculture.fr/
European Agroforestry Federation (EURAF)	https://euraf.isa.utl.pt/
European Commission Agriculture and Rural Development	https://ec.europa.eu/
European Environment Agency	https://www.eea.europa.eu/
Farm Woodland Forum (UK)	https://www.agroforestry.ac.uk/
Federal Ministry of Food and Agriculture, Germany	https://www.bmel.de/EN/ministry/ministry_node.html
Food and Agriculture Organisation	http://www.fao.org/
French Ministry of Agriculture and Food	https://agriculture.gouv.fr/french-ministry-agriculture-and-food
German Professional Association for Agroforestry (DeFAF) & Innovation group AUFWERTEN	https://agroforst-info.de/
INRAE – French National Research Institute for Agriculture	https://www.inrae.fr/
Institute for European Environmental Policy	https://ieep.eu/
Department of Agriculture, Food, and the Marine (Ireland)	https://www.agriculture.gov.ie/
SAFE: Silvoarable Agroforestry for Europe	http://www1.montpellier.inra.fr/safe/english/index.htm
Teagasc – Agriculture and Food Development Authority (Ireland)	https://www.teagasc.ie/
Organic Research Centre (UK)	http://www.organicresearchcentre.com/
Department of Agriculture, Environment and Rural Affairs (UK-NI)	https://www.daera-ni.gov.uk/
UK Department for Environment Food and Rural Affairs	https://www.gov.uk/government/organisations/department-for-environment-food-rural-affairs
Gov.Wales (Welsh Government services and information)	https://gov.wales/
Scottish Government	https://www.gov.scot/

The Rural Development Programmes of the countries/regions within the scope of this thesis were reviewed with the main objective of identifying the full description for measure 8.2, Establishment and maintenance of agroforestry systems. These documents were the main reference used for compiling the grants summaries, supplemented by specific grant call out information and specifications listed on some of the government websites. The free software programme, DeepL was used to translate documents.

2.2. Stakeholder interviews

Five interviews were conducted using online video conferencing with experts in Germany (3), France (1) and Ireland (1). The interviews were informal in nature rather than following a semi-structured process. The primary purpose of the interviews was to validate the legal framework overviews derived by the literature review rather than provide data, however they were also an avenue of further literature discovery. Where information collected during the interviews has been used, this has been denoted at the end of the statement.

3. Results and Discussion

This section presents the policy framework evidence collected as part of the literature review and interviews. The section is presented under separate country headings for Section 3.1 Enabling Policy, Section 3.2 Constraining Policy, and 3.3 Subsidies. Section 3.4. provides a comparative analysis and section 3.5. a discussion on the limitations of the research.

3.1. Enabling policy

A summary of supporting measures that promote agroforestry is presented in Table 5 with further discussion on these measures in the proceeding sub-sections.

Table 5: Summary of supporting measures relevant to agroforestry by measure typology. **Data source:** References for the measures are provided in the discussion for section 3.1.

Types of measures	*France*	*Germany*	*Ireland*	*UK*
Government plans & funded programmes	•Agroecological Project for France (2012) •The Agroforestry Development Plan 2015-202 •RDPs 2014-2020– Regional and National (measures 8.2, 4.4)	•RDPs 2014-2020 (e.g., Bavaria sub-measure 10.1 Agri-environment-climate schemes)	•Programme for Government 2020 •National Forestry Programme 2014-2020	•RDPs 2014-2020 National (sub measure 8.2) (UK-S, UK-W, UK-NI) •Countryside Stewardship Scheme (UK-E) •EIP-AGRI[i]: Rural Innovation Support Services (RISS) (UK-S)
Laws and regulatory standards	•2014 French law "for the future of agriculture, food and forestry"* from which Economic and Environmental Interest Groupings (GIEE) originate.		•Forestry Scheme Manual (Section 16 Agroforestry Scheme Specifications) (Updated in 2018)	
Voluntary codes of practice (e.g., labels, certification schemes)	•Label Haie •HVE Certification (2012) •Quality production specifications e.g., Kintoa Appellation d'Origine Contrôlée (AOC)			•RSPCA[ii] Welfare Standards •RSPCA Assured label (previously Freedom Food) •Woodland Eggs

*(Loi n° 2014- 1170 du 13 octobre 2014 d'avenir pour l'agriculture, l'alimentation et la forêt)

[i] Agricultural European Innovation Partnership (EIP-AGRI)
[ii] The Royal Society for the Prevention of Cruelty to Animals (RSPCA).

3.1.1 EU

Agricultural and forestry land use in the European Union have been strongly influenced by the Common Agricultural Policy (CAP), which sets out the main sectoral policy framework (Mosquera-Losada et al., 2018c). The policy has a predominately socio-economic focus set out under objectives in Article 39 TFEU, with the subsequent inclusion of environmental cross-compliance, followed by the introduction of Pillar two under the 'Agenda 2000' reform and agri-environment-climate measures (European Parliament, 2020). Recognition that farmers should be rewarded for public goods despite the absence of their market value is a defining feature of the 2014-2020 CAP, although this process has to be further developed (EEA, 2019).

There are three tiers of instruments under the current CAP policy for pursuing environmental and climate objectives:

Environmental measures under Rural Development

Based on Regulation (EU) No 1305/2013[i], these are contractual environmental measures such as the agri-environment-climate measure under Pillar II of the CAP. They are co-financed by the EU and Member States and are voluntary commitments made by farmers to compensate for the costs incurred and income foregone compared to the baseline requirements (EC, 2013a; ECA, 2017).

The work of the AGFORWARD project demonstrated that in the 2014-2020 CAP, there are up to 27 measures associated with agroforestry practices across 88 Rural Development Programmes, but they are not identified as agroforestry (Mosquera-Losada et al., 2018b). The most dedicated measure is Article 23 sub measure 8.2 support for establishment and maintenance of agroforestry systems. This is a continuation from measure 222, first establishment of agroforestry systems on agricultural land in the 2007-2013 Rural Development period. A definition of agroforestry is given in Regulation 1305/2013 in Article 23(2): "For the purposes of this Article, agroforestry systems means land use systems in which trees are grown in combination with agriculture on the same land. The minimum and maximum number of trees per hectare shall be determined by the Member States taking account of local pedoclimatic and environmental conditions, forestry species and the need to ensure sustainable agricultural use of the land" (EC, 2013a). This gives Member States flexibility to adapt the definition of agroforestry to local conditions and strategic policy objectives.

Green payments per hectare

Set out under Regulation (EU) 1307/2013[ii], green payments are compulsory, decoupled annual payments under the first pillar of the CAP to be granted to farmers for observing practices beneficial for the climate and environment (Mosquera-Losada et al., 2018b; EC, 2013b). The payment was introduced with the 2013 reform of the CAP and represents 30% of all CAP direct payments and almost 8% of the EU budget (ECA, 2017). For example, the average green payment was €80/ha in France in 2018 (Bonvillain, Foucherot and Bellassen, 2020). The allocation of the greening payment is subject to compliance with three obligations: crop

[i] Regulation (EU) No 1305/2013 of the European Parliament and of the Council of 17 December 2013 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD) and repealing Council Regulation (EC) No 1698/2005

[ii] Regulation (EU) No. 1307/2013 of the European Parliament and of the Council of 17 December 2013 establishing rules for direct payments to farmers under support schemes within the framework of the common agricultural policy and repealing Council Regulation (EC) No. 637/2008 and Council Regulation (EC) No. 73/2009.

diversification, maintenance of permanent grasslands, and a farmer with more than 15 hectares of arable land must designate an area corresponding to at least 5% of their arable land as an ecological focus area (EFA) (Mosquera-Losada et al., 2018b).

Table 6 shows that there are several landscape features and other greening elements associated with woody vegetation that potentially support agroforestry practices e.g., hedges, trees in line, group of trees/field copses. In accordance with Regulation 1307/2013 Article 46(2)(e), areas of agroforestry that received support during the 2007-13 and/or 2014-2020 RDP programming period, can also be considered as an EFA if the option was chosen by the member state (EC, 2013b). The table gives a general indication of the significant level of discretion exercised by countries in choosing EFA types and which countries see the land use change resulting from measure 8.2 as significant enough to include "Hectares of agroforestry" as an additional EFA. Out of the regions of interest to this research, France, Northern Ireland, and Scotland selected agroforestry to qualify as an EFA.

Table 6: Greening elements within Pillar I of the CAP that may support agroforestry practices, chosen to qualify as an EFA by France, Germany, Ireland, and the UK. **Data source:** Extracts from RDPs; (EC, 2013b).

Elements	***France***	***Germany***	***Ireland***	***UK-E***	***UK-NI***	***UK-S***	***UK-W***
Hedges/wooded strips	Eligible	Eligible	Eligible	Eligible	Eligible	Eligible	Eligible
Isolated tree	Eligible	Eligible					
Trees in line	Eligible	Eligible		Eligible			Eligible
Group of trees/Field copses	Eligible	Eligible	Eligible				
Hectares of agro-forestry (per 1 m2)	Eligible				Eligible	Eligible[i]	
Forest edge strips - productive	Eligible						
Afforrested areas[ii]	Eligible	Eligible	Eligible		Eligible		Eligible
Reference	(MAA, 2020a)	(BMEL, 2019)	(DAFM, 2020b)	(GOV.UK, 2020)	(DAERA, 2020)	(Scottish Government, 2018a)	(Gov.Wales, 2018)

Cross-compliance

Regulation (EU) No. 1307/2013 of the European Parliament and of the Council establishing rules for direct payments to farmers under support schemes within the framework of the common agricultural policy and repealing Council Regulation (EC) No. 637/2008 and Council Regulation (EC) No. 73/2009 (EC, 2013b).

This rule is compulsory and linked to existing EU legislation in other sectors and codes of good practice. It consists of statutory management requirements (SMRs) which include EU rules on public, animal, and plant health; animal welfare; and the environment and good agricultural and environmental conditions (GAECs) which set out the basic environmental requirements and obligations that must be fulfilled to receive CAP support. The cross-compliance measures are mainly concerned with existing woody vegetation on arable and pasture lands and not with the establishment, improvement or scaling up of agroforestry (Mosquera-Losada et al., 2018b).

[i] The Scottish Government Greening Guidance 2018 specifies that for the land to be eligible as an EFA it must have been BPS eligible, arable land in 2015 and must have been planted under a Forestry Grant Scheme (Pillar 2) Scheme since 2015.
[ii] Agroforestry is relevant to afforestation policy in Ireland and the UK only.

EIP-AGRI

The European Innovation Partnership for Agricultural productivity and Sustainability (EIP-AGRI) was launched in 2012 as part of the European Union's strategy 'Europe 2020' for smart, sustainable and inclusive growth (EC, 2020c). It pools different funding streams to support sustainable, innovative projects led by multi-stakeholders and thematic networks (EC, 2020c). An agroforestry relevant example is discussed further in section 3.1.5 United Kingdom.

LULUCF

The EU accounting rules on greenhouse gas emissions and removals resulting from activities relating to land use, land-use change and forestry (LULUCF) identify agroforestry as an indicative measure that may be included in the information on LULUCF actions submitted pursuant to Article 10(2)(d) (Decision 529/2013/EU) under "Cropland management", "therefore identifying agroforestry as agricultural land and an agricultural activity" (Mosquera-Losada et al., 2016).

European Green Deal

EU policy proposals of increasing future relevance to agroforestry falling under the initial roadmap of the European Green Deal (COM(2019)640), are the European Climate Law (COM(2020)80), A Farm to Fork Strategy for a fair, healthy and environmentally-friendly food system (COM(2020)381) and Biodiversity Strategy for 2030 (COM(2020)380) (EC, 2020e; EC, 2020a; EC, 2020b). They signify the EU Commissions commitment to sustainability and reaching climate neutrality by 2050. For example, in the Farm to Fork strategy there is a proposal to pay farmers through 'eco-schemes' for sustainable practices such as agroforestry. The Biodiversity Strategy emphasises the further uptake of agroforestry as an important measure for achieving multiple benefits for biodiversity, people, and climate. Notwithstanding the potential for amendments, these proposals are likely to have significant implications for agriculture and food policies for Member States and offer further funding opportunities to develop agroforestry activities at a sufficient scale.

3.1.2 France

Rural development support measures are predominately chosen and defined in the Regional Rural Development Programmes which are managed by the Regional Authorities. For example, in the region of Provence-Alpes-Côte d'Azur, Therville *et al.,* 2020 studied the "policyscape" covering a diversity of agroforestry systems and stakeholders in two Mediterranean protected areas, the Ventoux Biosphere Reserve and Verdon Regional Nature. Through consultation with policy representatives and practitioners, 121 instruments were found to be specifically associated with agroforestry. These included sub-measure 8.2, agroforestry training, grazing agreements, a hedge replanting plan for the Verdon Regional Nature Park, agri-environmental measures e.g. linked to the prevention of forest fires or to hedge maintenance, and Natura 2000 related contracts, mostly related to silvopasture (Therville, Antona and de Foresta, 2020).

France is viewed as one of the EU countries where the transition to sustainable agriculture is more evident with the policy support of the Agro-ecological project considered to be a key reason for this transition (Zilans, Vanni and Povellato, 2019). This has been enabled in part by France's 35-year long research history in agroforestry (INRAE, 2019).

The Agro-ecological project for France was introduced in 2012 and subsequently reflected in reformed agricultural law in 2014 (Mottershead and Maréchal, 2017). The project incentivises the agroecological transition with an "emphasis on voluntary, bottom-up approaches over regulation" (Mottershead and Maréchal, 2017,p.1). The UNISECO project identified the initiative as the only "initiative that explicitly promotes agro-ecological farming and food production as part of a comprehensive policy framework with cross-cutting actions" out of a cluster of National food and farming policies that support Agro-Ecological Farming Systems (AEFS) from European countries (Zilans et al., 2019,p.5). Echoing this finding, this review found no equivalent agroecological transition policy framework exists in Germany, the UK or Ireland.

The Agroforestry Development Plan 2015-2020 is one of eight thematic programmes of the Agro-ecological project. The plan was launched by the Ministry of Agriculture and Food (MAA) in December 2015 and is organised over 5 axes and 23 actions with the aims of improving understanding of agroforestry systems, and the legislative framework and support, developing tailored advice and training for practitioners, increasing the economic value of agroforestry produce and promoting and disseminating agroforestry internationally (MAA, 2015). The broad definition of agroforestry adopted in the development plan is: "Agroforestry is a dynamic system of natural resource management based on ecological foundations that integrates trees into farms and the rural landscape and thus enables production to be diversified and maintained in order to improve the social, economic and environmental conditions of all land users" (MAA, 2015,p.7).

Article 1(2) in the reformed agricultural law "for the future of agriculture, food and forestry" sets out the aim for the development agricultural production and food processing sectors which is to be achieved by combining "economic and social performance, in particular through a high level of social, environmental and health protection, capable of meeting the dual challenge of competitiveness and ecological transition, in a context of international competition" (Légifrance, 2014).

Two notable innovations introduced by the reformed law were revised agricultural education curricula and training to focus more on agroecological principles and practices, and the creation of GIEEs (Economic and Environmental Interest Groupings), which facilitate priority access to funding and increased aid rates through the creation of collective agroecological and territorially-based projects involving a broad spectrum of stakeholders (e.g. farmers and other local actors) (Mottershead and Maréchal, 2017; Gonzalez, Thomas and Chang, 2018). Mottershead and Maréchal, 2017 identify the role of GIEEs as encouraging "local knowledge and a willing transition by farmers and local stakeholders" which is "essential to the successful implementation of the agroecology project" (Mottershead and Maréchal, 2017,p.3).

The High Environmental Value (HVE) certification and labelling scheme, implemented in 2012, is a voluntary initiative managed by MAA, that recognises farms (all types) engaged in environmentally friendly practices. Level 3 is the highest level and grants the label of "High Environmental Value". It is results-based using environmental performance indicators relating to biodiversity conservation, plant protection, fertiliser, and irrigation management that make it possible to holistically assess the agro-ecological performance of the farm and activities. Validation occurs through on-site audits (MAA, 2020b). The scheme's relevance to agroforestry may be that it opens up further eligibility for regional agroforestry support

schemes for example the Nouvelle Aquitaine Alter'na regional scheme is only available to organic or HVE level 3 certified farms (Chambres d'Agriculture des Landes, 2020).

Launched in October 2019, 'Label Haie' is a sustainable hedge management and valorisation label being deployed to improve the social status of hedges across France (AFAC-Agroforesteries, 2020). The first year of implementation is taking place in Brittany, Normandy, and Pays de la Loire. Implementation on a national scale will be driven by the organisation Afac-Agroforesteries. The first phase of implementation is financed by a mix of national and regional government agencies (€195,000 in public subsidies) and private foundations (AFAC-Agroforesteries, 2020).

Some agroforestry systems are being introduced into various product quality specifications e.g., the Kintoa Appellation d'Origine Contrôlée (AOC) (2017). One of the main rules of the Kintoa AOC is that the pigs are reared in small batches of a maximum of 40 pigs, on fields which must be made up of meadows, moors and woods (Pinard, 2019).

3.1.3 Germany

Measures to support woody vegetation in agricultural landscapes are available in Germany, mostly with regards to support for individual agroforestry practices such as Streuobst and are usually co-financed with the EU through the Regional RDPs. Additionally, Mottershead and Maréchal, 2017 found that "small scale pilot projects and support to agroforestry through RDPs do exist in Germany, but this is not supported at federal level" (Mottershead and Maréchal, 2017,p.38).

The Bavarian RDP supports Streuobst through sub measure 10.1 Agri-environment-climate with a total expenditure of €13.697.527,00 and total area (ha) of 2.655,00 ha outlaid for the 2014-2020 programming period (StMELF, 2020c). Three examples of Bavarian Streuobst support schemes are outlined below and presented in Table 10 and Table 11.

The Cultural Landscape Programme (KULAP) offers measures (including for Streuobst) for the whole farm as well as measures for a branch of the farm or for individual areas. They are divided into the themes of climate protection, soil and water conservation, biodiversity, species diversity and cultural landscape (LfL Institute, 2020). The contract-based nature conservation programme (VNP) offers measures for the biotope types of arable land, meadows, pastures, and ponds. The aim of the measures is to preserve, develop or improve ecologically valuable habitats. The support measure for Streuobst is financed by the EU and the Federal State of Bavaria (LfL Institute, 2020).

Investment support under the Bavarian landscape conservation and nature park guidelines (LNPR) is managed by the Bavarian State Ministry for the Environment and Consumer Protection (Bayern.Recht, 2020). The objective of the aid is to maintain, restore and create ecologically viable habitats, for example there is a measure for establishment, maintenance and development of orchard meadows (Bayern.Recht, 2020). Funding is dependent on the conservation value of the stand or the nature conservation support setting. (Bayern.Recht, 2020).

3.1.4 Ireland

Ireland is unique in the EU**,** having the second lowest percentage cover of forests (11%), and has a target to reach 18% forest cover by 2050 (DCCAE, 2019). There is pressure from agriculture to remove trees on farms to maximise the amount of grass for grazing. Nutrient run-

off is a problem. Ireland needs to pursue alternative land-use/farming systems (Expert interview, 15/07/2020).

Agroforestry investment is part of the Afforestation Scheme in the current National Forestry Programme 2014-2020 and is funded fully by the Exchequer (not Pillar two of the CAP) under the legal framework of the European Union guidelines for State aid in the agriculture and forestry sector and in rural areas 2014 –2020, and Commission Regulation (EU) No 1407/2013 on the application of article 107 and 108 of the Treaty on the functioning of the European Union to de minimis aid (DAFM, 2015a). The scheme is administered by the Department of Agriculture, Food, and the Marine (DAFM) and operates on a national basis. This programme specifies grant and premium schemes including GPC 11 which caters for agroforestry.

The GPC 11 grant "is aimed at encouraging the application of silvo-pastoral agroforestry systems that combine forestry and pasture. Plots created under GPC 11 must satisfy the definition of a 'forest', as described in the national forestry inventory. The felling and replanting of trees is regulated by the 2014 Forestry Act. Agro-forestry plots will contribute to increasing the national forest cover" (DAFM, 2018b,p.2) (see Table 11 in the Appendix for forest definitions). Associated with the grant scheme are forest best practice guidelines and specifications for agroforestry and the legal framework is also influenced by EU rules such as nature Directives (Expert interview, 15/07/2020)(DAFM, 2018b; DAFM, 2015b).

Agroforestry has been promoted in the Programme for Government (Government of Ireland, 2020). The Programme signals policy changes to increase funding for research and development into innovative activities, including agroforestry that help to achieve climate change targets, and the provision of increased support for the development of agroforestry/silvopasture on farmlands to improve land use practices and associated ecosystem services.

3.1.5 United Kingdom

No country in the UK currently promotes the mainstreaming of agroecology or agroforestry into farming practice as has been done in France but there are financial incentive schemes in place that encourage agroforestry systems (Mottershead and Maréchal, 2017). The main driver for agroforestry support in the UK comes from the imperative to increase forestry cover and deliver a range of ecosystem services e.g. Northern Ireland has a long-term target of increasing woodland cover from 8-12% by 2050 (McAdam and Curran, 2018).

Scotland, Wales, and Northern Ireland directly support agroforestry through their RDPs. Additionally, Northern Ireland which supported agroforestry through its RDP during the 2007-13 programming period chose to allow farmers to count agroforestry as an ecological focus area. In England there is no agroforestry sub measure in the RDP, but there are opportunities for supporting the establishment and management of trees and hedges in the Countrywide Stewardship scheme (Smith, 2019).

The Environmental Farming Scheme (EFS) establishment of agroforestry option was introduced in Northern Ireland as an agri-environment scheme and is administered by the Department of Agriculture, Environment and Rural Affairs (DAERA). The aim of the scheme is to increase the area of agroforestry for carbon storage, biodiversity, nutrient cycling and water quality (DAERA, 2017).

The aim of the Forestry Grant Scheme (Agroforestry option) in Scotland is to create "small scale" silvopastoral systems (with sheep grazing only) and silvoarable systems to provide shelter for livestock, timber product, increase biodiversity, enhance the landscape and contribute to ecological focus areas (in specific situations) (Scottish Government, 2018b). Agroforestry is described as an "integrated approach to land management, where trees and agriculture co-exist to provide multiple benefits" (Scottish Government, 2018b).

In Wales, an agroforestry grant, 'Agroforestry – Scattered Trees Glastir Option 804', was added to the Glastir Woodland Creation (GWC) Scheme in 2018. The grant is administered by the Welsh Government. The scheme rule booklet describes agroforestry as "an integrated approach to land management, where trees and agriculture co-exist to provide multiple benefits" (Welsh Government, 2020). The grant allows for the establishment of 80 scattered trees per hectare on permanent, grazed grassland (Welsh Government, 2020).

The Rural Innovation Support Service (RISS), launched in Scotland in 2018 is a networking and innovation scheme for farmers, foresters and crofters, that brings together multi-stakeholders and provides facilitation from partner organisations to build project plans that can be used to apply for funding schemes (SRN, 2019). It is funded by the EU and Scottish government through the agricultural European Innovation Partnership (EIP-AGRI), part of the Scottish Rural Network and led by the Soil Association Scotland (EC, 2018). Examples of ongoing agroforestry projects being supported by the scheme are "Agroforestry - integrating sheep, beef and trees" and "Aspen Agroforestry" (Innovative Farmers).

Woodland egg production is an example of a marketing approach encouraging consumers to pay a premium price for an agroforestry product (Burgess, 2017). The system benefits include improved animal welfare and eggshell quality (Burgess, 2017). In 2013, at least 3.4% of eggs being sold in the UK under the label "Woodland eggs", which has existed since 2004 were produced with 20% tree cover within a free-range area (Burgess *et al.*, 2014; Sainsbury's). Burgess *et al.*, 2014 conducted an economic analysis of the market for Woodland eggs and found that retail premiums were sufficient to compensate farmers (Burgess et al., 2014). This type of scheme may encourage free-range farmers in other places to plant trees where there is a consumer demand.

Additionally, the RSPCA Assured scheme label (previously "Freedom Food") which is linked to RSPCA Welfare Standards requires producers of free range poultry products such as Woodland eggs, who use the RSPCA Assured label to adhere to a condition that 5% of the range must comprise of tree or shrub cover (RSPCA, 2017a; RSPCA, 2017b).

Figure 2: An example of a commercial free-range egg producer in Lincolnshire, England, establishing a plantation of trees to provide shelter and improve hen welfare. **Image credit:** (Burgess, 2017).

3.2. Constraining policy

Barriers to agroforestry are summarised in Table 7. They have been grouped into three types of institutional framework failures: economic support, administrative support, and adapted policies/policy coordination. The groupings are based on an analysis of the common themes found in the reviewed literature and expert interviews.

Table 7: Summary of obstacles to the implementation of agroforestry by institutional failure type and region. These are discussed further in the country sub-sections. **Data source:** Listed in the reference column.

Type of institutional framework failure	*Barrier description*	*Region/country*	*Reference*
Economic support	No public subsidies for general agroforestry systems exist to date in the German federal states (Bundesländer).	DE Brandenburg (DE)	(Otter and Langenberg, 2019; Drittler and Theuvsen, 2017; Böhm and Hübner, 2020) (Rois-Díaz et al., 2018; Tsonkova et al., 2018)
	Lack of data on economics, and finance to establish system.	UK	(Westaway and Smith, 2019)
	Economic assessments fail to account for ecological and social benefits agroforestry. Economic incentives do not reflect carbon sequestration potential.	EU scale, DE, FR, UK	(Kay *et al.*, 2019a; Aertsens, De Nocker and Gobin, 2013)
	Low levels of implementation of CAP agroforestry support and often the level and duration of funding is less than for afforestation projects.	EU scale; IE	(Torralba et al., 2016; Hernandez-Morcillo et al., 2018; Mosquera-Losada et al., 2018b); (Expert interview, 15/7/2020)
	Planting trees perceived as tying the land up for future uses.	UK-NI	(Rois-Díaz et al., 2018)
	Lack of government funding for agroforestry research hinders policy development.	IE	Expert interview, 15/7/2020
Administrative support	High administrative burden, limitations, complexity, policy uncertainties and/or lack of administrative support in the context of the CAP or regional interpretations of the CAP.	EU scale, FR, DE, UK	(de Jaoln *et al.*, 2018; Hernandez-Morcillo et al., 2018; Rois-Díaz et al., 2018; Réunir-AF, 2019; Westaway and Smith, 2019; Tsonkova et al., 2018) (ECA, 2017)
	Limitations/inflexibility of IACS.	DE	(Tsonkova et al., 2018)
	Time consuming for tenants to seek permission to plant trees with numerous owners.	DE	(Tsonkova et al., 2018)
	There is a shortfall in agroforestry specific training and lack of resources to train advisors.	IE	Expert interview, 15/7/2020
Adapted policies/policy coordination	Lack of adapted policies including limited legal recognition and definitions and/or aid eligibility criteria at both EU and regional levels.	EU scale; DE, FR, IE, UK	(Mosquera-Losada et al., 2018b; Böhm and Hübner, 2020; Tsonkova et al., 2018; Réunir-AF, 2019; Hernandez-Morcillo et al., 2018; DAFM, 2018c; Santiago-Freijanes *et al.*, 2018)
	Marginality of direct instruments and challenge of policy coordination in a protected area.	Provence-Alpes-Côte d'Azur/FR	(Therville et al., 2020)
	Agroforestry policy framing is too narrow.	EU scale, IE, UK, FR, DE	(Kay et al., 2019a; Böhm and Hübner, 2020)
	Short-term nature of land tenancies.	UK, DE	(Gordon, Newman and Coleman, 2018; Howe and Ross, 2019; Tsonkova et al., 2018)
	Agroforestry is a highly regulated land use (see sections 3.2.3 and 3.2.4).	DE, IE	(Böhm and Hübner, 2020; Expert interview, 15/7/2020)
	Agroforestry is classed as “forest". Replanting obligation applies.	IE	Expert interview, 15/7/2020

3.2.1 EU

Until the early 1990s, the CAP discouraged tree planting on agricultural land (Mosquera-Losada *et al.*, 2012). Woody elements are now recognised in the CAP and new establishment of agroforestry has been offered through Pillar two since the 2007-2013 programming period (as measure 222 followed by sub-measure 8.2 since 2014)(Santiago-Freijanes et al., 2018). However, agroforestry recognition and promotion throughout both Pillars of the CAP remains marginal which reduces the flexibility of farmers to pursue optimal integration strategies between woody vegetation and the understorey arable and/or pastoral activities across a range of spatial and temporal scales (Mosquera-Losada et al., 2018b). The potential to lose Pillar I payments if the agroforestry measure is implemented has been a strong barrier to promoting agroforestry in Europe (Santiago-Freijanes et al., 2018).

Additionally, low levels of implementation of CAP agroforestry support by Member States stifles the potential of agroforestry and often the level and duration of funding is less than for afforestation projects (Torralba et al., 2016; Hernandez-Morcillo et al., 2018; Mosquera-Losada et al., 2018b); (Expert interview, 15/7/2020). CAP economic incentives do not reflect carbon sequestration potential. Out of four agri-environmental measures studied, agroforestry was the measure with the highest technical carbon sequestration potential. Yet the economic incentives at that time were not reflecting this positive externality (Aertsens, de Nocker and Gobin, 2013).

The effectiveness of green payments in enhancing the CAP's environmental and climate-related performance, has been widely criticised (Bonvillain et al., 2020). Despite its financial importance and its wide coverage of EU agricultural area, a report in 2017 by the European Court of Auditors found that the instrument made income support more complex while only changing farming practices on less than 5% of European agricultural land (ECA, 2017; EC, 2016). Lack of ambition during the design of the mechanism meant most farmers already met its criteria or were exempt when it was launched and therefore did not need to change their practices (ECA, 2017). The rule's impact on agroforestry promotion is likely to be negligible in terms of establishing new systems.

Going beyond agricultural sector policy framing of the CAP, Kay *et al.*, 2019 suggest that better integration and coordination between spatial planning and agricultural measures is required. e.g. agroforestry should be considered as a key component of green infrastructure (Kay et al., 2019a).

3.2.2 France

France experiences obstacles across the three types of institutional failures. In protected areas in Southern France, Therville, et al., 2020 found that out of 121 instruments identified as relevant to agroforestry only nine were dedicated specifically to agroforestry systems and policy coordination was the main challenge (Therville et al., 2020). An important conclusion was that when framing agroforestry policy at the landscape scale it is necessary to consider interactions between agroforestry systems, broader agroecological practices and territorial issues and "focus on interactions between places, people and networks, and to emphasise their connections rather than focussing on the boundaries of the object" (Therville et al., 2020,p. 1446).

3.2.3 Germany

The lack of a "controllable" definition for agroforestry at the National level is listed as the top obstacle in Germany (Böhm and Hübner, 2020). No public subsidies for general agroforestry systems are in place in the German federal states (Bundesländer) in the context of the Rural Development Programmes, even though a measure exists in the European Union agricultural policy (Otter and Langenberg, 2019; Drittler and Theuvsen, 2017; Böhm and Hübner, 2020). Moreover, no national level public financial support for first establishment of agroforestry exists in Germany (Tsonkova et al., 2018).

The "Gemeinschaftsaufgabe Agrarstruktur und hKüstenschutz" (GAK-Framework) 2020-2023 is a national framework plan and is the most important national funding instrument of agricultural measures, for example for payments for environmental services. Agricultural funding in Germany is co-financed by the federal government of Germany and the federal states (Länder) (Expert interview, 14/08/2020). If a program is not accounted for in the GAK-Framework, such as agroforestry systems and Rural Development sub measure 8.2, then there is no funding by the federal government of Germany and the State has to finance the support measure (Böhm and Hübner, 2020, Expert interview, 14/08/2020).

The lack of available compensation was reflected in perceptions of German conventional farmers for which agroforestry represented an opportunity cost as "land is a very valuable scarce resource, for which the production must be maximized, especially if it is a high-quality soil, or if the plots are small" (Rios-Diaz *et al*, 2018 p.819).

No single land use code exists for agroforestry in the Integrated Administration and Control System (IACS) e.g., this inhibits the establishment of alley cropping as a holistic system, with the tree row and crop needing to be enrolled separately. Additionally, the minimum parcel area of 0.3ha in IACS inhibits the establishment of agroforestry on smaller land parcels (Tsonkova et al., 2018).

More legal regulations constrain rather than enable agroforestry systems with the most important examples being the legal regulations concerning the protection of nature and water rights (Expert interview, 14/08/2020). For example, agroforestry systems at watercourse edges require approval under the Federal Water Act ("Wasserhaushaltsgesetz" - WHG), although the Länder may decide on exemptions that may permit such use, and approval is also required to establish agroforestry on grasslands (Böhm and Hübner, 2020,p.103;107).

Security of land tenure can be a major obstacle for tenant farmers in Germany. Short-term tenancies are perceived as insufficient for the tenant farmer to benefit from growing trees and some land parcels have hundreds of owners making it time consuming for tenants to seek permission to plant trees (Tsonkova et al., 2018).

In terms of policy framing, it is recommend that agroforestry be included in spatial planning mainly at the federal level (Böhm and Hübner, 2020).

Case study: Agroforestry farm, State of Baden-Württemberg, southwest Germany.

Three hectares of multifunctional agroforestry systems (arable croplands and grasslands) were established in 2019 and a further 5000 woody plants were planted over 5ha in Spring 2020 within an Ecovillage "Akademie für angewandtes gutes Leben" (the Academy of Applied Good Living). Funding for the agroforestry systems comes from Pillar I Basic Payment Scheme (administered by the lower Agricultural Office for the region) and from private sources through

trusts and donations. The farm does not receive government support for planting and establishment of these systems. Barriers to establishing the systems were a national nature law transposed from an EU rule, protecting grasslands which limits trees on grassland to no more than 300 and as there is no specific code for agroforestry to receive the Pillar I payment, the farm uses a miscellaneous code (Expert interview, 17/07/2020).

3.2.4 Ireland

Under the agroforestry aid programme, the land becomes forestry land and is protected under the provisions of the 2014 Forestry Act. Therefore, a replanting obligation applies. Additionally, forestry is a highly regulated land use in Ireland when compared with other agricultural systems (Expert interview, 15/07/2020).

Figure 1 shows that the GPC 11 agroforestry grant is a relatively underutilised option within the afforestation scheme. This may be partly because premiums are for 5 years (this is due to an EU rule) whereas premiums for other forestry schemes are for 15 years. There is a need for a solution to this and the Department of Agriculture, Food and Marine (DAFM) recognises that (Expert interview, 15/07/2020).

A mid-term review of the Forestry Programme 2014-2020 contained feedback on the afforestation grant schemes, including the agroforestry grant (DAFM, 2018c). Some of the issues raised in relation to the agroforestry scheme include (in order of frequency):

- Remove the agroforestry grant from forestry as resources must be targeted on the productive elements of the programme, move to agri-environment/bioenergy instead of forestry.
- Remove the replanting obligation.
- Broaden grazing options to free range poultry, pigs, artisan projects etc.
- Increase the grant rate/number of premiums.
- Introduce fruit and nut production.

There is limited government funding for agroforestry research in Ireland. DAFM relies on international research to develop policy and guidance (Expert interview, 15/07/2020).

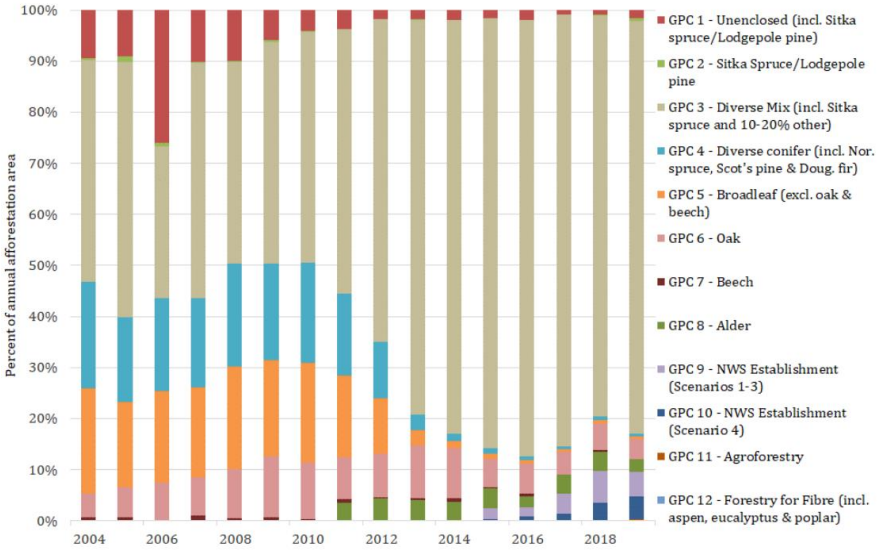

Figure 3: Proportion of annual grant aided afforestation area in Ireland by Premium Grant. **Data source:** (DAFM, 2020a).

3.2.5 United Kingdom

In Northern Ireland a reason for not establishing agroforestry is that planting trees is perceived as tying the land up for future uses., e.g., both agroforesters and non-agroforesters in UK-NI would consider planting trees, if there were higher financial incentives, or if it were on marginal land (Rois-Díaz et al., 2018).

In England there is a funding gap for agroforestry, with its position and definition unclear, as it sits within a "policy and delivery void between forestry, environmental stewardship and agriculture" (Soil Association, 2018).

Similarly, to Germany, reduced security of tenure and short-term tenancies for tenant farmers under the Agricultural Tenancies Act 1995 are viewed as a major obstacle for some farmers to convert to agroforestry or other agroecological farming practices (Howe and Ross, 2019; Gordon et al., 2018). For example, if tenure is less than 15–20 years, the uptake of agroforestry is unlikely. As a further disincentive, if trees planted result in CAP eligibility loss, a dilapidation notice will be served on the tenant seeking compensation (Gordon, Newman, and Coleman, 2018).

The perspective on the barriers to uptake of sub measure 8.2 from the point of view of the beneficiaries in Wales was that the barriers are more cultural rather than connected with the EU Regulations (Alliance Environnement, 2017).

3.3. Subsidies

This section presents the payment and criteria information for agroforestry grants. Specific details on the payment rates and criteria for each instrument is provided in Table 8, Table 9, and Table 10 below, and in Table 11 the Appendix.

Table 8: Comparisons of agroforestry establishment grants for a summarised selection of case studies. **Data source:** See Table 11 in the Appendix for references.

Country/Region	*Tree density*	*Minimum scheme area*	*Establishment payment (one-off)*	*Maintenance payment*	*Total payment (€)*
France – Occitanie (Midi-Pyrenees)	Planting density of trees 30 -150 trees/ha	The surface area of the project may be spread over several blocks, but may not exceed 5% of the total surface area	There are 4 types of cost ceilings (excl. VAT): •14.75 €/plant (project management (PM) included) •34.75 €/plant (with PM and livestock protection) •11.5 €/plant (without PM) •31.5 €/plant (with livestock protection, no PM)	Not offered	No. trees planted × 80% of the regional scale E.g., 150 trees/ha = €4,168.8 (with PM and livestock protection)
France – Occitanie (Languedoc-Roussillon)[+]	•Planting density 10-100 trees/ha for forest trees •Max. 150 fruit trees/ha. •Max. 300 shrub/ha	1 ha	A regional scale (excl. VAT) is set at: •13 €/plant and 33 €/plant (with livestock protection), for forest trees. •PM & forest trees: 3.25 €/tree for projects with (forest trees, shrubs, fruit trees) > 1000 plants OR a lump sum of 3250 € for projects involving < 1000 plants. •5.50 €/plant for shrubs and fruit trees, PM.	Not offered	There is a ceiling on eligible expenditure per project: €25,000.
France – Hauts-de-France (Nord-Pas de Calais)	30-250 trees/ha Mixed agroforestry must include >50% forest species.	1 ha	Cost ceilings per tree including protection: •25 €/plant of forest tree for forest/non-grazing agroforestry •70€/forest plant in pasture system •140 €/plant of fruit trees in pastured systems •110 €/plant of fruit trees outside pastured systems •10€/shrub plant	Not offered	No. trees planted × 80% of the regional cost ceiling E.g., €19,600 (150 forest trees +100 fruit trees in pastured system)
Ireland[+]	•Initial planting density 400-1000 trees/ha equal spacing. •Thinning to 160-250 trees/ha to enable continued grass growth.	0.5 ha and at least 20 m wide	•Total funding available is €6,220/ha (this comprises of a 1st grant €4,215/ha, 2nd grant €1,405/ha, & additional fencing €600/ha)	•€645 (€/ha) <10ha or •€660 (€/ha) >10ha •for 5 years	•€9,445/ha <10ha or •€9,520/ha >10ha
UK – Northern Ireland	400 trees/ha or 80 trees/0.20 ha	0.1 ha	£1,637/ha	•£65.00/ha •Years 2-5	€2,048/ha
UK - Scotland	There are two stocking levels: 400 trees/ha or 200 trees/ha	0.25 ha	£3,600/hectare (400 trees/ha stocking rate); £1,860/hectare (200 trees/ha stocking rate)	•£84/hectare/year (400 trees/ha stocking rate) or £48/hectare/year (200 trees/ha stocking rate) •for 5 years	•€4,341/ha (400 trees/ha) or •€2,268/ha (200 trees/ha)
UK - Wales	80 scattered trees/ha	0.25 ha	£1,600/ha	£30 for 5 years	€1,890/ha

[+]Funding provided by a government scheme outside of the Rural Development Programme.

Table 9: Common subsidy eligibility criteria for the case study regions**. Data source:** References are provided in Table 11 in the Appendix.

Common criteria	***Details***	***Regions / Examples***
Tree planting densities and spacings	Planting densities range from 30–1000 plants. Some aid specifications include spacing requirements.	DE (KULAP) – Max. 100 trees/ha FR – ranging 30 – 250 trees/ha IE – 400 – 1000 trees/ha UK – ranging 80 – 400 trees/ha IE – Equal spacing
Minimum scheme area	Minimum scheme areas range from 500 m^2 – 1 ha.	FR (various regions) – 1 ha DE – 500 m^2 IE – 0.5 ha UK – 0.25 ha UK-NI – 0.1 ha
Species composition	Forest tree species composition when combined with fruit/nut trees >50% – 85% (IE).	Ile de France, Limousin, Midi-Pyrenees, Nord-Pas-de-Calais, Pays de Loire, Picardie, IE, UK-NI, UK-Scotland
Species diversity	Minimum species range 2 – 5 per project	Min. 2 species – Pays de Loire (<10ha) Min. 3 species – Pays de Loire (>10ha); Nord-Pas-de-Calais; Association d'Agroforesterie Française Min. 5 species – Nouvelle Aquitaine
	Ineligible exclusions e.g., plantations of Christmas trees, poplar cultivars, softwoods and growing species, truffles, and rapid short-term cultivated	Normandie, Limousin, Pays de Loire, Île de France
Eligible actions	Planting, individual tree protection and tree maintenance Animal infrastructure Preparatory work Preservation maintenance	IE, UK-NI, UK-S, UK-W, DE[i], FR UK-NI FR DE[ii]
Allowable agricultural activities	Streuobst Silvopastoral, silvoarable Hedges, alignments, market gardening orchards, forest gardens	DE FR, UK[iii], IE[iv] FR[v]

3.3.1 France

Rural Development Programming since the 2007-2013 programming period through to the 2014-2020 period has been the main lever supporting the development of agroforestry. Grants offered through RDPs are co-financed by the Federal Ministry and Regions. France had a target of 3000 ha for agroforestry in the 2007-2013 period and no national target was set in its National RDP for the 2014-2020 period, although some regions have specified targets e.g. Pays de Loire proposed an establishment area target of 700 ha (Mottershead and Maréchal, 2017).

A total of 11 schemes were reviewed for France. Ten out of the 11 schemes allow both silvoarable and silvopastoral system establishment. Eight regions out of the nine regions covered offer financial support to agroforestry through their regional RDPs. Activities included by the schemes are preparatory work, planting, tree protection and maintenance (in 6 out of 11 schemes). Some regions also offer aid schemes outside of the RDP framework (e.g., Nouvelle Aquitaine "Alter'na regional scheme - PCAE" administered by the Chambres d'Agriculture des Landes and Occitanie (Languedoc-Roussillon)). One example of a non-government aid

[i] LNPR
[ii] KULAP, VNP
[iii] UK – Focus on Silvopastoral, only sheep grazing permitted in Scotland, silvoarable permitted
[iv] IE – Focus on silvopastoral, grazing, silage, and hay production is permitted.
[v] Support Program for Agroforestry Plantations - Trees and Hedges in Agricultural Systems (Association Française d'Agroforesterie).

scheme was also reviewed, the “Support Program for Agroforestry Plantations - Trees and Hedges in Agricultural Systems” which is administered by the Association Française d'Agroforesterie.

3.3.2 Germany

There are many contractual funding programmes within regional RDPs for Streuobstwiesen (orchard meadows), a traditional agroforestry system in Germany. An overview of some support programmes is provided in Table 10 using the example of Bavaria. Farmers in Bavaria can apply for funding for maintenance, preservation and replanting of existing orchard meadows via the Bavarian Cultural Landscape Programme (KULAP) or the Contract Nature Conservation Programme (VNP). These are financed by the EU, the National government, and the Federal State. The LNPR guidelines scheme allows for establishment of new orchard plantations as well as maintenance.

Figure 4: Streuobstwiesen in Bavaria. **Image credit:** Bavarian State Ministry of Food, Agriculture and Forestry.

Table 10: Examples of conservation and establishment contracts available in Bavaria for Streuobst (orchard) systems. **Data source:** References are provided in Table 11 in the Appendix.

Scheme	Payment details	Criteria
Measure B57. Cultural Landscape Program (KULAP)/RDP for Bavaria 2014-2020	€ 8 per tree per year, Minimum funding: € 250 per applicant	•Max. 100 trees / ha •Tree species are vigorous fruit trees (apple, stone fruit, and nut trees) •Aid is for the promotion of the existing orchard tree •AF system is Streuobst - Orchards
Measure W07: Contractual Nature Conservation Program (VNP)/ RDP for Bavaria 2014-2020	€ 12 per tree per year	•Max. 100 trees / ha •Minimum scheme area 500 m^2 •Permitted tree species are fruit trees •Funding is for the existing orchard tree •AF system is Streuobst - Orchards
Bavarian Landscape conservation and nature park guidelines (LNPR)/ RDP for Bavaria 2014-2020	Funding project related, usually up to 70% of the expenses incurred for the measures and regional settings listed in the LNPR.	•Minimum volume €2,500 •New plantings above 12 fruit trees (+ protective cages, trees etc.) •Permitted tree species are fruit trees •Funding of measures includes new planting and maintenance of orchards •AF system is Streuobst - Orchards

3.3.3 Ireland

Total payment available under the agroforestry grant is €9,445/ha <10ha or €9,520/ha >10ha, with the establishment grant going to the forestry contractor and the premium paid to the farmer (see Table 8). A higher grant and premium rate was introduced after a mid-term review of the Forestry Programme in February 2018 to accommodate revised system specifications (DAFM, 2018c). Under State aid rules, 80% of eligible costs can be funded. The criteria for grant assistance in Ireland are as follows: premiums are paid for five years and cover the cost of maintenance only. The agricultural activities permitted include pasture, grazing, silage, and hay production. Grant applications must be made through a registered forester and in accordance with principles of sustainable forest management, the National Forest Standard and Code of Best Forest Practice and any circulars amending the scheme requirements (DAFM, 2015a). The Woodland Improvement Scheme (WIS) which provides aid for trees to be shaped after coming out of shelter can be used for thinning activities.

DAFM organised talks with agroforestry landowners which had an impact on people. The planned area target for establishing agroforestry in the 2014-2020 period is 195 ha (Expert interview 15/07/2020). In 2020, there is approximately 140ha in the system (Expert interview 15/07/2020). Main drivers for change to agroforestry for landowners are that they want to do something different, that is more environmentally sensitive and /or aesthetic reasons (Expert interview 15/07/2020).

Figure 5: Demonstration plot, Co. Cork. Established in April 2012, 1.89 hectares of silvopastoral, ash and oak at 5x5 meter spacing. Sheep have grazed it; silage and hay are cut. **Photo credit:** DAFM, 2019.

3.3.4 United Kingdom

Northern Ireland

Total payment available in Tranche 4 of the EFS is €2,048/ha. The actions supported by the grant include planting, individual tree protection, tree maintenance and animal infrastructure, including stock-proof fencing and gates. The land between the trees is to be managed or grazed and remains eligible for the BPS payment. The minimum scheme area is 0.1ha. Selection of tree species is from an approved list and trees are planted at approximately 5 m spacing (400 trees/ha). These areas are eligible for BPS in the initial years of tree establishment, provided agricultural activity remains predominant and is not significantly affected by the presence of

trees (Scottish Government, 2018b). The proposed establishment area target in the RDP was 52 ha by 2020.

A 2014 survey of farmer's attitudes to agri-environment schemes and woodland creation in Northern Ireland found that most of the agroforestry farmers perceived landscape and environmental improvement as especially important factors, as well as provision of shelter for livestock (Rois-Díaz et al., 2018).

Scotland

The total payment rate of the grant depends on two types of planting density: €4,341/ha (400 trees/ha) or €2,268/ha (200 trees/ha). The grant specifications state that Pillar 1 CAP payments will continue as agroforestry land falls under the definition of permanent grassland as per point (h) of para 1 article 4 reg 1307/2013, which states that permanent grassland can include other species such as shrubs and trees provided the grasses remain predominant. The grant rate covers planting activities, individual tree protection and maintenance. The minimum scheme area is 0.25ha with a maximum area of 15ha per farm business unit. Applicants must follow the UK Forestry Standard. According to its RDP, the proposed establishment area target for agroforestry is 300 ha by 2020, with a €1.2 million budget (Scottish Government, 2018c).

Wales

The total subsidy under the Glastir Woodland Creation (GWC) agroforestry grant is €1,890/ha (see Table 8). There is no annual premium offered because the design of the system allows for BPS payments to continue and beneficiaries are not eligible for a fencing grant. The actions supported by the grant include planting, individual tree protection and tree maintenance. An additional £800 support is provided for the registered planner's fee to complete the GWC Plan. The proposed establishment area target set in the RDP is 147 ha by 2020.

3.4. Comparative analysis

Enabling policy

Seventeen enabling policy measures were discovered during the review and these were classified into three broad typologies: government plans and funded programmes**,** laws and regulatory standards and voluntary codes of practice (e.g., labels, certification schemes). Most of the measures are categorised as government plans and funded programmes. Seven of these measures, across all three typologies, came from France. Germany had the lowest result, with just one type of measure (RDPs e.g., Bavaria Agri-environment-climate schemes).

France is leading in promoting the mainstream application of agroforestry into farming practice. The UK, Irish and German national ambitions for agroforestry were much less than those of France which has enshrined the principle of ecological transition into agricultural law and published a National Plan for the development of agroforestry. In the case of Germany and England, there is an absence of national government spending and targets for agroforestry (Soil Association, 2018; Mottershead and Maréchal, 2017).

Examples of marketing, farm assurance and certification schemes relevant to agroforestry were found in France and the UK. These demonstrate how the introduction of agroecological, or animal welfare standards may encourage more farmers to plant trees. Measures for all countries predominately fall into the category of voluntary and incentive based, rather than regulatory.

Constraining policy

All the case study countries experience institutional framework failures across the three identified types: economic support, administrative support, and adapted policies/policy coordination.

Lack of economic data and economic assessments which have failed to account for ecological and social benefits of agroforestry undervalues the potential of agroforestry during policy development cycles. A recent study with relevance to France, Germany and the UK, found that "relatively low costs per ES unit (nutrient emission: > 2.5 €/kg^{-1} N; soil loss: > 17 €t^{-1} soil; carbon sequestration > 30 €t^{-1} C) would be sufficient to render AF profitable" (Kay et al., 2019a). Subsidy contracts can last up to 15-20 years in in the cases of Normandy and Scotland, despite the premiums or maintenance payments only enduring for up to five years. Similarly, the agroforestry subsidy in Ireland only attracts a premium payment for 5 years rendering it uncompetitive against other forestry schemes. In terms of solutions, researchers suggest improving access to public subsidies, provision of higher, longer, and more flexible financial incentives and creation of regionalised premiums, and results-based incentives (Hernandez-Morcillo et al., 2018; Schleyer and Plieninger, 2011).

Lack of adapted policies including limited legal recognition and definitions and/or aid eligibility criteria is more pronounced for Germany and England but remains an issue for the other case study countries. Improving eligibility criteria for agroforestry systems in the CAP Pillar I, and the legal recognition of agroforestry systems is recommended by researchers (Hernandez-Morcillo et al., 2018; Mosquera-Losada *et al.*, 2018a; Böhm and Hübner, 2020).

Short-term tenancies and/or the burden of various other existing regulations was an issue common to all four case study countries. Improved land ownership schemes is one suggested solution (Hernandez-Morcillo et al., 2018).

Overall, high administrative burden, limitations, complexity, policy uncertainties and/or lack of administrative support in the context of the CAP or regional interpretations of the CAP were commonly cited constraints for agroforestry (de Jaoln et al., 2018; Hernandez-Morcillo et al., 2018; Rois-Díaz et al., 2018; Réunir-AF, 2019; Westaway and Smith, 2019; Tsonkova et al., 2018).

Subsidies

National and Regional RDPs are the major sources of economic support for agroforestry for all case study countries, except for Ireland, which provides support through the Exchequer funded National Afforestation Programme. All countries except Germany and England offer establishment and maintenance grants specifically dedicated to converting to agroforestry as a long-term farming system. Analysis of the grant details of 18 aid schemes reveals two different types of payment rate settings. Payment rates in the UK and to lesser extent Ireland[i] are predominately set according to planting density. In contrast, payment rates in France are per tree or linear meter for hedges and based on species type (with fruit tree species attracting a higher rate) and the use of contract project management. There is an emergence of regionalised payment rate setting in France and Ireland.

[i] where the aid rate in was increased in 2018 to accommodate higher specifications relating mostly to plant protection.

The criteria in the French subsidy schemes generally offers more flexibility in spatial arrangements of plantations than in Ireland and the UK. The analysis of the subsidy criteria reveals the diverse expressions of agroforestry definitions adapted by France, Ireland, and the UK to suit territorial conditions and strategic policy objectives. This is a result of the broad definitions set at the EU level allowing the minimum and maximum number of trees per hectare to be determined by the Member States "taking account of local pedoclimatic and environmental conditions, forestry species and the need to ensure sustainable agricultural use of the land" (EC, 2013a).

3.5. Limits of qualitative research

A key limitation of this research has been the language barrier, resulting in very few French and German literature sources being incorporated into the review. The experience of using the software DeepL to translate documents was generally satisfactory, however limitations were encountered for some of the abbreviated policy and legal terms and the program was extremely limited for the translation of material in figures and tables. The three interviews conducted with German agroforestry experts enhanced the depth of information, which may not have otherwise been discovered. There were also very few published journal sources focussing specifically on agroforestry legal frameworks, particularly in the Irish context, so the review has strongly relied on the information gained from the grey literature and in the case of Ireland, the expert interview.

Regarding the interviews, due to time constraints, the availability of experts, and language barriers, less interviews were conducted than had been originally planned (Germany (3) and Ireland (1)) and interviews were not completed for the UK and only partially for France due to technical difficulties. Biases and gaps in information cannot be ruled out with such a small number of interviews. The experience of the Irish expert in developing and implementing the agroforestry support mechanism in Ireland was perhaps also a strength as it was a source of highly relevant information. This type of research would be enhanced using the method of group workshops and by using a multi-country research team, to get a better representation of the policy frameworks and expert views.

Lastly, most of the measures described in Section 3.1 have been introduced within the last 5 years with only a minority having had mid-term reviews or ex-post analyses completed which limited the findings on scheme impact that could be included in this research.

4. Summary and policy perspectives

This research investigated three questions: 1) How is agroforestry defined within the legal frameworks of France, UK, Ireland, and Germany? 2) What are the enabling policies, economic incentives, and legal constraints for agroforestry systems in these regions? 3)What are the policy relevant insights and recommendations?

In relation to the first question, the definition of agroforestry is derived from the head of power for the enabling measure being used to implement the system. France, the UK (excluding England) and Ireland use measure 8.2 schemes so their definitions stem from EU Regulation 1305/2013 and subordinate agricultural legislation or in the case of Ireland, forestry legislation at the national level. Further definitional boundaries are then navigated in Rural Development

Programmes and aid specifications on a national or regional scale. The analysis of the subsidy criteria reveals the diverse expressions of agroforestry definitions adapted by France, Ireland, and the UK to suit territorial conditions and strategic policy objectives. Agroforestry policy positions and definitions are less clear in Germany and England.

Seventeen enabling policies covering government plans and funded programmes**,** laws and regulatory standards and voluntary codes of practice/assurance schemes were identified across the study regions. France is leading in promoting the mainstream application of agroforestry into farming practice. Analysis of the grant details of 18 aid schemes reveals two different types of payment rate settings. All countries or devolved administrations, except Germany and England offer establishment and maintenance grants specifically dedicated to converting to agroforestry as a long-term farming system. Institutional framework failures across the three identified types: economic support, administrative support, and adapted policies/policy coordination arise in all regions. Current EU policy proposals have the potential to offer further funding opportunities to develop agroforestry activities at a sufficient scale.

In response to the third question the research suggests improved national support for agroforestry research, better legal recognition, flexible incentive conditions based on improved economic evaluations of the public benefits of agroforestry systems, wider policy framing with multi-actor involvement focussing on interactions and connections rather than boundaries of an object, and a broader mix of cross-cutting, coordinated measures is important for implementing agroforestry on a landscape scale.

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References

Aertsens, J., De Nocker, L. and Gobin, A. (2013) 'Valuing the carbon sequestration potential for European agriculture', *Land Use Policy,* 31, pp. 584-594.

AFAC-Agroforesteries (2020) *Actualities: Label Haie*. Available at: https://afac-agroforesteries.fr/category/label-haie/ (Accessed: 25 September 2020).

Association, S. (2018) *Agroforestry in England Benefits, Barriers and Opportunities*: Soil Association. Available at: https://www.soilassociation.org/media/15756/agroforestry-in-england_soilassociation_june18.pdf (Accessed: 29 July 2020).

Bayern.Recht (2020) *Announcement of the Bavarian State Ministry for the Environment and Consumer Protection on the Guidelines for the Promotion of Measures for the Protection of Nature and Species, Landscape Management and Nature-compatible Recreation in Nature Parks (Landscape Management and Nature Park Guidelines - LNPR) of 16 January 2014 (AllMBl. p. 34, ber. p. 162), last amended by announcement of 3 March 2020 (BayMBl. No. 132)*: Bavarian State Chancellery. Available at: https://www.gesetze-bayern.de/Content/Document/BayVwV281680?AspxAutoDetectCookieSupport=1 (Accessed: 25 September 2020).

Beckert, M. R.*, et al.* (2016) 'Soil and tree biomass carbon sequestration potential of silvopastoral and woodland-pasture systems in North East Scotland', *Agroforestry Systems,* 90(3), pp. 371-383.

BMEL 2019. Beantragte Ökologische Vorrangflächen im Jahr 2019. Bundesminister für Ernährung und Landwirtschaft.

Bonvillain, T., Foucherot, C. and Bellassen, V. (2020) *Will the obligation of environmental results green the CAP? A comparison of the costs and effectiveness of six instruments for the transition to sustainable agriculture. I4CE. 2020*: Institute for Climate Economics. Available at: https://hal.inrae.fr/hal-02894104/document.

Borremans, L.*, et al.* (2018) 'Nurturing agroforestry systems in Flanders: Analysis from an agricultural innovation systems perspective', *Agricultural Systems,* 162, pp. 205-219.

Brown, S. E., *et al.* (2018) 'Evidence for the impacts of agroforestry on agricultural productivity, ecosystem services, and human well-being in high-income countries: a systematic map protocol', *Environmental Evidence,* 7(1).
Burgess, P. (2017) 'Agroforestry in the UK', *Quarterly Journal of Forestry,* 111(No.2), pp. pp.111-116.
Burgess, P. J., *et al.* 'The economics of woodland eggs in the UK'. *2nd European Agroforestry Conference: Integrating Science and Policy to Promote Agroforestry in Practice, 4-6 June 2014, Cottbus, Germany. Book of Abstracts*, Cottbus, Germany, 2014: European Agroforestry Federation (EURAF), 67-70.
Burgess, P. J. and Rosati, A. (2018) 'Advances in European agroforestry: results from the AGFORWARD project', *Agroforestry Systems,* 92(4), pp. 801-810.
Böhm, C. and Hübner, R. (2020) *Bäume als Bereicherung für landwirtschaftliche Flächen: Ein Innovationskonzept für die verstärkte Umsetzung der Agroforstwirtschaft in Deutschland*. Cottbus: IG AUFWERTEN. Available at: https://agroforst-info.de/wp-content/uploads/2020/03/Innovationskonzept-Agroforstwirtschaft.pdf (Accessed: 1 August 2020).
d'Agroforesterie, A. F. (2020) *Programme de Soutien aux Plantations Agroforestières l'Arbre et la Haie dans les Systèmes Agricoles*: Association Française d'Agroforesterie. Available at: https://www.agroforesterie.fr/documents/programmes-soutien-plantation/Association-Francaise-dAgroforesterie-Flyer-programmes-soutien-aux-plantations-agroforestiere-Avril-2020.pdf (Accessed: 16 August 2020).
DAERA (2017) *Information sheet: Establishment of agroforestry (EAF). Department of Agriculture, Environment and Rural Affairs.*: Department of Agriculture, Environment and Rural Afairs.
DAERA 2020. Guide to the Greening Payment (with Crop Diversification Derogation). Department of Agriculture, Environment and Rural Affairs.
DAFM (2015a) *Afforestation Grant and Premium Scheme 2014-2020*: Department of Agriculture, Food and the Marine. Available at:

https://www.gov.ie/en/publication/07f6dc-afforestation-grant-and-premium-scheme-2014-2020/ (Accessed: 1 September 2020).
DAFM (2015b) *Forestry Standards Manual*. Johnstown Castle Estate Co. Wexford: Forest Service Department of Agriculture, Food & the Marine. Available at: https://www.agriculture.gov.ie/media/migration/forestry/grantandpremiumschemes/2015/ForestryStandManNov15050116.pdf (Accessed: 1 September 2020).
DAFM 2018a. Agroforestry (Afforestation Scheme - GPC 11) Leaflet No.9a. Department of Agriculture, Food and the Marine. Department of Agriculture, Food and the Marine.
DAFM, Service, F. (2018b) *Circular 7/2018 RE: Updated specifications replacing Agroforestry Scheme Specifications in the Forestry Standards Manual Section 16 Agro-Forestry (GPC 11), 11 May 2018.* Johnstown Castle Estate Co. Wexford: Department of Agriculture, Food and the Marine.
DAFM (2018c) *Forestry Programme 2014-2018 Midterm Review, Department of Agriculture, Food and the Marine, February 2018*, Johnstown Castle Estate, Co. Wexford: Department of Agriculture, Food and the Marine. Available at: https://www.agriculture.gov.ie/media/migration/forestry/forestservicegeneralinformation/2014-2020midtermreview/MidTermReview210218.pdf (Accessed: 3 July 2020).
DAFM (2020a) *Forest Statistics Ireland 2020, Department of Agriculture, Food and the Marine, July 2020*, Johnstown Castle Estate, Co. Wexford: Department of Agriculture, Food and the Marine. Available at: https://www.agriculture.gov.ie/media/migration/forestry/ForestStatisticsIreland2020210820.pdf (Accessed: 5 September 2020).
DAFM 2020b. Helpsheet/Terms and conditions for the 2020 EU Basic Payment Scheme (BPS)/Greening payment and other 2020 area based schemes. Department of Agriculture, Food and the Marine.
DCCAE (2019) *Climate Action Plan 2019 to tackle climate breakdown, Government of Ireland*: Department of Communications, Climate

Action and Environment. Available at: https://www.dccae.gov.ie/documents/Climate%20Action%20Plan%202019.pdf (Accessed: 3 September 2020).
de Jaoln, S. G., *et al.* (2018) 'How is agroforestry perceived in Europe? An assessment of positive and negative aspects by stakeholders', *Agroforestry Systems,* 92(4), pp. 829-848.
den Herder, M., *et al.* (2017) 'Current extent and stratification of agroforestry in the European Union', *Agriculture Ecosystems & Environment,* 241, pp. 121-132.
DFAAF 2015. France - Rural Development Programme (Regional) 2014-2020 Version 1.4 - Basse-Normandie. Direction Régionale de l'Alimentation, d'Agriculture et de la Forêt. Direction Régionale de l'Alimentation, d'Agriculture et de la Forêt.
DRAAF (2015) *France - Rural Development Programme (Regional) 2014-2020- Haute-Normandie Version 1.3. Direction Régionale de l'Alimentation, d'Agriculture et de la Forêt*: Direction Régionale de l'Alimentation, d'Agriculture et de la Forêt.
DRAAF 2020. Aide à la mise en place de systèmes agro-forestiers Sous mesure 08.02 des Programmes de Développement Rural 2014-2020 Périmètres: Calvados, Manche, Orne et Eure, Seine-Maritime Dernier appel à projets.: Direction Régionale de l'Alimentation, de l'Agriculture et de la Forêt de Normandie.
DRIAAF (2015) *France - Rural Development Programme (Regional) - Île-de-France version 1.2*: Direction Régionale Interdépartementale de l'Alimentation, d'Agriculture et de la Forêt.
DRIAAF 2019. Notice d'Information a l'Attention des beneficiaires potentiels dispositif Mise en Place des Systemes Agroforestiers sous-mesures 8.2 du Programme de Developpment Rural de l'Île-de-France. Direction Régionale Interdépartementale de l'Alimentation, d'Aggriculture et de la Forêt.
Drittler, L. and Theuvsen, L. (2017) 'Agricultural wood as an ecological focus area in the framework of the common agricultural policy', *Berichte Uber Landwirtschaft,* 95(2).
Regulation (EU) No 1305/2013 of the European Parliament and of the Council of 17 December 2013 on support for rural development by the

European Agricultural Fund for Rural Development (EAFRD) and repealing Council Regulation (EC) No 1698/2005.
Regulation (EU) No. 1307/2013 of the European Parliament and of the Council of 17 December 2013 establishing rules for direct payments to farmers under support schemes within the framework of the common agricultural policy and repealing Council Regulation (EC) No. 637/2008 and Council Regulation (EC) No. 73/2009.
EC 2016. Review of greening after one year Staff Working Document SWD(2016) 218 final. European Commission. Brussels: European Commission.
EC (2018) *EIP-AGRI - Launch of Scottish Rural Innovation Support Service*: European Commission. Available at: https://ec.europa.eu/eip/agriculture/en/news/launch-scottish-rural-innovation-support-service (Accessed: 4 July 2020).
EC 2020a. Communication from the Commission to the European Parliament, the Council, The European Economic and Social Committee and the Commit-tee of the Regions A Farm to Fork Strategy for a fair, healthy and environmentally-friendly food system, COM(2020) 381 final, Brussels. European Commission.
EC 2020b. Communication from the Commission to the European Parliament, the Council, The European Economic and Social Committee and the Commit-tee of the Regions EU Biodiversity Strategy for 2030 Bringing nature back into our lives, COM(2020) 380 final, Brussels. European Commission.
EC (2020c) *EIP-AGRI - Agriculture and Innovation*: European Commission. Available at: https://ec.europa.eu/eip/agriculture/en.
EC (2020d) *Eurostat: Agri-environmental Indicators - Agriculture*: European Commission. Available at: https://ec.europa.eu/eurostat/web/agriculture/agri-environmental-indicators (Accessed: 20 September 2020).
EC 2020e. Proposal for a Regulation of the European Parliament and of the Council establishing the framework for achieving climate neutrality and amend-ing Regulation (EU) 2018/1999 (European Climate Law), COM(2020) 80 final, Brussels. European Commission.

ECA (2017) *Special Report No 21/2017: Greening: a more complex income support scheme, not yet environmentally effective. European Court of Auditors*. Available at: https://www.eca.europa.eu/Lists/ECADocuments/SR17_21/SR_GREENING_EN.pdf (Accessed: 26 September 2020).
EEA (2018) *Indicator Assessment - Agriculture: nitrogen balance. European Environment Agency*. Available at: https://www.eea.europa.eu/data-and-maps/indicators/agriculture-nitrogen-balance-1/assessment (Accessed: 25 September 2020).
EEA (2019) *The European environment — state and outlook 2020 Knowledge for transition to a sustainable Europe*: European Environment Agency. Available at: https://www.eea.europa.eu/publications/soer-2020 (Accessed: 20 September 2020).
EEA (2020) *Indicator assessment - Abundance and distribution of selected European species*: European Environment Agency. Available at: https://www.eea.europa.eu/data-and-maps/indicators/abundance-and-distribution-of-selected-species-8/assessment-1 (Accessed: 20 September 2020).
Environnement, A. (2017) *Evaluation study of the forestry measures under rural development. Final report*. Available at: https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/forestry/documents/study-forestry-measures-ruraldev_sept2017_en.pdf (Accessed: 26 September 2020).
europe-en-hautsdefrance (2020) *AAP 2020-2021 Aide à la mise en place de systèmes agroforestiers (Mesure 08.02 PDR Picardie)*. Available at: https://europe-en-hautsdefrance.eu/fiche_programme/aap-2020-2021-aide-a-la-mise-en-place-de-systemes-agroforestiers-mesure-08-02-pdr-picardie/ (Accessed: 15 September 2020).
Fagerholm, N.*, et al.* (2016) 'A systematic map of ecosystem services assessments around European agroforestry', *Ecological Indicators,* 62, pp. 47-65.
Farmers, I. *Rural Innovation Support Service - Current RISS groups, Innovative Farmers*. Available at:

https://www.innovativefarmers.org/welcometoriss/current-riss-groups/ (Accessed: 4 July 2020).
Fornara, D. A., *et al.* (2018) 'Land use change and soil carbon pools: evidence from a long-term silvopastoral experiment', *Agroforestry Systems,* 92(4), pp. 1035-1046.
Friggens, N. L., *et al.* (2020) 'Tree planting in organic soils does not result in net carbon sequestration on decadal timescales', *Global change biology,* 26(9), pp. 5178-5188.
García de Jalón, S., *et al.* (2018) 'How is agroforestry perceived in Europe? An assessment of positive and negative aspects by stakeholders', *Agroforestry Systems,* 92(4), pp. 829-848.
Gonzalez, R. A., Thomas, J. and Chang, M. (2018) 'Translating Agroecology into Policy: The Case of France and the United Kingdom', *Sustainability,* 10(8).
Gordon, A. M., Newman, S. M. and Coleman, B. R. W. (2018) *Temperate agroforestry systems.* Second edn. Wallingford, U.K.: CAB International.
GOV.UK (2020) *Basic Payment Scheme: rules for 2020, Version 3. Rural Payments Agency. UK Government*. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/900670/BPS_2020_scheme_rules_v3.0.pdf (Accessed: 12 August 2020).
Gov.Wales (2018) *Greening Booklet (Revised October 2018). Welsh Government*. Available at: https://gov.wales/sites/default/files/publications/2018-11/181107-basic-payment-scheme-greening-guidance.pdf (Accessed: 12 August 2020).
Government, S. (2018a) *Rural Payments and Services - Greening Guidance 2018 Ecological Focus Areas*: Scottish Government. Available at: https://www.ruralpayments.org/topics/all-schemes/basic-payment-scheme/basic-payment-scheme-full-guidance/greening-guidance-2018/efa-ecological-focus-areas/#652585 (Accessed: 29 July 2020).
Government, S. (2018b) *Rural Payments and Services: Forestry Grant Scheme - Agroforestry*: Scottish Government. Available at:

https://www.ruralpayments.org/publicsite/futures/topics/all-schemes/forestry-grant-scheme/agroforestry/ (Accessed: 28 July 2020).
Government, S., Division, A.a.R.D. (2018c) *United Kingdom - Rural Development Programme (Regional) - Scotland 2014-2020*.
Government, W. (2019) *United Kingdom - Rural Development Programme (Regional) 2014-2020 - Wales Version 3.1*: Welsh Government - Agriculture, Fisheries and Marine Group.
Government, W. (2020) *Glastir Woodland Creation Rules Booklet. Welsh Government Rural Communities - Rural Development Programme for Wales 2014-2020, Version 9 - March 2020.*: Welsh Government.
Hauts-de-France, R. (2020) *PDR FEADER Nord-Pas de Calais 2014-2020 - Appel a Projets Aide à la mise en place de systèmes agroforestiers 2020*: Région Hauts-de-France. Available at: https://europe-en-hautsdefrance.eu/fiche_programme/aap-aide-a-la-mise-en-place-de-systemes-agroforestiers-2020/ (Accessed: 21 August 2020).
Hernandez-Morcillo, M.*, et al.* (2018) 'Scanning agroforestry-based solutions for climate change mitigation and adaptation in Europe', *Environmental Science & Policy,* 80, pp. 44-52.
Howe, H. R. and Ross, M. (2019) 'Brexit's Shades of Green-(Missing) the Opportunity to Transform Farming in England?', *Journal of Environmental Law,* 31(3), pp. 413-441.
INRAE (2019) *L'agroforesterie, priorité de recherche au cœur de la transition agro-écologique. INRAE*. Available at: https://www.inrae.fr/actualites/lagroforesterie-priorite-recherche-au-coeur-transition-agro-ecologique (Accessed: 25 September 2020).
Institute, L. (2020) *Cultural landscape and biodiversity Support programmes for orchards in Bavaria*: Bavarian State Ministry of Food, Agriculture and Forestry (StMELF). Available at: https://www.lfl.bayern.de/iab/kulturlandschaft/030830/index.php (Accessed: 25 September 2020).
IPBES (2018) *The regional assessment report on biodiversity and ecosystem services for Europe and Central Asia. Intergovernmental*

Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). Available at: https://ipbes.net/sites/default/files/2018_eca_full_report_book_v5_pages_0.pdf.
IPCC (2019) *Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystem. Intergovernmental Panel on Climate Change. [P.R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.-O. Pörtner, D. C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M.Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, J. Malley, (eds.)]. In press.*
Ireland, G. o. (2020) *Programme for Government - Our Shared Future*: Government of Ireland. Available at: https://www.greenparty.ie/wp-content/uploads/2020/06/ProgrammeforGovernment_June2020_Final_accessible.pdf (Accessed: 21 August 2020).
Kay, S.*, et al.* (2019a) 'Agroforestry is paying off - Economic evaluation of ecosystem services in European landscapes with and without agroforestry systems', *Ecosystem Services,* 36.
Kay, S.*, et al.* (2019b) 'Agroforestry creates carbon sinks whilst enhancing the environment in agricultural landscapes in Europe', *Land Use Policy,* 83, pp. 581-593.
Landes, C. d. A. d. (2020) *Mise en place de systèmes agroforestier PCAE Nouvelle Aquitaine*: Chambres d'Agriculture des Landes,

Nouvelle Aquitaine. Available at: https://landes.chambre-agriculture.fr/fileadmin/user_upload/Nouvelle-Aquitaine/101_Inst-Landes/Documents/gestion_entreprise/aides_investissements/PCAE_agroforesterie.pdf (Accessed: 1 September 2020).
LaregionOccitanie (2020) *Appel à projets - Opération d'installation de systèmes agroforestiers. La Region Occitainie*. Available at: https://www.laregion.fr/IMG/pdf/annexeix_aap_agroforesterie_2020.pdf (Accessed: 15 September 2020).
Liagre, F., Santi, F. and Vert, J. (2012) 'L'agroforesterie en France : intérêts et enjeux.', *Forêt Entreprise, Forêt Privée Française*, pp. pp.21-26.

Loire, R. P. d. l. 2020. France - Rural Development Programme (Regional) 2014-2020 - Pays de la Loire version 8.1.
LOI n° 2014-1170 du 13 octobre 2014 d'avenir pour l'agriculture, l'alimentation et la forêt (2014).
MAA (2015) *Plan de Développement de l'Agroforesterie: Pour le développement et la gestion durable*: Ministère de l'Agriculture et de l'Alimentation. Available at: https://agriculture.gouv.fr/sites/minagri/files/160517-ae-agrofesterie.pdf (Accessed: 2 September 2020).
MAA (2020a) *La Politique Agricole Commune 2015-2020: Les Éléments Topographiques Dans La PAC*: Ministère de l'Agriculture et de l'Alimentation. Available at: https://agriculture.gouv.fr/telecharger/96541?token=200ffbfa99d82b976e7aa4ef57f5ca45 (Accessed: 17 September 2020).
MAA (2020b) *Les chiffres clés de la Haute Valeur Environnementale (HVE)*: Ministère de l'Agriculture et de l'Alimentation. Available at: https://agriculture.gouv.fr/les-chiffres-cles-de-la-haute-valeur-environnementale-hve (Accessed: 22 September 2020).
McAdam, J. and Curran, E. 2018. Presentation: Adoption of agroforestry options in land use policy measures in Northern and Southern Ireland. Agri-Food and Biosciences Institute.
Mosquera-Losada, M. R.*, et al.* (2012) 'Past, Present and Future of Agroforestry Systems in Europe', *Agroforestry - The Future of Global Land Use*. Dordrecht: Springer Netherlands, pp. 285-312.
Mosquera-Losada, M. R.*, et al.* (2018a) 'Agroforestry in the European common agricultural policy', *Agroforestry Systems,* 92(4), pp. 1117-1127.
Mosquera-Losada, M. R.*, et al.* (2018b) 'Agroforestry in the European common agricultural policy', *Agroforestry Systems,* 92(4), pp. 1117-1127.
Mosquera-Losada, M. R.*, et al.* (2018c) 'Agroforestry in Europe: A land management policy tool to combat climate change', *Land Use Policy,* 78, pp. 603-613.
Mosquera-Losada, R.*, et al.* (2016) *Extent and Success of Current Policy Measures to Promote Agroforestry across Europe*:

AGFORWARD. Available at: https://www.agforward.eu/index.php/en/extent-and-success-of-current-policy-measures-to-promote-agroforestry-across-europe.html.
Mottershead, D. and Maréchal, A. (2017) *Promotion of agroecological approaches: Lessons from other European countries, a report for the Land Use Policy Group.*: Institute for European Environmental Policy. Available at: https://ieep.eu/uploads/articles/attachments/dbe71322-2b48-4b60-bb7c-8f2f02ff96e4/LUPG%20Agroecology%20report%20-%20FINAL.pdf?v=63670205327 (Accessed: 3 July 2020).
Nair, P. K. R. (2007) 'The coming of age of agroforestry', *Journal of the science of food and agriculture,* 87(9), pp. 1613-1619.
Nair, P. K. R., Kumar, B. M. and Nair, V. D. (2009) 'Agroforestry as a strategy for carbon sequestration', *Journal of Plant Nutrition and Soil Science,* 172(1), pp. 10-23.
Nerlich, K., Graeff-Honninger, S. and Claupein, W. (2013) 'Agroforestry in Europe: a review of the disappearance of traditional systems and development of modern agroforestry practices, with emphasis on experiences in Germany (vol 87, pg 475, 2013)', *Agroforestry Systems,* 87(5), pp. 1211-1211.
Nouvelle-Aquitaine, R. 2017. France - Rural Development Programme (Regional) 2014-2020 - Limousin Version 4.0.
Occitanie, E. e. (2020) *Appel a Projets Type d'Opération 8.2.1 Opération d'installation de systèmes agroforestiers Version 12 du PDR*. Available at: https://www.europe-en-occitanie.eu/IMG/pdf/821_aap_8.2.1_2020_mp_v1.pdf (Accessed: 1 September 2020).
Otter, V. and Langenberg, J. (2019) 'Willingness to pay for environmental effects of agroforestry systems: a PLS-model of the contingent evaluation from German taxpayers' perspective', *Agroforestry Systems*.
Parliament, E. (2020) *The Common Agricultural Policy (CAP)*. Available at: https://www.europarl.europa.eu/factsheets/en/section/196/the-common-agricultural-policy-cap- (Accessed: 20 September 2020).

Pinard, C. (2019) *Le point sur... Le plan de développement de l'agroforesterie. Sciences Eaux & Territoires n°30 – 2019. Ministère de l'Agriculture et de l'Alimentation (MAA)*. Available at: http://www.set-revue.fr/sites/default/files/articles/pdf/setrevue-bocage-plan-agroforesterie.pdf (Accessed: 21 September 2020).
Plieninger, T.*, et al.* (2015) 'Patterns and Drivers of Scattered Tree Loss in Agricultural Landscapes: Orchard Meadows in Germany (1968-2009)', *Plos One,* 10(5).
Raworth, K. (2017) *What on Earth is the doughnut?...* Available at: https://www.kateraworth.com/doughnut/ (Accessed: 23 September 2020).
Rockström, J.*, et al.* (2009) 'Planetary Boundaries: Exploring the Safe Operating Space for Humanity', *Ecology and society,* 14(2), pp. 32.
Rois-Díaz, M.*, et al.* (2018) 'Farmers' reasoning behind the uptake of agroforestry practices: evidence from multiple case-studies across Europe', *Agroforestry Systems,* 92(4), pp. 811-828.
RSPCA 2017a. RSPCA welfare standards for laying hens. Royal Society for the Prevention of Cruelty to Animals.
RSPCA 2017b. RSPCA welfare standards for meat chickens. Royal Society for the Prevention of Cruelty to Animals.
Réunir-AF 2019. Rapport - Enquête Réglementation Septembre 2019. Réunir-AF Réseau National pour L'Agroforesterie.
Sainsbury's *Woodland hens roam free – for cracking eggs*: Sainsbury's. Available at: https://about.sainsburys.co.uk/making-a-difference/our-values/our-stories/2017/woodland-hens-roam-free-for-cracking-eggs (Accessed: 25 September 2020).
Santiago-Freijanes, J. J.*, et al.* (2018) 'Agroforestry development in Europe: Policy issues', *Land Use Policy,* 76, pp. 144-156.
Schleyer, C. and Plieninger, T. (2011) 'Obstacles and options for the design and implementation of payment schemes for ecosystem services provided through farm trees in Saxony, Germany', *Environmental Conservation,* 38(4), pp. 454-463.
Smith, J. 2019. Presentation: Agroforestry in the UK. AFINET.
Smith, J., Pearce, B. D. and Wolfe, M. S. (2012) 'A European perspective for developing modern multifunctional agroforestry

systems for sustainable intensification', *Renewable Agriculture and Food Systems,* 27(4), pp. 323-332.
SRN (2019) *Rural Innovation Support Service presentation - Rural development operational committee meeting May 2019. Scottish Rural Network*. Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/minutes/2019/05/rural-development-operational-committee-meeting-may-2019/documents/rural-innovation-support-service-presentation/rural-innovation-support-service-presentation/govscot%3Adocument/Rural%2BInnovation%2BSupport%2BService%2Bpresentation.pdf (Accessed: 4 July 2020).
StMELF (2020a) *Annex 3 Bavarian Cultural Landscape Programme (KULAP) - Measures from 2020 onwards Obligation to connect (AVP) and new obligation (NVP)*: Bavarian State Ministry of Food, Agriculture and Forestry. Available at: https://www.stmelf.bayern.de/mam/cms01/agrarpolitik/dateien/massnahmenuebersicht_kulap.pdf (Accessed: 25 September 2020).
StMELF (2020b) *Annex 4 Bavarian contractual nature conservation programme - from 2020 onwards, connection obligation (AVP) and new obligation (NVP) - Overview of measures*: Bavarian State Ministry of Food, Agriculture and Forestry. Available at: https://www.stmelf.bayern.de/mam/cms01/agrarpolitik/dateien/massnahmenuebersicht_vnp.pdf (Accessed: 25 September 2020).
StMELF (2020c) *Germany - Rural Development Programme (Regional) 2014-2020 - Bavaria, Version 7.0. Bavarian State Ministry of Food, Agriculture and forestry (StMELF) and the State Ministry for the Environment and Consumer protection (StMUV)*. Available at: https://www.stmelf.bayern.de/mam/cms01/agrarpolitik/dateien/programm_eplr2020_gesamt.pdf.
Therville, C., Antona, M. and de Foresta, H. (2020) 'The policyscape of agroforestry within Mediterranean protected landscapes in France', *Sustainability Science*.
Torralba, M., *et al.* (2016) 'Do European agroforestry systems enhance biodiversity and ecosystem services? A meta-analysis', *Agriculture Ecosystems & Environment,* 230, pp. 150-161.

Tsonkova, P., *et al.* (2018) 'Addressing farmer-perceptions and legal constraints to promote agroforestry in Germany', *Agroforestry systems,* 92(4), pp. 1091-1103.
Tsonkova, P., *et al.* (2014) 'Ecosystem services assessment tool for agroforestry (ESAT-A): An approach to assess selected ecosystem services provided by alley cropping systems', *Ecological Indicators,* 45, pp. 285-299.
Westaway, S. and Smith, J. (2019) *Barriers to the uptake of agroforestry in the UK, AFINET*: Organic Research Centre.
Zilans, A., Vanni, F. and Povellato, A. (2019) *UNISECO Deliverable Report D5.1 Inventory of Market and Policy Incentives Supporting AEFS*. Available at: www.uniseco-project.eu.

Appendix

Table 11: Financial aid for agroforestry (presents payment rates and eligibility criteria). **Data source:** RDPs, technical details supplied in project call outs and grant information sheets.

Country	*Region*	*Grant ref/Funding scheme/Reference*	*Reference*	*Payment details*	*Eligibility criteria*
France	Normandie (Basse Normandie)	RDP 2014-2020 (Regional) Basse-Normandie	(DFAAF, 2015; DRAAF, 2020)	•The rate of public aid is set at 80%. The minimum amount of public aid is set at 1,000 € per application. The max. amount of subsidisable expenditure is €2,000/ha for installation costs. •€600/ha for an overall period of 5 years for maintenance (DRAAF, 2015).	•Plantation density of 30 trees/ha to 99 trees/ha •Minimum scheme area is 1 ha •15-year commitment •The project must contain at least two species listed for the main stems (trees). No other species outside the list provided must be included in the project. •No more than 50% fruit trees. •Christmas trees and fast-growing species grown in short rotation are excluded •Action covered include: Planning and preparatory work, planting, plant maintenance work within the limit of one year following planting (only work carried out by a company can be financed) •Plantations must comply with the regulations in force, those relating to the protection of habitats (Natura 2000: Directive 92/43/EC), species (2009/147/EC), water (Directive 2000/60/EC) and classified sites. •Contract duration: 15-years
	Normandie (Haute Normandie)	RDP 2014-2020 (Regional) Haute-Normandie	(DRAAF, 2015)	•Rate of support (all public aid combined): 80% maximum •One-time grant for the initial establishment •Annual maintenance grant for 4 years.	•Planting density of 30/ha to 200 trees/ha •Minimum scheme area is 1 ha •Silvoarable and silvopastoral systems are supported. Trees can be isolated, in rows or in groups within plots and on the boundaries between plots (hedges, tree alignments). •Actions included in the aid are preparatory works, planting, individual plant protection and maintenance for the first 4 years. •Plantations of Christmas trees, poplar cultivars, softwoods, and growing species, and rapid short-term cultivated are excluded.
	Île de France	RDP 2014-2020 (Regional) Île-de-France	(DRIAAF, 2015; DRIAAF, 2019)	•80% public aid rate or applicable aid scheme rate (excl. VAT). •Eligible actions include project planning, supplies and planting works. •Excluded actions: works related to agricultural cultivation between the "rows"; second-hand equipment; plantation maintenance costs.	•Planting density of 30/ha to 200/ha •Minimum scheme area is 1 ha •Plantations at the edge of plots are also eligible, in the case of hedgerows. windbreaks, provided that intra-plot trees are installed at the same time •Forest trees must make up at least half of the stand. •Christmas tree plantations and fast-growing species cultivated in the short term (type short or very short rotation coppice) are excluded
	Limousin	RDP 2014-2020 (Regional) Limousin	(Région Nouvelle-Aquitaine, 2017)	•80% public aid rate or applicable aid scheme rate for establishment and maintenance for the first 5 years.	•Tree density of 30/ha to 100/ha •At least 50% forest species •Excluded species are Christmas tree plantations and fast-growing species cultivated in short rotation (e.g., short rotation coppice).
	Occitanie (Midi Pyrenees/)	RDP 2014-2020 (Regional) Midi-Pyrenees	(Europe en Occitanie, 2020)	•80% public aid rate or applicable aid scheme rate. There are 4 types of cost ceilings (excl. VAT): •14.75 €/plant (project management (PM) included) •34.75 €/plant (with PM and livestock protection) •11.5 €/plant (without PM) •31.5 €/plant (with livestock protection, no PM)	•Tree density of 30/ha to 150/ha for mature stands •Planting lines should be 10 to 40m apart. 6 to 15m between the plants in a line •Minimum scheme area is 1 ha •At least 50% forest species •Eligible land: non-forested land •a prefectoral decree defines the list of eligible species •the design and technical monitoring of projects will have to be carried out by a project manager with recognised qualifications.
	Occitanie (Languedoc - Roussillon)	Regional scheme/Installation and operation of an agroforestry system	(LaregionOccitanie, 2020)	A regional scale (based on a set of eligible costs excl. VAT) is set at: •13 €/plant and 33 €/plant (with livestock protection), for forest trees. •Project management & forest trees: 3.25 €/tree for projects with (forest trees, shrubs, fruit trees) > 1000 plants OR a lump sum of 3250 € for projects involving < 1000 plants. 5.50 €/plant for shrubs and fruit trees, project management included.	•Planting density 10-100 trees/ha for forest trees, 10-40 metres distance between planting lines and distance of 6-15 metres between plants •Max. 150 fruit trees/ha •Max. 300 shrub/ha •Trees and shrubs must be evenly distributed over project area.

Country	*Region*	*Grant ref/Funding scheme/Reference*	*Reference*	*Payment details*	*Eligibility criteria*
	Nord Pas de Calais	RDP 2014-2020 (Regional) Nord-Pas-de-Calais	(Région Hauts-de-France, 2020)	•80% public aid rate or applicable aid scheme rate. •Ceilings : Subsidisable expenses per tree, including protection, are capped at: -25 €/plant of forest trees for forest agroforestry in non- grazing system, -70€/forest plants in pasture system, -120 €/plant of fruit trees in pastured systems, -90 €/plant of fruit trees outside pastured systems, -6€/ shrub plant	•Tree density of 30/ha to 250/ha •Minimum scheme area is 1 ha •For mixed agroforestry including forest and fruit tree species, the plantation must include a majority (more than 50%) of forest species. •Minimum 3 tree species implemented per project.
	Pays de Loire	RDP 2014-2020 (Regional) Pays de Loire	(Pays de la Loire, 2020)	•Public aid rate of 80% of eligible expenditure •Covers the cost of tree installation and maintenance during the first year.	•Tree density of 30/ha to 100/ha •Minimum scheme area is 1 ha •At least two different eligible tree species for projects of less than 10 ha and three eligible tree species for projects of more than 10 ha •No eligible species must represent more than three-quarters of the trees planted •Grafted fruit trees must represent less than 50% of the stand •Ineligible systems include plantations on the edge of plots; grazed forest and copses, which come under the Forest Code; Christmas tree plantations, poplar cultivars, truffle trees, fast-growing species cultivated in the short term; and demonstration and advisory actions related to agroforestry.
	Hauts-de-France (Picardie)	RDP 2014-2020 (Regional) Picardie	(europe-en-hautsdefrance, 2020)	•Public aid is 80% of the eligible operations and maintenance expenditure. •Maintenance costs are eligible for aid for the first 5 years.	•Tree density of 30/ha to 250/ha, which must be maintained for at least 5 years after the date of payment of the subsidy. •minimum scheme area is 1 ha •Fruit trees may not make up more than 50% of the main stems.
	Metropolitan France and French overseas departments and territories	Support Program for Agroforestry Plantations - Trees and Hedges in Agricultural Systems/ Association Française d'Agroforesterie	(Association Française d'Agroforesterie, 2020)	Supplies and technical support are covered by the plantation support program within the limit of: 14,50€ to 24,50€ per tree 9€ per linear meter of hedge. Labour cost is not covered.	•No minimum scheme area specified •Minimum No. of trees = 200 •Eligible plots: agricultural land. •Hedges, alignments, market gardening orchards, forest gardens, etc. •All leafy species adapted to the pedoclimatic context will be considered, and sufficiently diversified (at least 3 different species, with a maximum of 60% for the dominant species) •Preparation of the soil - Planting of trees between November 15 and April 15 - Installation of mulch and protections for each tree •Contract duration: 20 years
	Nouvelle Aquitaine	Alter'na regional scheme - PCAE Establish an agroforestry system/Chambres d'Agriculture des Landes	(Chambres d'Agriculture des Landes, 2020)	Rate of aid: 50% of the amount of the investment before tax Flat-rate aid: €10/plant for projects without protection against rearing €16/plant for projects with protection against rearing Subsidy floor: €500 Subsidy ceiling: €15,000	•minimum scheme area is 1 ha •Tree density 30 to 100 trees/ha •Eligible land: non-forested land that was farmed in the previous year •At least 5 different species, minimum 5% of the total (in number of plants) representation from each species. •The creation of hedges and groves, Christmas tree plantations and mycorrhizae truffle species are excluded. Hedge planting at the edge of plots, groves, isolated trees are considered by another scheme, "Implementation of Agro-Ecological Infrastructures (IAE)". •This scheme is for farmers or agricultural development establishments whose holdings are under contract: either in Organic Agriculture (conversion or maintenance) on all or part of the holding or an HVE level 3 environmental certification.

Country	*Region*	*Grant ref/Funding scheme/Reference*	*Reference*	*Payment details*	*Eligibility criteria*
Germany	Bavaria	Measure B57. Cultural Landscape Program (KULAP)/RDP for Bavaria 2014-2020	(StMELF, 2020a; StMELF, 2020c)	€ 8 per tree per year Minimum funding: € 250 per applicant	•Max. 100 trees / ha •Tree species are vigorous fruit trees (apple, stone fruit, and nut trees) •Aid is for the promotion of the existing orchard tree •AF system is Streuobst – Orchards •5-year commitment period
	Bavaria	Measure W07: Contractual Nature Conservation Program (VNP)/ RDP for Bavaria 2014-2020	(StMELF, 2020b)	€ 12 per tree per year	•Max. 100 trees / ha •Minimum scheme area 500 m2 •Permitted tree species are fruit trees •Funding is for the existing orchard tree •AF system is Streuobst – Orchards •5-year commitment period
	Bavaria	Bavarian Landscape conservation and nature park guidelines (LNPR)/ RDP for Bavaria 2014-2020	(LFL Institute, 2020; Bayern.Recht , 2020)	Funding project related, usually up to 70% of the expenses incurred for the measures and regional settings listed in the LNPR.	•Minimum eligible expenditure €2,500 •New plantings above 12 fruit trees (+ protective cages, trees etc.) •Permitted tree species are fruit trees •Funding of measures includes new planting and maintenance of orchards •AF system is Streuobst - Orchards
Ireland		GPC-11-Agro-forestry/National Forestry Programme 2014-2020	(DAFM, 2018a; DAFM, 2015a)	•Total establishment funding available is 6,220/ha •(this comprises the following: 1st grant €4,215/ha, 2nd grant €1,405/ha, additional fencing €600/ha) •Annual premium payment (includes maintenance) of 645/660 <10ha/>10ha (€/ha) for 5 years. •Under State Aid rule, only 80% of eligible costs can be funded.	•Between 400 and 1000 trees/ha equally spaced out •Minimum scheme area is 0.5 ha •Permitted tree species include oak, sycamore, and cherry, including 15% fruit and nut trees. Other species can also be considered on a site-by-site basis. •Focus on silvopastoral systems, grazing, silage, and hay production is permitted. •Agroforestry must remain under forestry and is therefore subject to a replanting obligation. •Agroforestry plots planted under this scheme are eligible for WIS grants for thinning, tending, and pruning, a single payment per treated hectare (1st thinning €750/ 2nd thinning €500).
United Kingdom	Northern Ireland	Environmental Farming Scheme – Wider level Establishment of agroforestry / RDP 2014-2020 (Regional) Northern Ireland	(DAERA, 2017)	Year 1: £1637.00 per ha ; Years 2 –5: £65.00 per ha each year	• 400 trees/ha or 80 trees/0.20 ha with 5m spacing •Minimum scheme area is 0.1 ha •Silvopastoral, silvoarable •Where fruit trees are planted, they should be combined with forest tree species and the forest species should be in the majority >50%
	Scotland	Forestry Grant Scheme (Agroforestry option) / RDP 2014-2020 (Regional) Scotland	(Scottish Government, 2018c; Government, 2018b)	Establishment grant = £3,600 / hectare (400 trees/ha); £1,860 / hectare (200 trees/ha); Annual maintenance grant for 5 years = £84/hectare/ year (400 trees/ha) or £48/hectare/ year (200 trees/ha)	•There are two stocking levels: 400 trees/ha or 200 trees/ha. •Minimum scheme area is 0.25 ha with a maximum area of 15 hectares per farm business unit •Permitted tree species include oak, sycamore, cherry, beech, birch, aspen •Up to 20% of the planted area can be composed of fruit trees or native shrubs species •Minimum tree protection requirements apply •Silvopastoral (sheep only, grazing pasture) or silvoarable systems •Silvoarable with cropping between rows may also be eligible for EFA Agroforestry (EFSAF) •Eligible land area must be permanent grassland pasture, temporary grassland, or arable land (Land Capability for Agriculture – Class 1.1 to 4.2 inclusive) •UK Forestry Standard applies to applications.

Country	*Region*	*Grant ref/Funding scheme/Reference*	*Reference*	*Payment details*	*Eligibility criteria*
					•Contract duration: 20 years/10-year maintenance commitment
	Wales	Glastir Option 804 - Glastir Woodland Creation Scheme Agroforestry – Scattered Trees / RDP 2014-2020 (Regional) Wales	(Welsh Government, 2019; Government, 2020)	New planting payment £1,600/ha annual maintenance (5 years) £30 Not eligible for fencing grant or Premium payment	•80 scattered trees per hectare on permanent grassland with continued grazing. •Minimum scheme area is 0.25 ha •AF system is Silvopastoral

Table 12: Forest definitions. **Data source:** Annex V, LULUCF Regulations; Forestry Act 2014 (Ireland).

Country	*Min area (ha)*	*Crown cover (%)*	*Height (m)*	*Minimum width (m)*
*France**	0.5	10	5	20
Ireland	0.1	20	5	20
Germany	0.1	10	5	
UK	0.1	20	2	20

*Only France follows the FAO definition of a forest.