



EU CAP Network

**Focus Group - Enhancing the biodiversity on
farmland through high-diversity landscape features**



Table of Content

Introduction	3
1. Characteristics and benefits of the main HDLF	3
1.1 Definition	3
1.2 Description and characteristics of the main HDLF	4
1.3 Ecosystem services	5
1.4 Biodiversity benefits	6
2. Relevant good practices and studies identified by the FG experts	7
2.1 Woody features	7
2.2 Grassy features: Fallows, flower strips, grassland buffer strips, inter-row covering plants, field margins	8
2.3 Wet features	9
2.4 Stony features	10
2.5 Various landscape features	10
2.6 Specific actions for pollinators	11
2.7 General topics	11
3. Success factors and barriers to the adoption of these practices	12
3.1 Success factors	12
3.2 Barriers	13
4. Opportunities and challenges for developing solutions on farmland through HDLF	14
4.1 Innovation and good practices: Outcomes of discussion	14
4.2 Three examples of giving value to the ecosystem services provided by HDLF (from a social and economic point of view)	15
4.3 Capacity building experiences and needs for implementation of HDLF	17
4.4 Key issues related to the required changes	18
5. Recommendations	19
5.1 Main recommendations for future research projects	19
5.2 Ideas for Operational Groups	21
Conclusion	22
References	23
Annex 1: References on the areas covered by HDLF at different scales	29
Annex 2: List of FG experts	30
Annex 3: List of Mini Papers	31

Introduction

This report is the result of the work of the EU CAP Network Focus Group (FG) on High-Diversity Landscape Features (HDLF) and, more specifically, serves as a response to the main question: “How can farmers maintain, enhance and create HDLF that positively impact farmland biodiversity?”

The FG consisted of 20 experts (list of the members in [Annex 2](#)) from different European countries who met in Poitiers (France; February 2023 1-2) and in Ljubljana (Slovenia; April 2023 25-26) to share knowledge and experiences about HDLF. They looked into how the FG could contribute to efforts to make EU farming more biodiversity-friendly as per the EU biodiversity strategy. The experts collected and discussed good practices, identified needs and barriers from these practices and proposed relevant innovative actions and research projects.



To facilitate the discussions, a Discussion Paper (DP) was prepared before the first meeting. This paper provided an overview of HDLF and discussed the benefits of HDLF for farmland biodiversity. It also summarised good practices identified by the FG experts, which included information on success factors and the challenges associated with adopting these practices.

During the two meetings, the FG discussed the state of play and possible solutions based on the following tasks:

- Collect and highlight good practices and inspiring success stories, including “small changes-large gains” approaches and methodologies for maintaining and introducing an HDLF at different spatial scales.
- Identify the challenges and opportunities for farmers in introducing more HDLF to increase both the diversity and area of habitats and/or better connectivity between habitats.
- Suggest innovative HDLF and appropriate maintenance, including digitalisation and precision farming tools/management models

essential to the value of landscapes and HDLF for wildlife.

- Identify examples of giving value to the ecosystem services provided by HDLF (from a social and economic point of view).
- Identify capacity building experiences and needs for implementation of HDLF.
- Identify further research needs from practice and possible gaps in technical knowledge.
- Suggest innovative ideas for EIP-AGRI Operational Groups and other innovative projects.

Many HDLF emerged with farming or have been maintained by farmers over centuries. However, nowadays, HDLF are increasingly under pressure due to changes in farm structures, agricultural technologies and markets.

In this report, we focus on:

- Characteristics and benefits of main HDLF;
- Relevant good practices and studies identified by the experts;
- Success factors and barriers to the adoption of these practices;
- Opportunities and challenges for developing solutions on farmland through HDLF;
- Recommendations for research projects and ideas for Operational Groups.

1. Characteristics and benefits of the main HDLF

1.1 Definition

Farmland HDLF are areas of natural or semi-natural habitats that can range in size depending on the EU Member State, region or individual farm. No matter the size, they all provide important contributions to ecosystem services and biodiversity. They have long-standing historical and cultural roots in the agricultural landscapes of Europe but, with the advent of intensive agriculture, HDLF are threatened, as stated in the JRC report [Landscape features in the EU Member States](#).

HDLF include several mostly non-productive elements of traditional European agricultural landscapes, such as buffer strips, hedges, ponds, ditches, isolated trees, rows or groups of trees, field borders, terraces, dry-stone or earth walls, flowering borders, patches of natural habitats that receive no fertilisers or pesticides, but can also contribute to farm productivity. Forest edges represent an important part of the HDLF and also play a major ecological role.





HDLF can also be productive. However, their use is quite often limited by legal or funding restrictions. Permanent meadows are grazed (or mowed), the hedgerows produce wood for energy, trees in open-air orchards produce fruit, fallow land provides nectar and pollen to pollinating insects, and as a result honey is produced for food, ponds provide water for many different species. These are all a full part of the agricultural area and are managed extensively, mostly by farmers.

In addition, HDLF are any habitat of an agroecosystem in a specific area or around it, with developed spontaneous vegetation mostly composed of biennial, multi-annual or perennial species as a so-called "service cover" intentionally unharvested. According to Jean-Pierre Sarthou (Inrae, France, see [Ecophytopic website](#)), semi-natural habitat can have various forms:

- Linear, such as rows of trees and their grassy strips at the edge of or inside the fields, forest edges, hedges, embankments, low walls, edges of ditches, streams ...;
- Areal, such as floodplains, meadow orchards, rangelands, wastelands, groves, wetlands...;
- Punctual, such as ponds, springs, isolated trees, rocks...

1.2 Description and characteristics of the main HDLF

HDLF have been around for as long as agriculture has, but they developed very widely in the nineteenth century, 'traditional' HDLF include tree formations: hedges, groves, meadow orchards, isolated trees and alignments. In addition, there are extensive meadows. Grass strips, extensive crop strips, ground beetle benches and wildflower zones are of recent design, even more recent than agroforestry plots that combine trees and crops.

The main landscape features are described below and can be classified into 4 main types (Czúcz et al. -2022b): **woody features**, **grassy features**, **wet features** and **stony features**.

Woody features

Hedges can provide habitats for a wide range of species. They offer food, safety and shelter. Hedges can be connecting elements between the field and the forest, between open and closed environments, representing a major biological interest.

Isolated trees and groves: These are woody plant species, scattered or in small groups.



Grassy features

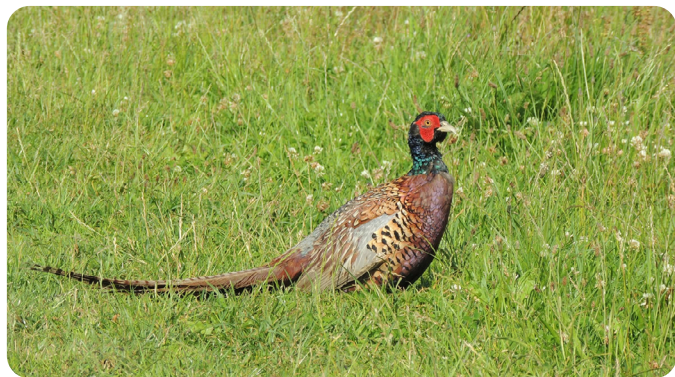
Perennial grass strips and field borders when they are neither fertilised nor chemically treated.



Fallow land is also considered HDLF as long as it is neither treated nor fertilised.



In addition, **unfertilised grasslands can host many HDLF**. They are often associated with tree formations: hedges, meadow orchards, scattered trees and groves. Pastures, meadows, salt meadows, scrubland, some floodplains and marshes are spaces kept open by extensive grazing and can also host HDLF.



Wet features

Agricultural ponds, are a major biodiversity preservation interest: Once frequent, agricultural ponds have gradually almost disappeared from the countryside. Their considerable biological richness, however, makes them of particular interest for biodiversity preservation in agriculture.



When their sides are vegetated, ditches play a role in purifying water run-off from surrounding areas. They also provide a valuable habitat and help in the maintenance of water-borne species.



Stony features

Whether they are raw, cut, stacked or piled up, stones can serve as a refuge for a wide variety of spiders, wasps, birds, reptiles and small mammals. Low walls, and terraces are common in vineyard landscapes.



1.3 Ecosystem services

HDLF are the place of permanent or intermittent life, allowing reproduction, feeding, refuge of all biological groups (archaea, bacteria, protists, fungi, flora, fauna). HDLF also actively contribute to the provision of ecosystem services, sustaining agricultural production and the implementation of the Green and Blue Grid policy (Carles-Mejane and al, 2022) for the connectivity of environments by allowing the circulation of species and genetic mixing, contributing to adaptation to climate change. They also participate in the completion of all, or part of, the water cycle, the carbon storage, nitrogen and all other mineral elements, future nutrients of microorganisms and plants. They also contribute to sustainably supporting agricultural production by allowing a lower use of some inputs (pesticides, fertilisers, water), for example by supporting natural pest control (Sarhou, 2022). Some HDLF play an important role in animal sheltering (and thus animal health and well-being) or as windbreaks. HDLF also play a role in limiting flooding and soil erosion, which can have drastic impacts on production.

However, HDLF can have negative impacts, such as increase of alien species and pests and these can act as a barrier to their adoption by farmers (see Chap. 3).



1.4 Biodiversity benefits

HDLF can be sources of food, resting places and shelter (from predators, weather and in-field farming operations) as well as sites for breeding, rearing and over-wintering for a range of animals, from soil organisms and invertebrates to small mammals and birds. An evaluation of the greening measures in the 2014-20 Common Agricultural Policy (CAP) (European Commission, 2017, 133 – 135) summarised evidence for the biodiversity benefits of some landscape features as described below:

Hedgerows and wooded strips: Hedgerows and other woody field boundaries benefit wildlife by providing habitats, feeding sites, refuges and movement corridors for invertebrates, birds, mammals, reptiles and amphibians and also support some wild species that would not otherwise exist in arable landscapes (Batáry, Matthiesen and Tscharnke, 2010; Belfrage, Björklund and Salomonsson, 2015; Farmer et al, 2008; Feber et al, 2007; Hinsley and Bellamy, 2000). However, individual hedges vary greatly in their character and management and hence their biodiversity value.

Trees, tree lines and tree groups or copses: Isolated mature trees can provide more resources for tree-hole nesting birds and bats compared to treeless arable fields (Eglington and Noble, 2010; Kalda, Kalda and Liira, 2015) while groups of trees provide refuges and key foraging habitats for generalist invertebrates (Farwig et al, 2009), plants and common farmland birds in arable areas (Sanderson et al, 2009) and can also provide corridors between habitats for mammals.

Ponds and ditches can be hotspots of high biodiversity value, e.g. for freshwater invertebrates and amphibians but biodiversity benefits may be low if levels of nutrient pollution are high and riparian vegetation is lacking (Céréghino et al, 2012; Mountford and Arnold, 2006; Williams et al, 2004). There is evidence that large numbers of farmland ponds have been lost, particularly in Western Europe in recent decades (Curado, Hartel and Arntzen, 2011; Ferreira and Beja, 2013).

Stone-walled terraces, which are typical of Mediterranean regions, provide disturbance-free habitats with specific micro-climates for plants, reptiles, amphibians, invertebrates, etc. typical of dry and stony habitats. Earth bank terraces can provide strips of exposed habitats suitable for some threatened arable plants and invertebrates, such as solitary bees, if the soil is of low fertility with bare patches. They contribute to the reduction of soil erosion and therefore to the preservation of soil fertility and of soil microfauna.

There is also a large body of evidence on the biodiversity benefits of grass strips, flowering strips and fallow lands, as described below:

Field margins, buffer strips, strips along forest edges: Depending on the plant species planted and the method of maintenance,

auxiliary insects and wildlife may be favoured. Permanent grass field margins and grassy buffer strips can have high densities of soil macrofauna, such as litter-consumers (that tend to be missing from arable systems), which benefit from absence of soil cultivation and a substantial surface litter layer (Nieminen et al, 2011; Smith, Potts and Eggleton, 2008). They also act as a reservoir or refuge of soil biodiversity which can re-colonise arable fields after disturbances, such as cultivations for tillage crops.

Permanent grassy margins are of little value for flower-visiting arthropods unless they are left uncut, but provide relatively undisturbed refuges for predatory arthropods (Holland et al, 2015; Inclán et al, 2016), nesting bees, small mammals (Rodríguez-Pastor et al, 2016) and birds overwinter until the first cut (Vickery, Feber and Fuller, 2009), whilst temporary field margins and in-field buffer strips sown with diverse flowering plant mixes can provide foraging resources for these groups (Scheper et al, 2013; Wood, Holland and Goulson, 2015).

Flowering strips: As permanent covers, flowering strips are refuges for ground dwelling predators such as carabid or staphylinid beetles and a food resource of pollen and nectar for many flying insects such as hymenopteran parasitoids, hoverflies or even lacewings that ensure pest regulation. Like grass strips, flowering strips promote the movement of species by creating interconnections between other HDLF.

Fallow lands: Uncultivated agricultural land must meet the needs of wildlife and biodiversity. A minimal maintenance with an annual shredding in autumn highlights the essential role of fallow land in the expression of local floral biodiversity within cultivated areas (Nitsch et al, 2017). Fallow land, whether floristic or hunting, is particularly favourable to the nesting of birds in spring and especially for species nesting on the ground. Many other wild species settle there. Fallow land therefore seems to fully meet its objective of preserving and increasing biodiversity.

To conclude, HDLF contribute to the preservation of biodiversity in different ways:

- › by promoting functional biodiversity, i.e. biodiversity useful to farmers;
- › by bringing together principles of agriculture, biodiversity and ecosystem functioning;
- › by allowing the connectivity of environments and thus the circulation of species;
- › by providing space for genetic mixing that promotes the evolution of species and their adaptation to climate change;
- › by providing habitat and food for the development of these species, including crop auxiliaries.



The connection of HDLF of different types helps to develop a wealth of fauna and flora in the landscape by creating vital habitats and circulation networks specific to each species. This is called an **ecological corridor**.

Finally, the biodiversity value of landscape features depends not just on their characteristics but also on their spatial location (in relation to agricultural land and other features/habitats), their size and their contribution to diversity of land cover. This diversity of HDLF contributes to maintaining high landscape heterogeneity, which is the key to the maintenance of diversity.

2. Relevant good practices and studies identified by the FG experts

The following overview is based on the 42 projects or practices that the experts are or have been involved in. The good practices are analysed following the HDLF typology presented in chapter 1.2: woody features, grassy features, wet features and stony features. Three additional items have been added for: various landscape features, specific actions for pollinators and general topics (not directly linked to HDLF).

2.1 Woody features

Hedges are known to represent a belt of primarily forestry vegetation positioned in agricultural land to support biodiversity. Their benefits are well-recorded:

- › They represent microhabitats, sources of food and nesting places for different small mammals, insects and birds. In France, an assessment of recent hedgerows (< 15 years) showed that they harbour similar diversity of taxonomic groups (carabids, vascular plants, butterflies) by comparison with old traditional hedgerows and grassy margins.
- › Hedges also have the capacity to sequester carbon, improve water infiltration and provide shelter for livestock as well as better thermoregulation of animals in summer and for wind protection.
- › They also constitute an extensive ecological network within a recognised cultural landscape.

Preservation of scattered trees, small woods and linear tree formations:

- › TOF (Trees Outside Forests) project in the UNESCO WHL site called 'The hills of Prosecco' in **Italy**.

Preservation of forest edges:

- › Preservation of the forest patches adjacent to the extensive grassland in **Germany**.
- › Maintaining scattered and isolated trees in grassland in **Italy**.
- › Maintaining forest edges as a transition zone forms a biodiversity gradient between agricultural and forest ecosystems in **Slovenia**.

Hedgerow restoration and creation:


- › Agroforestry hedgerows planted in **Brittany (France)** on farms with several objectives: restore biodiversity, prevent nitrogen leaching for water protection, increase plant density (spatial planning), create windbreaks, provide shelter for livestock and produce valuable products from trees.
- › Hedgerow restoration and creation on two farms in **England**, about 180 acres of mostly permanent pasture along with some Ancient Semi-Natural Woodland (ASNW) farm, several sites of nature conservation interest (SNCI), site of a Roman fort and other related archaeology.
- › Particular woodland management with undesirable species removal and infill planting of a variety of native species re-established habitat, particularly for woodland birds in **England**.
- › Leader of an EIP-AGRI project on hedges in **Slovenia** with the idea of introducing (among other elements) also local and high production species and genotypes of fruiting/flowering plants (trees and shrubs) and bringing in hedges of edible mycorrhizal fungi, such as summer truffle.

Creeping shrubs creation:

- › Complete restoration of waste landfills and drilling sites in **Bulgaria** by creating groups of creeping shrubs to be a refuge for wild animals, to provide places for nesting and feeding.



Box 1: Hedgerows planting in Brittany (France) by farmers of 'Terre et bocage association'

	<p>The practices of hedgerow planting and management are designed to promote an awareness of and a reasoning for tree development. The tree species and different methods of hedgerow establishment are chosen according to farmers' objectives, the use of their fields, the local conditions on farms, the observed vegetation structures and local tree species in the surrounding area.</p>	
Benefits for biodiversity	Economic benefit/value	Social benefit/value
<p>15 years after planting, the expected agroecological benefits of hedgerows can already be perceived in terms of flora and fauna diversity. New hedgerows also contribute to reinforcing the structure and ecological functions of the agroforestry hedgerow landscape/</p>	<p>Hedgerows contribute to and enhance crop and livestock production by sheltering crops and livestock in pastures against inclement weather. Farm use of and the sale of wood chips and logs contribute to covering the ongoing hedgerow maintenance costs. Mutual aid, recycling of material (e.g. for mulch) and the principle of parsimonious pruning contribute to controlling costs.</p>	<p>The Terres et Bocage association offers farmers the opportunity to join active groups of stakeholders, sharing agronomic and environmental concerns in relation to hedgerows. The farmers also reported that hedgerow planting improves landscape aesthetic and life quality on the farm.</p>
<p>More information: http://terresetbocages.org/; https://www.agforward.eu/bocage-agroforestry-in-brittany-france.html</p>		

2.2 Grassy features: Fallows, flower strips, grassland buffer strips, inter-row covering plants, field margins

Grassy features enhance the value of biodiversity and ecosystem services in agricultural landscapes. They provide support for pollinators, reduce soil erosion and lead to more abundant soil life.

Flowering strips, field margins, or even inter-row covers are a positive response for the establishment of a more robust trophic chain and the improvement in biodiversity of the fauna of the soil, pollinators, natural predators of cultivated plants, birds and small mammals.

Preservation and creation of fallows and flower strips:

- › Preservation and creation of perennial set-aside fields in **Germany** both as flowering areas and fallows.
- › **French study** about the use of flowering intercrops in autumn/winter to host aphid, natural enemies and limit the risks associated with Barley Yellow Dwarf Virus (BYDV). The flowering intercrops produced flowers late in the season. In the neighbouring cereals, ground dwelling arthropods were more abundant next to this intercrop than next to a classic grassy margin, and aphid control was slightly improved.

- › Biodiversity stripes in vineyards in the framework of a Life project called 'VineAdapt' in **Austria**.

Creation of grassland buffer strips:

- › The **Estonian LIFE project** was actually conducted in pilot fields to test the benefits of grassland buffer strips and unsown patches in arable land for skylark populations. These tested measures could officially be part of Estonian agricultural support schemes.
- › Forms the basis for the implementation and monitoring of multifunctional field margins within the framework of the new eco-schemes in **Spain**.

Implementation of inter-row covering plants:


- › Multi-species inter-row covering project in vineyards and orchards in **Hungary**.

Re-established native grassland vegetation:

- › The rehabilitation of kurgans on arable land in **Hungary** to provide important resting, overwintering and nesting habitats for multiple bird, reptile and amphibian species, habitats for pollinators and pest antagonists and extend the boundaries of protected natural areas.



Box 2: Life project called 'VineAdapt' in Austria

	<p>One part of the Life project called 'VineAdapt' (ongoing project running until 2025) focuses on biodiversity stripes in vineyards (which is also applicable to other permanent crops). Contents of the projects are - inter alia - development/testing of biodiverse seed mixtures in different winegrowing regions, investigation of the effects on flora/fauna/vines, practical and technical implementation and support for farmers.</p>	
Benefits for biodiversity	Economic benefit/value	Social benefit/value
<p>Natural pest control, fostering of insects and positive effects on soil biodiversity are expected.</p>	<p>Marketing value; Technical optimisation and knowledge on interactions with biodiversity lead to a more efficient and targeted use of machinery, and a reduction of pesticides.</p>	<p>Protection of species; less drift to non-target areas; some measures to enhance biodiversity enhance the attractiveness of the landscape.</p>


2.3 Wet features

Ponds are important habitats for amphibians, water insects and other species. They are also important elements of landscape diversity. They ensure water supply for wildlife, increasing the biodiversity of the entire ecosystem. Ponds are also semi-natural or artificial, man-made elements in karst areas, used to provide water for people and livestock.

Maintaining or creating ponds:

- › **Finnish farm project** on the creation of a pond between two fields and maintaining brands and natural trees on the sides of the pond. The pond works as a settling basin that collects water from 60 hectares, but the pond is also an oasis for wildlife such as deer and moose, but also smaller animals and insects.
- › **Italian farm project** of maintaining and/or creation of water ponds in pastures and forests for silvo-pastoral management.
- › **Croatian project** maintaining water ponds.

Box 3: Maintain and or create water ponds in pastures and forests for silvo-pastoral management in an Italian farm

	<p>Located in the Maremma region, this farm combines extensive rearing of the rustic traditional Maremmana cattle breed on a large and diverse farm encompassing over 1500 ha of forest (73%), pastures (7.3%), olive groves (0.4%), vineyards (0.2%) and arable crops (19.1%). The silvo-pastoral management of the farm is conducted by the farmer to maintain and or create water ponds. They are fenced off (with barbed wire and wood stakes, for example) so that farm animals cannot access them directly, but drink from them through water channelisation within a movable outdoor water trough: wild animals, on the other hand, can access them without problems.</p>	
Benefits for biodiversity	Economic benefit/value	Social benefit/value
<p>Ensure water supply for wildlife, increasing the biodiversity of the entire ecosystem (frogs, turtles, anatids, ...).</p>	<p>Potential to use the forest for animal husbandry (browsing, shelter, thermoregulation, ...), ensuring human control over the environment, fire prevention, etc...</p>	<p>Ensure accessibility to wooded places also for tourism and accommodation activities.</p>



2.4 Stony features

Dry stone walls provide an important habitat for many plants and animals and are particularly important for lichens, mosses, ferns and a number of invertebrates. Several bird species use dry stone walls as nest sites. Dry stone walls are important elements of landscape diversity and also act as a corridor between larger areas of other habitats, besides their role for the reduction of hydrogeological risk and for soil conservation.

Maintaining, restoration or creation of dry-stone walls:

- › **Italian project** of restoration of dry-stone walls in Lamole, a small village in **Chianti (Tuscany)**, traditionally characterised by vines and olive tree cultivations on dry-stone terraces. In that case, dry stones are mainly used as a defence from soil erosion and to improve the quality of the wine, but with positive impacts on the preservation of traditional landscape, on rural tourism and on biodiversity.
- › **Croatian project** of maintaining, protecting, reconstructing and creating dry stone walls.

Box 4: Farmland dry stone wall in Croatia



Farmland dry stone walls are man-made linear elements used as field boundaries to restrict livestock movement and/or to separate property. They are typically built using stones removed from fields and traditionally they are built of stones only, without the use of mortar. In Croatia, they are typical for the Mediterranean (coastal) region but they can also be found in some other parts of Croatia.

Benefits for biodiversity	Economic benefit/value	Social benefit/value
<p>Dry stone walls provide an important habitat for many plants and animals and are particularly important for lichens, mosses, ferns and a number of invertebrates. Several bird species use dry stone walls as nest sites. Dry stone walls are an important element of landscape diversity and also act as a corridor between larger areas of other habitats.</p>	<p>Well-maintained dry stone walls have an excellent water drainage performance and they can effectively minimise landslide risks and soil erosion. They are effective windbreaks and can also counteract forest fires that are very common in coastal areas of Croatia. Farmers can obtain 0.74 EUR per metre/year for the maintenance of dry stone wall as a part of the agri-environment scheme. They can also receive a payment of 100 EUR per m³ for the reconstruction or creation of dry stone walls.</p>	<p>Inscribing 'Art of dry stone walling, knowledge and techniques' into the UNESCO Representative List of the Intangible Cultural Heritage of Humanity in 2018 alongside several other countries brought a lot of attention and social recognition. Acknowledgement of the skills of local old master builders and transfer of their knowledge to the younger generation is very important. Organisation of local events around dry stone wall subjects, including workshops, student camps, etc. It also brought interest and encouraged visits from tourists.</p>
<p>More information: http://www.dragodid.org/, https://suhozid.giscloud.com/</p>		

2.5 Various landscape features

- › Creation of **woodlands**, small **orchards** or **wildlife ponds** in hare's corners in **Ireland** to provide shade and water for animals at times of drought. The term 'Hare's Corner' is an old farming expression for the corner of a field or an area of rough ground which was not intensively farmed, so instead it was 'left to nature'.
- › **Extensive management of pastures, meadows and wetlands;** creation of **dry stone walls**, plantations of **flowering strips**, **high**

trunk fruit trees, hedges and **perennial herbs on the forest edge** on a cattle farm of 18ha in the black forest in **Germany**. There are various benefits for biodiversity: It offers a space for insects to retreat to, a habitat and food source for birds, insects and much more, movement of seeds and small animals, higher diversity of plants, diverse structures and habitats on the forest edge and preservation of open land biotopes.



- › Creation of **numerous, diverse and high-quality landscape features** in the frame of the BirdLife **Switzerland's Farnsberg Orchard project** located in the Table Jura region of Basel-Landschaft (Since 2004). Various species have been detected or have reproduced in the project area for the first time in years during the course of the project, such as the honey buzzard, the cuckoo, the wryneck and the nightingale.
- › **Creation, preservation and promotion of small structures in Switzerland** to enhance high-quality biodiversity areas : Hedges, field and riparian woods and borders; ponds, ruderal areas, cairns and stone walls; High-stem orchards, extensive pastures and vineyards with a certain proportion of small structures; branch heaps, wet and damp places, groups of bushes, pollarded willows, ditches, wooden beams, natural stone walls, nesting aids for wild bees, open ground, cairns - litter heaps, pools / ponds, day butterfly embankment windows and deadwood trees.
- › **Irish Farmer** Moth Monitoring EIP Project, which focuses on how farmers led biodiversity monitoring on the farm. This project has shown the general interest and willingness of farmers in Ireland to engage in and contribute to citizen science. A total of 112 moth species was recorded across the 20 farms in 2022.
- › Branding a 'Live landscape' initiative by an NGO in **Slovakia** involving farmers to compete for ecological farming. This project improves the ecological conditions of farms and makes 'live farms' more visible.

Ongoing studies :

- › Conservation of natural biodiversity in agricultural land study and report in **Estonia**. The aims of this study were to bring together information on how to best conserve biodiversity on farmland and why it is important to do so.
- › Implement a methodology for regional or local study of a territorial network of ecological stability in **Slovakia** based on elements of green infrastructure in open landscapes to develop Eco-stabilisation measures, and agro-environment-climate measures for farmers.
- › In **France**, ARVALIS is conducting a project based on indicators of the quality of hedges. In this internal project, they are trying to define a protocol to assess the quality of hedges with respect to predators and parasitism of cereal aphids.

In addition, from 2020 to 2027, a resource project will run in the canton of Zurich to promote biodiversity on agricultural land in a target-oriented manner. Habitat targets are defined with the farmers, which are to be achieved in the biodiversity promotion areas. Farmers are free to choose their own measures to achieve the targets.

2.6 Specific actions for pollinators

- › Protecting Farmland Pollinators by **creating solitary bee nests on bare soil areas or 'bee boxes' in farmland** is the framework of an EIP Project in **Ireland**. Newly created nest sites on farms were immediately used by a range of different below ground nesting solitary bees and above ground cavity nesting solitary bees.
- › Implementation of various actions to help pollinators on **Irish farms** and increase land area managed for biodiversity such as: bird cover, catch crop, companion crop, cover crop, clover pasture, hay meadows, hedgerows, herbal ley, mixed species sward, non-farmed area and other field boundaries.

2.7 General topics

In the following section, the projects do not refer directly to landscape features. They are mostly implemented to conserve biodiversity in specific areas or to integrate biodiversity on farmland.

Education projects for farmers:

- › In **Austria**, two education projects are conducted with the aim of integrating biodiversity in production processes in Austrian farms. Farmers learn to implement various methods to foster biodiversity on their farms. The organic association BIO AUSTRIA integrated biodiversity guidelines into their framework. As one effect, farmers become aware of their actual contribution to enhance biodiversity.
- › Actions of protection, restoration or creation of **blanket bog habitats** in upland areas along the Atlantic seaboard of **Ireland**. Blanket bogs are home to many threatened species, including curlew, red grouse, salmon and freshwater pearl mussel. Payments for landowners are directly related to habitat quality and the ecosystem services it provides (e.g. water quality, biodiversity; climate regulation).
- › Preservation of the **mountain meadows** of the eastern Alps in several **Austrian farms**. The aim is to manage more and more of the remaining mountain meadows in the municipality of Molln in Austria to preserve this valuable and endangered biotope type in the long term and to return areas to a manageable condition. In addition, good practices of preservation of **semi-arid grassland and Fresh lean meadow** are implemented. These small fields are mowed only once (or at most twice a year) to preserve specific natural plants.
- › Action of **sprayer optimisation** with the aim of **protecting non-target areas** (including HDLF) by less drift. This Austrian **LEADER-project** is based on improvements and optimisation of sprayers and soil management (soil analyses, greening strategies, weed control without herbicides). The participants were fruit farmers and winegrowers.



- › **Maintenance of biodiversity in traditional agricultural landscapes (TAL)** based on the results of national inventory of TAL, including mapping of HDLF like natural or semi-natural habitats, stone walls or other farmland features. The database of TAL was the basis for identification of high nature value farmland dominated by traditional mosaic landscape (HNV2) and evaluation of the contribution of the rural development programme to maintenance of HNV2 in **Slovakia**.
- › **Monitoring, optimisation and use of natural capital** in the cultivation of **olive groves** in integrated production in **Andalusia** in **Spain**.

3. Success factors and barriers to the adoption of these practices

Based on their own experiences, practices or studies, the experts have identified different success factors and barriers to the adoption of good practices for implementation of HDLF. In this section, success factors and barriers are listed and grouped together under different items. The following points were the basis for the discussion and reflection through which the experts collectively identified the opportunities and challenges for developing solutions on farmland through HDLF (Chapter 4) and recommendations for future research projects and ideas for Operational Groups (Chapter 5).

3.1 Success factors

Co-design scheme

- › Co-design and implement an agri-environment scheme adapted to specific areas, which delivers favourable outcomes for the environment, farmers and local communities.
- › Build support, capacity, and collaboration among local and national stakeholders.
- › Involve local advisory services to monitor the project and ensure the achievement of expected outcomes.
- › Ensure good co-operation between the actors involved.
- › Cooperate with local governments and the local population.
- › Build capacity and support in local communities for long-term nature conservation.

Involve farmers from the beginning of the project: the key to success

- › Involve farmers and landowners in the co-design of the programme.

- › Build an approach that puts farmers and their skills, expertise and knowledge of their land central to the development of the initiative as active participants.
- › Make sure that farmers will adopt or choose the measures suitable for their farms.
- › Keep close contact with the farmers and consider their needs and experiences but also constraints on-farm in terms of production, material, labour, farm characteristics.

Relying on convinced and motivated farmers

- › Farmers already convinced, for a long time, by the results of their good practices in favour of biodiversity.
- › Participants motivated to do something for biodiversity.
- › Farmers that want to change their practices to adopt a new farming concept.
- › Sense of pride of the local farmers to take action for biodiversity farmland.

Support and training throughout the project

- › Offer personalised monitoring and consulting to help and support farmers in their chosen options for biodiversity on farmland.
- › Importance of training, practical, technical and scientific approaches: which areas to restore, maintain or create value for biodiversity, where does it make sense, what management methods, what added value of the measures implemented.



Cultural and social environment

- › Implement a project adapted to the environmental and social conditions of the concerned area.
- › Ensure availability of quality materials and social activity for reclamation of disturbed areas.



- › Give sense to a new agricultural concept: revival of traditional agriculture, sustainable development, maintenance of cultural and historical heritage, preservation of tradition, added value for tourism.
- › Support the Interest of many young farmers for the implementation of agricultural practices that are in favour of biodiversity for the local/regional development and/or will contribute to the preservation of beautiful natural landscapes.
- › Development of similar actions that have already shown interests for biodiversity farmland.
- › Presence of active NGOs.
- › Presence of preserved landscape not suitable for agricultural production: steep slopes, along small streams etc.



Regulation

- › The obligation for every farm to create at least 7% biodiversity promotion areas has resulted in a substantial increase of the surface area covered by Biodiversity Promotion Area (BPA) on Swiss farmland.
- › Introduction of agri-environment payments that reward farmers for delivering high-quality habitats.



3.2 Barriers

Barriers for the adoption of the good practices for implementation of HDLF have been classified as follows.

Technical barriers

- › For the flowering strips, the main barriers are the **unavailability of technical specific sowing equipment**, the **provenance of the species** (they should have a local provenance) and the flowering period (e.g. plants that are flowering in late autumn/winter with the aim to control aphids).
- › For the hedges, identified barriers concern the **selection of production species** and genotypes of fruiting/flowering plants (trees and shrubs) and also the lack of indicators reliably depicting the quality of hedges for a chosen biodiversity group. Another important aspect deals with the material and the time needed to manage bushes and trees. It is a major barrier to the maintenance of hedgerows on farms.

Ecological barriers

- › Even if HDLF aim at enhancing biodiversity, they might also foster pests, weeds and diseases, and compete for resources with the adjacent crops. This is often how farmers perceive hedgerows.

Economic barriers

- › **Cost of the investments** (e.g. tree species) remains expensive, specifically for small farmers that cannot compete with big producers. In addition, the cost of maintenance can be a source of demotivation.
- › **Payment amounts for farmers are often low**, not sufficient for the maintenance and creation of biodiversity-enhancing structures and can demotivate farmers.
- › It is not **easy to define** the **economic value** of HDLF.

Social barriers

- › The principal social barrier concerns the increased **workload**. For example, bare soil areas need to be maintained twice a year. Farmers must check HDLF at least once a year; when replacing or planting new scattered trees, the presence of animals must be interrupted in pastures, by an appropriate rotation plan.
- › The second barrier concerns the **communication** with the actors involved: communication can be difficult with local authorities, between farmers or with other land owners/managers and administration.



- › The third one is related to the fact that the **ecological value of structures is not known** to many farmers. Farmers often do not know where small structures should be created and which types make sense and also how they should look so that they are ecologically valuable.
- › At least, when **rural areas are affected by emigration** and the rural population is ageing, it is very difficult to implement such projects or to avoid the loss of ecological and technical knowledge needed for HDLF regular maintenance.
- › The current context (e.g. in the current CAP) does not provide sufficiently **attractive measures** to encourage farmers to adopt this good agricultural practice. There is little interest from the industry and other actors in the value chain.
- › Many of the HDLF elements in land are covered by the term 'agroforestry systems', which, despite several attempts, did not find its place in legislation and in the minds of the decision makers in Slovenia.
- › Unclear land ownership prevents farmers from getting agri-environment payments.
- › Too much administrative bureaucracy and control.

Psychological barriers

- › The principal psychological barrier is the **motivation** of farmers (mainly bigger farms) to get involved in biodiversity projects.
- › Some farmers think that seed mixtures would be **detrimental to the field management** (due to weeds in seed bank) relative to the maintenance/creation of fallow land or flowering strip for example.
- › **Image of the small structures** by many farmers: often the set-aside areas are allocated to marginal and poor soils and do not need to be managed as a cultivated field.
- › Not all measures that are beneficial for biodiversity are widely accepted by the population and /or tourists as "beautiful". Also neighbouring farmers are not necessarily happy about biodiversity measures.

Administrative barriers

- › **Status of certain areas:** the farmers that cultivate in protected areas in Germany, such as protected areas for flora-fauna-habitats (FFH) are very limited on what they can do.
- › **Difficult to obtain legal permissions for maintenance** (and even more so for a new implementation): managing, even properly, water points seems impossible in Italy, or at least too difficult.

4. Opportunities and challenges for developing solutions on farmland through HDLF

4.1 Innovation and good practices: Outcomes of discussion

The main ideas or **innovation and good practices** identified by the experts of the FG during the first meeting were grouped into **4 topics** to be further elaborated.

For each topic, the experts identified the **main challenges** to overcome (Table 1).

Table 1: Key issues and challenges to overcome

Key issues	Challenge to be overcome
How to encourage the introduction of HDLF in intensively managed agricultural land?	Encouraging the introduction of HDLF in intensively managed agricultural land requires a multi-faceted approach. By raising awareness, educating farmers, demonstrating success, providing training and capacity building, sharing farmers' stories, highlighting economic and social value, and providing support and funding , we can successfully promote the adoption of HDLF.
How to introduce the "small changes - large gains for biodiversity" approach?	Introducing the "small changes - large gains for biodiversity" approach requires a combination of education, incentives and support for farmers . By taking small steps, farmers can make a significant contribution to biodiversity conservation and sustainable agriculture.



<p>How can HDLF best contribute to pollinator preservation?</p>	<p>HDLF can best contribute to pollinator preservation by adopting a holistic approach that takes into account the specific ecosystem services provided by HDLF, focuses on local species and good practices, develops indicators for habitat connectivity at the landscape level, adopts a multi-disciplinary approach, and provides training and knowledge transfer activities.</p>
<p>Innovating ideas of getting value from HDLF for the farm</p>	<p>Marketing and branding are important aspects to consider. By promoting the unique qualities of HDLF, farmers can differentiate themselves from others and create a loyal customer base. This can lead to increased sales and revenue.</p> <p>Payments for Ecosystem Services (PES) is another approach that can be taken. This involves rewarding farmers for the ecosystem services that their land provides through clear indicators. This can include things like carbon sequestration, water quality improvement and biodiversity conservation.</p> <p>One of the first steps is to qualify the impact of HDLF. This means understanding the positive and negative effects that this type of farming has on the environment and the community. By doing so, we can create a more sustainable and responsible approach to HDLF.</p> <p>Another area to explore is the economic value of cultural tourism. Farms that offer unique experiences and showcase their local culture can attract tourists and generate revenue. This can be a win-win situation for farmers and the community.</p> <p>Finally, creating a market for their products and promoting the branding of farms can also be beneficial. By showcasing the quality of their products and the sustainable practices they use, farmers can attract more customers and generate more revenue.</p>

4.2 Three examples of giving value to the ecosystem services provided by HDLF (from a social and economic point of view)

There are various ways to draw value from the ecosystem services provided by HDLF. Some examples include selling products at a higher price, developing ecotourism opportunities such as summer cafes or

courses, receiving funding or agri-environmental payments, selling biodiversity to companies, and charging for other goods or services like parking spaces. By exploring and implementing these strategies, farmers can benefit economically while also contributing to the conservation of the natural resources on their land.

The following boxes provide three examples of how the ecosystem services provided by HDLF can be useful from both social and economic perspectives:

Box 5: Birdlife project Farnsberg- high-stem orchard tree



The high-stem orchard tree project in Farnsberg is an excellent example of how the ecosystem services provided by HDLF can have many benefits. The project provides both economic and social benefits to the community.

Economically, the orchard produces cherries which can be sold directly to consumers. Additionally, the products can be processed into juices and labelled for added value. The project can also receive policy funds to support its activities. Diversifying the products sold, such as offering tourists other fruits or marmalade, can increase income and support local businesses.



Socially, the orchard provides aesthetic value to the landscape, especially during apple blossom season, which can attract rural tourism. The project also offers opportunities for education and raising awareness about the importance of high-stem orchard trees and promoting sustainable practices. Overall, this project serves as a great example of how to successfully make use of the ecosystem services provided by HDLF.

More information: <https://obstgarten-farnsberg.ch/>

Box 6: Hedgerows and carbon sequestration



Hedgerows have been identified as an important means of carbon sequestration. Here are some ways to draw economic and social benefits from hedgerows:

Economic benefits:

- › Hedgerow support by the CAP has been established, but it is currently not enough for the time being.
- › Knowledge exchange support is provided by three major supermarkets, which is a positive development.

Social benefits:

- › Hedgerows can be used for walks along public footpaths, providing a relaxing and enjoyable experience. This can also be developed for ecotourism.
- › Money earned by farmers through the sale of hedgerow products is often considered more valuable than policy support, as it is earned through hard work and dedication.
- › Knowledge exchange can be facilitated through a group of 20 farmers who work on around 8000 hectares of land. This group is led by a farmer who is a member of the Dorset Wildlife Trust, and includes naturalists who are passionate about hedgerow conservation as a great example of how to successfully draw various benefits from the ecosystem services provided by HDLF.

More information: <https://www.dorsetwildlifetrust.org.uk/>

Box 7: Wild Atlantic Nature RBPS pilot



Wild Atlantic Nature Results-Based agri-environment Payment Scheme (RBPS) pilot is an agri-environment scheme adapted to upland areas, which delivers favourable outcomes for the environment, farmers and local communities:

- › **Local adoption:** The payment scheme was designed to fit the local context and needs of farmers, ensuring that it was relevant and attractive to them.
- › **Policy alignment:** The scheme aligned with existing policies and regulations, ensuring that it was supported by the wider policy framework.
- › **Voluntary:** The scheme was voluntary, allowing farmers to choose whether or not to participate based on their own interests and preferences.



- › **Local team support:** Local teams provided support and guidance to farmers throughout the process, helping to build trust and foster engagement.
- › **Engagement of many stakeholders:** The scheme engaged a wide range of stakeholders, including farmers, researchers, and policy makers, ensuring that it was well-supported and represented diverse perspectives.
- › **Whole farm approach:** The scheme took a holistic approach to farm management, encouraging practices that promoted ecological quality across the entire farm.
- › **Flexibility to farmers:** The scheme provided flexibility to farmers, allowing them to adapt to changing circumstances and tailor their practices to their specific needs and goals.

More information: <https://www.wildatlanticnature.ie/rbps-materials/>

4.3 Capacity building experiences and needs for implementation of HDLF

Based on their own experiences or studies, the experts identified the interests, the gaps and the needs concerning the capacity building experiences for implementation of HDLF.

Table 2: Information needs

Key issues	Interest	Lack of information	Needs
On farm consulting	<ul style="list-style-type: none"> › Individual/specific solution 	<ul style="list-style-type: none"> › Resources of advisors (time, money) 	<ul style="list-style-type: none"> › More advisors › More funding
Students' contributions to maintain, enhance, or create HDLF	<ul style="list-style-type: none"> › Bringing students to the farm to work with /for HDLF Knowledge networks with science › School programmes to advisors › Thematic training on demonstration farms › Field days › Annual farming roadshows 	<ul style="list-style-type: none"> › Not in the school regular programme › Not financed 	<ul style="list-style-type: none"> › Implementation of such approved programmes in the (national level) curriculum
Consumers' awareness and general public information/ education	<ul style="list-style-type: none"> › General public information › Education 	<ul style="list-style-type: none"> › Organisation of finances 	<ul style="list-style-type: none"> › Developing finances for programmes and campaigns
Farmer to farmer communication, groups of farmers	<ul style="list-style-type: none"> › Learning from practical experience and good examples › Networks between farmers 	<ul style="list-style-type: none"> › Time › Resources of farmers › Lacking organisation 	<ul style="list-style-type: none"> › More demonstration farms › Peer to peer communication › Supporting



	<ul style="list-style-type: none"> > Training and advice by farmers > Peer to peer learning > Demonstration by farmer to farmer > Advice by farmers 		
Machinery demonstrations and mechanisation options	<ul style="list-style-type: none"> > Ease of and convenient combination with existing management practices 	<ul style="list-style-type: none"> > Not all tasks on biodiversity mechanisation options are feasible > Expertise techniques 	<ul style="list-style-type: none"> > Co-operation between farmers, land machine retailers and advisors > Funding for machinery
Specialised trainings	<ul style="list-style-type: none"> > Training for creation/maintenance of HDLF > Thematic webinar series 	<ul style="list-style-type: none"> > Organisation of finances 	<ul style="list-style-type: none"> > Developing finances for programmes and campaigns

4.4 Key issues related to the required changes

The experts identified the key challenges and information required to advance knowledge on each of the topics discussed in Chapter 4, section 4.1, 4.2 and 4.3. This was accomplished through the collaborative development of five Mini Papers (MP) that drew upon the experts' collective understanding of successful case studies. The finalised set of five Mini Papers explores the following aspects.

MP1: The Role of Knowledge and Promotion

The paper focuses on the importance of High Diversity Landscape Features (HDLF), which are small areas of natural or semi-natural vegetation that provide significant contributions to biodiversity and other ecosystem services in agricultural land. The EU has set a goal to cultivate 10% HDLF in the coming years (this target being under political negotiation at the time of drafting this paper). To achieve this, farmers need to be motivated to maintain, enhance and/or create these areas. Various factors such as rewards, incentives and knowledge transfer can contribute to this motivation. Knowledge transfer is essential and different actors in the Agricultural Knowledge and Innovation Systems (AKIS) use different channels to obtain information. Personal contact and exchange are preferred by farmers, while scientists and professionals prefer technical literature or websites. Farm advisors play a crucial role in advising and supporting farmers, and personal contact between farmers and advisory services is a valued information channel. Effective

communication of knowledge and innovation is fundamental in supporting sustainable agriculture and resilient rural communities facing various challenges, including biodiversity loss. The Mini Paper proposes several tools for promotion and knowledge sharing, including face-to-face and phone support from advisors, knowledge exchange groups, results-based payment schemes, and demonstration farms.

MP2: Implementing High-Diversity Landscape Features on Farms: Small Changes but Large Gains

The aim of this Mini Paper is to showcase the potential benefits of HDLF for farmers from both ecological and economic perspectives. It also aims to highlight practical success stories and research needs for the implementation and assessment of HDLF. The team's focus is on small areas of land, such as hedges, flower strips, grass strips and the maintenance of existing HDLF, such as ditches, which can offer large ecological benefits with minimal land or low costs.

MP3: Managing High-Diversity Landscape Features for Pollinators

The role of pollinators in biodiversity is given additional weight due to the fact that many people have an affinity for bees and understand the benefits that they provide. Insect pollinators are just one group of organisms that have shown declines in recent years. It is widely agreed that insect pollinator decline is due to a combination of factors, including but not limited to, habitat loss, pests and diseases, and pesticide exposure.



Farmland is the dominant land use in Europe and the way it is managed is important for pollinator conservation. By providing food, safety and shelter for pollinators on the farm, not only halting but also even reversing their decline is possible. One way to do this is to manage High Diversity Landscape Features (HDLF) for pollinators across farmland. Managing farmland HDLF for pollinators will result in an increase in habitats across farmed landscapes for a broader biodiversity. This Mini Paper explains how HDLF benefit pollinators and farmers, and what are the associated costs, what farmer supports are needed to help farmers to manage HDLF and what to avoid when managing HDLF for pollinators.

MP4: The Social and Cultural Benefits of High-Diversity Landscape Features

The primary objective of this paper is to provide an overview of the main types of HDLF and to emphasise their social and cultural benefits, as well as the main threats and vulnerabilities they might face. Additionally, the paper demonstrates how both farmers and wider society can benefit from HDLF through the ecosystem services they provide, with a focus on their social and cultural aspects. The cultural dimension of the most common HDLF in European rural landscapes, including their origin, management, exploitation and restoration, is also highlighted. Finally, the paper showcases good practices and inspiring success stories when farms featuring HDLF provided social and cultural benefits. These include rural tourism, education, increasing a rural community's resilience, enhancing local wildlife and natural habitat connectivity and saving public money. The paper also identifies research needs and ideas for innovation.

MP5: Benefits of High-Diversity Landscape Features for Farmers to Adapt to Climate Change Issues

The primary objective of this paper is to explore the potential directions of HDLF management for their adaptation and mitigation to climate change and their future benefits to farmers and the environment. The paper reviews adaptation and mitigation strategies of HDLF for farmers and their environmental benefits, and explores the potential and limits of the productivity, functionality and existence of HDLF under changing climate. The synergies between woody features and water, which create microclimates, are beneficial for specific HDLF. However, the complexity of such features can pose challenges for other HDLF types. One idea for innovation includes creating a cluster of farmers, scientists and policy makers working together on these issues and how to give value to biodiversity.

5. Recommendations

One of aims of this final report is to inspire the setting-up of innovative actions such as Operational Groups (OGs) within the EIP-AGRI framework and to give direction to new research projects and educational programmes. This review shows that more research focusing on the social and economic aspects of the landscape features is needed.

5.1 Main recommendations for future research projects

Despite the large amount of research on the functions and benefits of HDLF, several gaps and research needs from social and economic aspects have been identified, both at the farm and landscape levels and in particular for aspects related to climate change, adaptation/mitigation and water retention. The five major research needs identified by the experts are:

5.1.1 Continue research on the understanding of farmer's motivation and barriers to the adoption of HDLF

Farmers seek information on issues that impact their farms or for which they require specific solutions. The topic of biodiversity is not yet openly in demand, highlighting the need for public awareness and educational activities. To tackle the challenging task of ensuring the appropriateness of such initiatives, research is necessary to understand the socio-cultural and environmental factors that facilitate farmers in maintaining or establishing HDLF, such as social norms and contextual suitability. Additionally, it is essential to identify factors that hinder them, such as conflicting arguments, workload, financial compensation and politics. This research should be conducted at a European-wide level and is relevant for both extensive and intensive farms, as well as various types of farm enterprises (e.g. livestock, tillage, mixed-use, etc.).

5.1.2 Research on the effectiveness of versus the effort involved in creating and engaging different communication channels

Biodiversity knowledge is communicated to farmers using various methods and tools. The success and effort involved in creating these tools, as well as the effort required to utilise different communication methods, can vary significantly. To determine the most effective cost/benefit combination of tools and methods for promoting biodiversity in the field, it is crucial to understand the communication needs of farmers, such as their preferences for digital or analogue approaches and face-to-face interactions. This research should be conducted at a European-wide level and is relevant for all types of farms.



5.1.3 Economic assessment and valuation

The economic assessment of the costs and benefits related to HDLF at the landscape level is currently lacking. Specifically, there is a need to gain a better understanding of the mismatches between economic and ecological outcomes across farm and landscape scales. This includes identifying the optimal number and size of HDLF for different farm types. This research need is applicable to all of Europe and encompasses both crop and livestock farming.

5.1.4 Research on the effects of HDLF on water retention and microclimate

Not all the effects of different HDLF on water, soil and microclimate are well-known or thoroughly explored. The correlations between HDLF and microclimate are not yet fully understood. In extremely dry conditions, for instance, it may be challenging to establish the initial wooden features. However, these features themselves can influence water conditions, making subsequent steps towards enhancing HDLF easier. Some research findings may not be widely known among farmers. The challenge for a scientific team is to identify knowledge gaps and conduct further interdisciplinary research. The results can then be effectively communicated to farmers using appropriate methods, as outlined in the Mini Paper on knowledge transfer. This approach would ensure that farmers are aware of the potential positive effects from the outset. This research can be conducted at a European-wide level and is particularly relevant to production farms that face issues related to water scarcity, soil degradation and drought.

5.1.5 Analysis of co-benefits of HDLF for climate change adaptation

There are numerous general sources of information available on various HDLF and their benefits, as well as financial tools for promoting landscape greening through the Rural Development Programs (RDP) in the previous programming period and CAP Strategic Plans in the ongoing 2023-2027 programming period, such as eco-schemes or support for Agri-Environment Climate measures. However, the implementation of these measures by farmers is progressing slowly due to concerns about potential loss of productive land and other management costs. A significant research challenge lies in conducting a cost-benefit analysis of HDLF concerning on-farm adaptation to climate change. This analysis would help disseminate knowledge regarding the eco-economic benefits of HDLF and eco-schemes, thereby motivating farmers to adopt and actively participate in eco-schemes through the CAP. Implementing climate change adaptation or mitigation measures can provide multiple co-benefits to farmers. The need for this research is particularly crucial on intensively managed landscapes with a low proportion of HDLF, such as lowland areas with highly productive soils, at a pan-European level.

5.1.6 Other research needs

Experts have identified more research needs to create and maintain HDLF that positively impact farmland biodiversity, that can be found in the Mini Papers in Annex 3 produced by the FG experts.

Technical practices issues

- › Research and practical examples for the integration of agroforestry elements in existing production systems
- › Research into effects of tillage management practices and regenerative and/or conservation agriculture on pollinators (direct drilling, min-tilling, and ploughing)
- › Research of the interaction of above and below-ground biodiversity
- › Research into the advantages or disadvantages of allowing wildflowers to naturally regenerate instead of seed sowing and the effects on plant and pollinator diversity
- › Research into co-benefits of pollinator conservation actions
- › Exploring how HDLF can contribute to the resilience of farming systems
- › Development of ecological indicators

Social and cultural issues

- › Studying the perception of different HDLF by various stakeholder groups (farmers, tourists, citizens, etc.).
- › Inquiring into the social and cultural norms that shape which HDLF are preferred by farmers and/or by society and if these norms are related to how HDLF are maintained, enhanced or created.
- › Exploring how place-based actions aimed at maintaining, restoring or enhancing HDLF can be used for socio-cultural benefits at the community level (e.g. social cohesion, integration of different groups).
- › Creating indicators for measuring and monitoring the social and cultural co-benefits of HDLF.
- › Exploring how HDLF projects can increase understanding between different groups in society, connecting rural areas and cities.
- › Studying how to reach parts of society often excluded from co-design processes to improve knowledge of HDLF.

Biodiversity advice and knowledge issues

- › Research on how biodiversity advice is organised in different European countries.
- › Research on knowledge exchange between different stakeholder groups.
- › A need for demonstration sites/examples/good practices.



5.2 Ideas for Operational Groups

The FG experts identified the following themes and ideas for Operational Groups. The sixth highest ranked ideas are written in bold in Table 3.

Table 3: Ideas for Operational Group and other innovative projects

Ideas which are in bold in the table below were identified by the FG experts as priority topics.

Topics of interest	Ideas for Operational Groups
Scoring/Reward system	<ul style="list-style-type: none"> > Development and testing of an innovative whole farm scoring system, on an EU level, to quantify how pollinator-friendly the entire farm is as a land parcel. > Development and testing of a reward system for climate change mitigation on farms.
Education / Training / Visits	<ul style="list-style-type: none"> > Farmer to farmer training: Advisors are often perceived as some highly educated people who want to tell the farmers what to do. > Model farms with HDLF can be created that can be visited and used for educational purposes, for practitioners or for the wider public. > Illustrate solutions. Suggest concrete and viable scenarios to policy makers and farmers, through the creation of maps with designs of effective HDLF for different areas and/or by production indexes. > Using current knowledge, attach a monetary value to the cultural and social benefits of HDLF.
Tools	<ul style="list-style-type: none"> > Development of advisory tools to help farmers establish HDLF on their farms. > Testing the integration of different tools for knowledge and promotion of HDLF, and in different contexts. > Farm management tools to integrate HDLF in a productive manner. > Create a tool catalogue for water management measures for farmers, based on scientific results. > Create a catalogue of local culturally significant HDLF, and any local folklore, stories, art or other forms of cultural and social value attached to them.
Topics for thematic networks	<ul style="list-style-type: none"> > Network of flower-rich meadows across farmland. > Interdisciplinary network for agroforestry species in different farming systems. > Network of climate-friendly farmers, scientists and policy makers. > Network for multi-actor monitoring and long-term observation of pollinators in areas with HDLF. > Network for the implementation of HDLF on a regional scale to improve soil-water retention in areas which are very dry and prone to flooding.
Economics studies	<ul style="list-style-type: none"> > Describe how the loss or conservation of HDLF would affect economies. > Solutions to reduce workload for farmers that are managing HDLF.



Conclusion

The FG has identified a large number of good practices and success stories for maintaining and introducing HDLF at different spatial scales. Case studies that positively impact farmland biodiversity were highlighted at different levels from the individual farm parcel up to whole farm level and landscape level.

Relevant options already exist for introducing more HDLF to increase both the diversity and area of habitats and/or better connectivity between habitats.

However, the Focus Group acknowledged the existence of barriers that hinder the widespread adoption of these good practices for HDLF implementation. These barriers encompass economic, social and psychological factors. The FG emphasised the need to enhance knowledge exchange to better understand the motivations and barriers faced by farmers when adopting HDLF.

The FG has also identified potential future actions aimed at improving farmland solutions through HDLF. These actions could take the form of innovative projects, such as OGs, or address research needs derived from practical experiences.



References

Publications

Batáry, P, Matthiesen, T and Tschardtke, T (2010) Landscape-moderated importance of hedges in conserving farmland bird diversity of organic vs. conventional croplands and grasslands. *Biological Conservation* No 143 (9), 2020-2027.

Belfrage, K, Björklund, J and Salomonsson, L (2015) Effects of farm size and on-farm landscape heterogeneity on biodiversity—case study of twelve farms in a Swedish landscape. *Agroecology and Sustainable Food Systems* No 39 (2), 170-188.

Carles-Mejane Julie, Lenna Berthie, Antoine Brin, 2022. Trame verte et bleue : Définition. Dictionnaire d'agroécologie. <https://doi.org/10.17180/gjxc-nf65>

Céréghino, R, Oertli, B, Bazzanti, M, Coccia, C, Compin, A, Biggs, J, Bressi, N, Grillas, P, Hull, A and Kalettka, T (2012) Biological traits of European pond macroinvertebrates. *Hydrobiologia* No 689 (1), 51-61.

Curado, N, Hartel, T and Arntzen, J W (2011) Amphibian pond loss as a function of landscape change – A case study over three decades in an agricultural area of northern France. *Biological Conservation* No 144 (5), 1610-1618.

Czúcz, B, Baruth, B, Angileri, V, Prieto Lopez, A and Terres, J-M (2022a) Landscape features in the EU Member States. EUR 31063 EN, Publications Office of the European Union, Luxembourg, ISBN 978-92-76-52324-6, doi:10.2760/101979, JRC128876. <https://publications.jrc.ec.europa.eu/repository/handle/JRC128876>

Czúcz, B, Baruth, B, Terres, J M and et al (2022b) Classification and quantification of landscape features in agricultural land across the EU: a brief review of existing definitions, typologies, and data sources for quantification. European Commission Joint Research Centre Publications Office of the European Union, <https://data.europa.eu/doi/10.2760/59418>.

Dohokou, K. X. (2022). Haies en milieu agricole : Impact sur les auxiliaires de culture et développement d'indicateurs [Mémoire de fin d'études]. Université de Haute-Alsace.

Eglington, S and Noble, D (2010) Understanding the causes of decline in breeding bird numbers in England. BTO Research Report No. 538, British Trust for Ornithology, Royal Society for the Protection of Birds and Centre of Agri-Environmental Research, UK.

Farmer, M, Cooper, T, Baldock, D, Tucker, G M, Eaton, R, Hart, K, Bartley, J, Rayment, M, Arblaster, K, mBeaufoy, G, Pointereau, P, Coulon, F, Herodes, M, Kristensen, L, Andersen, E, Landgrebe, R, Naumann,

S, Povellato, A, Trisorio, A, Jongman, R H G and Bunce, B (2008) Reflecting Environmental Land Use Needs into EU Policy: Preserving and Enhancing the Environmental Benefits of Unfarmed Features on EU Farmland. Final report prepared for DG Environment, Contract No. ENV.B.1/ETU/2007/0033, Institute for European Environmental Policy, London.

Farwig, N, Bailey, D, Bochud, E, Herrmann, J D, Kindler, E, Reusser, N, Schüepp, C and SchmidtEntling, M H (2009) Isolation from forest reduces pollination, seed predation and insect scavenging in Swiss farmland. *Landscape Ecology* No 24 (7), 919-927.

Feber, R E, Johnson, P J, Firbank, L G, Hopkins, A and Macdonald, D W (2007) A comparison of butterfly populations on organically and conventionally managed farmland. *Journal of Zoology* No 273 (1), 30-39.

Ferreira, M and Beja, P (2013) Mediterranean amphibians and the loss of temporary ponds: Are there alternative breeding habitats? *Biological Conservation* No 165, 179-186.

Jacques, J.-B. (2021). Approcher une notion de paysage multifonctionnel en mettant en œuvre un travail de diagnostic biodiversité sur la station expérimentale de Saint Hilaire en Woëvre dans son territoire : Validation d'indicateurs pertinents [Mémoire de fin d'études]. Université Haute Alsace.

European Commission, Directorate-General for Agriculture and Rural Development (2017) Evaluation study of the payment for agricultural practices beneficial for the climate and the environment: final report, Publications Office. <https://data.europa.eu/doi/10.2762/71725>

Hinsley, S A and Bellamy, P E (2000) The influence of hedge structure, management and landscape context on the value of hedgerows to birds: A review. *Journal of Environmental Management* No 60 (1), 33-49.

Holland, J M, Smith, B M, Storkey, J, Lutman, P J W and Aebischer, N J (2015) Managing habitats on English farmland for insect pollinator conservation. *Biological Conservation* No 182, 215-222.

Kalda, O, Kalda, R and Liira, J (2015) Multi-scale ecology of insectivorous bats in agricultural landscapes. *Agriculture, Ecosystems & Environment* No 199, 105-113.

Mountford, O and Arnold, H (2006) Aquatic plant diversity in arable ditches: scoping study. CEH: Project Report Number C02945, Eit36-05-011, Centre for Ecology and Hydrology, Unpublished.



Nieminen, M, Ketoja, E, Mikola, J, Terhivuo, J, Sirén, T and Nuutinen, V (2011) Local land use effects and regional environmental limits on earthworm communities in Finnish arable landscapes. *Ecological Applications* No 21 (8), 3162-3177.

Nitsch, H, Röder, N, Oppermann, R, Milz, E, Baum, S, Lepp, T, Kronenbitter, J, Ackermann, A and Shramek, J (2017) Naturschutzfachliche Ausgestaltung von Ökologischen Vorrangflächen - Endbericht zum gleichnamigen Vorhaben des Umweltforschungsplans 2015. BfN-Skripten, Bundesamt für Naturschutz, Bonn

Preti, F., Caruso, M., Dani, A., Errico, A., Guastini, E., & Trucchi, P. (2015, April). Agricultural terraces monitoring and modeling: a field survey in Chianti region, Firenze, Italy-First part. In EGU General Assembly Conference Abstracts (p. 7621).

Rodríguez-Pastor, R, Luque-Larena, J J, Lambin, X and Mougeot, F (2016) "Living on the edge": The role of field margins for common vole (*Microtus arvalis*) populations in recently colonised Mediterranean farmland. *Agriculture, Ecosystems & Environment* No 231, 206-217.

Roudine S, Le Ralec A, Le Lann C, van Baaren J. Role of Natural Enemies in controlling Barley Yellow Dwarf Viruses. BAPOA Seminar (Online), 24th February 2021.

Roudine S, Le Ralec A, Le Lann C, van Baaren J. Vector-borne plant virus controlled by natural enemies in agro-ecosystems. Second International Congress of Biological Control (ICBC2), Davos, Switzerland (Online), 26-30 April 2021.

Sanderson, F J, Kloch, A, Sachanowicz, K and Donald, P F (2009) Predicting the effects of agricultural change on farmland bird populations in Poland. *Agriculture, Ecosystems & Environment* No 129 (1-3), 37-42.

Santoro, A., Piras, F., Fiore, B., Frassinelli, N., Bazzurro, A., & Agnoletti, M. (2022). The Role of Trees Outside Forests in the Cultural Landscape of the Colline del Prosecco UNESCO Site. *Forests*, 13(4), 514.

Santoro, A., Venturi, M., & Agnoletti, M. (2020). Agricultural heritage systems and landscape perception among tourists. The case of Lamole, Chianti (Italy). *Sustainability*, 12(9), 3509.

Sarthou Jean-Pierre, 2022. Infrastructure agroécologique : Définition. Dictionnaire d'agroécologie. <https://doi.org/10.17180/q9h6-f326>

Šatalová, B., Špulerová, J., Štefunková, D., Dobrovodská, M., Vlachovičová, M., Kozelová, I., 2021. Monitoring and evaluating the contribution of the rural development program to high nature value farmland dominated by traditional mosaic landscape in Slovakia. *Ecol. Indic.* 126, 107661. <https://doi.org/10.1016/j.ecolind.2021.107661>

Scheper, J, Holzschuh, A, Kuussaari, M, Potts, S G, Rundlöf, M, Smith, H G and Kleijn, D (2013) Environmental factors driving the effectiveness of European agri-environmental measures in mitigating pollinator loss - a meta-analysis. *Ecology Letters* No 16 (7), 912-920.

Smith, J, Potts, S and Eggleton, P (2008) The value of sown grass margins for enhancing soil macrofaunal biodiversity in arable systems. *Agriculture, Ecosystems & Environment* No 127 (1-2), 119-125.

Torquati, B., Giacchè, G., & Venanzi, S. (2015). Economic analysis of the traditional cultural vineyard landscapes in Italy. *Journal of rural studies*, 39, 122-132.

Vickery, J A, Feber, R E and Fuller, R J (2009) Arable field margins managed for biodiversity conservation: a review of food resource provision for farmland birds. *Agriculture, Ecosystems & Environment* No 133 (1-2), 1-13.

Williams, P, Whitfield, M, Biggs, J, Bray, S, Fox, G, Nicolet, P and Sear, D (2004) Comparative biodiversity of rivers, streams, ditches and ponds in an agricultural landscape in Southern England. *Biological Conservation* No 115 (2), 329-341.

Wood, T J, Holland, J M and Goulson, D (2015) Pollinator-friendly management does not increase the diversity of farmland bees and wasps. *Biological Conservation* No 187 (0), 120-126.

Projects of Focus Group experts

AUSTRIA - Sabrina

LEADER project based on improvements & optimisation of sprayers and soil management in Austria
<https://obstwein-technik.eu/937/Uebersicht>

Awareness rising and education projects in Austria
<https://www.vielfalt-am-betrieb.at/>
<https://beep.expert/>

Biodiversity stripes in vineyards in the frame of a Life project "VineAdapt" in Austria
<https://www.life-vineadapt.eu/aktuelles>

Implementation of biodiversity guidelines in the framework of the organic association BIO AUSTRIA
<https://www.bio-austria.at/biodiversitaet-2/>
<https://www.bio-austria.at/app/uploads/2021/12/biodiversitat-broschure-2022-landschaftselemente-klein.pdf>

AUSTRIA - Stefan

Preservation of the remaining mountain meadows in the municipality of Molln in Austria
<http://bergwiesn.at/>
<https://www.bluehendesoesterreich.at/naturefolge/flora-region-steyrtal-kalkalpen-oberoesterreich>



BULGARIA - Petar

Complete restoration of landfill in Bulgaria in three areas (3 cases):

<https://www.moew.government.bg/bg/na-32-narasna-broyat-na-uskoreno-rekultiviranje-depa-ot-procedurata-za-narushenie-na-pravoto-na-es/>

<https://bnr.bg/starazagora/post/101532579/napalno-rekultivirano-e-depoto-za-otpadaci-v-chirpan>

<https://www.btv.bg/shows/predi-obed/videos/vazmozhno-li-e-edno-smetishte-da-se-prevarne-v-zelena-gradska-zona.html?fbclid=IwAR2KHgncXbe86jVylI-K1CmaoS2anzgNSMjixUs-NiZw2NhmMVLnSa2JN9zI>

CROATIA - Sonja

Maintaining, protecting, reconstructing and creating dry stone walls in Croatia:

<http://www.dragodid.org/>

<https://suhozid.giscloud.com/>

Maintaining of ponds in Croatia

<https://www.facebook.com/groups/kal.udruga>

ESTONIA - Rufus

"Conservation of natural biodiversity in agricultural land" study and report in Estonia:

<https://landscape.ut.ee/what-we-do/projects/conservation-of-natural-biodiversity-in-agricultural-land/?lang=en>

LIFE Integrated Project "ForEst&FarmLand" in Estonia:

<https://loodusrikaseesti.ee/en/biodiversity-agricultural-landscapes>

FRANCE - Stéphanie

Agroforestry hedgerows planted in Brittany, France, by the "Association Terres et Bocage"

<https://terresetbocages.org/>

https://afac-agroforesteries.fr/wp-content/uploads/2019/03/AGFORWARD_LEAFLET_France_Bocage.pdf

Biodiversity promotion areas (formerly ecological compensation areas = ECA) in Switzerland (by France)

<https://link.ira.agroscope.ch/fr-CH/publication/24462>

<https://link.ira.agroscope.ch/fr-CH/publication/17655>

FRANCE - Xavier

France project: Using flower strips in autumn/winter to host aphids natural enemies and limit the risks associated with BYDV:

Roudine S, Le Ralec A, Le Lann C, van Baaren J. Role of Natural Enemies in controlling Barley Yellow Dwarf Viruses. BAPOA Seminar (Online), 24th February 2021.

Roudine S, Le Ralec A, Le Lann C, van Baaren J. Vector-borne plant virus controlled by natural enemies in agro-ecosystems. Second International Congress of Biological Control (ICBC2), Davos, Switzerland (Online), 26-30 April 2021.

France project about indicator of edge quality: Two M2 internship reports:

Dohokou, K. X. (2022). Haies en milieu agricole : Impact sur les auxiliaires de culture et développement d'indicateurs [Mémoire de fin d'études]. Université de Haute-Alsace.

Jacques, J.-B. (2021). Approcher une notion de paysage multifonctionnel en mettant en œuvre un travail de diagnostic biodiversité sur la station expérimentale de Saint Hilaire en Woëvre dans son territoire : Validation d'indicateurs pertinents [Mémoire de fin d'études]. Université Haute Alsace.

GERMANY - Maria

ECO²SCAPE project in Germany (creation of set-aside field - fallows and flower strips):

<https://tu-dresden.de/bu/umwelt/geo/geographie/landoeko/forschung/forschungsprojekte/eco2>

HUNGARY - Orsolya

Species-rich inter-row covering in vineyards and orchards in Hungary:

<https://www.life-vineadapt.eu/en/aktuelles>

https://www.biokutatas.hu/en/page/show/inter_row_covering

<https://youtu.be/gmdQt28izz0>

<https://www.biokutatas.hu/en/page/show/floral-ground-cover-for-biodiversity-variety-not-just-for-beautys-sake>

Rehabilitation of kurgans on arable land in Hungary

<http://regi.bnpi.hu/oldal/kunhalmok-foldvarak-rehabilitacioja-a-bnpi-heves-es-borsod-megyei-teruletein-keop-3-1-2-2f-09-11-2013-0041-462.html>

<https://www.nak.hu/tajekoztatasi-szolgalatas/kolcsonos-megfeleltetes/99723-vedett-tajkepi-elemek-a-kunhalmok>

http://www.termesztvedelem.hu/_user/browser/File/Taj/Ertekorzo%20kunhalom%20leporello_v.pdf

http://real-d.mtak.hu/1142/7/dc_1573_18_doktori_mu.pdf

IRELAND - Gary

Wild Atlantic Nature Results-Based agri-environment Payment Scheme (RBPS) pilot from Ireland:

<https://www.wildatlanticnature.ie/rbps-materials/>

Hare's Corner is a biodiversity initiative conceived in the Burren in Co in Ireland:

<https://burrenbeo.com/thc/>



IRELAND - Saorla

Protecting Farmland Pollinators by creating solitary bee nests on farmland in Ireland:

<https://biodiversityireland.ie/how-to-create-solitary-bee-nest-sites-on-your-farm/>

https://biodiversityireland.ie/app/uploads/2022/05/ActionSheet_Solitary-Bees-WEB-2.pdf

Implement actions to help pollinators on farms in Ireland

<https://biodiversityireland.ie/protecting-farmland-pollinators-mid-term-report/>

<https://biodiversityireland.ie/app/uploads/2022/10/Protecting-Farmland-Pollinators-Midterm-Report-2022-WEB.pdf>

Farmer Moth Monitoring Project

<https://biodiversityireland.ie/app/uploads/2022/12/Farmer-Moth-Monitoring-Report-2022-WEB.pdf>

ITALY - Antonio

Drystone terraces in Chianti (Tuscany) in Italy:

<https://www.wechianti.com/2018/01/17/paesaggio-le-terrazze-lamole-diventano-un-patrimonio-storico-tutta-italia/?lang=en>

Trees Outside Forests (TOF) in Italy :

<https://whc.unesco.org/en/list/1571>

SLOVAKIA - Jana

Territorial System of Ecological Stability in Slovakia

Miklós, L., Diviaková, A., Izakovičová, Z., 2019. Ecological Networks and Territorial Systems of Ecological Stability. Springer International Publishing, Cham.

<https://doi.org/10.1007/978-3-319-94018-2>

Live landscape in Slovakia

<https://krajnaziva.sk/>

SLOVENIA - Tine

Leader of an EIP-AGRI project on hedges in Slovenia

<https://ec.europa.eu/eip/agriculture/en/find-connect/projects/mejice-kot-podpora-biotski-raznolikosti-ohranjanju>

SPAIN - Jose-Fernando

Operational Group "BIOLIVAR: Monitoring, optimization and valorisation of natural capital in the cultivation of olive groves in integrated production in Andalusia" - Spain

www.biolivar.es

Operational Group "SOWING BIODIVERSITY IN ANDALUSIA: Bases for the implementation and monitoring of multifunctional field margins within the framework of the new eco-schemes.

Spain Multi-functional field margins: a good agricultural practice:

<https://www.youtube.com/watch?v=UWV4-l7L5Qw>

SWITZERLAND - Corinne

Swiss Direct payment system- Biodiversity contributions (In German):

<https://www.agrinatur.ch/bff/ruderalflaechen-steinhaufen-waelle>

Project Target-oriented biodiversity promotion in the canton of Zurich (in German):

<https://zielorientierte-biodiversitaet.ch/home>

BirdLife Switzerland's Farnsberg Orchard project (in German):

<https://obstgarten-farnsberg.ch/>

Website - further information

AUSTRIA - Sabrina

<https://www.bio-austria.at/biodiversitaet-2/>

<https://www.bio-austria.at/app/uploads/2021/12/biodiversitat-broschure-2022-landschaftselemente-klein.pdf>

AUSTRIA - Stefan

<https://conbio.onlinelibrary.wiley.com/doi/10.1111/conl.12752>

BULGARIA - Petar

Strategy for biological diversity in the Republic of Bulgaria:

<https://www.moew.government.bg/bg/proekt-na-strategiya-za-biologichnoto-raznoobrazie-v-republika-bulgariya/>

The strategic plan for the development of agriculture and rural areas in Bulgaria for the period 2023-2027:

<https://www.mzh.government.bg/bg/obsha-selskostopanska-politika-2021-2027-g/tematichna-robotna-grupa/>

National program for protection, sustainable use and restoration of soil functions 2020-2030

<https://www.moew.government.bg/static/media/ups/tiny/%D0%A3%D0%9E%D0%9E%D0%9F%D0%9F%D0%9E%D0%A7%D0%92%D0%98/%D0%9D%D0%90%D0%A6%D0%98%D0%9E%D0%9D%D0%90%D0%9B%D0%9D%D0%90%20%D0%9F%D0%A0%D0%9E%D0%93%D0%A0%D0%90%D0%9C%D0%90.pdf?fbclid=IwAR-01mSNv5lowA1y3srSkcnfa8xLlrAAND0tBXrpY9VqU8wa4AmRX7D-TRAUU>

Guide to organic farming in Natura 2000 areas in Bulgaria

https://wwfeu.awsassets.panda.org/downloads/manual_n_2000_last_2.pdf?fbclid=IwAR1BA d g p x C f s a N V C k 1 e n 3 f M d - w C o A Q K B 9 Y 7 q V K 2 K - 5 h D o V o y S U O n l y s 0 - e y A

Handbook green and blue infrastructure

<https://www.biogea-project.eu/bio/library/tools-farmers-and-advisors/handbook-green-and-blue-infrastructure>

Handbook How to develop sustainable agriculture supported by the CAP 2014-2020

http://archive.zazemiata.org/v1/uploads/media/ZZ_Narachnik_web.pdf?fbclid=IwAR0nCIE1dQAaa0fkUYd47DjxTOfZlYsYdw6kjZ0TgP-PHud7MWsF6VcGqP0



Handbook for practical application of the conditions to maintain the land in good agricultural and ecological status

https://www.mzh.government.bg/media/filer_public/2018/02/13/narachnik_gaec_final_07_07_20_16izpratn1_1.pdf

Guidelines for the protection of biological diversity in tobacco growing areas

<http://uni-sz.bg/truni11/wp-content/uploads/biblioteka/file/TUNI10044018.pdf?fbclid=IwAR3ofbFRH8C0ukn-soHvYtRcZJMZfb7F95VvFcRS03swKtHjFeHUAAMIW5is>

CROATIA - Sonja

<https://feal-future.org/eatlas/en/node/45>
<https://suhozid.giscloud.com/>

ESTONIA - Rufus

List of HDLF-s and practices farmers can implement (in Estonian for now)

<https://heapold.ee/tegevused/>

PDF guide how to declare the features in your farmland to our national farmland registry

<https://www.pria.ee/sites/default/files/2020-01/Maastikuelementide%20deklareerimine%20%28tr%C3%BCkis%29.pdf>

FRANCE - Xavier

Montgomery, I., Caruso, T., & Reid, N. (2020). Hedgerows as Ecosystems: Service Delivery, Management, and Restoration. *Annual Review of Ecology, Evolution, and Systematics*, 51(1), 81-102.

<https://doi.org/10.1146/annurev-ecolsys-012120-100346>

Baudry, J., Rolland, D., Biet, M., Bonneville, R., Boussard, H., Defourneaux, M., Gonnet, G., Mercier, A., Meurice, P., Moret, C., Roger, J.-L., & Scherer, T. (2022). Les infrastructures bocagères pour la biodiversité. *Sciences Eaux & Territoires*, 40, Article 40.

<https://doi.org/10.20870/Revue-SET.2022.40.7083>

Wolton, R., Pollard, K., Goodwin, A., & Norton, L. (2014). Regulatory services delivered by hedges: The evidence base (LM0106 Report for Defra and Natural England; Issue LM0106 Report for Defra and Natural England, p. 99).

<https://randd.defra.gov.uk/ProjectDetails?ProjectId=19237>

GERMANY - Maria

There are several projects in Germany that use a co-design and multi-actor approach with farms that are addressing several types of HDLF with different perspectives:

<https://www.franz-projekt.de>

<https://tu-dresden.de/bu/umwelt/geo/geographie/landoeko/forschung/forschungsprojekte/eco2>

<https://www.uni-goettingen.de/en/628701.html>

<https://www.final-projekt.de/en/partners/thuenen-institute>

GERMANY - Simona

https://www.dvl.org/fileadmin/user_upload/Publikationen/Fachpublikationen/DVL-Publikation-Fachpublikation_Steckbriefe_fuer_die_Massnahmen_der_Gemeinwohlpraemie.pdf

<https://www.fibl.org/de/shop>

SWITZERLAND - Simona

<https://www.bioaktuell.ch/grundlagen/nachhaltigkeit/biodiversitaet>

HUNGARY - Orsolya

<https://www.nature.com/articles/s41559-017-0272-x>

<https://doi.org/10.1007/s42977-020-00015-7>

<https://conbio.onlinelibrary.wiley.com/doi/10.1111/conl.12752>

<https://doi.org/10.1016/j.agee.2021.107519>

IRELAND - Saorla

<https://www.farmingfornature.ie/resources/best-practice-guides/hedgerow-management/>

<https://www.farmingfornature.ie/resources/best-practice-guides/plan-for-nature/>

<https://www.farmingfornature.ie/resources/best-practice-guides/watercourse-management/>

<https://www.farmingfornature.ie/resources/best-practice-guides/managing-species-rich-grasslands/>

<https://pollinators.ie/farmland/>

ITALY - Antonio

<https://iale.uk/biodiversity-dry-stone-wall>

<http://www.parconazionale5terre.it/page.php?id=423>

<https://ich.unesco.org/en/RL/art-of-dry-stone-walling-knowledge-and-techniques-01393>

<https://www.teagasc.ie/environment/biodiversity--countryside/farmland-habitats/value-of-hedgerows/>

<https://www.openaccessgovernment.org/crop-pollination-restoring-biodiversity/131707/>

SLOVAKIA - Jana

Špulerová, J., Dobrovodská, M., Lieskovský, J., Bača, A., Halabuk, A., Kohút, F., Mojses, M., Kenderessy, P., Piscová, V., Barančok, P., Gerhátová, K., Krajčí, J., Boltžiar, M., 2011. Inventory and Classification of Historical Structures of the Agricultural Landscape in Slovakia. *Ekológia (Bratislava)* 157-170.

https://doi.org/10.4149/ekol_2011_02_157

Špulerová, J., Dobrovodská, M., Štefunková, D., Šatalová, B., Kenderessy, P., 2016. The Cultural-historical value of Traditional Agricultural Landscape in Slovakia, in: Corniello, L. (Ed.), *World Heritage and Degradation: Smart Design, Planning and Technologies*. Scuola Pitagora Editrice, Napoli, pp. 306-315.



Špulerová, J., Petrovič, F., Mederly, P., Mojses, M., Izakovičová, Z., 2018. Contribution of Traditional Farming to Ecosystem Services Provision: Case Studies from Slovakia. *Land* 7, 74.

<https://doi.org/10.3390/land7020074>

Kozelova, I., Špulerová, J., Miklosova, V., Gerhatova, K., Izakovičová, Z., Kalivoda, H., Kalivodova, M., Kanka, R., 2020. The role of artificial ditches and their buffer zones in intensively utilized agricultural landscape. *Environ. Monit. Assess.* 192, 656–656.

Melicher, J., Špulerová, J., 2022. Application of Landscape-Ecological Approach for Greenways Planning in Rural Agricultural Landscape. *Environments* 9, 30.

<https://doi.org/10.3390/environments9020030>

Miklós, L., Diviaková, A., Izakovičová, Z., 2019. Ecological Networks and Territorial Systems of Ecological Stability. Springer International Publishing, Cham.

<https://doi.org/10.1007/978-3-319-94018-2>

SWITZERLAND - Corinne

https://scnat.ch/de/uuid/i/f278cef9-b02b-51e1-8962-554847c00423-Biodiversit%C3%A4tsf%C3%B6rdernde_Strukturen_im_Landwirtschaftsgebiet

Agridea's publications on small structures and requirements for quality levels (publications are available in German and French):

<https://agridea.abacuscity.ch/de/3~410420~Shop/Publications/Plant-Cultivation-Environment-Nature-Landscape/Beitr%C3%A4ge-und-Conditions-in-%C3%96co-equalization>



Annex 1: References on the areas covered by HDLF at different scales

Ireland

63,000 ha of blanket bog and associated habitat in north west Ireland

Italy

Agnoletti, M., Conti, L., Frezza, L., Monti, M., & Santoro, A. (2015). Features analysis of dry stone walls of Tuscany (Italy). *Sustainability*, 7(10), 13887-13903.

Alessandro, P., & Marta, C. (2012). Heterogeneity of linear forest formations: differing potential for biodiversity conservation. A case study in Italy. *Agroforestry systems*, 86(1), 83-93.

Manenti, R. (2014). Dry stone walls favour biodiversity: a case-study from the Appennines. *Biodiversity and conservation*, 23(8), 1879-1893.

Sallustio, L., Di Cristofaro, M., Hashmi, M. M., Vizzarri, M., Sitzia, T., Lasserre, B., & Marchetti, M. (2018). Evaluating the contribution of Trees Outside Forests and Small Open Areas to the Italian landscape diversification during the last decades. *Forests*, 9(11), 701.

Sarti, M., Ciolfi, M., Lauteri, M., Paris, P., & Chiocchini, F. (2021). Trees outside forest in Italian agroforestry landscapes: detection and mapping using sentinel-2 imagery. *European Journal of Remote Sensing*, 54(1), 610-624.

Schnell, S., Kleinn, C., & Ståhl, G. (2015). Monitoring trees outside forests: a review. *Environmental monitoring and assessment*, 187(9), 1-17.

Tucci, G., Parisi, E. I., Castelli, G., Errico, A., Corongiu, M., Sona, G., ... & Preti, F. (2019). Multi-sensor UAV application for thermal analysis on a dry-stone terraced vineyard in rural tuscan landscape. *ISPRS International Journal of Geo-Information*, 8(2), 87.

France

For France, the "BD TOPO" is a free database referencing a lot of landscape features, including hedges, both as areas or as lines: <https://geoservices.ign.fr/bdtopo>

Used with the "RPG" referencing agricultural plots used for the CAP (<https://geoservices.ign.fr/rpg>)

, an R script could do the job of computing the area covered by hedges per ha of crops.

Pointereau, P., & Coulon, F. (2007). Atlas cartographique des infrastructures agroécologiques en France. Solagro.

https://solagro.org/images/imagesCK/files/publications/f18_atlasiae.pdf

France : 5 662 700 Ha ; 20,3 % of the UAA (ref : Solagro)

Bretagne : 182 500 km of hedgerows (data : 2010)

Germany

A lot of HDLF are listed as "Biotop" or "Naturdenkmal" beneath FFH areas

<https://udo.lubw.baden-wuerttemberg.de/public/pages/map/default/index.xhtml?mapId=68ded7ea-74a0-4edc-9ecd-24467ab00d01&mapSrs=EPSG%3A25832&mapExtent=251171.75633669196%2C5256081.5753161535%2C746327.1371616405%2C5500048.757743446>

<https://rp.baden-wuerttemberg.de/rpf/abt5/ref56/natura2000/>

<https://www.envidat.ch/#/metadata/habitat-map-of-switzerland>

Estonia

All registered landscape features in Estonia make up approximately 7600 ha. These features include trenches, strips/islands of trees. (Oja et al., 2016). Relevant synthesis/study (in Estonian) here:

<https://dspace.emu.ee/handle/10492/5839>

Switzerland

In the agricultural report, the proportions of biodiversity-promoting areas can be found in the various altitudinal zones in Switzerland (19% on average). This includes standard fruit trees and hedges. The other small structures make up only a very small part. Unfortunately, the report is only available in German, French and Italian.

<https://agrarbericht.ch/de/politik/direktzahlungen/biodiversitaets-beitraege>

Slovakia

High Nature Value Farmland: Šatalová, B., Špulerová, J., Štefunková, D., Dobrovodská, M., Vlachovičová, M., Kozelová, I., 2021. Monitoring and evaluating the contribution of the rural development program to high nature value farmland dominated by traditional mosaic landscape in Slovakia. *Ecol. Indic.* 126, 107661.

<https://doi.org/10.1016/j.ecolind.2021.107661>

Regional system of ecological stability. Sources: RUSES -

<https://www.sazp.sk/projekty-eu/ruses-ii.html>;

https://download.sazp.sk/RUSES_III/;

<https://www.sazp.sk/zivotne-prostredie/starostlivost-o-krajinu/zele-na-infrastruktura/dokumenty-uses-v-sr.html>

Land Parcel Information System (LPIS - including High Nature Value Farmland, Ecological Focus Area, Terraces, Green Infrastructure in LPIS):

<https://portal.vupop.sk/portal/apps/webappviewer/index.html?id=32beed691b01498d9ebe11bf8f9b7b04>

Slovenia

Data can be assessed through features of the Slovenia Forestry Service database:

<https://prostor.zgs.gov.si/pregledovalnik/>

Croatia

Here are partly data related to dry stone walls:

www.suhozid.hr



Annex 2: List of FG experts

Family name	First name	Interest	Country
Santoro	Antonio	Researcher	Italy
Zurbrügg	Corinne	Other	Switzerland
Stover	Daniel	Farmer	UK
Goggins	Gary	Civil servant	Ireland
Goracci	Jacopo	Farmer	Italy
Spulerova	Jana	Researcher	Slovakia
Robles del Salto	Jose-Fernando	Adviser	Spain
Kernecker	Maria	Researcher	Germany
Langstedt	Nina	Farmer	Finland
Nyarai	Orsolya	Working at NGO	Hungary
Petrov	Petar	Researcher	Bulgaria
Trepp	Ruffus	Civil servant	Estonia
Dreisiebner-Lanz	Sabrina	Adviser	Austria
Kavanagh	Saorla	Researcher	Ireland
Moosmann	Simona	Farmer	Germany
Kirchweger	Stefan	Researcher	Austria
Aviron	Stephanie	Researcher	France
Todorovic	Sonja Karoglan	Working at NGO	Croatia
Grebenc	Tine	Researcher	Slovenia
Mesmin	Xavier	Other	France



Annex 3: List of Mini Papers

MP	Mini Paper title	Core Team
1	The role of knowledge and promotion	Gary Goggins, Corinne Zurbrügg, Sonja Karoglan Todorovic, Simona Moosmann
2	Implementing High Diversity Landscape Features on farms: small changes but large gains	Stéphanie Aviron, Sabrina Dreisiebner-Lanz, Jacopo Goracci, Tine Grebenc, Stefan Kirchweger, Xavier Mesmin, Orsolya Nyárai ²
3	Managing High Diversity Landscape Features (HDLF) for pollinators	Saorla Kavanagh, Jana Špulerová, Maria Lee Kernecker, Daniel Stover, Stefan Kirchweger, José Fernando Robles
4	The social and cultural benefits of high-diversity landscape features	Orsolya Nyárai, Gary Goggins, Jacopo Goracci, Maria Kernecker, Nina Långstedt, Antonio Santoro, Rufus Trepp
5	Benefits of HDLFs for on-farm adaptation to climate change	Jana Spulerova, Sabrina Dreisiebner-Lanz, Simona Moosmann, Tine Grebenc, Petar Petrov, Sonja Karoglan



Innovation & Knowledge Exchange | EIP-AGRI
Koning Albert II-laan 15, 1210,
Brussel, België
+32 (0) 2 548 12 87
innovation-knowledge@eucapnetwork.eu

