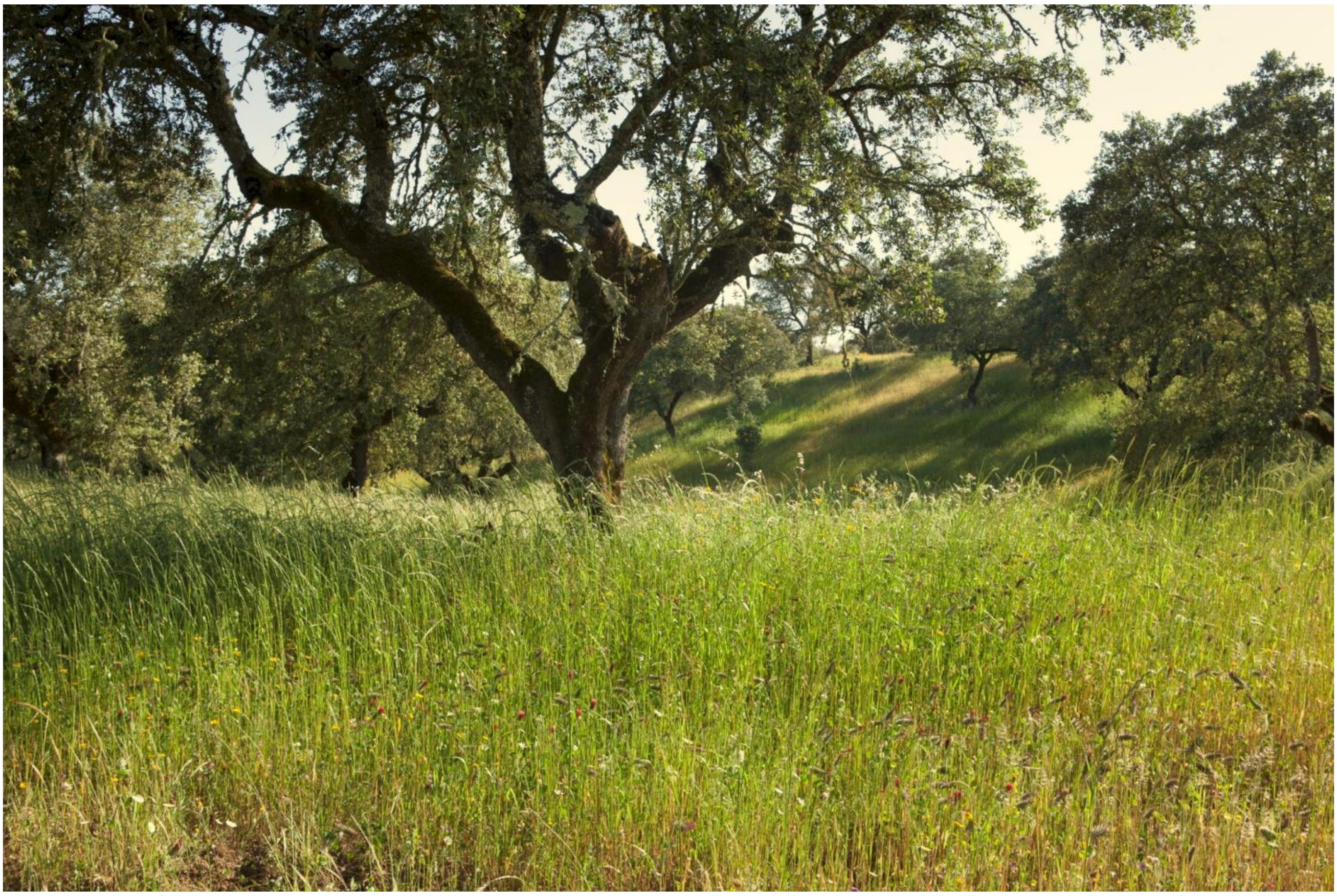
FOOD & BIODIVERSITY

Biodiversity Management

Guideline on the protection of primary ecosystems



Content

1. Primary ecosystems and semi-natural habitats

1.1. Primary ecosystems

Primary ecosystems are here defined as ecosystem that can or would be found in a given area in the absence of significant human management impacts. This includes all naturally occurring flowing and still water bodies (streams, rivers, pools, ponds), all naturally occurring wetlands, forests (rainforest, lowland, montane, broadleaf forest, needle leaf forest), and other native terrestrial ecosystems like woodlands and scrublands. A large part of ecosystems in Europe have been subject to human use since pre-historical times and were modified by cropland, pastures or forestry use (Kaplan et al., 2009). Therefore, current landscapes are no longer pristine but may nevertheless host high levels of biodiversity and have a critical role for the delivery of ecosystem services.

In Europe, the landscape mosaic is changing due to two opposing trends: intensification of use and abandonment. In the first case, changes are driven by anthropogenic factors that cause the fragmentation of natural ecosystems (including both primary and semi-natural ecosystems) and are mainly related to the expansion of agricultural areas, transport infrastructures, and settlements. In the second case, habitat change is driven by natural factors and defragmentation processes associated to natural regeneration occur. If occurring in a large extent, the increase of woody vegetation may cause habitat homogenization and the loss of biodiversity at the local scale and an increase in the risk of fire. In both cases, changes will have an impact on the supply of ecosystem functions and services and may cause major economic and social problems. For example, the loss of forest ecosystems may affect the local regulation of climate and the water cycle. It may also promote soil erosion and reduce the quality of the habitat for wild species (including pollinators and pest control agents) and threatened species.

Therefore, conserving ecosystems contributes to the protection of habitats and thereby biodiversity. Spatially explicit information on the pattern of primary (natural) and semi-natural ecosystems is also relevant to help to build a green infrastructure for Europe, which aims, amongst others, to develop networks of green, natural features, address impacts of urban sprawl and fragmentation, increase connectivity and improve landscape permeability.

1.2. Semi-natural habitats

Semi-natural habitats are habitats that despite being influenced by human activities did not lose their native structure and are very similar to natural habitats (e.g., reforested areas with autochthonous species). Semi-natural habitats also include artificially created but renaturalized habitats that have been largely left to develop naturally under unmanaged ecological processes and host typical native plant and animal species.

The classification of semi-natural habitats is not straightforward because the boundary between semi-natural and not semi-natural habitats occurs in a continuum where changes from one habitat type to another are gradual (as represented in Figure 1). For instance, considering the example in Figure 1 the boundary between semi-natural and not semi-natural grasslands is determined by the level of management intensity, which can be related to the amount of external inputs and human intervention necessary for pasture management or to the level of grazing pressure. Another issue is the context-dependent nature of the concept of semi-natural habitat, which may vary between countries or regions. Therefore, the classification of semi-natural habitat types should follow clear criteria that should be revised and adapted to local requirements.

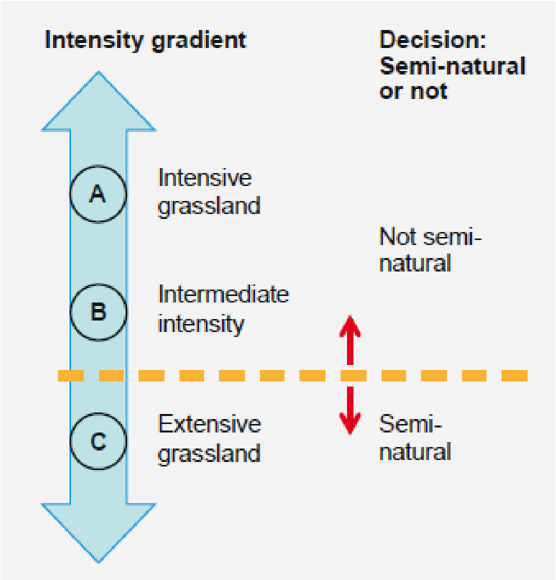


Figure 1: This scheme illustrates the difficulty in identifying the boundary between semi-natural and not semi-natural habitats. Grassland is taken as an example but the same types of uncertainty apply to other habitats. Source: Herzog et al. (2012).

Recently, the intensification and specialisation of farming practices has led to a simplification of agricultural landscapes and a loss of semi-natural habitats (Herzog et al., 2012). Semi-natural habitats can host a high diversity of animals and plants, being, therefore, important to promote biodiversity. Because they provide refuge and food for a variety of organisms, a well-designed planning of semi-natural habitats can mitigate the impacts of agricultural activities on biodiversity, but also support agricultural production through ecosystem services.

Examples of semi-natural habitats range from large ecosystem patches, such as scrubland, permanent grasslands, or fallow land, to vegetated banks associated with stone walls or more specific landscape elements such as hedges, buffer stripes, fallow land and flower strips; other examples include single trees (living and dead) in cropland and pastures, and reforested areas; there can also be semi-natural habitats associated with water elements, like water plots (streams, ditches) or water margins (riparian galleries).

2. Policy relevant concepts on habitat value

The Birds (EC, 1979) and Habitats (EC, 1992) Directives are the two main regulatory documents, in the European Union, regarding the identification and classification of habitats which are relevant in their own right and/or are relevant for the survival of one or more species. Based on these two directives, Special Protection Area (SPAs) and Special Areas of Conservation (SACs) are designated, respectively, across the European Union, and together they constitute the Natura 2000 network of protected areas.

The ecological value of habitats has been covered by two main concepts: the concept of High Conservation Value Areas (HCVA) and the concept of High Nature Value Farmland (HNVF).

The first concept has a global scope and was first proposed by the Forest Stewardship Council in 1999 and later adapted and adopted by a broader group of NGOs and private sector organizations, which form the HCV resource network (https://www.hcvnetwork.org), which promotes its use as part of certification schemes and sustainability standards (Brown et al., 2013).

The second concept is mostly used at the European level, its origin dates back to the early 1990s when its use was proposed to safeguard biodiversity and natural ecosystems in rural landscapes and the maintenance of traditional and extensive practices (EEA, 2014). Since then, the concept has been used by the European Commission to monitor the implementation of rural development interventions, assess the achievement of land use related targets from the EU Biodiversity Strategy for 2020 and support the evaluation of the Common Agricultural Policy. The two concepts while independent share similar values regarding the protection of vulnerable habitats and of rare or threatened species.

2.1. High Conservation Value Areas

High Conservation Value Areas are natural habitats, which are of outstanding significance or critical importance due to their high biological, ecological, social or cultural values at the national, regional or global level. These areas need to be appropriately managed to maintain or enhance those identified values (https://www.hcvnetwork.org/). Due to their outstanding value, these areas are mostly contemplated outside the European Union but there is European legislation aimed at promoting sustainability in biofuels production that recognize the statute of HCV for very biodiverse grasslands (Brown et al., 2013).

The identification of HCVA is supported by six main values (Brown et al., 2013):

HCV 1 Species diversity: Concentrations of biological diversity including endemic species, and rare, threatened or endangered species, that are significant at global, regional or national levels.

HCV 2 Landscape-level ecosystems and mosaics: Large landscape-level ecosystems and ecosystem mosaics that are significant at global, regional or national levels, and that contain viable populations of the great majority of the naturally occurring species in natural patterns of distribution and abundance.

HCV 3 Ecosystems and habitats: Rare, threatened, or endangered ecosystems, habitats or refugia.

HCV 4 Ecosystem services: Basic ecosystem services in critical situations, including protection of water catchments and control of erosion of vulnerable soils and slopes.

HCV 5 Community needs: Sites and resources fundamental for satisfying the basic necessities of local communities or indigenous peoples (for livelihoods, health, nutrition, water, etc.), identified through engagement with these communities or indigenous peoples.

HCV 6 Cultural values: Sites, resources, habitats and landscapes of global or national cultural, archaeological or historical significance, and/or of critical cultural, ecological, economic or religious/sacred importance for the traditional cultures of local communities or indigenous peoples, identified through engagement with these local communities or indigenous peoples

The six values can be used to identify areas of HCV at the farm scale or at the wider landscape scale. The multiple nature of the values ensures that the relevant ecological, social and cultural aspects of the habitats are all taken into consideration for management purposes. In regards to biodiversity, the values HCV1, HCV2 and HCV3 focus on species and habitats' vulnerability and irreplaceability at multiple scales, highlighting their need and demand for protection and conservation measures. HCV4, HCV 5 and HCV 6 are more focused on the value of these sites to people, from local communities to farmers and other stakeholders, based on their contribution to deliver critical ecosystem services and safeguard cultural values.

2.2. High Nature Value Farmland

High Nature Value Farmland (HNVF) encompasses areas where agricultural and pastoral land-use contributes to maintain high levels of biodiversity. These areas are generally associated to low-intensity systems and are characterized by a long-history of human use, where human intervention and livestock partially or greatly replaced natural disturbances and their role in maintaining habitat structure and species diversity in space and time. The contribution of these areas for biodiversity conservation ranges in a continuum from the maintenance of extensive areas of semi-natural habitats, with rich and diverse species communities, to the maintenance of habitat remnants critical for the persistence of rare species, in more intensified landscapes (Keenleyside et al., 2014). In the first case, the HNVF is an integral part of the agricultural land and often associated to livestock grazing, while in the latter case, the HNVF is not directly related to the agricultural use but very important to provide refuge to species and maintain biodiversity values.

In general, HNVF has been associated to the following types of farmland (Andersen, 2003; Keenleyside et al., 2014):

Type 1: Farmland with a high proportion of semi-natural vegetation.

Type 2: Farmland dominated by low intensity agriculture or a mosaic of semi-natural and cultivated land and small-scale features.

Type 3: Farmland supporting rare species or a high proportion of European or world populations.

These categories are not mutually exclusive, but their application may follow an hierarchical approach, where extensive areas of Type 1 or 2 are assumed to provide the adequate habitat conditions to support high species diversity, while Type 3 is more often used to identified important habitat remnants in intensified landscape (Beaufoy, 2008).

HNVF occurs across all Europe, but its presence is more accentuated in Southern and Eastern Europe and in the north-west, such as upland areas in UK and Norway, and lowlands in Iceland (Figure 2).

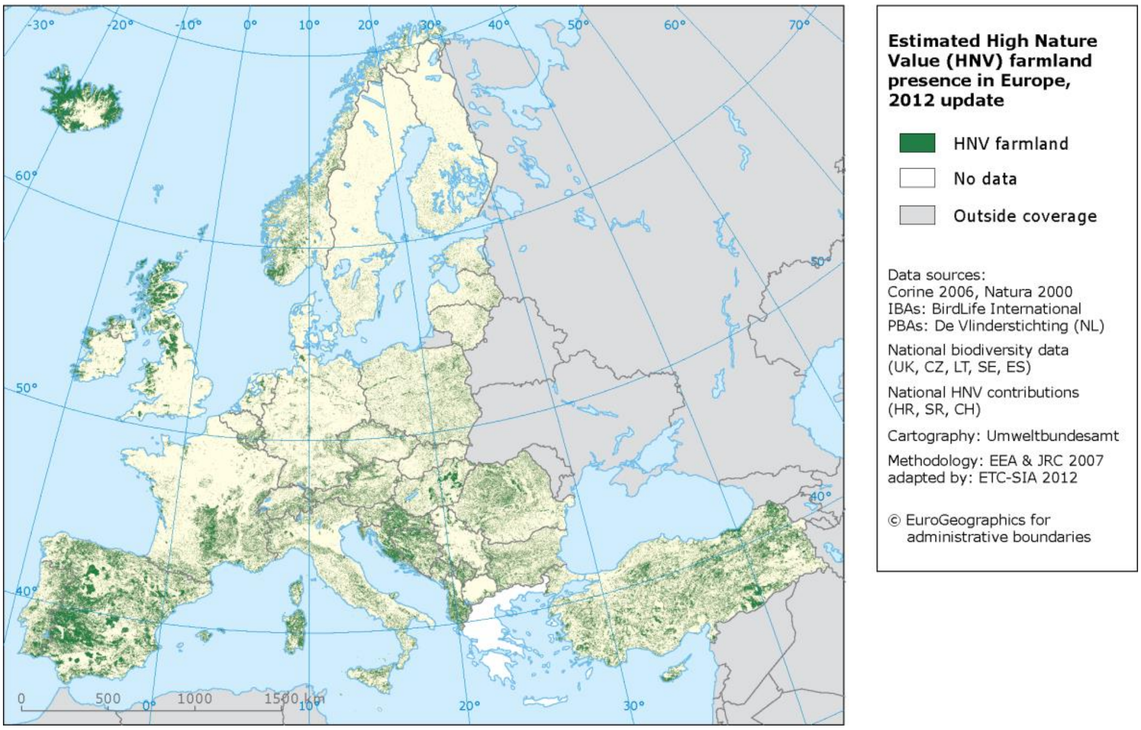


Figure 2. Distribution of High Nature Value Farmland in Europe (source: www.eea.europa.eu/)

2.2.1. Livestock production in High Nature Value Farmland

The majority of HNVF in Europe is associated to extensive pastoral use. Livestock systems in HNVF include off-farm grazing systems, such as free-ranging on communal land, often associated to mountain pastures, and on-farm grazing systems, where permanent grasslands or arable crops provide the main forage resource (EEA, 2004). Low-intensity pastoral systems grazing on semi-natural vegetation constitute the most common use of HNV farmland (Keenleyside et al., 2014). These Type 1 systems, represent the larger proportion of HNVF in the Mediterranean and south-eastern parts of the EU (Portugal, Spain, Italy, Greece, Cyprus, Romania and Bulgaria) in the north-west (the United Kingdom, the Netherlands, Ireland and France), the north-east (Sweden, Finland and Estonia) and in the Czech Republic, Austria and Slovenia in central Europe (Keenleyside et al., 2014; Figure 2). Many of these livestock farming systems use wood pastures, particularly on dry land in Spain, Portugal and Greece but also significant areas of alpine and mountain wooded pastures in Italy, Slovenia and Austria, and important but smaller fragments of lowland wooded pastures in Latvia, Estonia and Hungary (Keenleyside et al., 2014).

Wood-pastures systems in Portugal and Spain, locally designated as *montados* or *dehesas*, provide an excellent example of this type of HNV livestock farming. These systems, characterized by a savanna type structure and dominated by cork oak (*Quercus suber*) and/or holm oak (*Q. rotundifolia*), are protected by the EU Habitats Directive, providing habitat for many species of birds, mammals, and flora, among other groups. The elevated levels of species diversity are maintained by the structural diversity of the system, both at the stand (e.g., multiple vegetation layers) and at the landscape level (e.g., variation in tree density), and by their extensive distribution and generally good connectivity at the regional level. The maintenance of structural diversity derives from a low-intensity silvo-pastoral use, which can be combined with other uses, such as hunting, beekeeping, mushroom picking and bird watching. Maintaining structural diversity requires a good balance between management practices, with the risk that the same activities that enable multifunctional use and biodiversity conservation (e.g., livestock grazing) becoming a threat if poorly managed (Pinto-Correia & Mascarenhas 1999; Almeida et al., 2015). For instance, extensive grazing is needed to avoid vegetation encroachment and keep open areas in the understory, it also contributes to the recycling of nutrients, but high stocking densities may hamper tree recruitment, reduce habitat heterogeneity, and in the case of cattle cause soil compaction and trampling (Almeida et al., 2015).

Today agricultural intensification constitutes the main threat to the maintenance of low-intensity grazing systems in HNVF, including both the intensification of grazing pressure, through an increase of stocking rates, and the conversion of semi-natural areas and crop mosaics into large patches of homogenous intensified systems, without seasonal or fallow dynamics, and with the use of destructive tillage and agrochemicals, that pollute the system and kill invertebrate and soil fauna. In Europe, the regions with higher loss of HNVF due to intensification include the area of distribution of *montados*/*dehesas* in south Portugal and Spain, extensive livestock systems in the Baltic countries, central and eastern Europe (Figure 3).

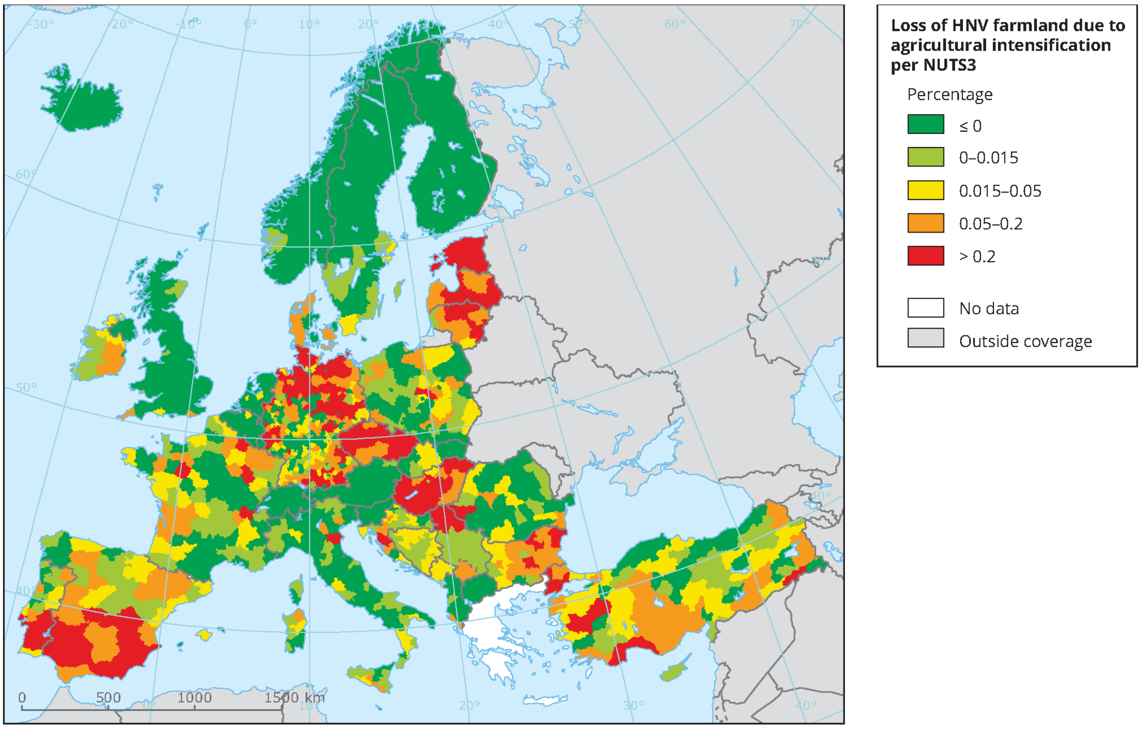


Figure 3. Loss of High Nature Value Farmland due to agricultural intensification between 2006-2012 (source: www.eea.europa.eu).

2.2.2. Crop production in High Nature Value Farmland

The HNVF associated to crop production is characterized by low intensity systems, including permanent crops (e.g., olive groves) and arable crops, notably extensive cereal systems. HNVF landscapes are often shaped by a mosaic pattern that includes a mix of permanent and arable crops and pastures. The value of these farmland landscapes for biodiversity depends not only on the structure, composition and management of the individual land parcels, with seasonal and fallow dynamics, but also on the mosaic pattern that emerges at the larger scale and provides diverse feeding and breeding niches, both in space and time, for many wildlife species.

Traditional olive groves, vineyards, carob groves, fruit and nuts orchards provide good examples of permanent crops with high nature value (Keenleyside et al., 2014). These systems occur across Europe but are particularly relevant and strongly associated to the cultural heritage of Mediterranean countries. The structural diversity created by the vertical layers (understory and canopy), the low intensity management practices and the old age of some of the groves, which is associated to higher levels of naturalization, including strengthened ecological processes or the presence of old trees with crevices, all contribute to maintain high levels of biodiversity and safeguard important ecosystem services (e.g., soil and water regulation, pollination, pest control, food, cultural values etc.)

Dryland cereal systems are the most important example of HNV arable crops (Keenleyside et al., 2014). These systems are facing a rapid decline, being mostly found in Iberia and Eastern Europe (Sutcliffe et al., 2014). The seasonal and fallow dynamics associated to these systems are critical to the survival of several endagered species of farmland birds, notably the great bustard (*Otis tarda*), the little bustard (*Tetrax tetrax*) and the lesser kestrel (*Falco naumanni*) that find food, refuge and nesting grounds in steppe-like grasslands (Figure 4). The conversion of extensive farmland, composed by a mosaic of habitats with seasonal and fallow dynamics, into large patches of homogenous intensive systems, where the use of pesticides kills invertebrate preys, has severe impacts for the survival of these species.

Figure 4. Distribution of the great bustard (*Otis tarda*) in Europe, the species is strongly associated to cereal crops in HNV farmland. Portugal and Spain support the largest populations of the species, with other populations in Central and Eastern Europe. (source: http://ec.europa.eu/).

3. Indicators of change or loss of ecosystems with high ecological value

Spatial extent is the most commonly used indicator to monitor changes in ecosystem and habitat condition and asses or estimate impacts on biodiversity. The first step when establishing a Biodiversity Action Plan, as required by some food standards, is to conduct a baseline assessment which gathers information on sensitive and protected biodiversity areas, endangered and protected species and semi-natural habitats located on the farm and or the overall landscape directly affected by the management practices at the farm. Examples of sensitive and protected biodiversity areas include high conservation value areas important to maintain sensitive species populations, habitats and ecosystems (HCVs 1 to 3) and areas whose protection is necessary to safeguard critical ecosystem services (HCVs 4 and 5). Also important, in the European region, is to identify the presence of high nature value farmland, considering both the specific land cover elements and habitats present in the farm and the broader landscape matrix that contains the farm. At the farm and surrounding landscape scales the concepts of HCV and HNV will cover most of natural ecosystems and habitats with high ecological value. The presence of habitats listed under the EU Habitats Directive, as well as terrestrial or freshwater ecosystems protected for their conservation of ecological value should also be identified.

The identification and mapping of the ecosystems and habitats with high ecological value is a necessary step to define management goals and monitor their impact on these areas. Following the mitigation hierarchy approach (Arlidge et al., 2018), the extent of the ecosystems and habitat patches reported in the baseline assessment should be at least maintained, and whenever possible enhanced, while the loss of area and fragmentation should be avoided. The extent and configuration of these areas should be regularly monitored to assess potential changes. This can be done using in-situ surveys or airborne of satellite imagery, depending on the survey area, the size and the structural features of the ecosystems or habitats of interest.

In some cases, the maintenance of the native structure of the habitat is as important as maintaining or increasing its extent. For instance, the removal of the shrub layer in forest patches will not change the apparent extent of the habitat but will change its structure with potential effects on its quality for forest birds. Therefore, and depending on the ecosystem or habitat of concern, other indicators should be selected in addition to spatial extent, which provides a straightforward but limited measure of change. Examples include changes in the abundance of key indicator species, changes in habitat structure, recruitment and mortality rate of keystone species, such as trees or shrubs, etc. At the landscape level, when the maintenance of high nature value farmland mosaics is pursued, indicators of habitat richness and diversity, of crop richness, or percentage of semi-natural habitats can be used.

4. Good management of semi-natural habitats

Some of the most critical conservation issues today are related to changes in farming practices, which directly affect the wildlife on farms and adjacent habitats. On the other hand, the diversity of habitats, species, crop varieties and livestock breeds are the foundation of farming, and many wild species are reliant upon European farmland, so the loss of natural ecosystems is a threat to the sustainability of agricultural production systems because the benefits they provide can be lost.

Natural or semi-natural ecosystems with diverse vegetation, natural or planted such as hedges, flower strips, solitary trees, etc., provide habitat, shelter and food for a variety of animals and plants. In addition to the size and the level of connection between them, semi-natural habitats must also have a certain quality in order to be optimally used by the animals and plants as described above. Quality is expressed, among other things, by the diversity of landscape elements, plant selection and suitable maintenance.

The following selection of landscape features should be understood as examples that ensure more and contribute to the protection of biodiversity, creating the conditions to its recovery.

4.1. Hedges

Hedges, and other woody linear elements, such as lines of trees are important elements to maintain biodiversity in the landscape, as they provide nesting, breeding habitat and refuge for wild species. They can act as a stepping stone linking biotopes and stabilize the ecosystem, and provide ecosystem services. A more detailed list of benefits, risks and management options is described next:

Benefits for biodiversity: The multi-layered structure of hedges (soil, herb, shrub and tree layer) promotes species diversity. These landscape elements support structural diversity, contribute to regulate local (and global) climate and act as a windbreak (favouring for example the butterflies), serve as winter quarters (e.g., for hedgehogs and common toads), hiding place for hares and birds, forage (e.g., flowers, for wild bees and other insects; berries and other fruits). Hedges also act as territory borders (e.g., perches and song post for birds).

Benefits for farmers: Hedges serve as habitat for many different beneficial species that feed and hunt within different radius, but most within 30m from their retreatment area, thus, the need for pesticides is reduced next to hedges. Wind protection of hedges extend on the 10 to thirtyfold length of its height, so in that area, precipitation and soil humidity increase, and evaporation of soil humidity decreases, contributing to a yield increase of 10-20%. Hedges also help to reduce the risk of landslides in steep terrain and retain nutrients from cropland, avoiding leaching into water bodies.

Risks: Hedges and margins can allow some weed species to proliferate and spread into crops, such as annual *Gallium aparine*, perennial *Elytrigia repens* and biennial *Heraclium sphondylium* and harbour pest species such as black bean aphids which can have negative environmental consequences if applications of pesticide and herbicide are increased as a result. These semi-natural habitats may also support mice species. In direct surroundings of hedges, farmers may experience yield losses due to shade, water and nutrient concurrence of plants with crops.

Management: A planting scheme may help with the determination of amount of plants needed as well as their distribution. Only plants of autochthonous to the landscape should be used to create hedges. Local conditions, such as soil, humidity and shading must be regarded when choosing the species.

The hedge may include higher-growing bushes in the center and the distances between them must not be less than 2 x 2m. At the margins, lower shrubs in a distance of 1 x 1m shall be planted. Around the hedges there may be enough space for the establishment of wild herbs.

At least the first two summers after planting shoots should be protected from undergrowth by mowing or weeding. In a hot summer, irrigation of plants may be necessary in the first year. Starting with the 6th year after planting, pruning may be necessary in order to keep the plants on a certain height. In case of species with fruits which provide food for wildlife such as birds, pruning must be done ideally in February/March. Pruning must only be done on one side per year and on maximum of 30-50% of the whole hedge.

Coppicing of either trees within the hedge or fast-growing bush-species may be done every 5-10 years in order to regenerate the hedge. It is also advisable to maintain a buffer strip of, e.g. flowering strips along the hedge, which will increase furthermore the habitat quality.

4.2. Riparian zones

A riparian zone, with shrubs and or a tree gallery is an area of interface between terrestrial and freshwater ecosystems, namely rivers and streams, forming a wide and diverse vegetated strip along water bodies and serving as a buffer zone between managed land and natural ecosystems/water bodies.

Benefits for biodiversity: The prevention of nutrient and pesticide leaching into the water may be the most important effect. Moreover, riparian zones provide protection and refuge for insects, hares and partridges during agricultural work on the field. They are habitat and wintering grounds for many insects, and are especially important for the development of many dragonflies and butterflies. Overall, riparian zones functions, along with rivers and streams, as natural corridors that connect landscapes.

Benefits for farmers: Riparian zones are very important to prevent eutrophication of water bodies and thus are a central measure for human health. The permanent vegetation cover further contributes to erosion control, especially on steep slopes. The use of riparian zones to improve habitat quality for different wildlife may be a win-win situation, since regular maintenance of the gallery prevents the invasion of cropland by weeds or harmful insects.

Management: Good Agricultural and Environmental Conditions (GAEC) requirements (in the context of the Common Agricultural Policy) for buffer strips vary significantly, depending on the Member State, with the minimum width of strips ranging from 25 cm to 10 m (ECA, 2014). In Germany, for instance, buffer strips should be at least 10 m wide, but may extend on up to 50 m. Starting in 2019, any agricultural use within a distance of 5 m to the water body is forbidden (except for maintenance of flower strips and short-rotation coppices) (WBW and LUBW, 2015). In general, the development of shrubby structures should be promoted within a distance of at least 10 m from the plot under agricultural use to the natural vegetation connected to the water body.

To serve as a buffer, riparian zones must not be fertilized and no pesticide should be used. Therefore, these areas are sites with no or minor yields and may be valuable sites to implement biodiversity measures. If riparian zones are managed extensively, each side should be cut in different, alternating, years. Alternatively, one side may remain uncut overall and sides get switched after a few years. It is prohibited to cut native shrubs and trees, however, good agricultural practice also includes the maintenance of those structures.

4.3. Solitary Trees

Solitary trees in general are important landscape elements. They contribute to structural diversity and belong historically to the image of Europe’s cultural landscape. Solitary trees are also valuable elements on pastures as they serve as protection from sun and rain.

Benefits for biodiversity: Solitary trees provide shelter and breeding habitat for several species, especially old trees. They provide breeding holes for raptors and serve as perch in open landscapes. Several beetle species feed on bark and dead wood parts and many birds are dependent on these trees for nesting.

Benefits for farmers: Solitary trees are important cultural assets and contribute to the positive image of farming. They provide food and shelter to livestock animals, and serve as habitat for specialized insects. Trees also fulfil important ecosystem functions, such as CO2 fixation, but also erosion protection, water infiltration and purification.

Risks: The shadow cast by solitary trees may reduce the solar irradiance reaching the crop (in a certain area), impacting transpiration, temperature, and soil moisture and ultimately causing lower yields (Schmidt et al., 2019).

Management: Before planting a tree the local nature conservation authority should be consulted. There may be cases where planting of trees is regulated, for instance, when the planting ground is within a landscape protection area.

Old trees, including deadwood, shall be protected and more solitary native trees should be planted along field margins, paths, on meadows or pastures.

Digging a hole of 60 x 60 x 60 cm for plants/trees with 1 or 2 years old (advisable to plant young trees). It is advisable to water the tree straight after planting. In Mediterranean countries, irrigation must be ensured during summer and dry seasons at least the 2 first years after the plantation. Installing protectors around the plants helps to avoid damages caused by herbivorous species.
Maintenance work on the tree crown, like pruning, may not take place during spring to avoid the disturbance of animals. In a radius of about 10m around the tree, soil must not be tilled in order to protect the roots. Furthermore, fertilizer and pesticides should not be applied in that distance.

For younger trees without holes, nesting boxes for birds and/or wild bees can be provided.

4.4. Stone and Wood piles

Stone and wood piles provide of habitat and winter quarters for a variety of different beneficial animals and wildlife.

Benefits for biodiversity: Stone piles are dry and warm habitats and therefore important biotopes for native species. They provide valuable hiding, sunbath places and winter quarters for many different heat-dependent animals, such as lizards or blindworms. Stone piles are an important habitat for rabbits, carnivorous predators and birds of prey. Furthermore, piles pose habitats for thermophile plant species. As stones store heat from the sun and expose it at night, stone piles provide resting but also hunting habitats for nocturnal insects and reptiles.

Deadwood piles provide nesting, development, hibernation and hiding place for various species, like beneficial insects. Toads, lizards and other amphibian and reptiles, hedgehogs and weasels use deadwood piles as winter quarters.

Migrating birds use piles as resting site during passage in autumn and spring

Benefits for farmers: These landscape elements provide nesting habitats to a diversity of species, starting with wild bees, which constitute important pollinators, up to small predators such as marten and weasel, which may help controlling the mice population. Amphibians and reptiles such as sand lizard, common toad and blindworm feed on pests. Overall, this measure can help reducing the use of pesticides.

Risks: The construction of wood piles may be limited in certain regions due to fire or health risks.

Management: Stone and deadwood piles require minor care and can be established all year, but it is important to use materials (wood and rocks) from the area. The establishment of an herb or grass margin is important to ensure connectivity with the surrounding habitat. Ideally, this vegetation measures at least 50cm, stays fallow and gets only cut in case of scrub encroachment. It is very important that no pesticides are applied in a distance of 3m.

Shrubs growing on the side of the pile are acceptable as long as they do not shade the pile, once they affect its ability to capture, store and redistribute heat. Thus, surrounding shrubs and trees need to be regularly pruned. Plants such as ivy and clematis may overgrow the pile partly but not completely as it does not provide habitat for sun-dependent species anymore otherwise. Herbal vegetation islands, which establish over the years, may remain as well. Before pilling, the wood used to create the pile should be checked for the presence of pests (e.g., bark beetle) to avoid spreading on surround forests.

5. References

Almeida, M., Azeda, C., Guiomar, N., & Pinto-Correia, T. (2015). The effects of grazing management in montado fragmentation and heterogeneity. Agroforestry Systems, 1-17.

Andersen, E., Baldock, D., Bennett, H., Beaufoy, G., Bignal, E., Brouwer, F., Elbersen, B., Eiden, G., Godeschalk, F., Jones, G. and McCracken, D.I., 2003. Developing a high nature value indicator. Report for the European Environment Agency, Copenhagen.

Arlidge, W.N., Bull, J.W., Addison, P.F., Burgass, M.J., Gianuca, D., Gorham, T.M., Jacob, C., Shumway, N., Sinclair, S.P., Watson, J.E., Wilcox, C., Milner-Gulland, E., 2018. A global mitigation hierarchy for nature conservation. Bioscience 68, 336–347.

Beaufoy, G., 2008, HNV Farming–Explaining the concept and interpreting EU and National Policy Commitments. In European forum on nature conservation and pastoralism.

Brown, E., N. Dudley, A. Lindhe, D.R. Muhtaman, C. Stewart, and T. Synnott (eds.). 2013. Common guidance for the identification of High Conservation Values. HCV Resource Network.

EC, 1979. Council Directive 79/409/EEC of 2 April 1979 on the conservation of wild birds. Off. J. L 103, 1–18.

EC, 1992. Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. Off. J. L 206, 7–50.

ECA, 2014. Integration of EU water policy objectives with the CAP: a partial success. Publications Office of the European Union, Luxembourg.

EEA - European Environment Agency, 2004. High nature value farmland: Characteristics, trends and policy challenges. EEA.

EEA - European Environment Agency, 2014 Developing a forest naturalness indicator for Europe - concept and methodology for a high nature value (HNV) forest indicator. Technical report 13/2014.

Herzog, F., Balázs, K., Dennis, P., Friedel, J., Geijzendorffer, I., Jeanneret, P., Kainz, M., and Pointereau, P., 2012. Biodiversity indicators for European farming systems: a guidebook. Forschungsanstalt Agroscope Reckenholz-Tänikon ART Reckenholz, Zürich.

Kaplan, J. O., Krumhardt, K. M., & Zimmermann, N. (2009). The prehistoric and preindustrial deforestation of Europe. Quaternary Science Reviews, 28(27-28), 3016-3034.

Keenleyside, C, Beaufoy, G, Tucker, G, and Jones, G (2014) High Nature Value farming throughout EU-27 and its financial support under the CAP. Report Prepared for DG Environment, Contract No ENV B.1/ETU/2012/0035, Institute for European Environmental Policy, London.

Pinto-Correia, T., & Mascarenhas, J. (1999). Contribution to the extensification/intensification debate: new trends in the Portuguese montado. Landscape and Urban Planning, 46(1), 125-131.

Schmidt, M., Nendel, C., Funk, R., Mitchell, M.G., Lischeid, G., 2019. Modeling yields response to shading in the field-to-forest transition zones in heterogeneous landscapes. Agriculture 9, 1–15.

Sutcliffe, L. M. E., Batáry, P., Kormann, U., Báldi, A., Dicks, L. V., Herzon, I., Kleijn, D., Piotr Tryjanowski, P., Apostolova, I., Arlettaz, R., Aunins, A., Aviron, S., Balezentien, L., Fischer, C., Halada, L., Hartel, T., Helm, A., Hristov, I., Jelaska, S.D., Kaligari, M., Kamp, J., Klimek, S., Koorberg, P., Kostiukov, J., Kovács-Hostyánszki, A., Kuemmerle, T., Leuschner, C., Lindborg, R., Loos, J., Maccherini, S., Marja, R., Máthé, O., Paulini, I., Proença, V., Rey-Benayas, J., Sans, F.X., Seifert, C., Stalenga, J., Timaeus, J., Török, P., van Swaay, C., Viik, E., Tscharntke, T. (2014). Harnessing the biodiversity value of Central and Eastern European farmland. Diversity and Distributions, 21(6), 722–730. DOI: 10.1111/ddi.12288

WBW, LUBW, 2015. Gewässerrandstreifen in Baden-Württemberg. WBW Fortbildungsgesellschaft für Gewässerentwicklung mbH, Karlsruhe.

Overview of the Project EU LIFE Food & Biodiversity

Food producers and retailers are highly dependent on biodiversity and ecosystem services but also have a huge environmental impact. This is a well-known fact in the food sector. Standards and sourcing requirements can help to reduce this negative impact with effective, transparent and verifiable criteria for the production process and the supply chain. They provide consumers with information about the quality of products, environmental and social footprints, the impact on nature caused by the product.

The LIFE Food & Biodiversity Project "Biodiversity in Standards and Labels for the Food Industry" aims at improving the biodiversity performance of standards and sourcing requirements within the food industry by:

A) Supporting standard-setting organisations to include efficient biodiversity criteria into existing schemes; and encouraging food processing companies and retailers to include biodiversity criteria into respective sourcing guidelines;
B) Training of advisors and certifiers of standards as well as product and quality manager of companies;
C) Implementation of a cross-standard monitoring system on biodiversity;
D) Establishment of a European-wide sector initiative.

Within the EU-LIFE Project Food & Biodiversity, a Knowledge-Pool with background information linked to agriculture and biodiversity is provided. You can access the Knowledge Pool under the following link:

www.business-biodiversity.eu/en/knowledge-pool

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