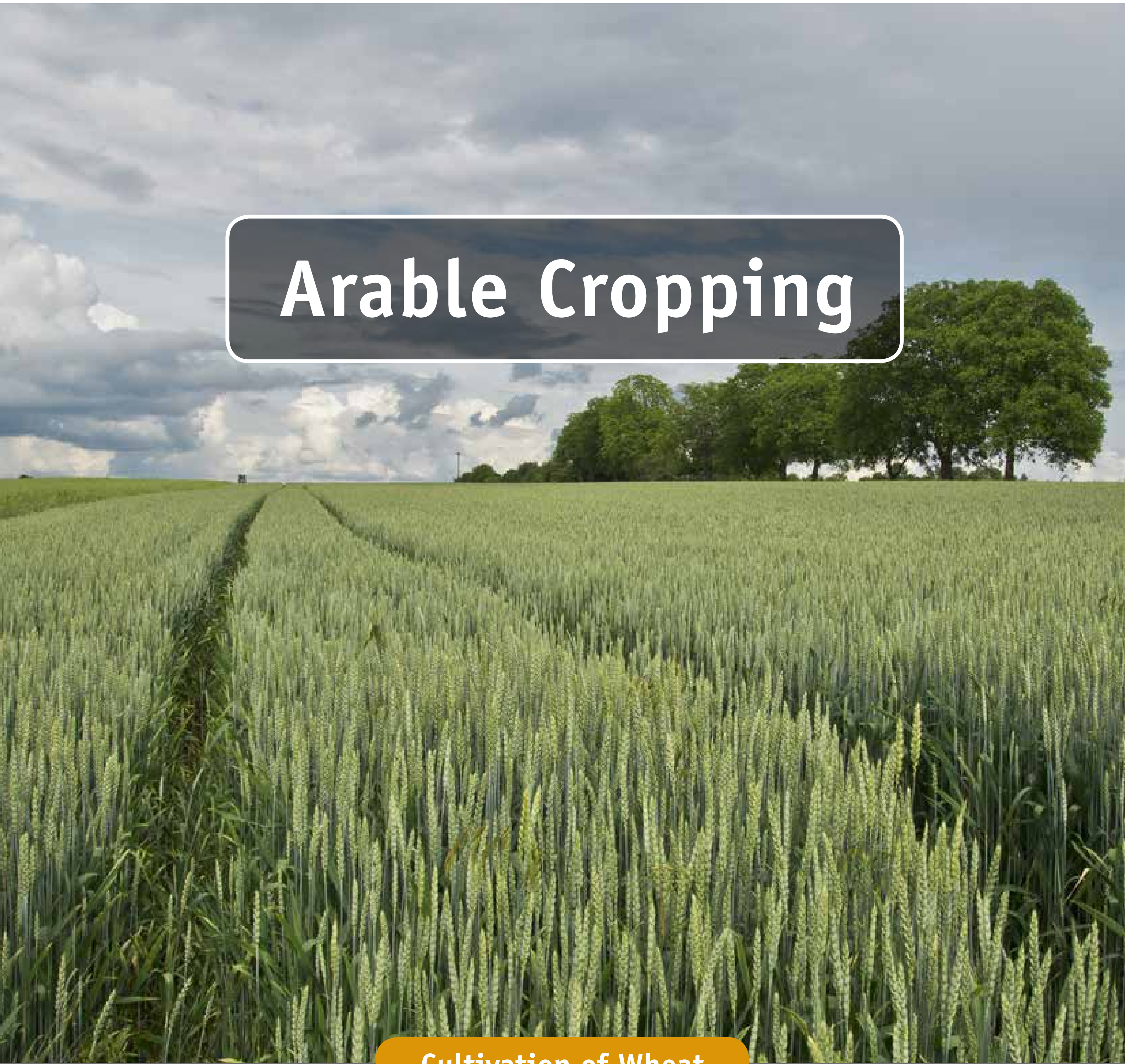
BIODIVERSITY FACT SHEET

FOOD & BIODIVERSITY

Arable Cropping



Cultivation of Wheat

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1. INTRODUCTION

The LIFE Food & Biodiversity project supports food standards and food companies to develop efficient biodiversity measures and to include these measures in their pool of criteria or sourcing guidelines.

In this Biodiversity Fact Sheet, we provide information on the impacts of the production of wheat on biodiversity in temperate climate regions of the EU, as well as ways to very good practices and biodiversity management. Biodiversity-friendly agriculture is based on two main pillars, shown in the graph below. Within this paper, the aspects of "very good agricultural practices" are discussed in each chapter. The aspect of biodiversity management, including a biodiversity action plan, is described in more detail in the fifth chapter.

BIODIVERSITY FRIENDLY AGRICULTURE

Reduction of negative impacts on biodiversity and ecosystems (e.g. reduction of pesticides) **VERY GOOD AGRICULTURAL PRACTICES for MORE BIODIVERSITY**	Creation, protection or enhancement of habitats (e.g. creation of semi-natural habitats and biotope corridors) **BIODIVERSITY MANAGEMENT**

The Fact Sheet is aimed at everyone who takes decisions on product design and development, supply chain management, product quality, and sustainability aspects in food processing companies and food retailers in the EU. We wish to raise awareness on the importance of biodiversity in the field of providing key ecosystem services as the fundamental basis for agricultural production. In this Fact Sheet we focus on the cultivation of wheat in temperate climate regions in Central Europe.

2. AGRICULTURE AND BIODIVERSITY

Biodiversity loss: time for action

The loss of biodiversity is one of the biggest challenges of our time. Species loss driven by human interventions happens around 1,000 times faster than under natural circumstances. Many ecosystems, which provide us with essential resources, are at the risk of collapsing. The conservation and sustainable use of biodiversity is not only an environmental issue. It is a key requirement for nutrition and other ecosystem services such as water, clean air and micro-climate, the basis for production processes and overall good quality of life of mankind.



Biodiversity is defined as the diversity within species (genetic diversity) between species and of ecosystems.

The main drivers of biodiversity loss are:

- **Habitat loss due to land use changes and fragmentation.** The conversion of grassland into arable land, land abandonment, urban sprawl, and rapidly expanding transport infrastructure and energy networks is causing large habitat losses. 70 % of species are threatened by the loss of their habitats. Particularly farmland fauna and flora has declined by up to 90 % due to more intensive land use, increased use of pesticides and over-fertilization.
- **Pollution.** 26 % of species are threatened by pollution from pesticides and fertilizers containing nitrates and phosphates.
- **Overexploitation of forests, oceans, rivers and soils.** 30 % of species are threatened by overexploitation of habitats and resources.
- **Invasive alien species.** The introduction of alien species has led to the extinction of an increasing number of species. Currently around 22 % of species are threatened by invasive alien species.
- **Climate change.** Shifts in habitats and species distribution due to climate change can be observed. Climate change interacts with and often exacerbates other threats.

Agriculture and biodiversity – A symbiosis

The main task of agriculture is to provide a secure food supply for a fast-growing world population in order to ensure stable livelihoods. Consumption patterns in industrialized and emerging economies have led to an intensification of agriculture and a more globalized food market, resulting in a vast exploitation of agricultural land, highly intensive production systems and a simplification of agricultural landscapes.

Agriculture depends on biodiversity and at the same time plays an important role in shaping it. Since the Neolithic Age until the start of the 20th century, agriculture significantly increased the diversity of landscapes and species within Europe. The European continent was previously covered with forest; new landscape features emerged with the expansion of agriculture; including fields, pastures, orchards and cultivated landscapes such as meadows. The conservation of biodiversity and habitats is closely linked to agro-systems ever since. Currently more than 210 million hectares of arable and grassland areas, which equates to almost half of the surface in Europe (EU-28), are used for agriculture. Consequently, 50 % of European species depend on agricultural habitats. This symbiotic and beneficial relationship between agriculture and biodiversity has altered fundamentally over the last decades towards a massive loss of biodiversity on agricultural land and its surroundings due to a non-sustainable agricultural production.

Standards and companies of the food sector play an important role for agricultural production. Therefore, they can substantially contribute to biodiversity conservation on the farm and its surroundings. The continuous propagation of standards and procurement guidelines shows the large scale of effect they have on production level. Appropriate integration of biodiversity as a sustainability and quality factor into sourcing strategies will recover and secure biodiversity within our agricultural landscapes. At the same time it facilitates the evaluation of risks for internal operations, brand management or legal and policy changes, improves the product quality, and helps to ensure a secure supply chain. A good strategy for biodiversity conservation, i.e. a positive biodiversity performance, creates opportunities regarding differentiation in the market, value proposition and meeting stakeholder expectations and consumers' demands.

Legal Framework for Agriculture in Europe – Common Agricultural Policy (CAP)

Since 1962, the EU-Common Agricultural Policy (CAP, Directive 1782/2003/EG and the 2013 amendments) presents the legal framework for agriculture in the European Union. It was based on the experience of hunger and starvation in Europa and targets on securing food supply for the population and the independence of European food supply from international markets. The CAP regulates subsidies to farmers, the market protection of agricultural goods and the development of rural regions in Europe. Farmers receive payments per hectare of cultivated land and get additional subsidies related to production and farm management.

The EU CAP references to a set of EU directives, which must be respected by farmers:

- **Directive 91/676/EEC –** "Nitrates Directive" regulates best practices for fertilisation of crops.
- **Directive 2009/128/EC –** "Pesticides Directive" regulates best practices for the use of insecticides, herbicides and fungicides.
- **Directives 92/43/EEC –** "Flora-Fauna-Habitats Directive" and 79/409/EEC – "Birds Directive" provide the legal framework for biodiversity conservation in Europe, which is ratified by all member states and directly transferred into national conservation laws.
- **Directive 2000/60/EC –** "Water Framework Directive" is targeted to improve the state of water bodies in Europe and relates closely to biodiversity.

Since 2003, Cross compliance (CC) regulations address shortcomings concerning environmental issues of the CAP-philosophy described above. CC represents a first step towards environmentally friendly farming, forming a principle of linking receipt of CAP support by farmers to basic rules related to the protection of the environment (besides others). These regulations target general measures to reduce severe impacts of agriculture on the environment like erosion, nitrification, pollution of water bodies, landscape change and others. Conservationists only see a small improvement, if any, to biodiversity protection by the cross compliance regulations.

Since 2012, the CAP promotes the implementation of voluntary agro-environment measures supported by payments per hectare that depend on the efforts and losses in yield due to the implementation of these measures. Member states, federal states and provinces define regionally adopted agro-environmental measures. Those encompass actions which directly focus on the protection and conservation of agro-biodiversity. Farmers can sow blooming stripes, set aside fields temporarily or permanently, organise buffer strips along open waters, plant hedgerows and others. Studies show positive effects of such measures on biodiversity (What Works in Conservation 2017).

The most recent CAP „REGULATIONS OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL" (No. 1305/2013 - on support for rural development; No. 1306/2013 - on the financing, management and monitoring of the common agricultural policy; No. 1307/2013 - establishing rules for direct payments to farmers; No. 1308/2013 - establishing a common organisation of the markets for agricultural products), introduced in 2014, oblige farmers to implement "greening measures" when applying for direct payments. Hereby, biodiversity and clean water are explicitly targeted. Farmers have to fulfil criteria to diversify crops, maintain permanent pastures and preserve environmental reservoirs and landscapes. 30 % of direct payments are tied to strengthening the environmental sustainability of agriculture and enhancing the efforts of farmers, especially to improve the use of natural resources. First assessments after two years indicate the necessity to adjust the current set of greening measures, as the effect on biodiversity is not apparent.

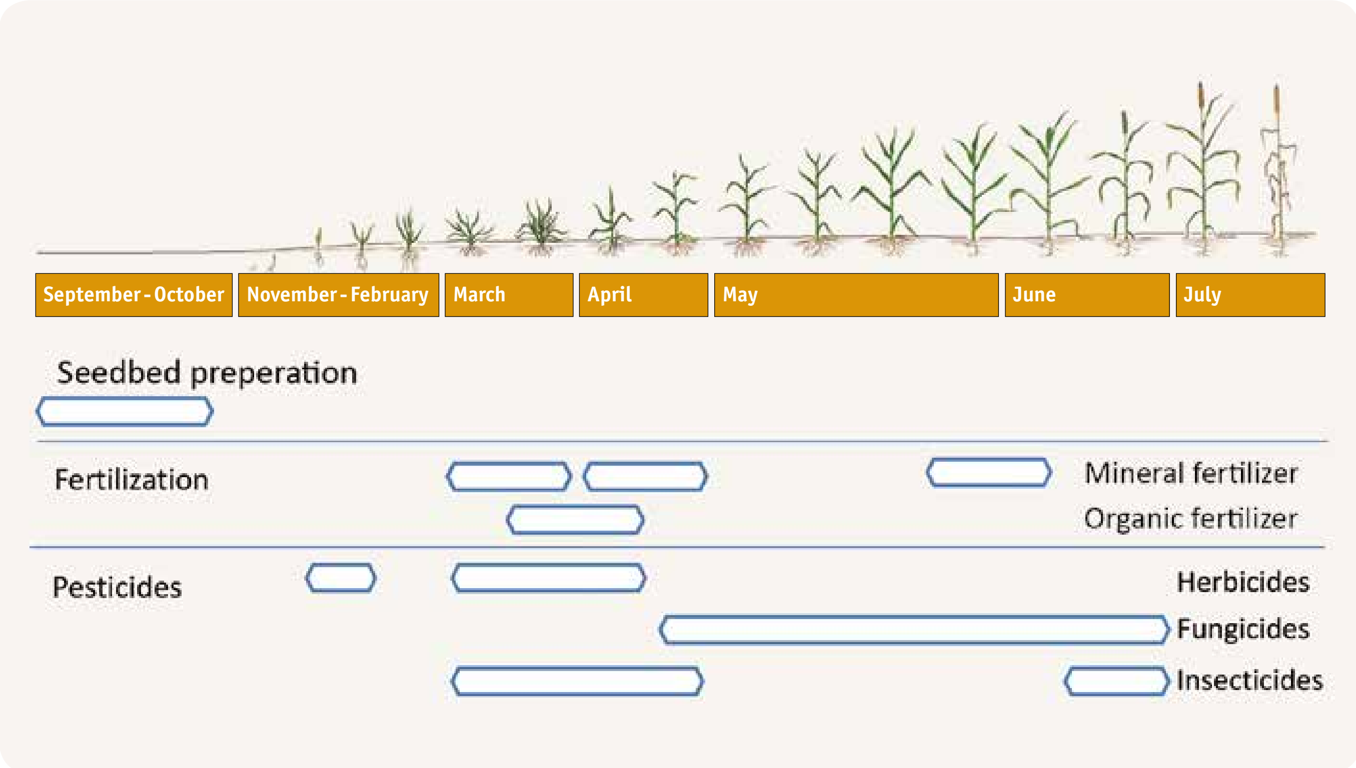
3. ARABLE FARMING IN EUROPE

Arable farming as a production system includes a variety of different crop types, ranging from foliage crops such as sugar beet to cereals. In this document, we focus on the cultivation of conventionally produced wheat as one of the most important crops in Europe. The production of wheat is part of a highly intensified production system and as such only leaves little space for biodiversity on the fields and also negatively influences the surrounding nature.

According to Eurostat, cereals (wheat, maize, barley, rye, oat and rice) make up the biggest contribution to the total crops produced in Europe. The annual yield of cereals (including rice) in the EU-28 is about 301 million tons (2017); this corresponds to a 11.6 % share of the global cereal production. Common wheat and spelt, barley, grain maize and corn-cob-mix (CCM) account for a high share (85.4 %) of the cereals produced in the EU-28. Compared to the 5-year average level, EU-28 cereal production increased by 5.7 % in 2017. This increase was driven by common wheat and spelt (14 %) as well as and barley (10 %). The biggest wheat producers in the EU-28 are France (56 million tons), Germany (52 million tons), and Poland (32 million tons).

The average yield per hectare of wheat varies strongly between countries, depending on biotic and abiotic factors, but mainly on the degree of agricultural intensification. Highest yields of wheat per hectare in Europe are obtained in northern Germany and the Ukraine and are ten times higher than in developing countries. In Semi-arid Mediterranean regions, where cereals are grown as rain fed crops, smaller yields are obtained. Technological advances in the preparation of soils, optimisation of sowing procedures, crop rotation and the use of fertilizers as well as improved harvesting techniques have contributed to a tremendous increase in wheat yields over the last decades. Today, higher yields can only be achieved with the use of new varieties that are more adapted to climatic conditions or resistant to diseases.

4. CULTIVATION OF WHEAT AND IMPACTS ON BIODIVERSITY



Wheat calendar with major cultivation treatments

Wheat is generally seeded in late autumn, fertilizer is applied early in the growing season in spring and once again in early summer. Herbicides are used when wheat plants are very small, fungicides in late spring and summer, depending on weather conditions. Insecticides against different pests are used in spring and again in summer.

4.1 Soil preparation and seeding

In arable cultivation systems, soils are treated with machinery up to three times to prepare the seedbed. Winter wheat is seeded between September and December after harvest of the previous crop. Usually the "mulch-seed" method is applied, i.e. loosening the upper soil level with a grubber and seeding with a seed drill. Direct seeding is applied less often, with seeds being placed directly into the residues of the previous crop. Deep ploughing is used to prepare the seedbed and aims to reduce soil-borne diseases, activate nutrient mineralization from organic matter and to loosen the soil. Ploughing is recommended once in a crop rotation system as a measure against soil-borne diseases. Nowadays, farmers plough when wheat is set after corn. After ploughing, the seedbed is prepared by using a whirl-harrow, and then wheat is seeded with a seed drill.

EFFECTS ON BIODIVERSITY

According to the German Federal Environment Agency, a gram of soil contains billions of microorganisms: bacteria, fungi, algae and protozoans. A mere one cubic meter of soil is home to anywhere from hundreds of thousands to millions of soil fauna such as nematodes, earthworms, mites, woodlice, springtail, and insect larvae. A hectare of soil rooting layers contains around 15 tons of live weight – the equivalent of around 20 cows. In other words, immeasurably more organisms live in the soil than on it. Soil ecology plays a key role for the natural soil functions. The biological processes in soil ecosystems e.g. fulfil functions such as the integration of plant residues into the soil, by shredding, breaking them down and releasing the previously fixed nutrients as minerals for plant growth. Soil organisms create favourable physical conditions in the soil: by storing and mixing soil materials (bioturbation) with sticking the soil particles together through mucus secretion (revegetation), soil organisms play an instrumental role for the formation of soil pore systems. Soil organisms form stable clay-humus complexes with high water and nutrient storage capacity, and create a fine-grained quasi erosion-resistant crumb structure. These organisms can, to some extent, mitigate the harmful effects of organic substances on soil, groundwater, and the food chain.

In general, soil treatments affect biodiversity negatively, as natural processes described above are interrupted. Oxygen, ultraviolet radiation and heat will come in contact with the soil, particularly when turning the soil by ploughing and its resulting furrows lead to severe edge effects for life in the soils. Humification processes, which take place under exclusion of oxygen, will be hindered; the natural soil pore system is disrupted. Each treatment affects biological diversity within the soil and the fauna and flora above the ground to a different extent. Farmland birds are not directly affected by soil treatments, as the breeding season starts after winter. Anyway, food can become so scarce in intensively farmed landscapes, that skylark territories are 40 times larger than in natural habitats. Consequently, many ground breeding birds show population decreases of up to 90 % in the last 20 years, e.g. lapwing (Vanellus vanellus), skylark (Alauda arvensis) and partridge (Perdix perdix).

In the past, stubbles and leftovers of the crop provided food for animals directly after the harvest, during winter and migration time. Today's effective harvest methods hardly leave grains for mice and other animals in winter. Consequently, in many European regions, barn owls (Tyto alba) and kestrel (Falco tinnunculus) show population declines as well. Soil preparation usually takes place directly after harvest and thus limits the food supply and in winter changes arable land to areas without much potential for biodiversity.

4.1

Very good agricultural practices to ensure more biodiversity

Superficial treatments are less harmful than ploughing. It is thus a trade-off for the farmer between preventing soil-borne diseases and soil biodiversity. Earthworms, spiders and ground beetles are less affected by mulch-seeding and direct-seeding compared to conventional ploughing. Ground beetles are supported in terms of increasing species and population sizes by conservational soil preparation. Avoiding ploughing the upper soil layer (0 to 30 cm) leads to a significant increase of small invertebrates, which form the basis for soil food chains. With increased biological activity on the field, the self-regulation of the soil ecosystems rises, leading to a faster decomposition of organic material. A diverse predator community will also reduce the risk of pests and diseases caused by prey-species.

4.2 Nutrient management and fertilization

Soil fertility, climatic conditions and the characteristics of the cultivar have great influence on the nutrient demand of wheat and its yield. Wheat is modest concerning the quality of the soils, but fertile clay soils with beneficial structure and porous subsoil provide highest yields. Fertile soils can deliver around one-third of the needed nutrients. This influences the nutrient balance and fertilization strategy. In an integrated crop management, soil analyses determine N-min values in spring, which provide the basis for calculating the required nitrogen supply. Wheat needs between 200 and 250 kg of N per hectare in favourable abiotic conditions. In areas with lower yields, N intake is much lower. Nitrogen provided by the soil (N-min values) is subtracted from that calculated intake. Applications of fertilizers should be divided into at least two or three treatments, according to region, soil type and precipitation. The first dose of fertilizer is applied in early spring before the vegetation period starts, the second close to the main vegetation period of wheat.

Organic manure is usually applied as slurry in spring and complements the intake of chemical and mineral fertilizers. Modern machines use strip application with tubes that spread the matter directly on the ground. The largest amount of fertilizers is applied in an optimized mixture of phosphorus, potassium and sulphur (macronutrients), usually applied in combination with nitrogen. Some micronutrients are needed to sustain plant growth and are applied to the mature crop by foliage spraying.

EFFECTS ON BIODIVERSITY

Two aspects must be taken into account with regard to the effects of fertilization on biodiversity. The first is about changes in the trophic state of plant communities, the second affects run-offs into the environment, including pollution with nitrogen and phosphorous.

Plant communities are composed by biotic and abiotic factors such as soil quality, precipitation, competition with other vegetation etc. Crops are no naturally composed plant communities, so this concept cannot be applied here. There is a set of about 300 wild flowers species (Central & Western Europe) accompanying cereal production, hurtsickle (Centaurea cyanus) and corn rose (Papaver rhoeas) representing the most common ones. Scientists observed a significant decline in flora typical for cereal crops, e.g. hurtsickle and corn rose. This expresses in a 75 % decline in species numbers and 95 % in population sizes. This is largely attributed to the intensification of agriculture and changed nutrition management.

Excessive fertilization with pollution of soils and water bodies by nitrogen and phosphorus leakage is not an issue for the adopted fertilization methods fulfilling the regulations of integrated production. In integrated farming, as described above, the crop will consume applied fertilizers for plant growth; some remnants can be absorbed by the soil. Pollution caused by manure and slurry and the severe impacts on soils and water bodies is mainly an issue of disposing manure from intensive livestock farming and meat production outside the growing season. “Accidents” can easily destroy the entire life in a stream and it will take a long time to re-establish that. Also, moderate manure disposals lead to significant changes in limnic organisms with a small set of species tolerant to water pollution dominating the species composition.

Hence, even with a good nutrient management on the field, plant communities of buffer stripes along pathways, hedges, and creeks are regularly influenced by nutrients from adjacent crops. This is indicated by nutrient-tolerant plants like stinging nettle (Urtica dioica). In addition, alien invasive plants, e.g. fleece flower (Fallopia japonica) and bee-bums (Impatiens glandulifera) benefit from nutrient efflux and cover vast areas along riparian buffer stripes.

More nutrients lead to higher biomass production and therefore to a higher food supply for herbivorous arthropods at the first glance. Some more generalist species can benefit from this increase in biomass and show increasing populations. Biodiversity on the other hand is not driven by generalists, but by specialized species occupying a huge number of ecological niches. Long-term studies show a significant and strong decrease of many species typical for agricultural landscapes and ecological niches within these landscapes.

4.2

Very good agricultural practices to ensure more biodiversity

Diversified crop rotations improve soil biodiversity and soil fertility. Crop rotation fulfils the requirement for preventing soil damage, i.e. caused by erosion and compaction, which is essential to keep the soil in good conditions. EU Cross Compliance regulations give many, but not exhaustive regulations to prevent erosion and degradations of soils.

One way to improve the quality of soil and to increase the amount of humus in the long term is to regularly apply organic matter in form of manure, compost or cover crops. In general, it is recommended to use organic fertilizer instead of mineral fertilizers due to the complexity of such substances and multiple positive effects on soil fertility and structure. It is important that these fertilizers are applied according to some basic rules, which aim at prohibiting the nutrient run-off into waterbodies. Manure is not applied on…

- …water saturated or flooded soils;
- …deeply frozen soils;
- …soils covered with snow.

To further decrease the risk of run-off, a minimum distance of one meter (with precision application machinery) and four meter with common application machinery towards water bodies must be ensured. Furthermore, farmers should be able to store their own manure for nine month in order to prevent any situation where manure is applied on the field due to a lack of storage facilities. In 2017, this situation arose in Northern-Germany after enduring rainfalls that were preventing the application of manure for over six months.

The sustainable use of soils is based on a balanced nutrient application and extraction. To achieve this, farmers have different farm management tools, such as the farm gate nutrient balance. Certified farms are often required to fulfil prescribed nutrient limits, given by the standard or procurement guideline, which go beyond the legal requirements. These are efficient tools to regulate the farming inputs. At best, the nutrient limits are crop-specific and adopted to regional circumstances.

4.3 Pest control and plant protection

From an ecological point of view, crops like wheat are a monoculture without biodiverse food chains, because comparably few species feed on the crop in limited time periods, and consequently a very limited diversity of arthropod predators (spiders, bugs, etc.) can evolve. Pests and diseases can have a considerable impact on the economic output of a farm. Wild flowers compete with the farmed crops, insects harm plants, fungal, bacterial and viral infections decrease yields and can lead to a complete crop failure in humid periods during the summer.

Integrated Pest Management – Cereal farmers have to apply an integrated pest management to cope with diseases, pests, and weeds. Thereby, close monitoring of the pest levels, cultural practices (e.g. crop rotation, tillage or non-tillage, water and nutrient management, seeding rates and depths) and biological control tactics are combined with the judicious use of pesticides. Crop rotation e.g. focuses on the reduction of crop infections by reducing build-ups of insect pests, weeds, nematodes or other soil-borne diseases. Pesticides should only be applied when pests and diseases exceed economic thresholds. The amount of active matter applied needs to be adjusted to the degree of infection. Preventive and calendar spraying, i.e. the application of pesticides without reported signs of diseases or risk assessment, was common in the past and is now prohibited in Europe. Spot applications rather than comprehensive field treatments are recommended. Many growers employ preventive pest management strategies such as planting certified seed, using appropriate resistant varieties, manipulating planting date, modifying fertilization and irrigation.

Herbicides – For wheat, competition with wild flora is the biggest issue in crop management and herbicides make up a high proportion of costs. Due to the large areas of wheat cultivation, most herbicides applied in Europe are used on wheat. The number of herbicide applications is defined by the product used and the efficiency of the applied mechanical methods to reduce weeds. Thereby, herbicides are divided into contact and residual, total and specific. Residual products seal the ground and inhibit development of wild plants; contact herbicides enter emerging plants and poison its metabolism. Total herbicides target any plant species (note that e.g. monocotyledonous like grass or maize and dicotyledonous plants have slightly diverging metabolisms), specific herbicides only some. In wheat, herbicides (often total herbicides) are applied once in autumn to target grasses and wild flowers. Depending on the active substance chosen, a second treatment may be due in spring.

Insecticides – Wheat has a large number of insect pests, varying by region and production methods. Most pests are of minor importance with insignificant yield losses. The most harmful pests occur annually and cause severe yield losses. Insecticides are used to reduce such pests, in accordance with the processes described above. The application of insecticides is bound to the annual population development of a given pest and might not be needed in some years, while in others several applications are due. Broadband insecticides target any arthropod/insect, ovicides, larvicides or acaricides only some stages or groups of species.

Fungicides, bactericides etc. – Fungal infections and the application of fungicides is ideally managed with monitoring systems and prediction models, which assess the risk of infection and provide advice to farmers. According to the integrated pest management regulations, farmers have to monitor diseases and may only apply fungicides (and other pesticides), if the economic loss is outbalanced. Targeting diseases inefficiently can lead to resistances, meaning that a disease becomes insensitive to a particular fungicide. Fungicides are commonly applied up to three times in spring.

EFFECTS ON BIODIVERSITY

Despite the optimizations and regulations, the application of pesticides is common in conventional European agriculture. Every conventional crop is treated several times with a combination of active substances, along with the criteria and regulations described above. The pesticides purpose in general is to erase biodiversity from the cropped area, preventing quick re-population and ideally keep the crop clean and sane until the harvest. Despite the efforts of the farmers, this is achieved to a very large extend and very efficiently. Fields are clean from wild flowers and butterflies are hardly ever seen in most of the summer. Statistically in the EU, out of 100 farmland birds breeding in 1995, only 20 are left on a given area.

Pesticides are a big environmental issue for water bodies and the environment in general. Water legislation restricts the application of some extensively used herbicides, and those with high risks of leaching due to their application times. In winter, drain flow is the main transport mechanism; herbicides attached to soil particles can be introduced into water bodies during heavy rains. Careful application of pesticides is the key to minimize collateral damages. The efficiency of the herbicides is directly interlinked with the surface of the plant targeted. Small droplets sprayed have the highest impact, but fine sprays lead to the highest drifts.

Herbicides – Wild flowers form the basis of food chains in arable landscapes. As mentioned above, plants that once were common, like hurtsickle (Centaurea cyanus) and corn rose (Papaver rhoeas), declined by 75 % in species numbers and 95 % in population sizes. Many typical farmland species are almost extinct in many agricultural landscapes. Herbicides, working either as contact or systematic toxin, which is taken up by any plant part and transported within the plant, are very effective in combating weeds. Glyphosate is an example for a total herbicide working as contact toxin. 0,1 ml/m² of active matter leads to the desired effect. Estimations by NGOs indicate that 75 % of arable land in Central Europe is treated with glyphosate once a year. Herbicides are mostly applied to combat already established weeds on the field, but some products are also used to seal the ground and to prevent the upcoming of unwanted weeds. However, these pre-emergence herbicides can mostly be substituted by mechanical weeding techniques.

Insecticides – The purpose of insecticides is to erase pests and arthropod biodiversity from arable countryside. One current well-known example is neonicotinoides. This group of active substances targets the nervous system of insects. Far less effective, but still recognizable, these substances also affect non-target groups like mammals and other animals. Several means of application can limit the impact on species not targeted by a treatment, e.g. spraying in the evening when pollinators will be affected less, or application methods that limit drift to adjacent landscapes, buffer strips along habitat edges, etc. Selectivity in pesticides does not mean exclusiveness, so the effect on a target group can be 100 % and only 10 % in others, but some impact will remain. In summary, the majority of land cultivated with wheat and other cereals is free from animal biodiversity for most of the year and especially in spring and summer when most insects and arthropods breed.

Fungicides, bactericides, etc. – The direct effect on biodiversity here is not as obvious as in the other pesticides. The fungus etc. species targeted are often poisonous to arthropods, too, and are not missing in the food chain per se. However, even very specific chemicals have an impact on other, non-targeted fungus species, and thus an impact on e.g. the microflora and -fauna of decomposers in the soils.

4.3

Very good agricultural practices to ensure more biodiversity

Integrated pest management is a reference found in European legislation, which aims at preventing the use of pesticides by applying cultivation aspects to reduce pests and diseases in crops. These measures should always guide the farm management. A basic set of agricultural practices to reduce the risk of pests and diseases in crops includes the following:

- intercropping
- crop rotation
- adequate cultivation techniques like
  - seedbed sanitation
  - sowing dates and densities
  - conservation tillage,
- use of pest resistant/tolerant cultivars adapted to the region of cultivation (traditional cultivars)
- certified seed and planting material
- optimal use of organic matter
- preventing the spreading of harmful organisms by field sanitation and hygiene measures, e.g.
  - removal of affected plants or plant parts
  - regular cleansing of machinery and equipment
  - balanced soil fertility or water management,
- promotion of beneficial organisms

If these measures have been implemented and defined thresholds for pest and disease infections are exceeded, the use of pesticides can be part of an integrated pest management in non-organic farming. In order to protect open water bodies, buffer zones must be installed and maintained along the edges of waterways and waterbodies (minimum width: 10 meters). The best available spraying techniques, i.e. devices, which inhibit or reduce drift of pesticides to adjacent areas, should be used and spraying equipment should be calibrated at least every three years.

Application of pesticides is limited to authorized employees only. Mechanical weeding in early stages of crop growth is recommended to substitute pre-emergence herbicides. The use of pesticides, which are dangerous to bees, pollinating insects, beneficial organisms, amphibians or fish should be prohibited, furthermore very harmful substances, e.g. Glyphosat, Diquat, Paraquat, Glufosinate ammonium, Indaziflam and the salt equivalent versions should not be allowed.

4.4 Water management and irrigation

Wheat is grown as „rain fed crop" in Central Europe which means that in Central and Northern Europe wheat is generally not irrigated due to favourable precipitation patterns. In these regions, temporary irrigation is used to increase yield in dry summers during sensitive stages of plant growth. However, the required investment amounts in (new) irrigation machinery and rights for the use of water outweighs the increase in yield. Agricultural water extraction accounts for less than 1 % of total extraction in Belgium (0.1 %), Germany (0.5 %), and The Netherlands (0.8 %). However, the impact of irrigation will likely increase with the rise in global wheat prices and changing precipitation patterns following global warming. Droughts are expected to occur more frequently and will also affect Europe's temperate regions. This would lead to an increase in the demand for irrigation in many crops, including wheat.

In the Mediterranean countries, wheat crops are irrigated more regularly, with significant consequences for yields. Irrigation can be due during all stages of the crop, starting with the emerging phase. According to many climate models, rain fed wheat in semi-arid areas is more vulnerable to climate change. Water availability and efficiency will be a cornerstone for competitiveness in the coming years, as yields may fall under productivity thresholds. Today, in Southern European countries, irrigation is essential in agricultural production and agricultural water use makes up a substantial proportion of total water use (e.g. Spain 64 %, Greece 88 %, and Portugal 80%, according to Eurostat. France, Greece, Italy, Portugal and Spain account for 70 % of the total area equipped with irrigation techniques in EU-27.)

EFFECTS ON BIODIVERSITY

Irrigation is an essential driving force in water use management in many regions and has a huge impact on environment and biodiversity. Drawing water from groundwater, rivers, lakes or overland flow, irrigation systems redistribute this water, having numerus effects on biodiversity, foremost in Mediterranean areas. Building dams and channels reduces downstream river flows and changes the hydrology of entire river systems with impacts on all life in the watersheds. Over-extraction of water for agriculture can alter water habitats and limnic fauna from biodiverse communities to poor systems with only few species. Note that about half of the amphibian species in Europe are threatened.

Water tables may be altered as groundwater recharge in the area is increased on the irrigated areas, but may be reduced where the water is taken. With changing hydrology, ecologically important wetlands or flood forests dry out, change the character or disappear completely. Such wetlands are core-habitats in arid and semi-arid landscapes, providing drinking water for many species, taking important roles e.g. for bird migration, and having numerous other ecological functions. Rain fed cereal areas in semi-arid areas are habitats for a diverse community of fauna and flora, including endangered steppe birds and rare plant species with very high environmental value. Here, irrigation can cause another problem for biodiversity: irrigated crops often grow more dense, quicker and higher. This has consequences for many species, e.g. in terms of breeding sites, movement inside the crops, bare grounds for foraging etc.

4.4

Very good agricultural practices to ensure more biodiversity

Agricultural cultivation should be adapted to the regional and climatic conditions, so that local or regional water resources, natural wetlands or regional protected areas are not overused or damaged. The link between water source and water use (ecosystem and ecosystem service) is critical. In general, water use from open waters as well as groundwater bodies in Europe has to be in compliance with strict legal requirements. Regional governments and water authorities set withdrawal limits (legal compliance) and any withdrawal is subject of authorisation procedures. The quality and functioning of protected aquatic areas must be safeguarded in every scenario. Watershed management plans released by regional nature protection authorities need to consider the impact of climate change and the actual water needs of the agriculture in the area. These plans indicate the maximum sustainable water use per year as well as per certain times within the area.

Use of water from illegal sources such as unauthorized wells or unauthorized water extraction from ponds, is not pursued in some parts of Europe, but does not follow legal compliance regulations, which are prescribed in any standard. Generally, farmers must follow legal requirements and should use the most efficient irrigation techniques available and applicable in the region (e.g. drip irrigation, reduced evaporation through evening irrigation).

5. BIODIVERSITY MANAGEMENT

A tool proposed to tackle the issue of biodiversity at farm level is the Biodiversity Action Plan (BAP). The BAP facilitates the management of biodiversity at farm level. Some food standards prescribe the implementation of a BAP without defining the content and the approach to develop it. Such a plan should include:

1. Baseline assessment

The baseline assessment gathers information on sensitive and protected biodiversity areas, endangered and protected species and semi-natural habitats on or around the farm/collection area, including fallow/set aside land, cultivated and uncultivated areas as well as already existing biodiversity measures. These provide the information necessary to identify priorities, to define measurable goals, to assess the impact of implemented measures and if necessary, select approaches that are more appropriate.

2. Setting goals

Based on the baseline assessment the farmer sets goals for the improvement. The aim is to identify the main impacts the farming activities have on biodiversity, which should be avoided, and the main opportunities existing to protect/enhance biodiversity.

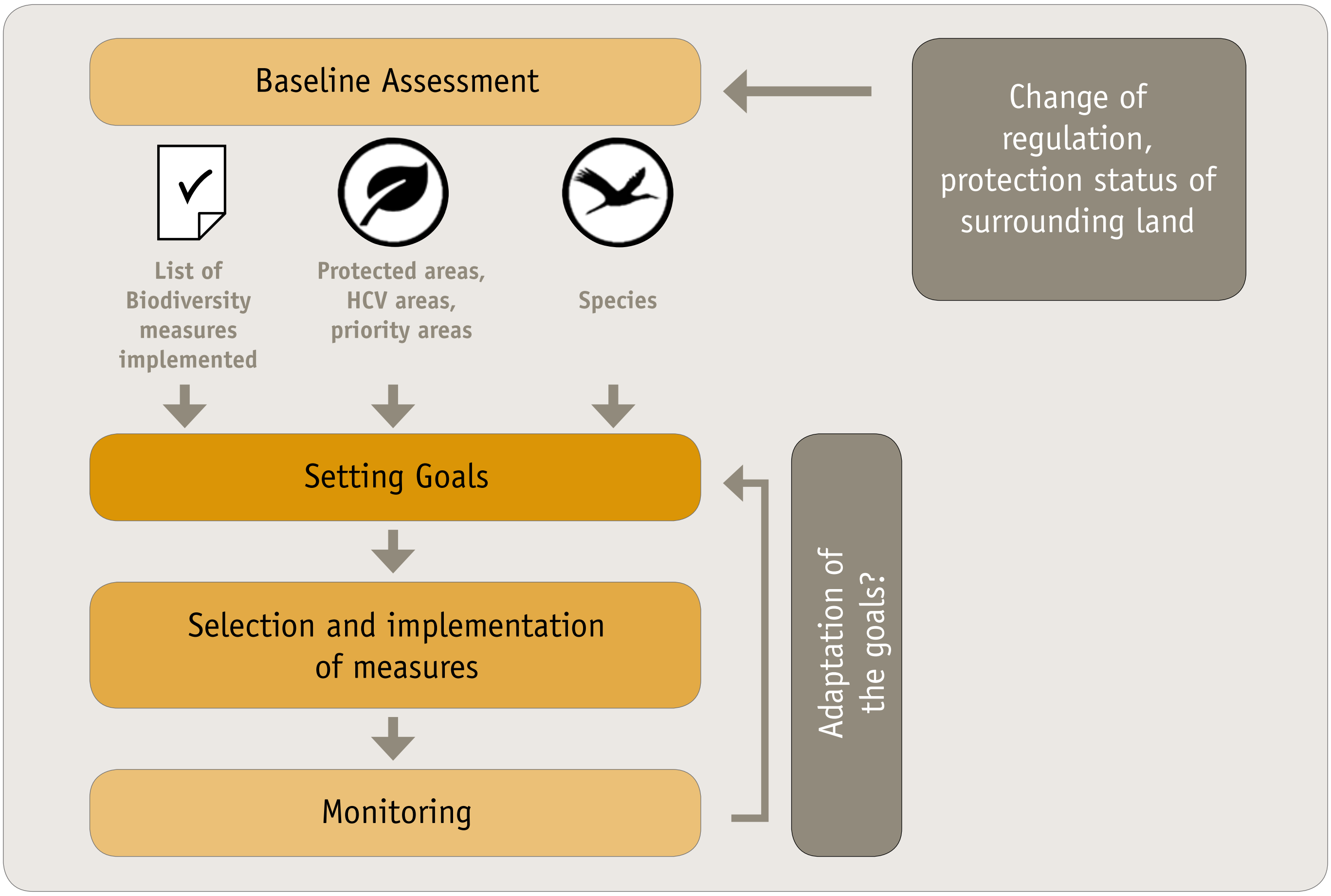
3. Selection, time line and implementation of measures for enhancing biodiversity

Some examples are:

- **Semi-natural habitats (trees, hedges, dry stones)/set aside areas:** Criteria will be set for type, size, and minimal quality of semi natural habitats and ecological infrastructures, for areas set aside or fallow land, and for newly acquired areas for agricultural production. A minimum of 10 % of the UAA (utilized agricultural area) is used to provide semi-natural habitats.
- **Establishment of Biotope corridors:** Specified areas for biodiversity on the farm will be connected with habitat corridors like hedges and buffer strips.
- **Grassland conservation:** Grassland is not transferred into other kinds of agriculturally used land; grazing densities are kept in a sustainable range and regeneration rate of grassland is respected in the grassland management.

The whole catalogue of measures was published within the Recommendations of the EU LIFE project: www.business-biodiversity.eu/en/recommendations-biodiversity-in-standards

4. Monitoring and evaluation



6. OVERVIEW OF THE EU LIFE PROJECT

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

The project has been endorsed as "Core Initiative" of the Programme on Sustainable Food Systems of the 10-Year Framework of Programmes on Sustainable Consumption and Production (UNEP/FAO).

European Project Team:

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