

## Biodiversity and agriculture

### SUMMARY

In its mid-term review of the Biodiversity strategy, the European Commission identified a continuing decline in the species and habitats associated with agriculture. It concluded that the strategy was not fulfilling expectations with regard to the contribution of agriculture and forestry to maintaining and enhancing biodiversity.

Numerous studies show that agricultural biodiversity loss is linked to intensification of agricultural activities on the one hand, and the abandonment of farming on the other hand. Intensification is generally associated with high yields, but also with significant changes in the natural environment. Abandonment generally implies the loss of cultivated landscapes and corresponding habitats.

There are essentially two different models of how to reconcile biodiversity and agricultural activities: the land-sharing model based on more extensive farming, and the land-sparing model based on further intensification of farming.

The reformed Common Agricultural Policy offers various instruments aimed at supporting biodiversity while guaranteeing a decent living for farmers. Conservationists consider the reforms to be lagging behind expectations, whereas farmers fear a loss of income through lower yields.

The European Parliament has expressed concern regarding biodiversity loss and has called on the Commission to assess the effectiveness of the measures taken so far.



A grey partridge, a farmland bird undergoing population decline.

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### Glossary

**Agricultural biodiversity:** All components of biological diversity that are of relevance to food and agriculture, and all components of biological diversity that constitute the agricultural ecosystems or agroecosystems.

**Agroecosystems:** A dynamic association of crops, pastures, livestock, other flora and fauna, the atmosphere, soils and water.

**Ecosystem services:** Benefits people obtain from ecosystems, including provisioning services such as food and water; regulating services such as flood and disease control and air purification; cultural services (spiritual and recreational) and benefits; and supporting services, such as nutrient cycling, that maintain the conditions for life on earth.

**Semi-natural habitats:** Parts of agricultural land where agricultural activities with a reduced environmental impact or with a certain importance to wildlife species are present.

## Background

In its [mid-term review of the Biodiversity strategy](#), the European Commission reported 'no significant overall progress' towards the strategy target aimed at increasing the contribution of agriculture and forestry to maintaining and enhancing biodiversity. The Commission based its assessment on two 2015 reports by the European Environment Agency (EEA): the European environment-state and outlook report ([SOER](#) report), which identifies intensification in agricultural practices and land abandonment as being among the key pressures on biodiversity; and the [report on the State of Nature in the EU](#), which also points to agricultural intensification and abandonment as being among the most prominent pressures on terrestrial ecosystems in the 2007-2012 period. The State of Nature report, which examines the status of species and habitats covered by EU nature legislation (the [Birds Directive](#) and the [Habitats Directive](#)), indicates that **grassland and cropland** – the two main agricultural ecosystems – have the highest share of unfavourable assessments among terrestrial ecosystems.

## Intensification and abandonment

According to [Eurostat](#), farmland accounts for about 40% of the EU's land area. It has consequently a very strong impact on the natural environment.

Notwithstanding the significant differences between Member States,<sup>1</sup> European farmland can be characterised by two general trends since the 1950s: intensification and specialisation<sup>2</sup> on the one hand, and abandonment of agricultural activities on the other hand. Intensification can be associated with higher productivity as a result of higher food demand and growing competition. Land abandonment is often connected with the question of the economic viability of farming.

### Forestry and biodiversity

Forests and woodland account for about 30% of the EU's land area. Forests play an important role in the conservation of biodiversity, and provide a range of ecosystem services, such as protection of the soil from erosion and other detrimental processes; capturing and storing of carbon; provision of fuel-wood and timber; and social and cultural benefits.

According to the [SOER](#) report, increased land use, expanding urban areas, intensified harvesting of trees to meet the demand for biomass, as well as forest fires put pressure on forests. This can result in fragmentation of forest habitats, which reduces the survival rates of forest-dependent species.

Although there is no common forest policy, a [new EU Forest strategy](#) aims to enhance the coordination of national forest-related policies. The strategy supports the use of Forest Management Plans as required by the EU 2020 Biodiversity strategy. The European Parliament welcomed the new strategy in a [resolution](#) on 28 April 2015.

### Intensification and specialisation

According to numerous studies, agricultural intensification in general implies an increase in inputs (for example, of fertilisers and pesticides) and a simplification of the agricultural landscape and working patterns, meant to increase efficiency and yield.

Increased agricultural production and a steady food supply have provided better living conditions for people. The elimination of food scarcity goes hand in hand with healthier nutrition and higher life expectancy. Scientists have pointed out that food security has been a prerequisite for population growth and for the economic and political development of societies. Between 1960 and 2000 alone, the 'green revolution' enabled global cereal [production to double](#) thanks to higher inputs of fertiliser, water and pesticides as well as new crop strains, among other things.

However, studies also point out that intensification and specialisation bring about substantial changes in farmland ecosystems. Higher input is characterised by higher consumption of **fertilisers**, increased use of **pesticides**, higher **livestock density**, a focus on certain **livestock types and breeds** as well as on **limited types and varieties of crops**, a higher share of **productive land** and **increased activity** throughout the year. All the above can seriously affect biodiversity:

- High consumption of **fertilisers** (containing in particular nitrogen and phosphorus) can have a negative impact on farmland biodiversity, as plants that are able to thrive in low-nutrient conditions are outcompeted by more demanding plants that benefit from higher nutrient levels. This can also induce changes in the species composition of a given site, as outcompeted plants might have been a source of food for birds, pollinators and/or useful insects. High nitrogen levels can also favour bacterial decomposition, leading to rapid depletion of the soil's organic matter and a reduction in its biodiversity. As crops take up only 30-50% of the nitrogen and around 45% of the phosphorus applied to them, the surplus nutrients can also damage off-site terrestrial and aquatic ecosystems. [Nitrogen emissions](#) from fertilisers into water and air are considered one of the major causes of terrestrial and aquatic biodiversity loss;
- **Pesticides**, which are applied to kill or control insects, weeds, fungi, rodents or micro-organisms, can impair certain ecosystems. They can affect target and non-target organisms and have knock-on effects on the **food chain**, damaging wildlife (for instance, birds, hedgehogs, wood-mice, beetles, butterflies, bees and amphibians feeding on the targeted species). Despite the [significant decline](#) in the recorded volume of pesticide use across the EU in the past 20 years, this has not led to a corresponding decline in environmental impact, due to more concentrated active ingredients;
- A higher **livestock density** per hectare implying intensive grazing or overgrazing may reduce the heterogeneity of plants and lead to soil compaction hindering birds, for instance, from accessing soil invertebrates;
- Specialisation in certain **livestock types** (in particular cattle<sup>3</sup>) **and breeds** can, as [Eurostat](#) figures illustrate, imply fewer habitats with reduced feeding and breeding options, fewer plant species and reduced connectivity amongst habitat patches;
- A higher share of certain **crop types and varieties** goes along with a reduction in genetic diversity on farmland. However, such diversity is important for pest and

#### Farmland Bird Indicator

Based on 37 farmland bird species, the [farmland bird indicator](#) is used for monitoring the biodiversity of agricultural landscapes in Europe. It shows a decline in bird populations since 1980, by about 51%, which was particularly rapid up to about 1985. The falling trend has levelled off since the late 1990s.

disease management, as well as for ecosystem services such as pollination and soil fertility. Specialisation in one or a limited number of crop types also implies limited possibilities for crop rotation;

- A higher share of **arable areas** under [conventional tillage](#) (as opposed to [conservational tillage](#) or [zero tillage](#)<sup>4</sup>) usually goes hand in hand with a loss of undisturbed habitats. Soil cultivation techniques like ploughing can kill soil fauna (for instance, worms) necessary for the soil's functioning and might reduce food availability for birds. Moreover, some species, such as hares and ground-nesting birds, depend on undisturbed land for breeding. According to [Eurostat](#), almost two thirds of the EU's arable land is tilled conventionally, almost a fifth is under conservational tillage, and zero tillage is very limited;
- A higher share of **productive land** with enlarged **field and farm sizes** often goes together with the **removal of unproductive landscape elements**, such as hedgerows, ponds, trees, walls, and so forth. This results in the loss of shelter, food resources, breeding sites and undisturbed breeding habitats. It also involves a time aspect: an increase in winter-sown crops means limited availability of winter stubble to wildlife, and earlier mowing of grass for silage has significant consequences in terms of biodiversity since grassland provides valuable food and breeding habitats.

Rich biological diversity on farmland is not only of value for its own sake. With its ecosystem services, such as pollination, pest control and maintenance of soil fertility, this natural capital is a precondition for the long-term viability of farmland production. Several [studies](#) show that 75% of the crops traded on the global market depend on pollinators and that a diversity of pollinators can contribute to a higher crop yield.

**Grassland.** Permanent grassland is defined as land used for growing grasses or other herbaceous forage naturally (self-seeded) or through cultivation (sown), and not included in a holding's crop rotation for five years or longer (Commission Regulation EU No 796/2004). Practically all grassland in Europe is linked to agriculture. Grasslands include a particularly high plant diversity that provides food for butterflies, pollinating insects, birds and rodents. These semi-natural habitats are however among the most endangered habitat types. Over the 20th century, more than 90% of semi-natural grasslands were lost owing to intensification or abandonment, and a large number of grassland species experienced population decline.

### **Abandonment of farming activities**

Many habitats, such as meadows, pastures and orchards are the result of the evolution of extensive agricultural activities over a long time. Agriculture has facilitated the formation of a heterogeneous mosaic of semi-natural habitats with a rich fauna and flora, which would not have existed without interventions such as grazing or mowing. These habitats are particularly threatened in areas where agricultural activity is difficult, for example, in mountainous regions and in areas with poor soils or harsh weather conditions. As farms in these regions produce lower yields and intensification is not an option, agricultural activity is often abandoned. Abandonment can benefit biodiversity by providing the opportunity for reconnecting highly fragmented landscapes and resettling wild species. This is particularly the case for previously intensively managed land. According to a study by consultancy [IEEP](#), the abandonment of the particularly species-rich grasslands is however likely to have a detrimental effect on biodiversity. Many of the species adapted to specific land management practices are endangered and are subject to conservation measures under the Habitats and Birds Directives.

## Coexistence models

With regard to the possibilities for coexistence between biodiversity protection and farming, there are two broad approaches: **land sharing** and **land sparing**.

The **land-sharing** theory is based on the assumption that farming and wildlife are compatible and can thrive on the same piece of land, provided that ecosystem elements are incorporated in the productive area. A [study](#) on different conservation options in agriculture points out that land sharing provides conservation opportunities in particular for species tolerant to disturbance, that is, species which recover quickly from human interference in their habitats. The land-sharing concept is reflected in **extensive farming**, which has a low environmental impact. A prominent example of land-sharing or extensive farming is [high nature-value farming \(HNV\)](#).

According to the [EEA](#), the main features of extensive farming include low input in terms of fertilisers and pesticides, a variety of crops and livestock types, a proportion of unproductive areas, and a high number of natural and structural elements supporting wildlife populations. Extensive crop production is practiced on about 12% of the utilised agricultural area (EU-27). This farming method is most common in eastern and southern EU countries, in particular among the Member States that joined the EU more recently. Extensively farmed cropland produces, however, a cereal yield below 60% of the EU average and may thus result in a lower income for farmers. As compensation for lower yields and income, additional farmland could be required. In cases where farmland is scarce, demand might need to be satisfied from elsewhere.

The **land-sparing** concept is based on strict separation of wildlife and farming. This approach is based on the assumption that habitats untouched by human activity are usually the most species-rich. Land sparing is usually coupled with an intensification of agriculture in the production areas. According to the above study, land sparing is favourable for species intolerant to disturbance.

A [study](#) notes that a preference for one of the models is determined by different factors, such as the share of land already used for agriculture within a given landscape, the opportunities for agriculture to expand further, the crops to be cultivated and the species to be protected. Moreover, in a landscape with already constrained productivity, conversion to extensive farming may entail a small loss in yield but a big gain in biodiversity, whereas in highly productive areas, a farm converted to extensive farming might offer a small gain in biodiversity, but a big loss in yield.<sup>5</sup>

The concept of **ecological intensification** tries to mitigate the detrimental effects of intensive land use: this method is based on high-yield farming, but aims to make optimal use of ecosystem services and biodiversity to improve efficiency.<sup>6</sup> Resilient **agro-ecosystems**, for example, could help maintain populations of pollinators with beneficial effects on yields. A [study](#) conducted between 2005 and 2011 in England indicates that the creation of habitats for pollinators and predatory ground beetles at the edges of fields can have a positive effect on crop yields. The study suggests that it is possible to remove up to 8% of land from production while maintaining or even increasing yields. However, there is also evidence to suggest that the efficacy of, for instance, biological pest control depends on a variety of circumstances, such as the surrounding landscape, the development of resistances, but also modified enemy-prey interactions due to climate change.

## Biodiversity and the reformed Common Agricultural Policy

The reformed [Common Agricultural Policy \(CAP\) 2014–2020](#), adopted in 2013, includes various instruments that provide potential support to biodiversity. They comprise **compulsory and voluntary measures**.

Under the [first CAP pillar](#), **greening measures** are **compulsory** and farmers are granted 30% of direct payments on the condition that they introduce three environmental-friendly practices. These include:

- Establishing **ecological focus areas (EFA)**. At farm level, EFAs must be established on 5% of the total arable land. This measure applies only to **farms exceeding 15 hectares (ha) of arable land**. A broad range of features can be counted as EFA, including fallow land, field margins, ponds, terraces, hedges and trees as well as better soil protection by growing crops between plantings of main crops or nitrogen-fixing crops. Member States are free to choose the number of types of EFA that farmers can use to make up their 5% area. The [most popular elements](#) chosen are nitrogen-fixing crops and fallow land.
- Maintaining **permanent grassland**. Member States must make sure that, on national or regional level, the ratio of permanent grassland to the total agricultural area does not fall by more than 5% compared to the reference year in the past. In case the 5% threshold is passed, farmers can be obliged to reverse previously converted arable land to permanent grassland.
- Enhancing **crop diversification**. This requirement applies only to farms with **more than 10 ha of arable land**. On farms with up to 30 ha of arable land, farmers have to grow at least two crops, on farms with over 30 ha, farmers have to grow at least three crops. The main crop cannot represent more than 75% and the secondary one not less than 5% of the arable land.

Under the [second CAP pillar](#), the agri-environmental measures are **voluntary** for farmers and are part of the national **rural development programmes**. Member States have to earmark at least 30% of the budget of these programmes for environmentally beneficial measures. These include [agri-environmental measures](#), under which farmers may choose to commit to adopting environmentally friendly farming and receive in return compensation for additional costs and lost income. Agri-environmental measures tend to support low-intensity, extensive and sustainable farming.

Moreover, [the Rural Development Regulation](#) provides a measure to support organic farming practices, with an allocation of more than €6 billion to be shared within the EU.

However, the measures under the new CAP have been criticised. According to a [study](#), the CAP reform has rather limited potential for biodiversity protection. Its authors point in particular to the considerable degree of Member State flexibility to choose the number and type of greening measures and the high percentage of farms exempted from applying them: as the mandatory establishment of 5% ecological-focus areas applies only to farms with more than 15 ha of arable land, the authors criticise not only the high number of exemptions,<sup>7</sup> but also the lack of criteria for habitat quality as well as the focus on areas themselves rather than on the connectivity between them, which is important for habitat quality. The situation concerning crop diversification is similar to that for ecological-focus areas, as the rule applies only to agricultural holdings with more than 10 ha of arable land.

## European Parliament

In its 2016 [resolution on the Biodiversity strategy](#), Parliament stresses its concern about the continuing loss of biodiversity and the destruction of habitats. It regrets that there has not yet been a measurable improvement in biodiversity status in agriculture, but recognises that it is still too early to evaluate the real outcome of the reformed CAP. It urges the Commission and the Member States to assess the effectiveness of the measures undertaken, including assessing the Member States' flexibility and scope for permission concerning, for instance, the use of pesticides and fertilisers in EFAs. In the same context, it asks the Commission to make public the justifications given by Member States for their choice of greening measures. Concerning the [biodiversity aspects within the reform of the Common Agricultural Policy](#), Parliament opted in the negotiations on the Commission's initial proposal from 2011 for higher thresholds above which greening measures should apply.

## Stakeholders

Environmental NGO [Birdlife](#) considers that the CAP is the main driver of biodiversity loss, as it promotes the abandonment of traditional low-intensity farming and supports more intensive agriculture with negative impacts on biodiversity. It argues that greening measures have failed due to poor implementation by Member States and a lack of criteria and monitoring. It points out that almost all Member States allow [measures](#) which are not proven to be effective in terms of biodiversity (such as the growing of nitrogen-fixing crops in ecological-focus areas). Moreover, it regrets the lack of data available to prove the effectiveness of agri-environmental schemes and the large number of exemptions impairing habitat connections. Finally, it argues, together with the [European Environmental Bureau](#), that over a third of [rural development funds](#) earmarked for environmentally beneficial measures go to measures for areas of natural constraints (ANC), despite the fact that they do not necessarily entail environmental benefits.

The European Crop Protection Association representing the plant protection industry, together with the [European Landowners Organisation](#), points out that the widespread use of mechanised farm machines, the application of mineral fertilisers and crop-protection technologies have helped to minimise expanding land use despite steadily increasing demand. They also point out that modern agricultural technologies increasing yields on existing agricultural land should be seen as a significant contribution to biodiversity conservation, as it leaves more land for that purpose.

European farmers' association [Copa-Cogeca](#) agrees that many habitats rely on extensive agricultural practices and that 'any change in the intensity of the land use (be it intensification or land abandonment) has a negative effect on the species living in the area'. It stresses however that farmers willing to adapt their farming methods to enhance biodiversity need financial **support** to ensure sufficient income, as the higher market prices for biodiversity-friendly products alone cannot compensate for lower yields.

## Main references

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## Endnotes

- <sup>1</sup> According to Eurostat, there is a slight trend towards extensification in the former EU-15 and a trend towards intensification in the Member States which joined the EU in 2004.
- <sup>2</sup> See for example: [Agriculture and environment in EU-15 – the IRENA indicator report. EEA Report No 6/2005](#), p. 89, and The agri-environment, p. 21–23. The Commission developed the IRENA indicators (Indicator Reporting on the Integration of Environmental concerns into Agriculture Policy) in cooperation with the EEA.
- <sup>3</sup> According to Eurostat, cattle account for almost 50% of livestock units in the EU-28.
- <sup>4</sup> Zero tillage is not to be confused with no tillage. It is a minimum-tillage practice in which the crop is sown directly into soil not tilled since the harvest of the previous crop.
- <sup>5</sup> Land use intensification, p. 32–33. A stronger EU demand for organic production might also compromise food security and induce imports from other regions, which in turn have had to intensify their agriculture. The price in terms of biodiversity would then be even higher.
- <sup>6</sup> This concept is supported by the FAO, which considers it as an opportunity to 'reduce reliance on external inputs while maintaining high productivity levels.
- <sup>7</sup> According to Eurostat, the number of farms exceeding 10 ha of utilised agricultural area (UAA) is around 80%, accounting for around 12% of UAA. As the greening requirement only applies to arable land, accounting for 60% of UAA, but not to non-arable areas such as permanent grassland or permanent cropland, the percentage of exemptions can be slightly higher.

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