

## More biodiversity through organic farming

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The loss of biodiversity has serious consequences for humans and for the environment. The extensive loss of biodiversity in many regions is increasingly impairing key ecosystem services such as the pollination of wild and cultivated plants. The avoidance of chemical pesticides and fertilisers and a high proportion of semi-natural areas on organic farms have a positive effect on (functional) biodiversity - not only in the fields, but in the agricultural landscape as a whole.

High production intensity in agriculture is contributing to a massive decline in biodiversity in agricultural land<sup>[1]</sup>. The main causes are the high use of agrochemicals, high livestock numbers, narrow time-frames of crop rotations, the loss of valuable semi-natural areas such as dry meadows, hedges and trees, as well as overbuilding, fragmentation and homogenisation of the landscape. Climate change, invasive species and light pollution are also exacerbating the problem<sup>[2]</sup>.

As a result, the overall population of insects - a very species-rich, important group of animals in agricultural ecosystems - has declined sharply in recent decades. Within three decades, a 75 % reduction in insect biomass was recorded in 63 nature conservation areas surrounded by agricultural land in Germany<sup>[3]</sup>. In grasslands, an equally dramatic decline in insects was observed, with biomass decreasing by 67 % and the number of species by 34 % in 10 years<sup>[4]</sup>. A decline in insect biomass and numbers is problematic in many respects, as insects serve as a food source for many animal species (e.g. amphibians, birds and bats)<sup>[2,5]</sup>. A change in ecological food webs also impairs key ecosystem services in agriculture<sup>[6,7]</sup> such as the natural pollination of cultivated and wild plants (cascade effect). Long-term monitoring programmes are urgently needed to better assess the extent of species extinction.

### **Organic farming increases biodiversity and abundance of flora and fauna**

As chemically synthesised pesticides are banned in organic farming, less fertiliser is used, a greater variety of crops is grown and the proportion of semi-natural areas on farms is higher, organic farming differs considerably from conventional production methods in terms of its impact on biodiversity<sup>[6-18]</sup>.

Numerous comparative studies between organic and conventional farming systems prove that organic farming has a positive effect on the diversity of flora and fauna not only in the field, but also both in the surrounding nature and at farm level<sup>[10]</sup>. Global meta-studies show an average of one third more species and 50 % more individuals on organic farmland<sup>[11]</sup>. The differences observed have been stable over the last 30 years<sup>[12]</sup>. The effects of the cultivation systems differ depending on the group of organisms and also vary with the features of the landscape, the cultivation system and cultivation intensity. The effect of organic farming is greatest in arable crops, followed by special crops (viticulture and orchards). The smallest differences were found in grasslands.

These positive effects are not only felt locally, but also at landscape level<sup>[6,7,12]</sup>. A wide spectrum of animal groups and many plant species are supported: Soil organisms, various rare as well as widespread insect groups, spiders, birds and mammals benefit more than average from organic farming, depending on the crop. A global meta-study also shows that organic farming can support rare insects and spiders compared to conventional farming (abundance +55 %, diversity +27 %)<sup>[13]</sup>. The skylark, a typical bird species of open cultivated landscapes that has been severely forced back by the intensification of agriculture, as well as the now rare lapwing and grey partridge, achieve higher densities with organic farming<sup>[14]</sup>. This also applies to numerous rare plant species in fields<sup>[15,16]</sup>. Pest organisms, on the other hand, usually occur in similar numbers in the different cultivation systems<sup>[17]</sup>. A global meta-study on soil microorganisms confirmed that indicators of microbial biomass activity are increased on average by 32 to 85 % by organic farming<sup>[18]</sup>.

## **Strengthened functional groups improve key ecosystem services**

The preservation of ecosystem services is essential for sustainable, resource-conserving cultivation systems. Diverse and individual-rich functional groups such as pollinators, beneficial organisms, decomposers and producers (plant diversity) are an important basis for their functioning. These functional groups are favoured by organic farming<sup>[9]</sup>. Three global meta-studies show that organic farming has a positive effect on the diversity and density of pollinators, beneficial organisms, decomposers (only density), herbivores (only diversity) and plants compared to conventional production<sup>[10, 20]</sup>. The increased densities show that pollinators (+90 %), beneficial organisms (+38 %) and rare arthropods (+55 %) benefit the most<sup>[14]</sup>.

A higher diversity (of beneficial organisms, decomposers, mycophages and phytophages) was also found in organic vineyards<sup>[19]</sup>. The natural regulation of certain pest species (e.g. grape berry moth) can be stronger at both local and landscape level than in conventional viticulture<sup>[11]</sup>. In addition, an increasing proportion of organic vineyards in a landscape characterised by viticulture supports important groups of beneficial organisms even more than near-natural areas<sup>[20]</sup>.

The higher biodiversity and higher population densities of certain species found on organic farms promote important ecosystem services. It has been proven that organic farming can significantly favour natural pollination<sup>[16,21,22]</sup>, natural reduction of harmful organisms<sup>[11,17,23,24]</sup> and manure decomposition in pastures<sup>[25]</sup>.

## **More near-natural areas**

Comparisons of organic farms with conventional farms in Switzerland<sup>[27]</sup>, Denmark<sup>[28]</sup> and England<sup>[29]</sup> show that the proportion of semi-natural areas (biodiversity areas) is higher on organic farms than on conventional farms. In many cases, organic farms have smaller field sizes, a greater diversity of utilised areas and more diverse land use<sup>[30]</sup>. An analysis of all Swiss farms showed that on average 22 % of the utilised area of organic farms and 13 % of non-organic farms were identified as semi-natural land. Organic farms therefore implement two thirds more nature conservation measures. In very productive favourable locations, however, there is also a clear deficit of valuable biodiversity areas on organic farms.

## **Positive effects also at landscape level**

Organic farming promotes biodiversity not only locally, but throughout the entire landscape. With an increasing proportion of farmed organic land in the landscape, the multiple benefits for biodiversity increase. This very remarkable, positive landscape effect has been observed for arable flora<sup>[10]</sup>, pollinators<sup>[13,21]</sup> and various groups of beneficial organisms such as predators and parasitoids<sup>[6,7,13]</sup>. In general, the positive effects of organic farming systems are most pronounced in moderately structured landscapes<sup>[21,23,31-33]</sup>. Organic farming therefore plays a complementary and synergistic role in the promotion of flora and fauna in the context of agri-environmental programmes<sup>[9,34,39,41]</sup>. By structuring the landscape in combination with the conversion to organic farming, a considerable improvement in biodiversity can therefore be expected<sup>[39,41]</sup>.

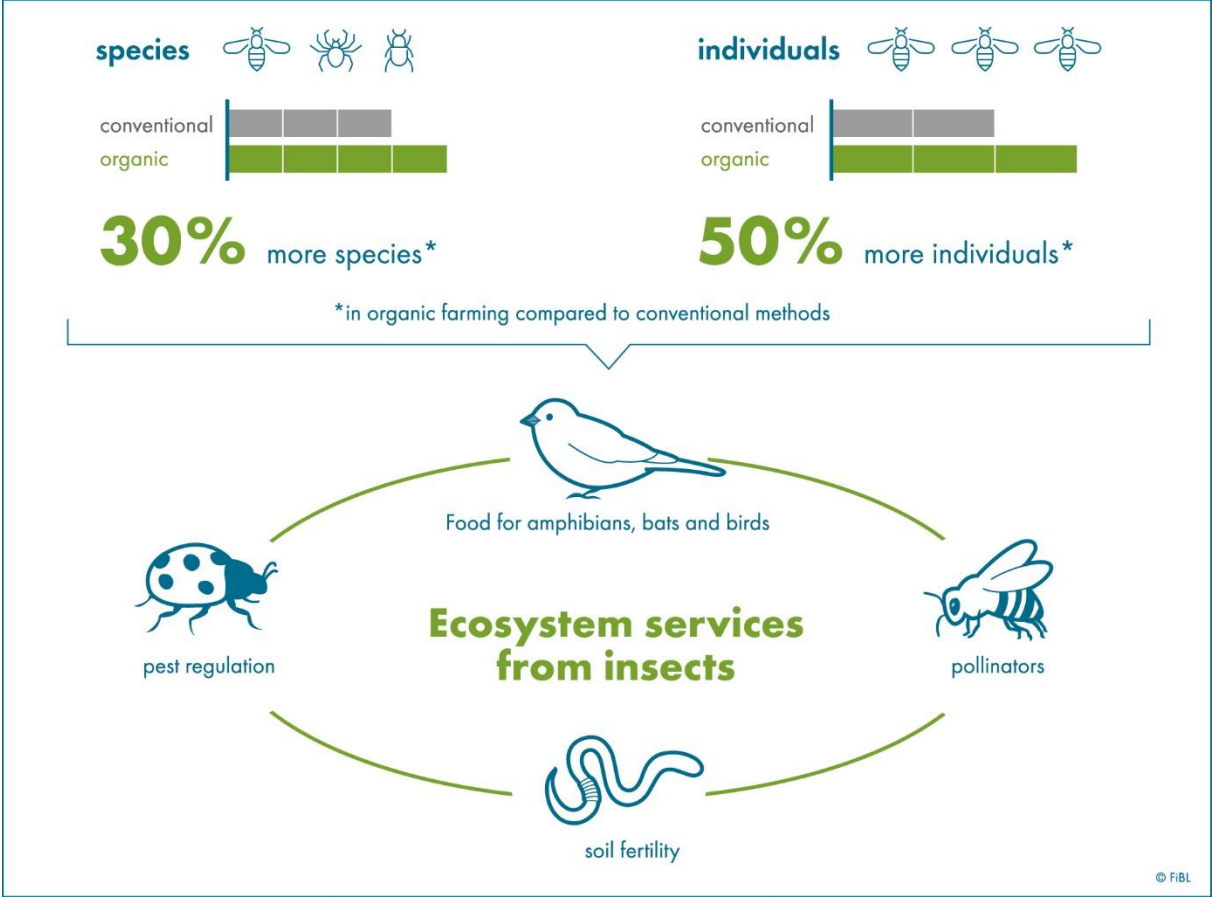
The heavy pollution of the landscape with contaminants, particularly pesticides and fertilisers, is a key anthropogenic factor with regard to loss of biodiversity<sup>[35,37]</sup>. The ubiquitous, long-term pollution of the landscape with synthetic pesticides has serious consequences for flora, fauna and ecological networks not only in production areas, but also through drift into surrounding near-natural areas, forest edges and water bodies<sup>[35,36,37]</sup>.

## **Utilising potentials in a targeted manner**

Even if organic farming per se contributes to greater biodiversity, there is potential for development and improvement on many organic farms. Excessive intensification of organic production and specialisation in a few crops can jeopardise various ecological advantages<sup>[41,43]</sup>. In order to compensate for or reduce the lower yields compared to conventional farming, agroecological diversification and improvement of functional biodiversity of crops is necessary<sup>[42,43]</sup>. Further development of biological

plant protection and bio-breeding play an important role here. In addition, ecological benefits can be further improved by providing specialised advice for the entire farm and by appropriately remunerating agroecological measures<sup>[44]</sup>.

### Effect of organic farming on biodiversity



Organic farming increases biological diversity and functional biodiversity - both on fields and in the landscape as a whole. On average, 30 % more species and 50 % more individuals occur on organic farms compared to conventional farms. As a result, organic farming improves important ecosystem services such as natural pollination or pest regulation.

## Literature and notes

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