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Report

Nature restoration as a driver for resilient food systems

Reviewing the evidence

Institute for European Environmental Policy

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EXECUTIVE SUMMARY

Nature plays a crucial role in food production through the delivery of key ecosystem services including soil productivity, water supply and quality, crop pollination, control of pests and diseases, contributing to nutrient and carbon cycles, and mitigating droughts and floods.

The negative impacts of our current food production systems on biodiversity and land are threatening the provisioning of the ecosystem services on which they depend. Climate change is already reducing yields of major crops globally. In the EU, extreme weather events, such as floods and droughts, are causing significant losses in agricultural production.

Nature restoration, i.e. the recovery of degraded areas, can contribute to increasing the resilience of food production systems through two main mechanisms: (i) by restoring biodiversity, soil fertility and provision of other ecosystem services, and (ii) by reducing the negative impacts of extreme weather events (floods and droughts), becoming more frequent with climate change.

The Nature Restoration Law, brought forward by the European Commission, aims to restore ecosystems in peatlands and wetlands, arable land, grasslands and other grazed land, and agricultural land in riparian zones and floodplains. Some of the measures will require improving land management, while others will imply changing current land use. New farming approaches, and improved knowledge and financial support for existing ones, can help farmers increase their resilience and gain economic value from restored land. In the case of peatland restoration, the highest benefits to food security can be obtained when rewetting, although this will imply changes in the production system on that land.

This report reviews this evidence, which shows that with properly designed measures, nature restoration actions can contribute to making farming systems more resilient and productive for the long run. It does not look at the other benefits to environment and climate from nature restoration, which are covered in other publications.

1. INTRODUCTION

1.1 Aim of the report

This report reviews the links between nature restoration actions and food security. It should be noted from the outset that food security itself is not a direct question of how much is produced: according to the Food and Agriculture Organisation of the United Nations (FAO), food security has four main components: food availability (how much is produced), food access, food utilisation and food stability. Whilst food insecurity globally and in the EU is still mainly driven by lack of access (e.g. due to conflict) and affordability (poverty), extreme weather events linked to climate change are increasingly contributing to food insecurity, highlighting the need for building resilience (FAO et al, 2021). Therefore, discourses that restoring nature is a threat to food production and food security are overly simplistic. Food security is not simply a question of yield, and yield is not simply a question of maximising area in production.

In order to shed light on the more complex reality, this brief presents the current context of nature degradation and reviews the scientific evidence on the role of nature restoration as a course of action to increase the sustainability and resilience of our current food production systems.

1.2 Context

Nature and the services it provides are crucial for global economic activity, but are under severe pressure. The Global Risks Report of the 2020 World Economic Forum ranked biodiversity loss and ecosystem collapse as one of the top five threats faced by humanity in the coming decade, showing that over half of the world's GDP depends moderately or highly on nature (WEF, 2020). Habitats and species are especially under pressure from the impacts of current food production systems. In the agro-ecosystem, 60% of species and 77% of habitats protected by the EU Habitats Directive are found in an unfavourable conservation status (EEA, 2019). Nearly a third of EU land in protected areas (*Natura 2000*) is used for agriculture (grazing or arable), and traditional or extensive agricultural practices are essential for maintaining much of the biodiversity in Europe.

At the same time, food production depends on healthy ecosystems for the provision of services such as soil productivity, crop pollination, control of pests and diseases, nutrient and carbon cycling. Farmed land in the EU represents 40% of its total land area (Eurostat, 2018). Currently, unsustainable agricultural practices (i.e. intensive tillage, excessive fertiliser and pesticide application) are driving land degradation, which is estimated to affect between 61% and 73% of agricultural soils in the EU (Midler, 2022). The impacts of these degradation processes on agricultural production itself are significant and increasing. Losses in crop productivity related to soil erosion from water are estimated to cost the EU agricultural sector around €1.25 billion annually (Panagos et al, 2018). Unsustainable soil erosion rates affect 25% of EU's agricultural soils, with 7% of agricultural soils suffering from extreme erosion (Panagos et al, 2020). Globally, land degradation has reduced productivity with losses up to $577 million (IPBES, 2019).

In addition, an increasing body of evidence reveals that the precipitous decline of pollinator populations over recent decades is negatively affecting crop yield and quality, and potentially threatening food security (IPBES, 2016). Globally, 85% of the main types of food crops, mostly fruit and vegetable crops, rely on pollination for yield and/or quality (Klein et al, 2007). If current trends of biodiversity loss are not halted, the production of many fruits and vegetables could be compromised. Globally, up to €524 billion of crop output are at risk annually from pollinator loss (IPBES, 2019). In Europe, the contribution of bees to crop pollination has been estimated at €3 billion a year (Vallecillo et al, 2018), and the total value of pollination-dependent crops at €15 billion a year (Gallai et al, 2009).

Climate change is exacerbating these trends. According to the IPCC's sixth assessment, agriculture is already negatively affected by global warming (IPCC, 2022). The severity of extreme heat and drought events has tripled over the past 50 years in Europe, resulting in economic losses in crops, including staples like wheat, and livestock production (Brás et al, 2021). In the EU crop losses due to droughts rose from 2% between 1964-1990 to 7% between 1991-2015, with cereals being the most affected crops (Brás et al, 2021). In Germany, losses to drought for winter wheat, during the period from 1995 to 2019, exceeded €23 million in costs (Schmitt et al, 2022). The severe droughts experienced in the EU in August 2022 led to large losses in agricultural production, averaging 5-10% for crops like grain maize, sunflower and soybeans (Baruth et al, 2022). In Spain, the costs of the drought could amount to €8 billion, comprising a 30% reduction in winter crop yields and up to 80% of almond harvest losses among other reductions in production[1]. These losses have not only affected southern Europe; in Wallonia, Belgium, the 2022 drought was estimated to result in losses for the agriculture sector as high as €200 million[2].

These numbers will substantially increase in a 2-degree temperature rise scenario, where it is predicted that declines in maize yields could be higher than 20% in all

[1] According to ASAJA (the Association of Young Farmers)
[2] According to the Féderation Wallone de l'Agriculture (FWA)

EU countries, and up to 80% for some southern European countries (IPCC 2022). Besides southern Europe, yield reductions are also expected for irrigated crops in central and northern Europe (Ciscar et al, 2018). Changes in crop production will also be affected by changes in water demand and supply, and the distribution of pests and diseases, which are all worsened by climate change (Ciscar et al, 2018). In addition, the increased frequency and severity of extreme events such as floods and droughts can impact food affordability and accessibility by increasing prices and/or reducing the supply of affected products. Given that these trends, and their impacts on yields, are predicted to intensify over the course of the 21st century (Trnka et al, 2014), continuing to produce food in a business-as-usual scenario is not a viable course of action.

2. NATURE RESTORATION AS PART OF THE SOLUTION

The aim of nature restoration, also called ecosystem restoration or ecological restoration, is to support the recovery of degraded, damaged or destroyed ecosystems by bringing more nature and biodiversity back (EC, 2022c). Nature restoration measures can cover all ecosystems and take many forms; from the introduction of flower strips in cultivated fields to large-scale river restoration programmes (Gerner et al, 2018). The United Nations, with its *Decade on Ecosystem Restoration (2021-2030)*, aims to raise awareness and halt ecosystem degradation throughout the globe, calling on countries to deliver on nature restoration commitments. This should contribute to achieving Paris Agreement objectives as well as Sustainable Development Goals.

Nature restoration has been shown to be cost-effective in socio-economic terms, especially when it comes to climate change mitigation and adaptation (Dicks, Dellaccio and Stenning, 2020). Positive impacts of nature restoration have also been estimated on economic development and employment (Newton et al, 2021). Regarding yields, a report from the Joint Research Centre compiling evidence on the benefits of nature restoration on food production concluded that there is a positive impact of nature restoration measures on the environment and food productivity in the long-term (Liquete Garcia et al, 2022), despite a lack of quantitative estimates. This paper provides some additional evidence on the benefits that nature restoration can bring to increasing the resilience of food production systems.

2.1 The EU Nature Restoration Law

In line with these international commitments, and as part of the EU Green Deal, the European Commission published a Nature Restoration Law (NRL) proposal in June 2022. The proposal, which aims to restore damaged ecosystems and bring nature back across Europe establishes a framework for Member States to put in place nature restoration measures (EC, 2022b). It explicitly states that these must cover at least 20% of the EU’s land and sea areas by 2030 and all ecosystems in need of restoration by 2050. The regulation will enter into force once the European Parliament and the Council agree on the final text, obliging Member States to prepare their implementation measures through the production of national restoration plans. The proposal also expects to address climate change mitigation and adaptation as well as contribute to natural disaster prevention and control.

Agricultural systems will have an important role to play under the NRL (Box 1) as several of the objectives and measures relate to them, both within and outside agricultural areas (i.e. when targeting species restoration targets). Restoration measures will need to be implemented in drained peatlands and other wetlands, arable land, grasslands, and riparian and floodplain areas. Agricultural systems, and the farming community, can benefit from the increased ecosystem service provision and the ecological resistance building that the proposed nature restoration processes can offer. The impact assessment underpinning the NRL showed that the estimated benefits for achieving the restoration targets linked to Annex I agricultural ecosystem restoration were 9.2 times higher than the costs (EC, 2022a). The text of the NRL itself states: "*Evidence shows that restoring agro-ecosytems has positive impacts on food productivity in the long-term, and the restoration of nature acts as an insurance policy to ensure the EU's long-term sustainability and resilience*".

Box 1: Targets linked to agricultural ecosystems in Chapter 2 of the NRL

- Achieve an increasing trend for the following indicators: grassland butterfly index, farmland bird index, organic carbon stock in cropland mineral soils and share of high-diversity landscape features on agricultural land (**Article 9**)
- Restoration and rewetting of drained peatlands under agricultural use and in peat extraction sites (up to 70% restored, and at least half rewetted, by 2050) (**Article 9**)
- Restore degraded Annex I habitats (measures in place on at least 90% of the area of each group of habitats by 2050) (**Article 4**) – including grasslands, wetlands and peatlands, scrub, and forest habitats
- Reversing the decline of pollinator populations by 2030 and increasing their populations from there on (**Article 8**)
- Removing barriers to longitudinal and lateral connectivity of surface waters, complemented with measures to improve natural functions of floodplains (**Article 7**)

3. NATURE RESTORATION MEASURES AND FOOD PRODUCTION

There are two main mechanisms by which nature restoration measures can impact food production. The first is the restoration of agricultural biodiversity and ecosystems, with a direct impact on yields. This can be positive, by contributing to enhancing the ecosystem services needed for sustained crop growth (e.g. pollination, pest control, improved soil fertility). The second increases the resilience of food production systems by reducing the impacts of extreme events on crops (e.g. floods, droughts, erosion), which are becoming more frequent and/or intense with climate change. Nature restoration can also contribute to reducing GHG emissions from agriculture (e.g. peatland restoration).

This section reviews the evidence in relation to measures proposed in the NRL under Articles 8 and 9. These measures are the restoration of pollinator populations including grassland butterflies (we include restoration of natural predators as well[3]), the restoration of agricultural soils (including mineral and organic soils), the restoration of landscape features, and the restoration of farmland bird populations. Some of the restoration measures foreseen in the Law, such as the rewetting of drained peatlands or restoring floodplains will involve changing current production practices (i.e. in the case of peatland a shift to paludiculture or very extensive grazing) or an overall reduction in the area under agricultural use.

In some cases, restoration will involve changing current land uses (e.g. peatland rewetting, introduction of landscape elements). There are a number of reasons why the impact of this on production in the long run would be limited or in many cases positive, and these are explored further in the following sub-sections. In brief because in the case of drained peatlands the area of land in question is small, and continued intensive agricultural production will only be possible for a short time into the future, whilst on arable land the positive impacts of boosting ecosystem services and resilience can offset the reduction in cropped area).

3.1 Restoration of pollinator and natural predator populations

Restoring pollinator and natural predator populations can be achieved by different interventions including reducing pesticides and increasing food resources and habitat for them in the landscape. There are many high-diversity landscape features which can be introduced on agricultural land or made more

[3] Restoring biological pest control contributes to reaching pesticide reduction targets

pollinator-friendly. These include buffer strips, hedgerows, field margins, fallow, tree rows, small wetlands and ponds, patches, terrasses and even stone walls[4]. All these elements provide habitat for wild plants and animals, which in turn contribute to many ecosystem services. These landscape features also contribute to preventing soil erosion (through wind and runoff) and thus reducing nutrient losses, filtering air and water, sequestering carbon and overall supporting adaptation to climate change, for example by sheltering livestock.

The benefits of introducing landscape elements on enhancing ecosystem services and yields are well documented, and the evidence suggests that this can offset any reductions from area taken out of production. A 2020 synthesis of studies looked at the impact of flower strips and hedgerows on ecosystem services (pollination and pest control) and yields. Overall, the results show that planting flower strips increases pest predator and pollination services. Whilst there is variability in the studies on the impact on yields, on average yields were maintained across different studies (Albrecht et al, 2020). Some landscape elements, such as woody ones can lead to yield losses in the areas adjacent to the structure, although ways can be sought to minimise these losses and calculate compensations for farmers (Raatz et al, 2019). The losses can be partly balanced by the shelter provided – decreasing impacts from soil erosion, wind and drought.

Management interventions for increasing crop pollination on farmland include actions to create more flowering sources (like flower strips) and the restoration and management of semi-natural habitats such as hedgerows, trees, wood patches, old fallow fields, meadows, heathland, or scrubs. Such actions enable pollinators to complete their life cycles by providing food sources, nesting and refuge sites (Menz et al, 2011). Interestingly, conventional farms with high in-field habitat diversity maintained similar pollinator abundance as organic farms with low in-field habitat diversity, which shows the positive impact that the introduction and restoration of semi-natural habitats can have on pollinators (Garibaldi et al, 2014). Recent research calls for a minimum of 20% semi-natural habitat to be maintained within agricultural areas to ensure the provision of multiple ecosystem services (Garibaldi et al, 2021).

Scientific evidence has shown that crop pollination services improve the quantity and quality of crop yields (Christmann et al, 2021; Katumo et al, 2022). This is due to increases in flowering plant species richness of adjacent flower strips (Albrecht et al, 2020), although the effect can decrease exponentially with distance to planting (Ricketts et al, 2008). Converting 10% of an area of intensively farmed

[4] All these, and more, are listed in the NRL proposal (52)

agricultural land to a more natural habitat land-use could return a 35% increase in wild bee species abundance and richness (Kennedy et al, 2013). Other management practices, such as increasing the diversity of crops grown at the landscape level or reducing the size of farm plots have shown to support high crop yields, even increasing yield over time, particularly for pollinator dependent crops (Magrach et al, 2022), which provide the greatest amount of nutrients and vitamins (Chaplin-Kramer et al, 2014).

There is abundant evidence in the scientific literature on the role that natural predators of pests can play by providing biological control services to nearby crops. High levels of natural biological control can give higher yield and/or crop quality, allowing for crop production with less or no pesticide (insecticide, fungicide, herbicide) use (organic or integrated pest management) and for fewer interventions in the crop (with fewer demand of time and machinery). These natural predators require habitats near the crops, which can be provided by species-rich or flower-rich grasslands, diversified landscapes, flowering strips and hedges. A review of studies on semi-natural habitats on farmland providing natural biological control found evidence that herbaceous ungrazed areas and grassy linear habitats (e.g. field margins) next to crops reduce pest densities in the crop. Species rich native grassland and linear woody habitats (e.g. hedgerows) enhance natural enemy densities in the adjacent crop, and these natural enemies may be contributing to controlling pests (Holland et al, 2016).

Diversified landscapes with small-scale diversity of crops, grassland, and field edge habitats provide better conditions for effective pest control by natural enemies than do landscapes with large fields and few field edges, little or no permanent grassland, and a low density and diversity of field edge habitats (Martin et al, 2019). A meta-analysis of studies found a 44% increase in abundance of natural enemies, a 54% increase in herbivore mortality, and a 23% reduction in crop damage on farms with species-rich vegetational diversification systems (including within or around the field) as compared to farms with species-poor systems (Letourneau et al, 2011).

The reviewed literature suggests that the introduction of landscape elements is highly beneficial for pollination and natural biological control services in agricultural areas. The choice and design of the landscape elements can optimise these benefits while reducing the impacts on yield losses following their establishment.

Box 2: An eco-farm with agri-environmental management

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Location: Šardice, South Moravia, Czech Republic

Problems addressed: low soil fertility, high soil erosion rates (40 Tn/ha/y), biodiversity decline, vulnerability to extreme events

Main interventions (during 13 years): introduction of landscape elements (bio-belts, wetlands and pools, grass buffer zones), afforestation, diversification (ecologically grown forage mix), organic agriculture.

Benefits: 67-98% reduction of soil erosion rates (*on the 10 ha where they were measured*), improved soil fertility, presence of natural predators, improved water retention, increased landscape diversity and biodiversity, enhanced carbon sequestration

Total cost of the action: €56.000

More information: https://enrd.ec.europa.eu/projects-practice/agri-environment-business-focused-adaptation-climate-change-ekofarma-petra-marada_en

3.2 Restoration of soil organic matter in mineral soils

One of the indicators for achieving restoration of agricultural systems identified within the NRL is the restoration of organic matter in mineral soils. Soil organic matter plays a crucial role in the performance of soil functions such as absorbing, storing and filtering water, transforming nutrients and substances, providing the basis for biodiversity and acting as a carbon reservoir. By increasing the soil's water holding capacity, soil organic matter increases soil's resilience to the impacts of floods and droughts, while soil biodiversity improves soil fertility by enhancing nutrient management and helps fight pests and diseases. Increasing the organic matter content of agricultural soils is therefore an effective way to increase their health and resilience, contributing to yield stability (Dainese et al, 2016).

Soil organic matter can be restored in agricultural soils following a set of practices, most of which keep soil from being eroded. Such practices include limiting the physical disturbance of soils (reduced or no-till), ensuring that soil is covered at all times (cover/catch crops, mulching, permaculture), diversifying crops and adding organic inputs to soil (i.e. compost, manure). Keeping soils covered (i.e. cover crops, agroforestry, perennials) can also increase resistance to drought, by increasing porosity and water retention in soils. Adding cover crops to olive orchards can reduce erosion by up to 80%, reducing the loss of soil organic carbon (Márquez-García et al, 2013). Landscape features can also contribute to reducing soil erosion and organic matter loss. In the UK, in field buffer strips and riparian buffer strips reduce runoff by 20%-43% and 9-98% (with an average of 72%) respectively, reduced soil loss by 40%-78% and by 5-50%, and reduced phosphorus loss by 40% and 30% (Posthumus et al, 2013). The same study found hedgerows reduced soil loss by 5-20% and phosphorus loss by 10-50%.

Organic agriculture and conservation agriculture are two of the best-known alternatives to conventional agriculture, and which can lead to increases in organic matter in soils (El-Hage Scialabbad and Müller-Lindenlauf, 2010). Practices such as increasing crop diversity, adding fertility crops and organic matter which enhance ecosystem service provision have been shown to have positive effects on crop yields where nitrogen fertiliser requirements are generally low (MacLaren et al, 2022). A global meta-analysis found that diversification of cropping practices enhances biodiversity, pollination, pest control, nutrient cycling, soil fertility, and water regulation without compromising crop yields (Tamburini et al, 2020). Most often, diversification practices resulted in win-win support of services and crop yields.

3.3 Restoration of organic soils (peatland restoration)

Peatland covers 7.7% of EU land surface (Tanneberger et al, 2017). Over time peatlands have been drained to allow the land to be used for agriculture and forestry, as well as to extract peat to burn for energy, amongst other uses. While it is estimated that 88% of global peatlands remain in an almost natural state, more than 50% of peatlands in Europe are degraded, with percentages above 90% in the case of Germany, the Netherlands and Denmark (Tanneberger et al, 2021). Peatland drainage brings the organic material in contact with air, giving microorganisms the opportunity to decompose this organic matter and transform it into CO_2 that is released to the atmosphere. It is important to note that over time, drained peatlands lose their peat due to microbial degradation, erosion and subsidence. Annual losses from subsidence range between 1 and 5 cm (Ilnicki, 2002) and are irretrievable, leading to the loss of productive land. Continuing production on these soils is therefore not sustainable.

The objective of nature restoration measures on peatland is threefold: to reduce GHG emissions, to improve flood protection and water quality, and to restore biodiversity in degraded areas. In terms of GHG emissions, peatland restoration has a high mitigation potential and is comparatively lower in cost when compared to other sources of agricultural emissions (Buschmann et al, 2020). Though drained peatlands represent only 3% of the EU's agricultural land, rewetting them would avoid up to 25% of GHG emissions from agriculture (UNEP, 2022). Furthermore, rewetting all drained peatlands in the EU could reduce total nitrous oxide emission by 70% (Liu, Wrage-Mönnig and Lennartz, 2020). The economic benefits of rewetting drained peatland in relation to avoided CO2 emissions could amount up to €2000 per ha per year (Kopsieker, Costa Domingo and Underwood, 2021).

Conventional agriculture is not possible on rewetted peatlands. The socioeconomic consequences of changing their use need to be better understood (Schaller, Kantelhardt and Drösler, 2011) and the provision of alternatives or compensations need to be assessed. The most common uses, also considered within the NRL, include: (i) paludiculture, with plants such as peat moss, reeds, and others used for biogas, construction materials, protein extraction, liquid fuels or even paper production[5], (ii) wet extensive pasture (with water buffaloes), and (iii) dry extensive pastures for suckler cow husbandry (Buschmann et al, 2020). These uses can provide ecosystem services in a similar way to natural peatlands, while providing an economical reward for farmers (Tanneberger et al, 2022). Ongoing peatland restoration projects should allow a better understanding of the potential economic activities as well as the ecological resilience of restored peatlands, in particular to droughts, floods and fires which can be crucial but remains less understood (Loisel and Gallego-Sala, 2022).

Restoration of some of these areas has already taken place in several EU countries funded by the LIFE programme (EC, 2020), although the Common Agricultural Policy (CAP) could be a key instrument in this transition. Because peatland is unevenly distributed within the EU, its restoration will be important for some

[5] https://www.moorwissen.de/files/doc/infothek/Broschure%20Paludiculture%20EN.pdf

countries, while others will not be affected. One such country where peatland restoration will be significant is Germany (see Box 3).

Given the inevitable degradation of drained peatland areas over time, the most important contribution they can make to a resilient food production system, and therefore to longer-term food security, is water storage through rewetting. The benefits of avoiding the release of additional CO2, while contributing to flood prevention and reducing wildfire risks outweighs the reduction in land under agricultural use. Further, despite lower output per ha, production on rewetted peatlands can be sustained over the long run, contrary to the intensive production which is currently exhausting peat. Rewetting peatlands, however, will not restore them to their original state in terms of biodiversity, ecosystem functioning and land cover characteristics (Kreyling et al, 2021). Several decades can pass before peatlands become functional ecosystems again (Strobl, Kollmann and Teixeira, 2019), which makes the need for rewetting all the more urgent (Schaller, Hofer and Klemm, 2022).

Box 3: Peatland restoration in Germany

Peatland covers around 5% of the country’s area and represents 7% of its total agricultural land area (1). 95% of Germany´s peatland is considered to have been drained for cropland and forestry use, placing Germany on the top of GHG emitters from drained peatland in the EU (2). The German National Peatland Protection Strategy plans to coordinate peatland protection and restoration (3). Paludiculture projects (farming on rewetted soils) will be an important part of the strategy, funded under the Environment Ministry. Suitability maps have shown that the majority of the drained agricultural area in Germany can be used for paludiculture (Tanneberger et al, 2022).

Alongside the publication of their National Peatland Strategy, the German Federal Government has also established a natural climate protection action programme (ANK), with an allocated budget of €4 billion, that aims to strengthen biodiversity and promote climate protection through the protection and restoration of important ecosystems such as peatlands via the 'protection of intact moors and rewetting' and prioritising 'soils as carbon stores'. (4).

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3.4 Floodplain restoration

The catastrophic consequences of the floods taking place in the EU over the past years have exposed the vulnerability of floodplains to these extreme, but increasingly frequent, events. Agriculture is one of the sectors most affected by flooding since 35% of ecosystems in floodplains are croplands and 15% are grasslands (EEA, 2020). It is therefore not surprising that two thirds of the area affected in the 2021 floods in central Europe were croplands and grasslands (He et al, 2022). In this sense, improving the coordination between flood risk management and agriculture authorities could benefit farmers' management of flood risks (EC and DGEnvi, 2021). Part of this management can be fulfilled by implementing nature restoration measures (included under Article 7 in the NRL) that contribute to reducing flood risks and mitigating their impacts, providing habitat and improving water quality. Despite the importance of these benefits, which can also be felt on surrounding land (i.e. reduced flood risks), data on the impact of floodplain restoration on agricultural production is difficult to find (an example is presented in Box 4).

Box 4: An example of floodplain restoration

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Location: Delta of the Ebre river, Catalonia, Spain

Problems addressed: Vulnerability to the effects of climate change, particularly to sea level rise, exacerbated by a sediment deficit due to river regulation and subsidence. Natural habitats affected by intensive rice farming.

Main interventions (2009-2018): Habitat restoration through removal of infrastructures, creation of lagoons in rice fields, restoration of march habitats, creation of small islands for biodiversity, reconnecting the lagoon and the river for sediment transport and restoring marsh habitat (Funded by LIFE)

Benefits: restoration of 62 ha of wildlife habitats, increased resilience of lagoons and marshes against sea level rise, contributing to increased life-span of rice production, creation of jobs.

Total cost of the action: €5.2 million

4. CONCLUSIONS

Nature plays a crucial role in food production through the delivery of key ecosystem services including soil productivity, water supply and quality, crop pollination, control of pests and diseases, contributing to nutrient and carbon cycles, and mitigating droughts and floods. These services are being compromised due to environmental degradation and the effects of climate change. Impacts on agricultural production are significant and are undermining the resilience of agricultural systems. This not only compromises long-term food security: the evidence shows that environmental degradation and lack of resilience are already having an impact through soil erosion, loss of ecosystem services and harvest losses from extreme weather events.

Nature restoration, i.e. the recovery of degraded areas, can contribute to increasing the resilience of food production systems through two main mechanisms: (i) by restoring biodiversity, soil fertility and provision of other ecosystem services, and (ii) by reducing the impact of extreme weather events linked to climate change. While a change in the use of currently managed land is in some cases unavoidable to implement nature restoration measures (i.e. peatland rewetting, flood plain restoration, landscape elements), the evidence reviewed shows that this is unlikely to threaten food security as these represent very small areas, and these actions can still help to build resilience or simply replace systems that are unsustainable from a production perspective.

A narrow focus on the amount of land under production is therefore not an accurate measure of long-term production potential. Addressing the impact of nature restoration on food security implies factoring in the vulnerabilities linked to climate change and the costs of inaction. The Nature Restoration Law provides an opportunity to reverse the trends in degradation of biodiversity and land and enhance our capacity to mitigate and adapt our food production systems to the current challenges.

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