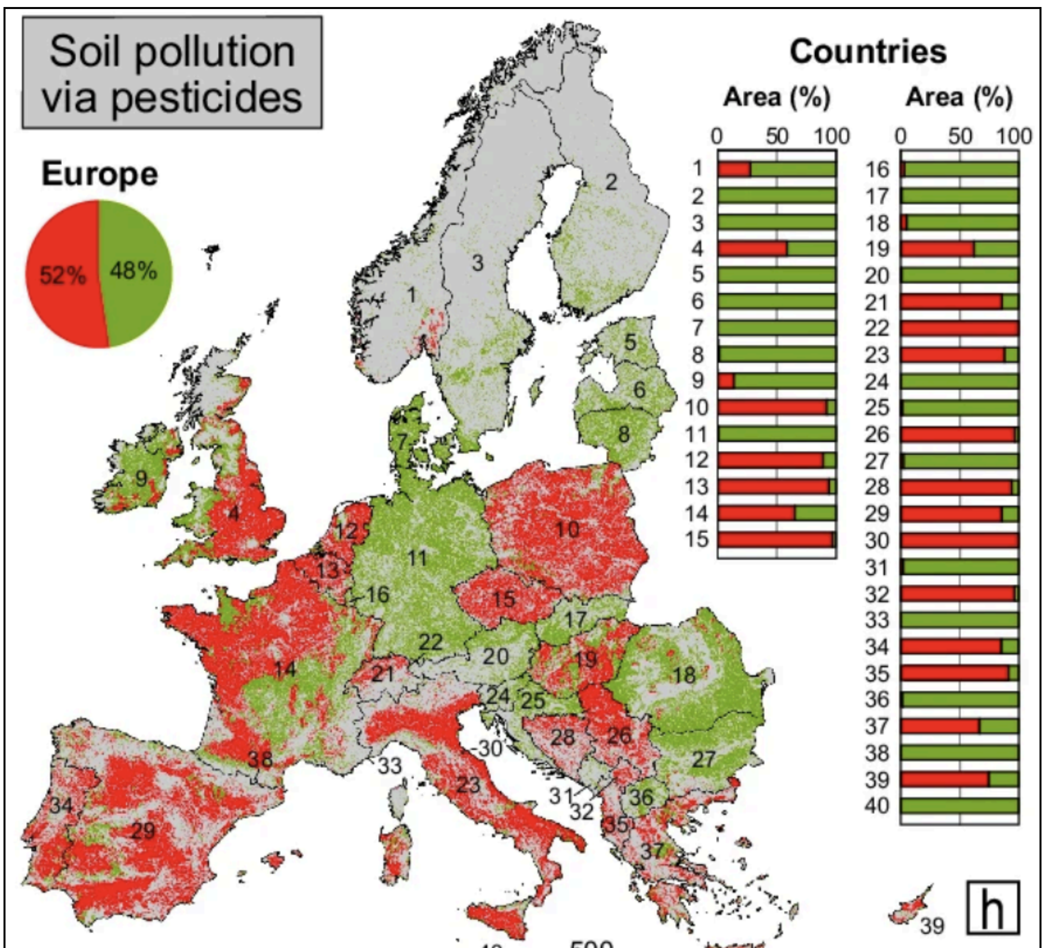
Nature Restoration Regulation: Recommendations for National Restoration Plans

Pesticide Action Network - Europe
BeeLife

For a successful National Restoration Plan: Reducing pesticide pressure on biodiversity

Pesticide Action Network Europe

BeeLife European Beekeeping Coordination



Source: [Prăvălie et al. 2024.]()

Purpose

These recommendations are intended to assist policymakers and stakeholders engaged in preparing and developing National Restoration Plans (NRPs) under the Nature Restoration Regulation (NRR). They provide Member States with scientific insights and a policy rationale for including pesticide use reduction in the NRPs, as a major, necessary and overarching measure to halt biodiversity loss and restore ecosystems.

For ease of reference and consultation, the document follows the Uniform Format for NRPs and includes direct cross-references to the relevant sections.

Summary

The EU Nature Restoration Regulation (NRR) establishes a legally binding framework to halt biodiversity loss and restore degraded ecosystems across terrestrial, freshwater, coastal, agricultural, and urban landscapes. Achieving its objectives, however, requires directly addressing one of the principal drivers of ecological decline: the harmful impact of chemical pesticides.

A substantial and growing body of scientific evidence shows that pesticide contamination is pervasive in soils, surface water and groundwater, vegetation, air, and even protected areas. This contamination represents the single greatest threat to land productivity in Europe and contributes significantly to the decline of insects, pollinators, farmland birds, soil organisms, and aquatic biodiversity. Such impacts cascade across trophic levels, undermining ecosystem functioning, agricultural resilience, and long-term food security.

This document sets out science-based recommendations to integrate robust pesticide-reduction measures into NRPs under Articles 4, 8, 10, and 11 of the NRR. It demonstrates that reducing dependency on chemical pesticides, strengthening Integrated Pest Management (IPM), expanding organic and agroecological systems, and prohibiting the use of harmful pesticides in sensitive and protected areas as well as in urban environments are indispensable to restoring ecological integrity.

These measures also deliver substantial co-benefits, including enhanced soil health, improved water quality, pollinator recovery, greater climate resilience, strengthened public health protection, and more secure livelihoods for beekeepers.

Aligning restoration planning with ambitious pesticide-reduction strategies will ensure coherence with existing EU legislation and respond to citizens' expectations, while reinforcing the long-term sustainability, resilience, and socio-economic viability of European food systems. The responsibility now lies with Member States to act decisively.

Introduction

The NRR represents a critical intervention to avert ecosystem collapse and limit the escalating impacts of biodiversity loss and climate change. Restoring ecosystems across agricultural land, wetlands, rivers, forests, grasslands, marine and urban environments is a cost-effective investment in protecting biodiversity and ecosystem functions, long-term food security, climate resilience, public health, and societal well-being. **However, achieving the NRR's restoration targets will be unattainable without a substantial reduction in chemical pesticide use, which constitutes one of the major drivers of biodiversity decline.**

Sampling studies show that pesticide mixtures are widely present in soils, water, vegetation and air, also far beyond agricultural areas[1]. There is a strong scientific consensus that biodiversity decline - particularly among terrestrial insects that form the foundation of food webs - is primarily driven by habitat loss and pollution linked to intensive agricultural practices[2]. Agrochemical pollution has been consistently identified as a major cause of insect decline, including pollinators[3], and of biodiversity degradation in agricultural landscapes[4]. Large-scale meta-analyses show that pesticides have a significant negative impact on species diversity in farmland[5]. These effects extend beyond croplands: dramatic reductions in insect biomass have been documented even in protected areas within agricultural regions[6]. Pesticide drift has been linked to over 50% reductions in diversity of wild plants within 500 m of fields, shrinking resources for pollinators[7].

[1] Stehle and Schulz, 2015; Hvězdová et al., 2018; Silva et al. 2019; Mamy et al. 2022; Silva et al. 2023; Navarro et al. 2023; Brühl et al. 2024; Knut et al. 2024; EEA 2024; Meyer et al. 2024; Schemmer et al. 2024; PAN Europe 2025, Ban PFAS pesticides and TFA; Carvalho et al. 2025.

[2] Geiger et al., 2010; Brooks et al., 2012; Dudley and Alexander, 2017; Sánchez-Bayo and Wyckhuys, 2019; Habel et al., 2019; Seibold et al., 2019; Forister et al., 2019; Harvey et al., 2020; OPECST, 2021; Mamy et al. 2022; Honert et al. 2025.

[3] Pisa et al., 2014; Ollerton et al., 2014; Gill and Raine, 2014; IPBES, 2016; Woodcock et al., 2016; Sánchez-Bayo and Wyckhuys, 2019; Warren et al., 2021; Giorio et al., 2021; van Lexmond et al., 2014; Nicholson et al. 2023 ; Basu et al. 2024; Knauer et al. 2025.

[4] Mineau and Whiteside, 2013; Mamy et al. 2022; Albaseer et al. 2025; Honert et al. 2025; Wan et al. 2025.

[5] Geiger et al., 2010; Mamy et al. 2022; Rigal et al. 2023 ; Stehle and Schulz, 2015; Wan et al. 2025.

[6] Hallmann et al., 2017; Brühl et al., 2024; Mauser et al. 2025.

[7] Albaseer et al. 2025.

Pesticides are shown to be detrimental to soil organisms, eroding a large part of global biodiversity[8]. Pesticides are also a leading cause of biodiversity loss in aquatic ecosystems[9] and contribute to declines in bats and amphibians[10].

The cascading effects of insect decline are evident across trophic levels. Long-term EU-wide monitoring shows an overall 25% decline in bird abundance, with farmland birds declining by approximately 60%, reflecting the loss of insect prey. Pesticides and fertilisers are primary drivers for most bird population declines, especially for invertebrate feeders[11]. Comprehensive assessments drawing on thousands of scientific studies confirm a causal link between pesticide use and sustained declines in invertebrate and bird populations[12]. Analysis of pesticide purchase data, validated by comparison with independent data on pesticide residues in surface waters, also shows a negative correlation with the abundance of 84.4% of 64 common bird species in croplands. These results, confirmed through a more integrative pesticide metric, combining quantity, toxicity and degradability of the substances, suggest a widespread negative impact of environmental contamination, extending beyond farmland specialists to common bird species foraging in croplands, with potential cascading effects within and outside these landscapes[13]. Conversely, evidence from pesticide bans - such as the restriction of neonicotinoids in France - demonstrates that reducing harmful pesticide use enables biodiversity recovery, including rebounds in insectivorous bird populations[14].

Similarly, a substantial body of evidence indicates that organic farming increases species richness by approximately 30%. This effect has been consistently documented over the past three decades of research and shows no indication of weakening over time[15]. In parallel, the effective implementation of IPM can significantly reduce the negative impacts of pesticides on biodiversity, including pollinators, without compromising yields - and in some cases even enhancing them[16]. Practical experience from farmers across Europe further demonstrates that pesticide use can be substantially reduced without adversely affecting farm profitability[17].

8 Beaumelle et al., 2023; Gunstone et al., 2021; Köninger et al., 2026; Silva et al., 2019; Silva et al., 2023; Knuth et al., 2024.
9 Liess et al., 2021.
10 Hayes et al. 2006; Brühl et al. 2013; EFSA 2018; Garcês & Pires 2023; Mineau & Callaghan 2019.
11 Rigal et al. 2023; Monnet et al. 2026.
12 Mamy et al. 2022.
13 Monnet et al. 2026.
14 Perrot et al. 2025.
15 Tuck et al. 2014; Stein-Bachinger et al. 2020; Habel et al. 2025.
16 Pecenka et al. 2021.
17 Lechenet et al., 2017 ; Pecenka et al. 2021; Tibi et al. 2022 (INRAE); Nandillion et al. 2024; Nandillon et al. 2026 ; PAN Europe, 2025. Farming beyond pesticides: success stories from the field; IPMWORKS project - Smarter agriculture: farmers work with nature to cut pesticides; EARA 2025, Farmer-led Research on Europe's Full Productivity The Realities of Producing More and Better with Less.

Long-term ecosystem recovery and functional restoration, as required by the NRR, demand measures that directly address pesticide pressure. Reducing pesticide use is a proven and effective lever to restore biodiversity, rebuild ecological interactions, and protect human health, while strengthening the resilience and sustainability of food systems. If no such measures are taken, projections indicate continued deterioration of biodiversity and ecosystem services. Scientific advisers have concluded that the current EU food system is environmentally, economically, and socially unsustainable[18].

We therefore recommend that NRPs explicitly integrate pesticide-reduction targets into a broader transition to sustainable agricultural practices, as a necessary condition to achieve the NRR's objectives, notably under Articles 4, 8, 10, and 11.

A. Information across targets

(**PART A** of the NRPs)

Listening to scientists and citizens while ensuring public participation

With relevance to point "2.1. **Public participation"** (Art. 14(20) and Art.15(3)(w))

Scientists and citizens are increasingly concerned about the use of pesticides and the build-up of their residues and metabolites in the environment. More than 3,300 European scientists supported the Green Deal and its pesticide-reduction targets[19].

Citizens across Europe have repeatedly called for a reduction in pesticide use, identifying it as one of their foremost concerns in relation to public health and biodiversity loss. The European Citizens' Initiative Save Bees and Farmers, which calls for a transition to phase out synthetic pesticides, was successfully presented to the European Commission in October 2022 after having collected over one million statements of support from EU citizens. Also, during the Conference on the Future of Europe, participants explicitly urged a "*drastic reduction of chemical pesticides and fertilisers across all types of farms*" and the "*development of sustainable agriculture that respects both nature and agricultural workers*."

[18] SAPEA 2020, A sustainable food system for the European Union: Evidence review report
[19] Scientists support the Green Deal.

The present recommendations, advocating for the integration of efficient measures to reduce pesticide use and associated risks into the NRPs, are fully aligned with these public demands.

Pesticide Action Network (PAN) Europe and BeeLife European Beekeeping Coordination (BeeLife) bring together more than 80 organisations across Europe. Adopting these recommendations would therefore ensure that the perspectives of civil society and citizens are duly reflected, fulfilling the commitment to public participation in NRPs as stipulated in Articles 14(20) and 15(3)(w) of the NRR. This network of organisations could also facilitate fostering synergies among Member States (art. 14(17)), to optimise the implementation of the measures presented in this document.

General co-benefits and impacts
With relevance to "4.1 **General co-benefits and impacts**" (Art.15(3)(r) and (s))

Reducing pesticide use and associated risks helps to build a more sustainable and healthy food production system, while tackling the impacts of harmful pesticides on soil, air, and water will protect biodiversity, ecosystems, and, ultimately, human health and well-being.

Minimising the environmental footprint of the EU's food system will also mitigate the economic losses that we are already incurring due to declining soil health and pesticide-induced pollinator loss.

Furthermore, reducing pesticide use has clear synergies with other EU policies and contributes to the implementation of EU and international commitments.

Co-benefits for climate change mitigation
With relevance to "4.1.1. **Co-benefits for climate change mitigation**" (Art.15(3)(r))

Pesticides are a significant source of greenhouse gas (GHG) emissions. At the production stage, 99% of synthetic chemicals - including pesticides - are derived from fossil fuels. Studies indicate that manufacturing one kilogram of pesticide requires, on average, around ten times more energy than producing one kilogram of nitrogen fertiliser. In addition, pesticides can generate GHG emissions after application: fumigant pesticides, for example, have been shown to substantially increase nitrous oxide emissions from soils. Many pesticides also contribute to the formation of ground-level ozone, a GHG that harms both human health and vegetation[20].

By contrast, alternative agricultural systems reduce or entirely eliminate the use of synthetic fertilisers and pesticides, while enhancing the resilience of farming systems to better adapt to and mitigate the impacts of climate change.

Soil - rather than forests or the atmosphere - constitutes the largest carbon reservoir in terrestrial ecosystems. Approximately 2,400 billion tonnes of carbon are stored within the top two metres of soil, a quantity three times greater than that found in the atmosphere. Although soils alone cannot dramatically lower atmospheric concentrations of climate-altering greenhouse gases, they can nonetheless play a crucial role. This is achieved not only by safeguarding substantial underground carbon stocks, but also by restoring degraded land through specific agricultural practices that increase carbon sequestration in soils[21].

A range of agricultural practices, and especially the combination of the three “pillars” of conservation agriculture, i.e. reduced or no-tillage, permanent soil cover, and diversified cropping systems through rotation or intercropping, enhance carbon sequestration in soils. These practices reduce soil erosion, increase carbon storage, support soil biota (including bacteria, fungi, and earthworms), limit pest and disease pressure, increase resilience against extreme weather events, and ultimately improve crop productivity through enhanced soil functioning. Maintaining the use of harmful pesticides undermines the benefits of the above-mentioned practices.

Promoting the widespread adoption of the three pillars of conservation agriculture practices, in combination with organic agriculture techniques allowing the progressive phase-out of harmful pesticides, would simultaneously enhance carbon sequestration, restore biodiversity, protect water quality, and scale up nature-based solutions.

Co-benefits for land degradation neutrality
With relevance to “4.1.2 **Co-benefits for land degradation neutrality**” (Art.15(3)(r))

[20] Pesticides and Climate Change: A Vicious Cycle
[21] Trapping carbon in the soil: what agriculture can do - University of Montpellier

Soil health and productivity are declining across Europe[22]: Soil degradation affects all EU Member States, with an estimated 60–70% of soils currently in an unhealthy condition and 89% of agricultural soils exhibiting a critical loss of functions[23].

Land degradation represents a complex socio-environmental challenge that typically manifests itself through multiple and convergent processes, including water and wind erosion, soil organic carbon loss, nutrient imbalances, salinization, acidification, compaction, pesticide and heavy metal pollution, vegetation degradation, groundwater decline, and aridity.

Crucially, intensive agricultural practices and the loss of below-ground biodiversity associated with pesticide use are a major driver of soil degradation. Studies have shown that the majority of soil samples contain mixtures of pesticides[24], and that these substances have detrimental effects on soil biodiversity[25].

A recent pan-European analysis of multi-degradation in agricultural environments, drawing on an extensive geospatial dataset covering the processes most relevant to agricultural productivity, found that pesticide pollution has the largest spatial footprint at the continental scale, affecting 52% of the cumulative agricultural area across the countries studied. **Soil pollution via pesticides is therefore the single greatest threat to land productivity**, followed by soil nutrient imbalances, heavy metal pollution, and aridity - four processes that each affect more than a quarter of European agricultural land and collectively represent the most significant degradation pressures in spatial terms. By contrast, soil salinization, vegetation degradation, groundwater decline, and wind erosion cover considerably smaller agricultural areas, and based on their spatial footprints, appear to pose comparatively lower threats to land productivity across Europe[26].

Reducing pesticide inputs would help prevent soil contamination and further degradation, and at the same time it would strengthen soil biodiversity, particularly microorganisms and fauna that are essential for soil structure (aeration), nutrient cycling, and carbon storage.

Pesticides are the leading cause of land degradation in the EU. Reducing their use in crop production through the promotion of sustainable farming practices would make a significant contribution to achieving land degradation neutrality, in compliance with articles 1(b) and 14(9) of the NRR.

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22 Arias-Navarro et al. 2024.
23 Soil Monitoring Law.
24 Silva et al., 2019; Silva et al., 2023 ; Knuth et al. 2024.
25 See note 8.
26 Prăvălie et al. 2024.

Foreseeable socio-economic impacts and estimated benefits of the restoration measures
With relevance to "4.1.3 **Foreseeable socio-economic impacts and estimated benefits of the restoration measures**" referred to in Art. 4 to 12 (Art.15(3)(s))

Pesticides can cause well-documented health impacts: increased risks of chronic health conditions[27], including specific cancers[28], neurodegenerative diseases (Alzheimer's, Parkinson's)[29], neurodevelopmental disorders[30], reproductive and fertility impacts[31], and immune or metabolic effects, including on the gut microbiome[32]. Risks may be higher for vulnerable groups such as pregnant women, infants and children, farmers, and residents of intensively farmed areas[33]. In France, for instance, public health expenditures directly linked to pesticide-induced diseases have been estimated to at least 48.5 million euros per year[34]. Curbing pesticide use will therefore have a beneficial effect on human health and reduce public health expenses.

Reducing the use of hazardous pesticides will also be beneficial for water resources, limiting their contamination and depollution-related costs. Pollinator populations will highly benefit from the reduction of pesticide use, and this in turn will enhance agricultural productivity as well as the production of healthier, more nutritious food. More than 75% of global food crop types rely on animal pollination[35]. Biodiversity loss threatens our food systems[36]: biodiversity-friendly agricultural practices will thus directly benefit **EU food security.**

Adopting more sustainable agricultural practices also helps align economic activity with nature restoration while safeguarding the long-term productivity and value of natural capital. Such practices can also improve agricultural productivity and rural livelihoods[37], generating diversified economic opportunities for rural communities beyond primary agricultural income. A clear example is Italy's agritourism model, which has developed over the past three decades into a well-established cultural and economic phenomenon.

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27 Kim et al. 2017; Inserm 2021; European Environment Agency 2024, How pesticides impact human health.
28 Vinson et al. 2011 ; Cavalier et al. 2022.
29 PAN Europe, EU citizens are not protected against neurotoxic effects of pesticides; Gama et al. 2022 Bloem & Boonstra 2023; Matsuzaki et al. 2023; Diwan et al. 2023.
30 Romàn et al. 2024; Mowafi et al. 2025; James & OShaughnessy 2023.
31 Albadrani et al. 2024; Chiu et al. 2018.
32 Matsuzaki et al. 2023; Puigbò et al. 2022; Lehman et al. 2023; Motta et al. 2018.
33 Kab et al. 2017.
34 Alliot et al. 2022.
35 IPBES 2019, Summary for policymakers, p. 3, A1.
36 World Economic Forum 2020, The Global Risks Report 2020.
37 FAO 2019, State of the World's Biodiversity for Food and Agriculture.

Conceived for farms and farmers, agritourism has grown to include more than 20,000 enterprises and has played a key role in preserving historic farm buildings and sustaining traditional and organic agriculture, particularly in marginal areas. Many agritourism farms are located in hilly and mountainous regions where intensive, mechanised agriculture is not viable. Instead, this model supports small-scale, environmentally integrated farming systems, closely connected to surrounding forests and landscapes.

More broadly, beyond environmental benefits for biodiversity, water and soil, the transition to eco-friendly agriculture can help address broader socio-economic challenges by integrating the human dimension, notably through improvements in public health and the revitalisation of rural areas.

Proactive communication of these overall benefits, clearly presenting the tangible advantages for public health, the environment, and future generations - alongside robust, science-based awareness campaigns on the risks posed by harmful substances - can build strong public backing for the NRR and reinforce trust in institutional decision-making.

Beyond their crucial role in restoring biodiversity, reducing the use of hazardous pesticides and promoting more nature-friendly agricultural practices would generate a wide range of positive socio-economic effects. These include improved human health, lower levels of water and soil pollution, increased food safety and more nutritious food, and increased employment opportunities in rural areas. Such benefits should be duly recognised, assessed, quantified and communicated, and actively supported through the NRPs and aligned policy frameworks.

Considerations of climate change scenarios and the potential of restoration measures to minimise its impacts and support adaptation
With relevance to 4.2.1 “**Consideration of climate change scenarios for the planning of the type and location of restoration measures**” (Art.15(3)(t)(i)) and 4.2.4.“**Consideration of the potential of restoration measures to minimise climate change impacts on nature, to prevent or mitigate the effects of natural disasters and to support adaptation**” (Art.15(3)(t)(ii)).

By restoring degraded land through targeted agricultural practices that enhance carbon sequestration in soils, by increasing habitat heterogeneity in agricultural areas, and by strengthening the resilience and abundance of organisms that provide essential ecosystem services, a widespread transition to more sustainable agricultural practices will contribute to mitigating climate change impacts-particularly, though not exclusively, in food production-while also facilitating climate adaptation.

Consideration of key EU policies
With relevance to 4.2.7. "**Consideration of key EU and national policies with relevance to biodiversity taken into account**" (Art.14(14))

The recommended measures are fully in line with the Integration Principle, as embodied in art. 11 of the TFEU, requiring that environmental protection requirements be integrated into the definition and implementation of the Union's policies and activities, in particular with a view to promoting sustainable development. Reducing the use of - and dependency on - chemical pesticides in order to build a more sustainable and healthy food system generates cross-cutting, overarching impacts and co-benefits across several EU legislative instruments and action plans, both within and beyond the scope of the European Green Deal. These include, inter alia:

- The Zero Pollution Action Plan and its specific objective of improving soil quality by reducing nutrient losses and cutting the use of chemical pesticides by 50%
- The EU Biodiversity Strategy for 2030, which highlights that achieving the targets of reducing pesticide use, reaching at least 25% of agricultural land under organic farming management, and significantly increasing the uptake of agroecological practices by 2030 are key to reversing biodiversity loss.
- The revised EU Pollinators Initiative, and in particular its priority II ("**Improving pollinator conservation and tackling the causes of their decline"**), which acknowledges that pesticides remain a major driver of pollinator decline and identifies measures to mitigate the impacts of pesticide use on pollinators.
- The Birds and Habitats Directives, which aim to ensure that rare and threatened species are protected from further decline and restored to a favourable conservation status across the EU. In addition to the measures established under the Natura 2000 network of protected areas, these Directives require a strict system of species protection beyond Natura 2000 sites, including safeguards against pollution and habitat deterioration (Article 4(4) of the Birds Directive).
- The EU legal framework for water protection, as established by the Water Framework Directive (2000/60/EC), which aims to ensure the protection and good quality of all waters; the Groundwater Directive (2006/118/EC), and the Environmental Quality

Standards Directive (2008/105/EC), Drinking Water Directive (EU 2020/2184), which ensures the provision of safe and potable drinking water across Member States.

- The EU Soil Strategy for 2030, which seeks to protect and restore soils by ensuring their sustainable use, together with the Soil Monitoring Law (Directive (EU) 2025/2360), which entered into force on 16 December 2025. This Directive establishes an EU-wide framework for the assessment and monitoring of soils, with the overarching objective of achieving healthy soils by 2050. The monitoring framework covers key indicators, including soil biodiversity and contamination from pollutants such as pesticides and PFAS. Given the widespread pesticide contamination of soils across the EU and its significant contribution to soil degradation, reducing pesticide use is a central component of implementing the EU Soil Strategy.

- The Carbon Removals and Carbon Farming (CRCF) Regulation (EU/2024/3012), which creates the first EU-wide voluntary framework for certifying carbon removals, carbon farming and carbon storage in products across Europe.

- The Farm to Fork Strategy, which aims to make food systems fair, healthy, and environmentally friendly, and explicitly highlights the urgent need to reduce dependency on chemical pesticides and to promote organic farming.

- The Sustainable Use Directive (2009/128/EC), which aims to achieve a sustainable use of pesticides in the EU, by reducing their risks and impacts on human health and the environment and by promoting the use of IPM and other alternative approaches or techniques, such as non-chemical alternatives to pesticides.

- Regulation (EC) No. 1107/2009, concerning the placing of pesticides on the market, which establishes a high level of protection for human health, biodiversity and ecosystems from the harmful impacts of these substances.

- The European Climate Law, which sets a legally binding target of net zero greenhouse gas (GHG) emissions by 2050. Restoring ecosystems and implementing biodiversity-friendly agricultural practices can increase carbon storage and carbon removals from the atmosphere, and support adaptation to climate change. This is acknowledged by the proposed EU-level certification framework for carbon removals and carbon farming.

At the global level, reducing the use of chemical pesticides is fully aligned with the objectives of the Kunming-Montreal Global Biodiversity Framework (in particular target 7) and the United Nations Sustainable Development Goals (SDGs), in particular SDG 2 (promoting sustainable agriculture), SDG 13 (addressing climate change and its impacts), and SDG 15 (protecting, restoring, and promoting the sustainable use of terrestrial ecosystems). Implementing these measures will therefore contribute to achieving the global restoration target and the SDGs.

Reducing dependence on chemical pesticides represents a measure that creates broad, mutually reinforcing synergies across multiple EU legislative instruments, while also supporting the EU's international environmental and sustainability commitments.

Interplay with the national common agricultural policy (CAP) strategic plan
With relevance to 4.2.8. "**Overview of the interplay with the national common agricultural policy (CAP) strategic plan**" (Art.15(5))

Several core objectives of the Common Agricultural Policy (CAP) are closely aligned with the aims of the NRR, notably climate action in agriculture, environmentally sustainable farming practices, and the protection of landscapes and biodiversity.

Crucially, the transition to environmentally sustainable farming practices, including the progressive phase-out of harmful pesticides, is an essential prerequisite for the successful implementation of the NRR. In this context, the CAP must play a central role, by delivering targeted financial and technical support for nature-friendly farming. This support should encompass payments for ecosystem services and public goods, investment support, insurance schemes, and independent advisory services.

The 2023-2027 eco-schemes - designed to compensate farmers for additional costs or income foregone - offer a key instrument to support this transition. In addition, GAEC Standard 8 requires a minimum share of arable land to be dedicated to non-productive areas or landscape features, such as fallow land, hedgerows, or trees. This requirement supports the maintenance of high-diversity landscape features and directly contributes to the objectives of the NRR.

The CAP provides a strategic opportunity to better align agricultural subsidies with the objectives and implementation of NRPs. To guarantee effective and harmonised measures, avoiding counterproductive effects and the dispersal of resources, CAP subsidies should be fully aligned with the objectives of the NRR.

Existing agricultural and forestry practices that contribute to the restoration objectives
With relevance to 4.2.9. "**Identification of existing agricultural and forestry practices, including CAP interventions, that contribute to the restoration objectives**" (Art.14(10)and 15(5))

A range of existing agricultural and forestry practices contribute to restoration objectives, particularly those that rely on alternatives to chemical pesticides, such as organic farming, agroecology, conservation agriculture and agroforestry systems[38]. In addition, the effective implementation of IPM, combined with crop rotation, reduced tillage, low-intensity permanent grasslands, and maintaining high-diversity landscape features on agricultural land, can significantly support restoration efforts.

A systematic review of 331 studies on the impact of alternative agricultural practices on biodiversity found that, while no single practice benefits all taxonomic groups, practices that avoid pesticides - as well as those incorporating biodiversity-enhancing interventions within or around fields - consistently produced positive outcomes for overall biodiversity[39].

Examples of innovative agricultural policy schemes with intended support for biodiversity in the national CAP strategic plans are listed by EEA in its Briefing no. 13/2024 ("Solutions for restoring Europe's agricultural ecosystems")[40].

Harmful subsidies
With relevance to 4.3.2. "**Subsidies that negatively affect the meeting of the targets and the fulfilment of the obligations set out in the Regulation**" (Art.15(3)(v))

Agriculture is a major driver of the different environmental crises, yet it is also heavily impacted by them. Agricultural subsidies need to be urgently linked to environmental objectives. Currently, most subsidies don't contribute to these goals, but rather exacerbate environmental crises and associated impacts on society and farmers. In 2021, the European Court of Auditors found that "*the €100 billion of CAP funds attributed to climate action had little impact on such emissions, which have not changed significantly since 2010. The CAP mostly finances measures with a low potential to mitigate climate change. The CAP does not seek to limit or reduce*

[38] Liu et al. 2016.
[39] Cozim-Melges et al. 2024.
[40] EEA 2024, Solutions for restoring Europe's agricultural ecosystems

livestock (50 % of agriculture emissions) and supports farmers who cultivate drained peatlands (20 % of emissions)"[41].

Crucially, the CAP should not subsidise pesticide-intensive agriculture: instead, it should redirect subsidies towards practices that are phasing out, or have already phased out, harmful pesticides. Transition payments should be conditional on measurable reductions in pesticide use and toxicity, based on robust science- and performance-based indicators. The CAP performance framework should therefore include the indicators set out in the NRR (e.g. Farmland Bird Index, Common Bird Index, Grassland Butterfly Index, share of agricultural land with high-diversity landscape features, and pollinator indicators)[42].

The EU has formally committed to phasing out environmentally harmful subsidies and has acknowledged the need for structural readjustments[43]. In line with the 8th Environment Action Programme, as established by Decision (EU) 2022/591, and with recital 85 of the NRR, Member States should now take decisive action to rapidly eliminate harmful subsidies in order to safeguard the effectiveness of nature restoration efforts.

To ensure the credibility and effectiveness of nature restoration efforts, avoid counterproductive incentives, and prevent inefficient use of public funds, CAP subsidies must be fully aligned with the objectives of the NRR.

Ensuring the continuous, long-term and sustained effects of the restoration measures

With relevance to 5.4. "**Indications on the provisions for ensuring the continuous, long-term and sustained effects of the restoration measures**" (Art.15(3)(q))

Promoting and ensuring a transition toward environmentally sustainable farming practices and a phase-out of harmful pesticides will ensure the long-term effectiveness of restoration measures aimed at reversing biodiversity decline. Reducing pesticide input will generate perennial beneficial effects on biodiversity in croplands, grassland and other pastoral habitats, while also supporting conservation measures in forests and protected areas, which are also affected by pesticide contamination.

[41] ECA, Special Report 16/2021.
[42] PAN Europe, 2025: CAP post 2027 - an opportunity to answer citizens' demands and support farming beyond pesticides.
[43] EC, Phasing out environmentally harmful subsidies.

Moreover, reducing agrochemical pollution will lead to sustained improvements in water and soil quality, strengthening ecosystem resilience and enhancing the overall health of rural landscapes.

B. Cost-effective measures to restore nature by reducing pesticide impacts

With relevance to **Part B** (National approach to meeting restoration targets and fulfilling obligations, by article) and **Part C** (Measures) of the NRPs

Long-term ecosystem recovery and functional restoration, as required by the NRR, demand measures that directly address pesticide pressure. **Phasing out harmful pesticides is a proven and effective lever to restore biodiversity, rebuild ecological interactions, and protect human health, while strengthening the resilience and sustainability of food systems.**

Pesticide reduction has been demonstrated to be an effective and economical approach to fostering ecosystem recovery, while simultaneously contributing to a range of European Union policy objectives. The recommendations set out in this document should be regarded as an initial framework, intended to be tailored and implemented according to national and local circumstances.

The central aim of the NRR is the *"long-term and sustained recovery of biodiverse and resilient ecosystems across the Member States' land and sea areas through the restoration of degraded ecosystems"* (art.1(1)(a). Ecosystems are described as "*a dynamic complex of plant, animal, fungi and microorganism communities and their non-living environment, interacting as a functional unit [...]*" (art. 3(1)). In parallel, restoration is defined in the NRR as "*the process of actively or passively assisting the recovery of an ecosystem in order to improve its structure and functions, with the aim of conserving or enhancing biodiversity and ecosystem resilience"* (art. 3(3)).

Meeting the requirements for long-term, sustained recovery and proper ecosystem functioning calls for measures consistent with this framework. Lowering the use of harmful pesticides supports ecosystem recovery across all landscapes, particularly in regions that have suffered the greatest biodiversity loss, thereby advancing sustainability. This approach facilitates the re-establishment of dynamic ecological interactions and species that underpin food webs, ecosystem complexity, and overall functionality.

We therefore recommend that NRPs explicitly integrate pesticide reduction targets within a broader transition to sustainable agricultural practices, as a necessary and overarching approach to achieve the objectives of the NRR, notably under Articles 4, 8, 10 and 11.

Restoration of terrestrial, coastal and freshwater ecosystems
With relevance to 6.1.1.1. "**Descriptive overview of the Member State's approach to meeting restoration targets and fulfilling obligations for terrestrial, coastal and freshwater ecosystems, based on latest scientific evidence**" (Art.15(3)(c))

The NRR characterises habitats in "*good condition*" as being in "*a state where the key characteristics of the habitat type, in particular its structure, functions and typical species or typical species composition reflect the high level of ecological integrity, stability and resilience necessary to ensure its long-term maintenance*" (art. 3(4)). Achieving this objective of ecological integrity could be feasible in many national contexts, provided that a meaningful reduction in harmful pesticide use is ensured.

Reducing pesticide use would improve water and soil quality, which are currently heavily contaminated by these substances. Between 2013 and 2023, one or more pesticides were detected above their effect threshold in 19% to 27% of river water bodies. Exceedances of one or more pesticides were also detected in between 11% and 18% of groundwater bodies[44]. This contamination degrades water quality and reduces the supply of clean water for potable use, while also heavily affecting aquatic biodiversity[45].

The Sustainable Use of Pesticides Directive (SUD) requires Member States to ensure appropriate measures are taken to protect the aquatic environment and drinking water supplies from pesticides. The obligations include giving preference to pesticides not classified as dangerous for the aquatic environment, and establishing pesticide-free buffer and safeguard zones for aquatic organisms and drinking water (SUD, art. 11). Ensuring robust implementation of these requirements is also key to meeting the objectives of the NRR.

Monitoring studies of soils in Europe have confirmed that pesticide contamination occurs widely. The 2018 EU LUCAS survey detected pesticide residues in 74.5% of the 3,473 sites investigated; most samples (57.1%) had at least two different pesticide residues, 29.8% had more than five, and 11.1% had more than ten[46].

A major French study carried out with the support of the RMQS (Soil Quality Monitoring Network) illustrates the scale and the impacts of the problem. Pesticide residues were detected at 98% of sampled sites, with 67 distinct substances identified, predominantly fungicides and herbicides. Arable land was the most heavily contaminated, with up to 33 different molecules found at a single site and an average of 15 per soil sample. Notably, more than 32 different

[44] European Environment Agency 2025, Pesticides in rivers, lakes and groundwater in Europe.
[45] Liess et al., 2021.
[46] European Environment Agency 2025, Pesticides residues in EU soils.

pesticides were also detected in soils under forests, permanent grasslands, uncultivated areas and even long-established organic farms, albeit generally at lower concentrations than in conventionally farmed fields. Risk assessment of the detected pesticide concentrations underlined a moderate to high risk for soil organisms (earthworms) in all cultivated plots. Grasslands are also contaminated by the carry-over of pesticides and hazardous biocides used on cattle, impacting in-soil organisms and arthropods and, consequently, meadow birds.

Fostering sustainable agricultural practices that meaningfully curtail pesticide use - including hazardous biocides in livestock rearing - is indispensable not only to halting biodiversity decline, but equally to safeguarding and restoring water quality and soil health. Such measures directly support the overarching objectives of the NRR and its long-term, functionally integrated approach.

Restoration of urban ecosystems
With relevance to 8.1.1.1. "**National approach to meeting restoration targets and fulfilling obligations for urban ecosystems, based on latest scientific evidence**" (Art.15(3)(c))

In addition to the critical role that reducing pesticide use plays in achieving the objectives of Articles 10 and 11, restricting these substances can also deliver direct and significant benefits for other targets of the NRR, particularly the restoration of urban ecosystems.

The use of pesticides beyond low-risk and biological control measures should be prohibited in urban green spaces, and overall in areas used by the general public or by vulnerable groups. These areas include, for example, public parks and gardens, playgrounds, school grounds, recreational and sports facilities (Directive (EC) 128/2009, art. 12(a)). Such measures would help to reach the objectives of Article 8 by supporting the recovery of pollinator populations in urban environments directly, while simultaneously safeguarding human health - especially that of children and other vulnerable groups.

Several European countries and cities provide compelling evidence of the feasibility and benefits of pesticide-free urban management. Paris has progressively reduced pesticide use since the 1990s and has been entirely pesticide-free for several years. Since 2017, the use of pesticides has been banned in all towns and cities in France, followed by a ban in private gardens in 2019. Similar policies have been implemented nationwide in Denmark, Belgium, the Netherlands, Sweden and Luxembourg. These transitions have resulted in greener, healthier urban spaces that are not overrun by weeds and are increasingly recolonised by pollinators. For example, standardised surveys conducted in Paris after the prohibition of synthetic pesticides documented

118 species of wild bees and 37 species of hoverflies, including several species previously unrecorded in the city, updating pre-existing lists with 32 additional species[47]. These data clearly indicate that ecologically managed green spaces can effectively promote insect biodiversity.

A wide range of effective non-chemical alternatives to pesticides is already available, and the example of Paris and hundreds of other cities worldwide demonstrates that pesticide-free urban management is both technically feasible and environmentally beneficial.

Reversing pollinator decline
With relevance to 10.1.1.1. "**National approach to meeting restoration targets and fulfilling obligations for pollinator diversity and populations, based on latest scientific evidence**" (Art.10)

The scientific literature on pollinator decline is unequivocal in concluding that reducing pesticide use is a prerequisite for reversing current trends[48]. Extensive evidence demonstrates that many pesticides adversely affect pollinators and other beneficial insects both directly - through lethal and sublethal effects that impair reproduction[49], navigation, learning performance, foraging behaviour and physiology[50] - and indirectly, by eliminating essential floral resources[51]. Pesticide exposure also amplifies the effects of other major stressors, including habitat loss, pathogens, and disease, thereby accelerating population declines[52].

Together with honey bees, wild pollinators are indispensable to both ecosystem resilience and agricultural productivity. In natural ecosystems, reproductive success in natural plant communities is positively correlated with pollinator functional diversity[53]. Importantly, pollinator diversity also enhances pollination services under environmental and climatic perturbations[54]. In agricultural systems, diverse pollinator communities enhance both the quantity and quality of crop yields[55]. Conservation strategies must therefore explicitly include wild pollinator populations in farmland.

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47 Zaninotto & Dajoz 2022.
48 See note 3; see also Nicholson et al. 2024 ; Knauer et al. 2026.
49 Sandrock et al. 2014; Woodcock et al. 2017; Baron et al. 2017; Siviter et al. 2018; Milone & Tarpy 2021; Kozii et al. 2021.
50 Desneux et al. 2007; Schneider et al. 2012; Henry et al. 2012; Pisa et al. 2014; Fisher et al. 2014; Motta et al. 2018; Smith et al. 2020; Siviter et al. 2021; Liu et al. 2023; Lisi et al. 2024; Bartling et al. 2024.
51 Bretagnolle & Gaba 2015; Sanchez-Bayo 2021.
52 Goulson et al. 2015.
53 Albrecht et al. 2012; Fründ et al. 2013.
54 Bartolomeus et al. 2013; Brittain et al. 2013; Senapathi et al. 2021; Katumo et al. 2022.
55 Garibaldi et al. 2013; Garratt et al. 2013; Bartolomeus et al. 2014; Woodcock et al. 2019; Katumo et al. 2022.

These strategies would also deliver direct, tangible benefits to honey bees, with significant positive implications for beekeeping. Reducing exposure to harmful pesticides would improve colony health, survival, and productivity, thereby addressing a major constraint faced by beekeepers, while increasing the EU's honey self-sufficiency. Too often, beekeeping activities are undermined by pesticide-related mortality and sublethal effects that weaken colonies and increase management costs.

Pollinators in non-agricultural landscapes will also benefit from measures reducing pesticide use, as evidence shows that entomofauna in protected areas can be equally contaminated by complex pesticide mixtures[56]. For example, a study conducted in Germany detected residues of 47 commonly used pesticides in insects collected from nature conservation areas, with individual samples containing an average of 16.7 different pesticide compounds[57].

Reversing current trends requires a coordinated set of measures, including the progressive reduction and replacement of harmful pesticides with nature-based alternatives, the promotion of organic farming, increased landscape heterogeneity in agricultural areas, and the proactive prohibition of pesticide use in protected areas - such as Natura 2000 sites - and other ecologically sensitive habitats critical to threatened pollinators, as established by the SUD (art. 12(b)). Also, in areas surrounding these habitats, pesticide use should be prohibited or strictly limited to natural, low-risk substances, with an effective buffer zone established to ensure untreated or minimally treated adjacent crops.

Successful integration of pollinator protection into farming practices also depends on adequately supporting farmers through targeted financial incentives and specialised training. Farmers should be actively engaged in incorporating pollinator considerations at every stage of their work. To this end, establishing a network of independent pollination advisers to support the adoption of pollinator-friendly practices is essential.

Innovative tools such as the yield-based "realised pollination index" (RPI) could also be integrated into this approach. This tool captures variation in pollination services across landscapes, including the spatial arrangement of semi-natural elements and cultivated fields, and more local effects of pesticide use. By enabling automated, large-scale pollination monitoring, the RPI could provide farmers and policymakers with a practical, evidence-based tool to design biodiversity-friendly agricultural landscapes that deliver ecosystem services efficiently[58].

To restore pollinator populations effectively, one of the principal drivers of their decline must be decisively addressed: exposure to harmful pesticides. This calls for a coherent and

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56 Insect decline and pesticide contamination in nature conservation areas.
57 Brühl et al. 2021.
58 Gandara et al. 2025.

ambitious policy response, including the progressive reduction and replacement of hazardous substances, the expansion of pollinator-friendly farming practices, increased landscape diversity in agricultural areas, and a strict prohibition of pesticide use in protected areas.

Restoration of agricultural ecosystems
With relevance to 11.1.1.1. "**National approach to meeting restoration targets and fulfilling obligations for agricultural ecosystems, based on latest scientific evidence**" (Art.15(3)(c))

Article 11 (point 2) of the NRR directs Member States to put in place restoration measures to enhance biodiversity in agricultural ecosystems by achieving an increasing trend on at least two out of the three following indicators: the grassland butterfly index, the stock of organic carbon in cropland mineral soils, and the share of agricultural land with high-diversity landscape features (Annex IV). It also requires Member States to put in place measures to achieve a measured increase in common farmland bird index at national level, based on the species listed in Annex V and indexed in September 2025 at 100 (point 3).

The largest empirical dataset ever assembled in Europe to assess the effects of anthropogenic pressures on avian populations - encompassing 170 common bird species monitored across more than 20,000 sites in 28 European countries - demonstrates a dramatic decline of approximately 60% in farmland bird populations over the past 37 years. The evidence is unequivocal. Among the various anthropogenic drivers examined in this study, agricultural intensification - and specifically the widespread use of synthetic pesticides and fertilisers - emerges as the principal determinant of these declines[59]. The impact is particularly severe for insectivorous species, whose decline matches the documented depletion of invertebrate prey.

These findings establish a clear causal link between chemical-intensive agricultural practices and biodiversity loss. Consequently, achieving the objectives set out in Article 11 necessitates a substantial and measurable reduction in the use of chemical pesticides. A decisive transition towards environmentally sustainable agricultural systems, coupled with the progressive phasing out of harmful agrochemicals, is indispensable to secure the long-term effectiveness and ecological integrity of restoration measures.

A range of established agricultural and forestry practices can substantially contribute to ecosystem restoration. These include organic farming, agroecology, and agroforestry systems. In addition, the effective implementation of IPM, in compliance with the SUD, combined with crop

[59] Rigal et al. 2023.

rotation, reduced or no-tillage, low-intensity permanent grasslands, and the preservation of high-diversity landscape features, has proven effective in enhancing ecosystem restoration across agricultural landscapes. Scientific evidence and farmers' experience across Europe demonstrate that harmful pesticide use can be markedly reduced, while maintaining yields and farm profitability, through the implementation of IPM[60]. By prioritising prevention and soil health, IPM strengthens resilience to pests and to extreme weather events and supports natural pest regulation, pollination, soil fertility, and water quality.

IPM has been mandatory since 2014 under SUD (Articles 3 and 14, and Annex III). SUD prioritises pest management practices that pose the lowest risk to human health and the environment and cause minimal disruption to agro-ecosystems, with a strong emphasis on non-chemical methods and natural pest control mechanisms. The first principle of IPM explicitly prioritises prevention, including crop rotation, the use of cover crops, and the protection and enhancement of beneficial organisms (natural enemies), for example through the deployment of ecological infrastructures (SUD, Annex III).

Despite this legal obligation, IPM remains inadequately implemented across the European Union. Its long-overdue and effective enforcement, in full compliance with SUD, combined with complementary practices such as diversified crop rotations, reduced or no tillage, low-intensity permanent grasslands, and the ambitious expansion and preservation of high-diversity landscape features, is essential to achieving ecosystem restoration across agricultural landscapes.

In addition, Member States should establish independent IPM advisory services, as required under both the SUD and the CAP, and ensure that these services are widely accessible to farmers in order to provide tailored support for the phasing out of harmful pesticides. In parallel, Member States should develop crop-specific guidelines that clearly identify and prioritise effective non-chemical alternatives to pesticide use for each crop type, adapted to local pedo-climatic conditions, as required by the SUD.

These measures should be further reinforced by mandatory record-keeping requirements for farmers and other professional pesticide users. Although the recording of pesticide use has been mandatory under Regulation (EC) No 1107/2009, the obligation to maintain pesticide use records in electronic form will apply from 2027 onwards[61]. The availability of coherent, digital pesticide-use data will be essential for effective - also spatially explicit - monitoring of pesticide use and associated risks, and for informing targeted policy and management actions at local and regional levels.

[60] See note 17.
[61] See PAN Europe, 2024.

The benefits of reducing or phasing out pesticides in agriculture and forestry extend beyond biodiversity. Such practices also help counter pesticide resistance, pest resurgence, and outbreak dynamics. Resistance develops as pest populations evolve mechanisms to neutralise chemical treatments - including reduced uptake, enhanced detoxification, or diminished sensitivity at target sites[62]. Meanwhile, broad-spectrum pesticides frequently eliminate natural enemies, undermining biological control and triggering pest resurgence[63]. The loss of these beneficial organisms can further destabilise ecosystems, allowing previously minor species to reach pest status through reduced predation and competition[64]. Effective IPM implementation therefore offers a dual dividend: protecting biodiversity while curbing the chemical dependency that resistance itself drives.

Promoting environmentally-friendly farming practices is indispensable to the restoration of agricultural ecosystems. It would also directly support the objectives of land degradation neutrality and climate change mitigation. The widespread adoption of these practices, alongside the minimisation and progressive phasing out of harmful pesticides, would simultaneously restore biodiversity, protect soil and water quality, enhance carbon sequestration, and scale up nature-based solutions.

Conclusion

Chemical pesticides jeopardise human health, erode biodiversity, and contaminate ecosystems far beyond the fields where they are applied. Reducing their use is therefore not merely an environmental choice, but an indispensable condition for nature's recovery and for the protection of the life-support systems on which our societies depend.

An approach to nature restoration grounded in more sustainable agricultural practices and aimed at re-establishing agroecological balance across multiple regions would advance several objectives of the NRR (in particular art. 4, art. 8, art. 10, art. 11), while fostering synergies with broader EU environmental goals and integrating the human dimension, including efforts to improve human health and address rural depopulation.

We therefore strongly recommend that NRPs explicitly incorporate robust measures to reduce pesticide use and enable the transition to sustainable agricultural systems. Such measures would build a resilient and future-proof food system, enhance food safety and nutritional quality, mitigate the ongoing contamination of soils and waters, protect biodiversity, and safeguard human health, while directly advancing the core objective of the NRR: long-term, functional

[62] Hoy 1998.
[63] Hill et al. 2017.
[64] Van Driesche et al. 2008; Janssen & Van Rijn 2021; Agathokleous et al. 2023.

ecosystem recovery. These co-benefits should be fully recognised, systematically assessed, and actively supported through ambitious NRPs and coherent, aligned policy frameworks.

Finally, we urge competent authorities to heed the clear and consistent call of millions of European citizens for a drastic reduction in chemical pesticide use. The NRR offers a unique opportunity to drive a much-needed structural change in order to restore nature, protect public health, and secure a toxic-free future for generations to come.

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