

POLLINATOR CONTRIBUTIONS TO SYSTEM RESILIENCE: IMPLICATIONS FOR ENVIRONMENT, ECONOMIES, AGRI-FOOD SYSTEMS, AND HUMAN HEALTH

FACTSHEET

KEY MESSAGES

- Pollinators are essential to the resilience of agrifood, ecological, health and wider economic systems.
- Supporting pollinators is a resilience strategy, relevant across multiple sectors. Maintaining and restoring pollinator populations and pollination services offers opportunities to advance food security, sustainable land management and land degradation neutrality, climate adaptation, and biodiversity management and recovery while reducing supply chain vulnerabilities.
- The loss of pollinators and pollination services threatens multiple systems and sectors, including agri-food systems and wild ecosystems as well as health and trade sectors, among others.
- Pollinator decline and disrupted pollination services can pose interconnected risks across supply chains and to food and nutritional security.
- These risks can be mitigated through effective governance, regulations and policies that strengthen land management, reduce risks from pesticide use, restore habitat, and promote pollinator-friendly practices which in turn lead to improved trade and supply chains.



WHAT IS AT STAKE?

Simulations of global pollinator collapse forecast:

- A rise in crop prices by 30% → leading to a global welfare loss of USD 729 billion, or 0.9% of global GDP¹
- A loss of 15.6% of global agricultural production value used for human food → declines in food production and micronutrient availability such as an 8% reduction in global vitamin A availability¹

The actual damage to economies and ecosystem services could be much greater if the consequences from greater reliance on processed food and human health impacts were taken into account.



LINKS BETWEEN POLLINATORS AND RESILIENCE

Pollinators are fundamental to functioning ecosystems.

Pollination is an ecosystem service that enables reproduction in around 90% of flowering plants, supporting agricultural, urban and natural ecosystems^{2,3}. Wild and managed pollinators (Box 1) contribute to biodiversity, crop production (yield, quality and stability)⁴⁻⁹, and the livelihoods, culture and wellbeing of people who depend on and benefit from resilient agri-food systems and healthy landscapes¹⁰.

The loss of pollinators and pollination services is a risk to which multiple systems are exposed.

System resilience to these threats matters in many policy contexts (Box 2). From an economic perspective, system resilience involves the capacity of farms, value chains and economies to absorb and adapt to climate change and market shocks while maintaining productivity, income stability and functional supply systems. Pollination services contribute directly to this economic resilience by enhancing agri-food production stability, reducing dependence on external inputs and supporting the continuity of pollinator-dependent markets.¹¹ This resilience reaches beyond the farm: Governments are making explicit links between natural resources and security, underpinned by resources such as the [Ecological Threat Report](#)¹².

The resilience of ecosystems, agri-food systems and their outcomes such as diverse international trade, livelihoods and economic growth, food security, and human health depends on the presence of healthy pollinator populations and/or sustainable pollination services. In turn, actions addressing biodiversity loss, land use changes including habitat fragmentation and degradation, pollution and chemical exposure, biodiversity loss and climate change may positively influence the resilience of pollination services and the populations of wild pollinators¹³⁻¹⁴. Given projected biodiversity decline, the rising agricultural demand for sustained pollination services, and growing impacts from climate shocks and conflicts, early action may help to avoid disproportionate future impacts. However, the evidence base for how early response to pollinator declines can mitigate impacts is only emerging.

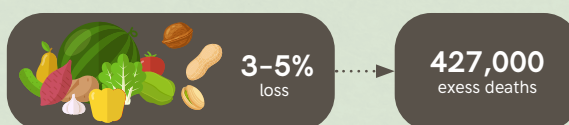
Policy development tends to view pollinators mainly through a biodiversity lens, rather than as a natural asset within a wider resilience agenda across sectors. This fact sheet identifies practical entry points for integrating considerations of pollinators and the conservation of pollination services into existing policy and planning processes beyond biodiversity and agriculture.

BOX 1

WILD AND MANAGED POLLINATORS

Managed pollinators (such as honeybees and commercially reared bumblebees) are distinct from wild pollinators, which include diverse bees, flies, butterflies, moths, beetles, birds, bats and other animals. All contribute to pollination, and wild pollinators often provide substantial and complementary services that managed species cannot fully replace.¹⁰ Wild pollinators are essential for the survival of endemic local plant species and the maintenance of their genetic diversity.¹⁰

However, despite broad understanding that “a diverse pollinator community generally provides more effective and stable pollination than any single species” (IPBES 2016)¹⁰, the numbers of wild pollinators are declining while the numbers of managed pollinators continue to increase. Nevertheless, managed pollinators suffer from parasites, diseases, and a lack of food from floral resources, raising management costs. Pollination services are becoming an acknowledged commercial farm input that is under threat.



Based on a 2022 study, 3% to 5% of global fruit, vegetable, and nut production is lost due to inadequate pollination, leading to an estimated 427,000 excess human deaths globally each year from lost healthy food consumption and associated diseases¹⁵.



Lost food production was concentrated in lower-income countries, whereas impacts on food consumption and mortality attributable to insufficient pollination were greater in middle- and high-income countries. In three case-study countries of Honduras, Nepal and Nigeria, the economic value of crop production was calculated to be 12% to 31% lower than if pollinators were abundant (due to crop production losses of 3% to 19%)¹⁵.

WHAT DOES 'RESILIENCE' MEAN ACROSS POLICY CONTEXTS?

BOX 2

Convention on Biological Diversity (CBD)

"The capacity of a system to absorb disturbance and reorganise while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks (Walker et al., 2004)." (CBD/WG2020/5/4)

Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)

"The level of disturbance that an ecosystem or society can undergo without crossing a threshold to a situation with different structure or outputs. Resilience depends on factors such as ecological dynamics as well as the organisational and institutional capacity to un-

derstand, manage, and respond to these dynamics." (<https://www.ipbes.net/glossary-tag/resilience>)

United Nations Food and Agriculture Organization (FAO)

"Resilience is the ability to prevent disasters and crises, and to anticipate, absorb, accommodate or recover from them in a timely, efficient and sustainable manner. This includes protecting, restoring and improving food and agricultural systems under threats that impact food and nutrition security, agriculture, and/or food safety/public health." (<http://www.fao.org/docrep/015/i2540e/i2540e00>)

See the accompanying webpage for additional definitions.

POLLINATORS SUPPORT SYSTEM RESILIENCE ACROSS INTERCONNECTED POLICY PRIORITIES

In **ecosystems**, diverse pollinator populations maintain biodiversity, ecological interactions, and regenerative capacity, strengthening the long-term resilience of ecosystem functions and services.¹⁰

Pollinators are essential **for biodiversity conservation and restoration**, for the diversity of pollinators themselves and particularly for the many plant species whose survival depends on pollination and which in turn support countless other species. In a case study on pollinator restoration nearby coffee production, restoring pollination services was linked to an increase, up to double, of agricultural profits, even accounting for the lost production on restored lands²⁸.



Coffee *Coffea arabica* can self-pollinate, but pollination can increase yields by 10% to 30%.¹⁶⁻¹⁸

In **agri-food systems**, pollinators sustain crop yields, quality, diversity and stability, underpinning food and nutrition security as well as livelihoods and income: 75% of the leading food crops and 35% of crop production volume depend on pollinators¹⁹⁻²³. Smallholder and rural farming systems are particularly sensitive to declines in pollinator communities²⁴⁻²⁶.

Stable pollination services underpin **stable economic systems**, particularly in the context of international trade of nature-derived products including agri-food products²⁷. An economic modelling approach found that large, developed economies were estimated to suffer

the greatest economic losses from reduced pollination services, even if the modelled pollinator declines were only applied to smaller, less-developed economies²⁸.

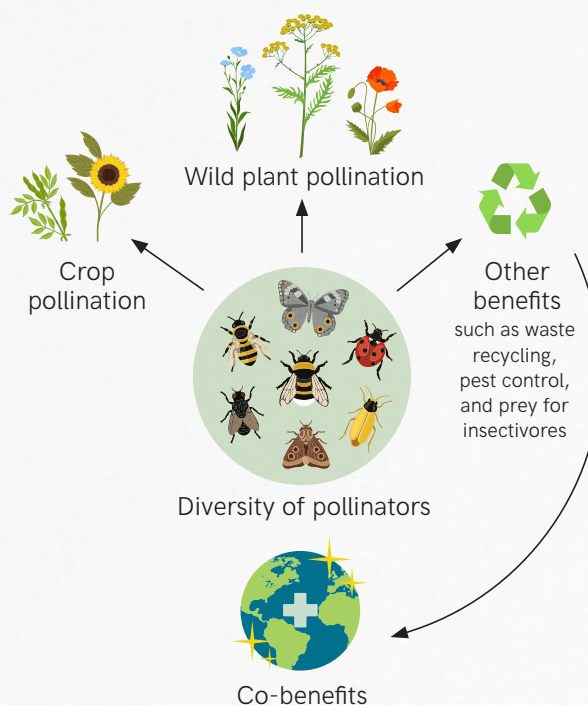
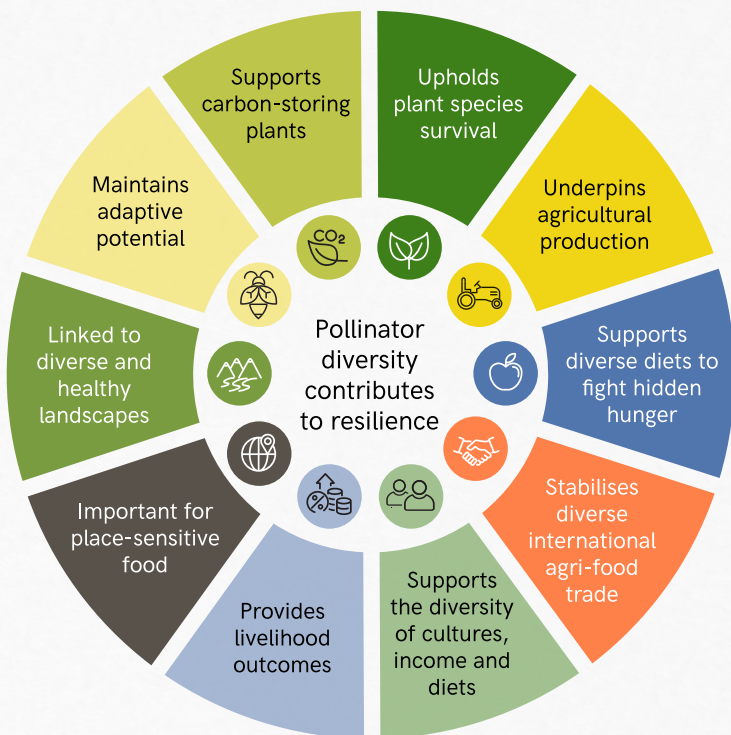
Many pollinator-dependent crops provide essential micronutrients, linking pollination directly to **human health**¹⁹. Human health is also reliant on the quality and availability of agri-food resources, including traditional and local wild and farmed crops^{21,22,29}. Human well-being benefits from diverse pollinator communities and the diverse, locally unique ecosystems that depend on them²⁹.



Many berries, a rich source of vitamins, depend on wild flies for pollination, exemplifying the links between health, wellbeing and culture.^{34, 35}

Land use practices influence pollinator health and survival while also benefiting from available and diverse pollination services^{23,25,26}. Landscape choices that benefit pollinators and their habitats can also contribute to land degradation neutrality. Through their burrowing activity, some pollinators help improve soil health, but they are also very vulnerable to stresses from land uses that degrade soil health^{30,31}.

Climate change mitigation can be positively influenced by pollination services, particularly through tree reproduction and forest longevity³². Although case studies demonstrate positive uses of pollinators such as honeybees in climate **adaptation** efforts³³, many of the interlinkages between climate change adaptation and pollinators remain a research gap.



such as climate regulation, human health and wellbeing, landscape and culture, stable soil, reduced flood risk

OPTIONS FOR ACTION

The summary for policymakers of the IPBES Assessment Report on Pollinators, Pollination and Food Production¹⁰ sets out a range of strategic responses to risks and opportunities associated with pollinators and pollination. More recent work has strengthened and built upon this foundation, which remains relevant.

A set of complementary approaches can support pollinators and thereby their contributions to broader system resilience, including:

- Aligning actions with existing biodiversity, climate, land and chemical-related commitments and efforts towards the Sustainable Development Goals⁴⁰ to enhance policy coherence and support coordinated action
- Strengthening landscape management and restoration to maintain pollinator habitats and their connectivity, which then feedback to strengthen those very landscapes⁴¹

- Reducing risks and pressures from pesticide use and unsustainable land-use practices through improved management and technology approaches⁴²⁻⁴⁵
- Considering supply chain and trade dynamics to avoid compounding or displacing among regions the pressures impacting pollinators
- Integrating pollinators into agri-food and land-use planning to support productivity, nutrition and resilience⁴⁵
- Enabling private sector engagement through supportive policy frameworks and incentives

These options highlight possible entry points, among others, to maximise the contributions pollinators make to system resilience across sectors, recognising that implementation will depend on national contexts and capacities. Implementing these actions may require investment in cross-sector coordination, data and capacity building and may deliver long-term benefits by reducing systemic risks and enhancing the adaptive capacity of wild pollinator populations.

This fact sheet was developed based on a review of global assessments and scientific literature on pollination and ecosystem services, including work by IPBES, FAO and other international organisations.

For further information, please see <https://agri4pol.eu/contact>



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