EUROPEAN
COMMISSION

Brussels, 4.6.2018
SWD(2018) 302 final

COMMISSION STAFF WORKING DOCUMENT
Accompanying the document

COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

EU Pollinators Initiative

{COM(2018) 395 final} - {SWD(2018) 303 final}

Table of contents

1. INTRODUCTION

Wild pollinators are declining in occurrence and diversity in the EU and numerous species are threatened with extinction. This is a serious cause for concern because pollinators are an integral part of healthy ecosystems. Without them, many plant species would decline and eventually disappear, along with the organisms that depend on them.

This phenomenon has attracted worldwide attention, leading to persistent calls for action. The decline of pollinators will have far-reaching consequences on terrestrial ecosystems where animal-pollinated plants play a vital role, and will lead to their collapse in the long term. This will inevitably hinder the EU's path to sustainable development and threaten human wellbeing.

The European Commission has therefore launched the first-ever comprehensive EU initiative on pollinators. The initiative will tackle the decline of pollinators through three priorities:

I. Improving knowledge on pollinator decline, its causes and consequences
II. Tackling the causes of pollinator decline
III. Raising awareness, engaging wider society and promoting collaboration

Besides addressing the problem in the EU, the initiative will also contribute towards global action on pollinators.

This document presents evidence about the decline of pollinators in the EU, its causes and consequences, and links the evidence base to the actions under the initiative. It also outlines existing measures and challenges under various EU policies that relate to the conservation of pollinators.

1.1. Pollinators

Pollinators are a functional group of animals that pollinate plants. Pollination — the transfer of pollen (male gametes) between the male and female parts of flowers — enables fertilisation and reproduction of plants. As many plants do little to no self-pollination, they rely on vectors like wind, water and animals for pollination. The vast majority of flowering plants (87.5 %) worldwide are pollinated by animals[1]. The pollinator-plant relationship is a mutualistic one. Plants provide pollinators with food resources (pollen, nectar, oils), fragrances and resins (for nest construction). In Europe, pollinators are dominated by insects, in particular bees and hoverflies.

Bees are the most prolific pollinators. There are almost 2 000 wild bee species in the EU. The most well-known bee species is the western honeybee (*Apis mellifera*), a domesticated species essential to the beekeeping sector and the production of honey and other beehive products. Besides honeybees, some bumblebee and solitary bee species are also actively managed.

Non-bee pollinators are also vitally important for plant reproduction and the functioning of ecosystems. Different species of flies dominate crop pollination in many colder and high-altitude environments[6]. The most important pollinating fly species are hoverflies. Besides providing vital pollination services, some hoverfly species are also biocontrol agents as they feed on pests. Other insect pollinators are butterflies, moths (important for night pollination), some beetles, wasps and thrips. Mammals (particularly bats), birds (e.g. hummingbirds) and lizards are important pollinators of certain flowers in subtropical and tropical environments.

[1] Ollerton, J., Winfree, R. and Tarrant, S. (2011), *How Many Flowering Plants are Pollinated by Animals?*, Oikos 120: 321-326

Such creatures are generally regarded as playing a marginal role in European environments, although they might be locally important[2].

2. POLLINATOR DECLINE

Our understanding of the status and trends of pollinators, the threats they face and the consequences of their loss has significantly improved in recent times thanks to a growing body of research. Although we do not yet have the full picture, the evidence has shown that the decline of pollinators is a serious cause for concern and primarily a consequence of human activities. While pollinators are a broad group of animals, their decline has been dominantly reported by data on bees, in particular honeybees[3,4,5].

In 2016 the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) published the first global assessment of pollinators (see Box 1).

Box 1: The IPBES report on pollinators, pollination and food production[6]

The IPBES provides governments, the private sector and society with scientifically credible and independent up-to-date assessments of available knowledge so that they can make informed decisions at local, regional, national and international levels.

The report, published in 2016, is the first-ever global report on pollinators. Experts from around the world assessed key issues facing decision makers, including the value of pollination and pollinators, status, trends and threats to pollinators and pollination. It also provides a list of strategic responses to the risks and opportunities associated with pollinators and pollination. By analysing a large body of existing evidence the report represents a major milestone in the consolidation of current knowledge on pollinators.

The Convention on Biological Diversity, to which the EU and all its Member States are a party, endorsed the report's key messages and encouraged the parties to use its recommendations for the conservation and sustainable management of pollinators[7].

The report confirmed that the pollinator decline is not limited to Europe and North America — it is a global phenomenon. While in the rest of the world data on wild pollinators are scarcer, preventing assessment of their regional status, declines in populations at local level have been recorded. National and regional assessments of wild pollinators reveal a high level of threat to insect pollinators. National Red List assessments on bees often show that more than 40 % of species are threatened with extinction. The report warned about major data gaps and called for long-term monitoring of wild pollinators in order to provide information on their status worldwide.

---

[2] Ollerton, J, (2017), *Pollinator Diversity: Distribution, Ecological Function, and Conservation*, Annual Review of Ecology, Evolution, and Systematics No 48 (1), 353-376.
[3] Brodschneider, R., *et al*., (2016), *Preliminary analysis of loss rates of honey bee colonies during winter 2015/16 from the COLOSS survey*, Journal of Apicultural Research 55: 375–378.
[4] VanEngelsdorp, D. and Meixner, M.D., (2010), *A historical review of managed honey bee populations in Europe and the United States and the factors that may affect them*, Journal of Invertebrate Pathology 103: S80–S95.
[5] Van der Zee, R., *et al*., (2012), *Managed honey bee colony losses in Canada, China, Europe, Israel and Turkey, for the winters of 2008-9 and 1009-10*, Journal of Apicultural Research and Bee World 51: 100–114.
[6] Potts, S.G., *et al*., (2016), *The Assessment Report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services on Pollinators, Pollination and Food Production*, Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, Bonn, Germany. 552 pp. https://www.ipbes.net/document-library-categories/assessment-reports-and-outputs
[7] https://www.cbd.int/doc/decisions/cop-13/cop-13-dec-15-en.pdf

2.1. Pollinator decline at EU level

While the availability of the data and information in Europe is significantly better than in most other regions of the world, the gaps are still significant. Among a number of relevant EU projects, two in particular contributed to the better understanding of the pollinator decline: ALARM and STEP (see Box 2).

Box 2: The ALARM and STEP projects

The ALARM[8] project (2004-2009) provided the groundwork for monitoring pollinators, quantifying their losses and identifying key risks. It also helped to set a broader agenda on pollinators by including work on wild species at a time when public attention was focused on the loss of honeybees (Colony Collapse Disorder). The key outputs of the project were also published in the form of an atlas[9].

The STEP[10] project (2010-2015) took over where ALARM left off. The project characterised the nature and extent of the pollinator decline, examined the relative importance of its potential drivers and their interaction, and the impacts this can have on society and mitigation options. STEP underpinned the development of the European Red List of Bees and provided a major source of evidence for the IPBES report.

The European Red List (see Box 3) is currently the key tool providing information on the status and trends of pollinators at the EU level (and in Europe as a whole). These assessments showed that around 9 % of bee and 7 % of butterfly species are threatened with extinction.

While this is already worrying, a high proportion of bee and butterfly species with a declining population indicates an even bleaker picture. A species population trend is key to assessing its Red List status. However, good population trend data are often lacking for many species and in many countries. For example, where no accurate trend data existed for butterfly species (in particular in eastern European countries), the assessors usually reported trends as stable. In countries where the trend data are better, more threatened species are reported. Furthermore, for more than half of the bee species there were not enough data to evaluate their status. The actual proportion of threatened species may therefore lie anywhere between 4 % and 60 %, depending on the status of the data-deficient species. Only 21 % of bee species have known population trends, and 37 % of those are declining.

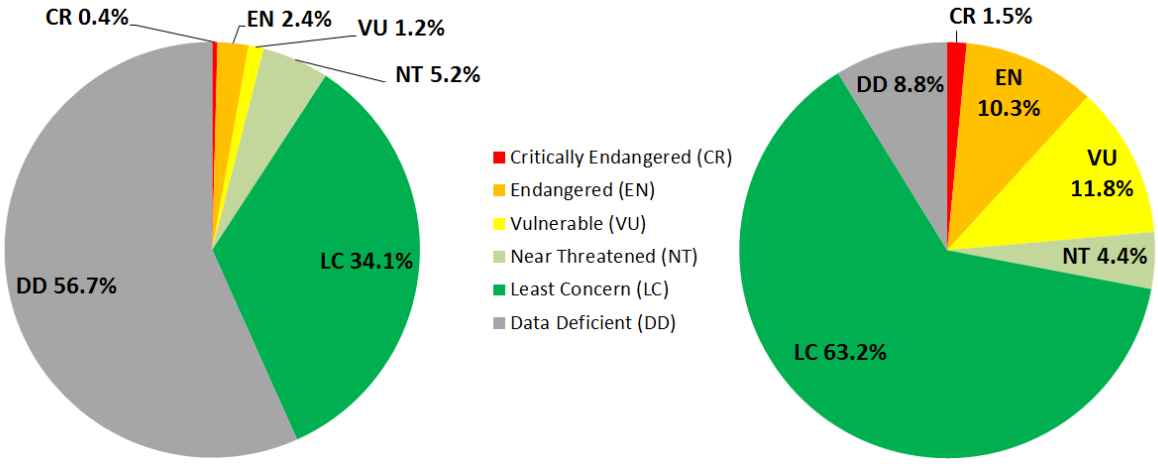
The case of bumblebees provide a good example of the importance of good data for informing us about the state of pollinators. They are the best studied group of bees, with less than 10 % of data-deficient species. Their status is considerably worse than for bees in general: almost 24 % of species are facing extinction, while more than 45 % of them have a declining population trend.

All of this shows that the lack of data limits our understanding of the status of pollinators. But more importantly it very likely conceals a considerably worse situation than currently perceived. Therefore long-term monitoring of pollinators to ensure robust data is not only indispensable, but also urgent, as the monitoring data are needed to guide mitigation actions. For insect pollinators other than bees and butterflies, the data are inadequate to provide information on the status and trends at EU level. At the moment there is no Pan-EU monitoring scheme for any pollinator group.

[8] Assessing LArge-scale environmental Risks for biodiversity with tested Methods (ALARM), http://www.alarmproject.net
[9] Settele, J., *et al*., (2010), *Atlas of Biodiversity Risk*, Pensoft Publishers, Sofia-Moscow, 280 pp.
[10] Status and Trends of European Pollinators (STEP), http://www.step-project.net/

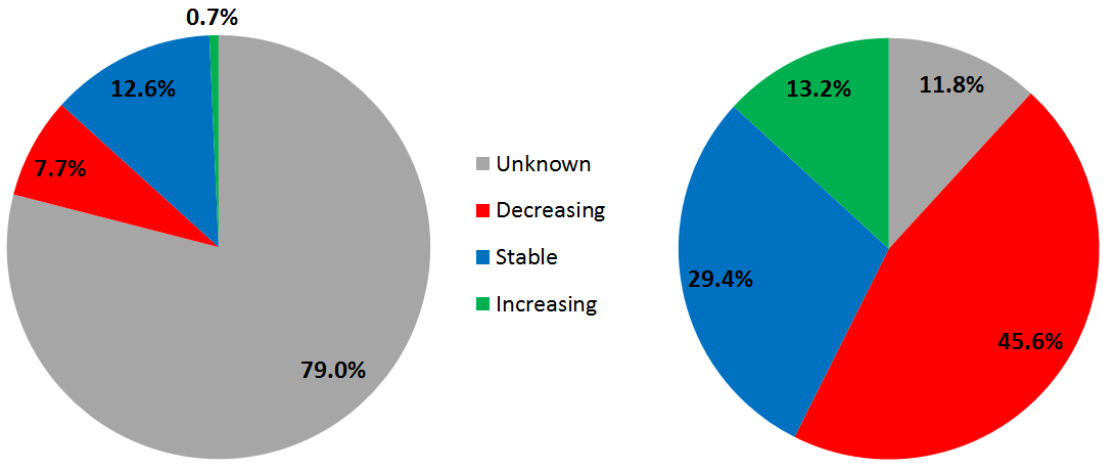
Box 3: European Red List

The European Red List is a review of the status of European species according to the Regional Red Listing guidelines of the International Union for Conservation of Nature (IUCN). It identifies those species that are threatened with extinction[11] at European level (both Pan-European and in the EU) so that appropriate conservation actions can be taken to improve their status. The Red List assessed so far two groups of insect pollinators: bees[12] and butterflies[13]. The European Red List assessments of bees and butterflies are presented in detail below (European level).



IUCN Red List status of European bees (left) and bumblebees - the best studied group of bees (right)

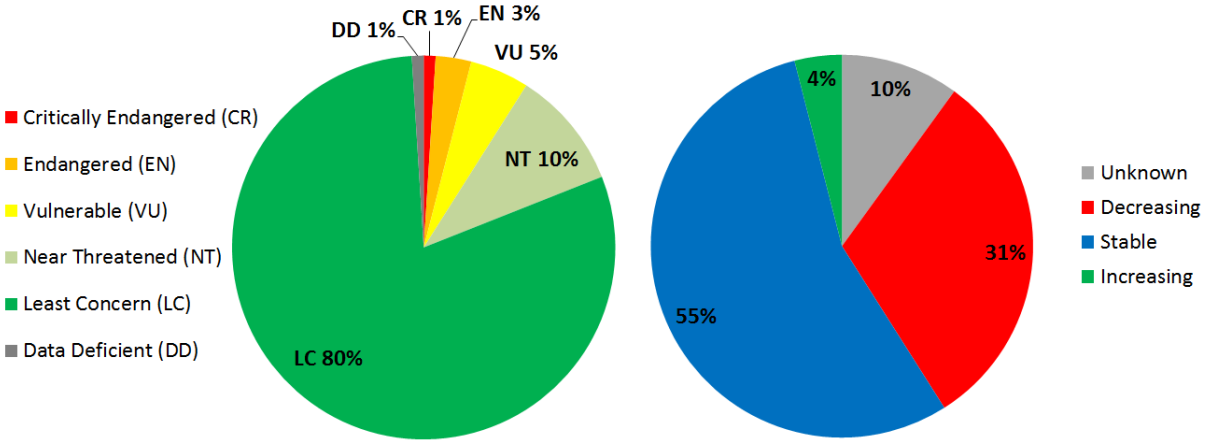
Compiled by the IUCN in 2014, this first-ever assessment of all European bee species showed that 4 % out of 1 942 species are threatened with extinction. For 56 % of species, however, the status is unknown. If only species with a known status are considered, the proportion of threatened species is 9.2 %. Bumblebees, the best studied group of bees, are in a significantly worse situation, with almost 24 % threatened. Population trends show that the status of bumblebees is likely to get worse in the future, while for bees in general trends are to a large extent unknown (79 %).



IUCN Red List — population trends of European bees (left) and bumblebees - the best studied group of bees (right)

[11] It includes the following IUCN Red List categories: critically endangered, endangered and vulnerable.
[12] http://ec.europa.eu/environment/nature/conservation/species/redlist/bees/status.htm
[13] http://ec.europa.eu/environment/nature/conservation/species/redlist/butterflies/status.htm

For butterflies, the data availability is significantly better, with an unknown status for only 1 %. However, 8.5 % of species are threatened with extinction, while almost a third have declining population trends. The Red List highlights that this is likely an underestimate due to lack of good trend data in many countries.



IUCN Red List status of European butterflies (left) and their population trends (right)

2.2. Pollinator decline at national, regional and local level

Only grassland butterflies are systematically monitored at national or regional level in the EU. The European Butterfly Monitoring Scheme[14] brings together data from national and regional butterfly monitoring schemes in 15 EU Member States[15]. Figure 1 shows a total decline of 33 % in grassland butterflies in those countries from 1990 to 2015[16].

Many EU countries have published national lists of threatened species based on IUCN Red List criteria. Some of these focus specifically on pollinators like bees and butterflies. For example, more than half of wild bee species are threatened with extinction in the Netherlands[17] and almost one third in Ireland[18].

A significant part of the evidence on these declines comes from research projects and studies. While various countries are covered by the research, the focus is predominantly on north-west Europe. Regions like the Mediterranean have been under-researched even though they are biodiversity hotspots. Studies on pollinator declines often provide insights into changes in species richness (number of species) and more rarely into changes in abundance, which is more data intensive.

The ALARM project quantified the loss of pollinators at national and local level. It showed parallel declines in the species richness of bee and hoverfly communities in Britain and the Netherlands: around 30 % fewer species, accounting for half of the post-1980 observation

[14] http://www.bc-europe.eu/index.php?id=339
[15] Belgium, Estonia, Finland, France, Germany, Ireland, Lithuania, Luxembourg, Portugal, Romania, Slovenia, Spain, Sweden, the Netherlands, United Kingdom.
[16] Van Swaay, C., *et al.*, (2016), *The European Butterfly Indicator for Grassland Species 1990-2013*,Wageningen, p. 19.
[17] Reemer, M., (2018), *Basisrapport voor de Rode Lijst Bijen*, EIS Kenniscentrum Insecten Leiden, Ministerie van Landbouw, Natuur en Voedselkwaliteit rapportnummer EIS2018-06, http://www.bestuivers.nl/Portals/5/Publicaties/RodeLijst/Basisrapport_Rode_Lijst_bijen_2018_Compleet.pdf?ver=2018-03-13-114054-730
[18] Fitzpatrick, Ú., *et al.*, (2006), *Regional Red List of Irish Bees*, National Parks and Wildlife Service (Ireland) and Environment and Heritage Service (N. Ireland).

records[19]. While observation records did not allow for the assessment of population densities, the research under the ALARM project showed that pollinator communities were increasingly dominated by a smaller number of species. A number of studies confirmed this trend, also in other countries:

- Great Britain:
  - decline in butterfly and bee species richness before 1990 and slowing down in the recent decades[20];
  - 75 % decline in species richness of bees and wasps across 17 sites in England over the past 80 years[21];
- decline in species richness of large moths in the Netherlands between 1985 and 2015[22], in particular nocturnally active species;
- decline in species richness of bumblebees[23] and butterflies[24] in Belgium during the 20th century, with 30 % of native butterflies having gone extinct in Flanders;
- decline in species richness of butterflies[25] and bumblebees in Denmark, with 42 % of long-tongued bumblebees no longer being observed compared to the 1930s[26];
- decline in bumblebee species richness in Sweden: two short-tongued bumblebee species dominating present communities, with relative abundances of 89 % compared to 40 % in the 1940s[27];
- decline in bumblebee[28] and butterfly[29] species richness in Spain, with a 90 % decrease in butterfly species richness in the Sierra de Guadarrama region between 1967-1973 and 2004-2005

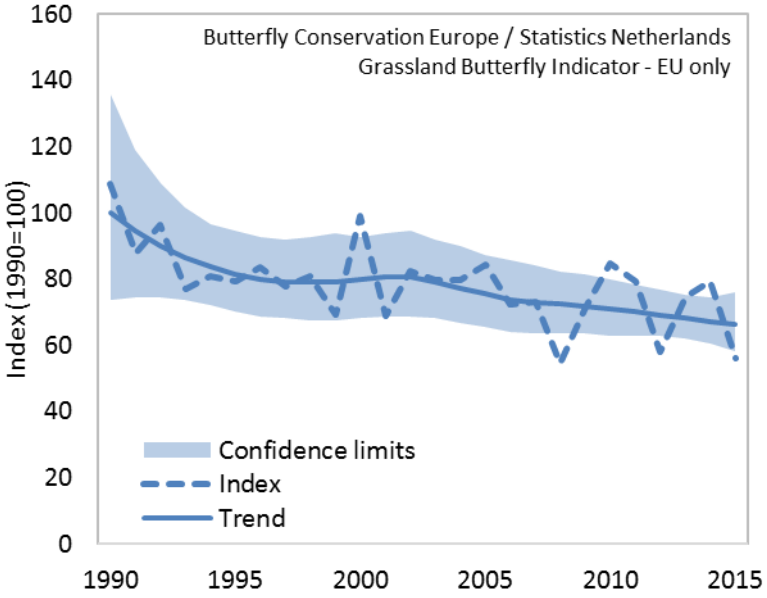
In addition to declines in species richness, declines in abundance of some pollinator groups have been also recorded. In the UK, 66 % of larger moth species declined in abundance between 1968 and 2007[30] and 72 % of monitored butterfly species declined in abundance between 2000 and 2009[31]. The total abundance of larger moth species declined by 28 % for the given period.

---

[19] Biesmeijer, J., *et al*., (2006), *Parallel Declines in Pollinators and Insect-pollinated Plants in Britain and the Netherlands*, Science 313.5785: 351-354.
[20] Carvalheiro, L.G., *et al*., (2013), *Species Richness Declines and Biotic Homogenisation have Slowed Down for NW-European Pollinators and Plants*, Ecology Letters, 16(7): 870-878.
[21] Senapathi, D., *et al*., (2015), *The Impact of Over 80 years of Land Cover Changes on Bee and Wasp Pollinator Communities in England*, Proc. R. Soc. B. 282(1806). The Royal Society.
[22] Langevelde, F., *et al*,. (2017), *Declines in Moth Populations Stress the Need for Conserving Dark Nights*, Global change biology.
[23] Rasmont, P. and Mersch, P., (1988), *Première Estimation de la Dérive Faunique Chez les Bourdons de la Belgique (Hymenoptera: Apidae)*, Annales de la Société Royale zoologique de Belgique, 118(2), Société royale zoologique de Belgique.
[24] Maes, D.. and Van Dyck, H.. (2001), *Butterfly Diversity Loss in Flanders (North Belgium): Europe's Worst Case Scenario?*, Biological conservation 99(3): 263-276.
[25] Eskildsen, A., *et al*., (2015), *Ecological Specialisation Matters: Long Term Trends in Butterfly Species Richness and Assemblage Composition Depend on Multiple Functional Traits*, Diversity and distributions 21(7): 792-802.
[26] Dupont, Y. L.,Damgaard, C and Simonsen, C., (2011), *Quantitative Historical Change in Bumblebee (Bombus spp.) Assemblages of Red Clover Fields*, PloS one.
[27] Bommarco, R., *et al*., (2011), *Drastic Historic Shifts in Bumble-bee Community Composition in Sweden*, Proceedings of the Royal Society of London B: Biological Sciences: rspb20110647.
[28] Ploquin, E. F.,Herrera, J. F. and Obeso, J. R, (2013), *Bumblebee Community Homogenization After Uphill Shifts in Montane Areas of Northern Spain* Oecologia 173(4): 1649-1660.
[29] Wilson, R. J., *et al*., (2007), *An Elevational Shift in Butterfly Species Richness and Composition Accompanying Recent Climate Change*, Global Change Biology 13(9): 1873-1887.
[30] Fox, R., *et al.*,(2013), *The State of Britain' Larger Moths*, Butterfly Conservation and Rothamsted Research, Wareham, Dorset, UK.
[31] Fox, R., *et al.*,(2015), *The State of the UK's Butterflies 2015*, Butterfly Conservation and the Centre for Ecology & Hydrology, Wareham, Dorset.

Recently a dramatic decline of flying insects has been reported in Germany[32]. The insect biomass declined by more than 75 % over 27 years (1989-2016) in 63 nature protection areas. While the study also covered non-pollinating insects, its results provide important insights into the status of pollinators. Due to lack of systematic monitoring processes, such studies based on long-term observation of pollinator abundance (biomass) are exceptional.

Figure 1: Grassland Butterfly Indicator for 15 EU Member States (Source: Butterfly Conservation Europe[16])



3. IMPORTANCE OF POLLINATORS

Actions to mitigate pollinator decline are underpinned by the recognition that in addition to their intrinsic value, pollinators are important contributors to human wellbeing. They also play a central role in the maintenance of ecosystem functioning[33]. Without pollinators, animal-pollinated plants would decline and eventually disappear and with it all organisms directly or indirectly depending on them. This would inevitably lead to the collapse of terrestrial ecosystems in the long term[9].

The majority of European flowering plants (78 %[34]) are pollinated by animals. By supporting wild plants, pollinators underpin wider biodiversity and ecosystem functioning. It is estimated that 5–8 % of current global crop production is directly attributed to animal pollination[6]. Around 84 %[34] of European crop species benefit to various extents from insect pollination. Among them the following have a medium to high need[35]: apple, orange, pear, peach, melon, strawberry, raspberry, plum, apricot, cherry, kiwifruit, mango, currant, turnip, pumpkin,

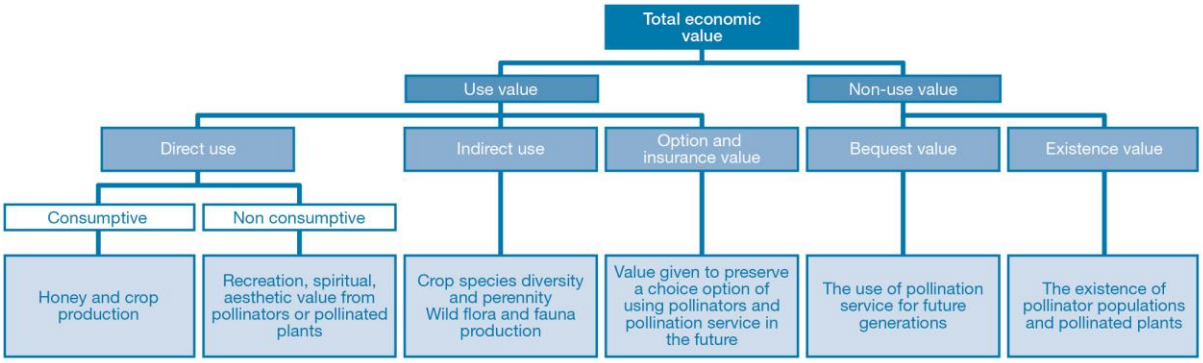
[32] Hallmann, C. A., *et al.*, (2017), *More Than 75 percent decline over 27 Years in Total Flying Insect Biomass in Protected Areas*, PloS one, 12(10).
[33] Millennium Ecosystem Assessment (Program), (2005), *Ecosystems and human well-being*, Washington, D.C: Island Press.
[34] Potts, S., et al., (2015), Status and Trends of European Pollinators. Key Findings of the STEP Project, Pensoft Publishers, Sofia, 72 pp.
[35] Corbet, S. A., Williams, I. H. and Osborne, J. L, (1991), *Bees and the pollination of crops and wild flowers in the European community*, Bee World, 72(2), 47-59.

various beans, squash, cucumber, sunflower, almond, chestnut, oilseed rape, white mustard, buckwheat, alfalfa and clover. Many herbs like basil, sage, rosemary, thyme, coriander, cumin, dill, chamomile and lavender also fall into this category. Other crops like tomato, pepper, aubergine, cotton, soybean, lemon and orange benefit as well from animal pollination. Significant knowledge gaps, however, exist and further research is needed to determine the level of dependency of different crops and the most effective pollinators for them.

Although many insect species are known to provide pollination services, it has long been considered that honeybees (*Apis mellifera*) provide the majority of crop pollination. This view has, however, been challenged[36], including through research under the STEP project[37,38,39] which showed that managed pollinators like honeybees supplement rather than substitute wild pollinators. While it is now increasingly recognised that wild pollinators play a central role in crop pollination, the real focus should be clearly on the diversity of pollinator communities. Species richness and abundance of pollinators enhance effectiveness of pollination across time and space and in this way can improve the quantity and quality of crop yields[6].

The importance of pollinators for food security is widely acknowledged. However, beyond food provisioning, animal pollination of crops and wild plants underpins multiple benefits to people. Pollinators contribute directly to medicines, biofuels, materials, culture, art, traditions, technology and education[6]. These benefits provide significant economic values that are seldom captured in markets. Figure 2 illustrates different types of values provided by pollinators and pollination services.

Figure 2: Total economic value of pollinators and pollination services (Source: IPBES[6])



Consumptive direct-use values like crop production are relatively straightforward to express in monetary terms due to the existence of markets. The value of the direct contribution of insect pollinators to EU agricultural output has been estimated at around EUR 15 billion per year[40]. In France the value was estimated at between EUR 2.3 and EUR 5.3 billion[41] while in

[36] Mallinger, R. E. and Gratton, C., (2015), *Species Richness of Wild Bees, but not the use of Managed Honeybees, Increases Fruit Set of a Pollinator-Dependent Crop*, J Appl Ecol, 52: 323-330.
[37] Breeze T.D., *et al.*, (2011), *Pollination Services in the UK: How Important are Honeybees?*, Agriculture, Ecosystems & Environment, 142(3-4): 137-143.
[38] Garibaldi, L. A., *et al.*, (2013), *Wild Pollinators Enhance Fruit Set of Crops Regardless of Honey Bee Abundance*, Science, 340(6127), 1608-1611.
[39] Garibaldi, L. A., *et al.*, (2011), *Stability of Pollination Services Decreases with Isolation from Natural Areas Despite Honey Bee Visits*, Ecology Letters, 14: 1062-1072.
[40] Gallai, N., *et al,. (2009), Economic Valuation of the Vulnerability of World Agriculture Confronted with Pollinator Decline*, Ecological Economics 68(3): 810-821.

Poland bee pollination alone was estimated at EUR 0.7 billion (2007[42]). Around 20 % of total farmgate crop value in the UK was calculated to come from insect-pollinated crops[37].

Monetary values of insect pollination have been estimated also for specific crops: EUR 112 million (£ 92.1 million) to the apple industry in the UK in 2012[43] (75 % of the value is attributed to wild pollinators), while the contribution of pollinators to apple and blueberry orchards in the Netherlands, may amount to the half of the profits[44]. Even in crops that depend on animal pollination to a lesser extent, pollinators can have a decisive impact on the economics of production. In Ireland the economic value of insect pollination to oilseed rape was estimated at EUR 3.9 million[45]. Pollinators are required to reach high yields and seed quality in oilseed rape, and 20 % of its market value may depend directly on insect pollination[46].

Pollinators impact not only the quantity, but also the quality of yield. For example insect-pollinated strawberries have higher quality and a longer shelf life than those that are self- or wind-pollinated, which translates into higher market value. In the EU, half of the market value of strawberries — over EUR 1 billion — is attributed to pollinators[47].

Honeybees provide a range of products for human use: honey, bee wax, royal jelly, pollen and propolis. Beekeeping provides important rural livelihoods in the EU. There are more than 600 000 beekeepers and 17 million beehives, which produce around 250 000 tonnes of honey per year[48].

Other benefits of pollinators are more challenging to express in monetary terms, but their value is well recognised. Pollinators enable diversity of crops, underpinning a diverse and healthy human diet. Animal-pollinated crops are vital sources of nutrients — in particular micro-nutrients like vitamins and minerals[49] — and provide an important contribution to nutritional security[6]. Besides pollination services, pollinators can enhance, especially at landscape scale, other ecosystem services like pest control, soil and water quality, landscape aesthetics and contribute towards biodiversity conservation[50].

---

[41] Beyou, W., *et al.*, (2016), *Le Service de Pollinisation*, L'évaluation française des écosystèmes et des services écosystémiques (EFESE), Service de l'économie, de l'évaluation et de l'intégration du développement durable Sous-direction de l'économie des ressources naturelles et des risques (ERNR). https://www.ecologique-solidaire.gouv.fr/levaluation-francaise-des-ecosystemes-et-des-services-ecosystemiques#e1

[42] Zych, M. and Jakubiec, A., (2006), *How Much is a Bee Worth? Economic Aspects of Pollination of Selected Crops in Poland*, Acta Agrobotanica 59(1): 289.

[43]Garrett, M. P. D., *et al.*, (2016), *Apple Pollination: Demand Depends on Variety and Supply Depends on Pollinator Identity*,, PloS one 11(5)

[44] De Groot, G. A., *et al.*, (2015), *De bijdrage van (wilde) bestuivers aan de opbrengst van appels en blauwe besse*,. Alterra, Wageningen UR, Alterra rapport 2636.

[45] Stanley, D.A., Gunning, D. and Stout, J. C., (2013), *Pollinators and Pollination of Oilseed Rape Rrops (Brassica napus L.) in Ireland: Ecological and Economic Incentives for Pollinator Conservation*, Journal of Insect Conservation 17(6): 1181-1189.

[46] Bommarco, R., Marini, L. and Vaissière, B.E.,.(2012), *Insect Pollination Enhances Seed Yield, Quality, and Market Value in Oilseed Rape*, 169: 1025.

[47] Klatt, B. K., *et al.*, (2014), *Bee Pollination Improves Crop Quality, Shelf Life and Commercial Value*, Proceedings of the Royal Society B: Biological Sciences. 281: 2013-2440.

[48] European Commission, https://ec.europa.eu/agriculture/honey_en

[49] Eilers E. J., *et al.*, (2011), *Contribution of Pollinator-Mediated Crops to Nutrients in the Human Food Supply*, PLOS ONE 6(6).

[50] Wratten, S, D., *et al.*, (2012), *Pollinator Habitat Enhancement: Benefits to Other Ecosystem Services*, Agriculture, Ecosystems & Environment 159: 112-122.

Pollinators are also a source of inspiration in art, music, literature, religion and technology, in social relations and for education and recreation[6], and represent symbols of identity as aesthetically significant landscapes and animals.

The decline of pollinators puts at risk the benefits arising from the ecosystem services they provide. The degree of dependency on insect pollination for crop production varies across the EU, but the Mediterranean countries — Italy, Spain and Greece — are particularly dependent and therefore vulnerable to pollinator losses[6]. While EU crop production has not yet experienced large-scale repercussions from pollinator decline, global examples provide invaluable insights into what could happen.

In some parts of China, apples have been human-pollinated after the decline of native pollinators. Alternative strategies failed and many farmers replaced apples with other crops[51,52].

In California, almond orchards — representing around 80 % of world almond production — depend on honeybees for pollination. High levels of overwintering colony losses and increased demand for pollination raised concerns about the dependency on one pollinator species. While wild pollinators could provide a solution, they would require natural habitats in what is otherwise a very intensive agricultural landscape[53].

The contribution of pollinators to nutritional security and a healthy diet is potentially significantly higher than reflected in estimates of their contribution to the quantity of yield or its market value. The decline of pollinators could lead to malnutrition and associated health problems, especially in poorer areas of the world[54,55].

The decline of pollinators also impacts wild plants. Recorded declines of animal-pollinated wild plants have mirrored the decline of pollinators, and this relation has been highlighted especially by local extinctions of functionally linked plant and pollinator species[19,56].

4. CAUSES OF POLLINATOR DECLINE

The current scientific knowledge suggests that there is no one single driver of pollinator decline. The IPBES report[6] lists the following threats to pollinators: land-use change, intensive agricultural management and pesticide use, environmental pollution, invasive alien species, diseases and climate change. The report provides a comprehensive review of the existing evidence on these direct drivers. The European Red List also presents a valuable source of information as it identifies threats per species. This section provides a brief description of each direct driver.

---

[51] Partap, U. and Ya, T., (2012), *The Human Pollinators of Fruit Crops in Maoxian County, Sichuan, China,* Mountain Research and Development 32(2):176-186.

[52] Partap, U.M.A., Partap, T.E.J. and Yonghua, H.E., (2001), *Pollination Failure in Apple Crop and Farmers' Management Strategies in Hengduan mountains, China,* Acta Hortic, 561, 225-230.

[53] Klein, A., *et al.,* (2012), *Wild Pollination Services to California Almond Rely on Semi-Natural Habitat,* Journal of Applied Ecology, 49: 723-732.

[54] Smith, M. R., *et al.,* (2015), *Effects of Decreases of Animal Pollinators on Human Nutrition and Global Health: a Modelling Analysis*, The Lancet 386.10007: 1964-1972.

[55] Chaplin-Kramer, R., *et al.*, (2014), *Global Malnutrition Overlaps with Pollinator-Dependent Micronutrient Production,* Proceedings of the Royal Society B. 281:20141799.

[56] Vanbergen, A.J., *et al.*, (2014), *Status and Value of Pollinators and Pollination Services*, Department for Environment, Food and Rural Affairs, 53pp.

Pollinators are negatively impacted by **land-use changes,** which increase landscape fragmentation and reduce the availability of pollinator habitats and their connectivity. These impact **land cover** important for pollinators (vegetation) and are driven by different types of land uses — agriculture, forestry, urbanisation and infrastructure. Habitats provide food and nesting resources for pollinators, and their loss or deterioration in quality reduces pollinator richness and their abundance. Particularly vulnerable are specialist species which depend on specific types of plants. The effects are manifested at different spatial scales. The link between declines of pollinators and historical landscape alterations is well established, in particular for agricultural landscapes in north-west Europe[21,57]. A number of studies[58,59] reported negative impacts resulting from urban sprawl and infrastructure development on pollinators. The latter is also listed on the European Red List as a significant threat to bees. However, the impact depends on the context: urban areas could also act as a refuge to pollinators in a wider landscape deprived of floral resources[60].

Intensive agricultural management practices such as high use of agrochemicals (pesticides[61] and fertilisers) and intensively performed tillage, grazing or mowing are well-established pressures leading to the decline of diversity and abundance of pollinators. They reduce food and nesting resources by creating homogenous landscapes, and affect pollinators directly through the use of pesticides. High use of fertilisers and herbicides, overgrazing and too intensive mowing reduce wild plant diversity in arable land and grassland. This leads to the disappearance of diverse surrounding flora and in this way the loss of season-long flowering resources, which threatens the viability of pollinator populations, especially in monoculture landscapes with little surrounding (semi-)natural areas. Tillage negatively affects ground-nesting bees as it disturbs soil surface.

Farmland abandonment may also negatively impact pollinators. Extensively-managed agricultural areas often support high-quality pollinator habitats like herb-rich grasslands. The abandonment of agricultural activities — like grassland mowing and grazing — leads to their disappearance.

Pesticides can affect pollinators directly (this is the case of insecticides or fungicides) or indirectly (herbicides). Herbicides reduce the availability of floral resources on which pollinators depend (see the previous paragraphs) in the intended areas of use, while insecticides have the highest potential to harm pollinators. The impacts are determined by the toxicity of the active substance and the level of exposure. Exposure depends on the use and properties of the active substance, the environment and the biology of pollinators. The effects can be lethal or sub-lethal. 'Sub-lethal' effects reduce the vitality of pollinators, for example by impairing foraging behaviour or immunity, and make them more susceptible to other pressures. Pollinators can be exposed to a mixture of pesticides rather than just one, which may lead to combined effects (known as 'cocktail effects'). Such interactions are complex and not fully researched. While the wide effects of pesticides on pollinators are well-established through studies in controlled conditions, field studies are rare and inconclusive. In particular, further research is needed on sub-lethal effects in realistic conditions over the long term. In recent times, research has focused on the impacts of neonicotinoid insecticides.

[57] Goulson D., Lye, G. C., and Darvill, B., (2008), *Decline and Conservation of Bumble Bees*, *Annual Review of Entomology*;53: 191-208.
[58] Ahrne, K., Bengtsson, J., and Elmqvist, T., (2009), *Bumble Bees (Bombus spp) Along a Gradient of Increasing Urbanization*, PLoS ONE, 4.
[59] Bates, A.J., (2011), *Changing Bee and Hoverfly Pollinator Assemblages Along an Urban-Rural Gradient*, PLoS ONE, 6.
[60] Hall, D. M., *et al.*, (2017), *The City as a Refuge for Insect Pollinators*, Conservation Biology, 31: 24-29.
[61] The term 'pesticides' in this document refers to plant protection products as defined in Regulation (EC) No 1107/2009.

While the impact of **environmental pollutants** other than pesticides has not been comprehensively researched, their impact on pollinators has been reported for heavy metals[62,63], air pollution[64], toxic chemicals (e.g. selenium[65]) and light pollution[22,66,67]. Light pollution affects nocturnal pollinator species like moths, particularly in the urban areas.

The effects of **invasive alien species** on pollinators depend on the context, i.e. on the species in question and the environment in which it operates. An example of an invasive alien predator that predates directly on pollinators is the yellow-legged hornet (*Vespa velutina*), which was recently introduced to Europe and has now been added to the list of invasive alien species of union concern under the EU Invasive Alien Species Regulation. The yellow-legged hornet is harmful to honeybees[68], while its impacts on wild pollinators are not yet well understood. Invasive alien plants can change native plant-pollinator relations in the ecosystem. They can outcompete native plants for flower visitation, which might lead to lower reproduction success by the latter. The implications of the spread of alien plant species for pollinators as well as for the ecosystem are complex and uncertain, and require further research. Finally, the introduction of invasive alien pollinators can harm native pollinators through competition for food and nesting resources or spread of diseases and pathogens.

Diseases (parasites and pathogens) are considered to impact primarily managed pollinators like honeybees. While the spread of diseases from managed to wild pollinators has been demonstrated and shown to present a threat to some wild species, the impacts are not yet well-known. Parasites and pathogens are not new to wild pollinators as they are naturally exposed to native parasites and pathogens, but strong exposure to non-native species in combination with other pressures like poor nutrition, pesticides and other pollutants can make them more susceptible to this threat.

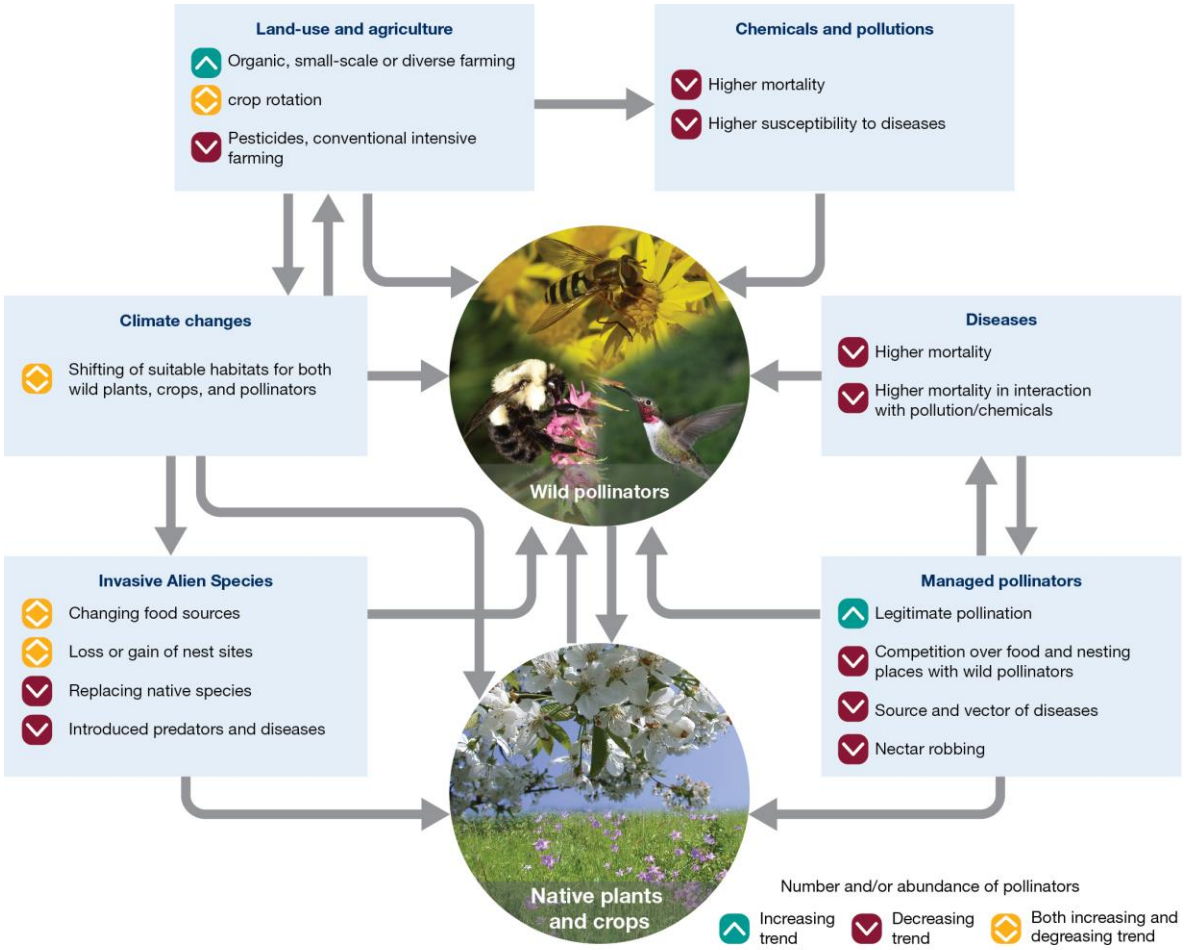
Climatic conditions are the main factor determining the European-wide distribution of pollinators. **Climate change** already impacts pollinators both through gradual shifts and extreme weather events[69,70,71,72]. In response to climate change, many pollinators have already shifted their distribution and ranges[73] and will likely continue to do so. Their adaptation success will depend on the dispersal ability of the species and on the availability of suitable habitats along the migration route. Conversely, some studies point to pollinators enhancing

[62] Nieminen, M., *et al.*, (2001), *The Effect of Metals on the Mortality of Parnassius apollo Larvae (Lepidoptera: Papilionidae)*, Journal of Insect Conservation 5(1): 1-7.
[63] Moroń, D., *et al.*, (2012), *Abundance and Diversity of Wild Bees Along Gradients of Heavy Metal Pollution*, Journal of Applied Ecology 49(1): 118-125.
[64] Fuentes, J.D., *et al.*, (2016), *Air pollutants degrade floral scents and increase insect foraging times*, Atmospheric Environment 141: 361-374.
[65] Hladun, K. R., *et al.*, (2012), *Selenium Toxicity to Honey Bee (Apis mellifera L.) Pollinators: Effects on Behaviors and Survival*, PloS One 7(4).
[66] van Langevelde F., *et al.*, (2018), *Declines in Moth Populations Stress the Need for Conserving Dark Nights*, Glob Change Biol. 24: 925-932.
[67] Geffen, K.G., *et al.*, (2014), *Artificial Light at Night Causes Diapause Inhibition and Sex-Specific Life History Changes in a Moth*, Ecology and Evolution 4(11): 2082-2089.
[68] Monceau, K., *et al.*, (2014), *Vespa Velutina: a New Invasive Predator of Honeybees in Europe*, Journal of Pest Science 87(1): 1-16.
[69] Ploquin, E.F., Herrera, J.M. and Obeso, J.R, (2013), *Bumblebee Community Homogenization After Uphill Shifts in Montane Areas of Northern Spain*, Oecologia 173(4): 1649-1660.
[70] Wilson, R.J., *et al.*, (2007), *An Elevational Shift in Butterfly Species Richness and Composition Accompanying Recent Climate Change*, Global Change Biology 13(9): 1873-1887.
[71] Pöyry, J., *et al.*, (2009), *Species Traits Explain Recent Range Shifts of Finnish Butterflies*, Global Change Biology 15(3): 732-743.
[72] Settele J., Bishop J. and Potts S.G., (2016), *Climate Change Impacts on Pollination*, Nature Plants, 2 (7) 16092.
[73] Parmesan, C, *et al.*, (1999), *Poleward Shifts in Geographical Ranges of Butterfly Species Associated with Regional Warming*, Nature 399(6736): 579.

plant yield recovery after extreme weather events[72]. Therefore choices related to land-use changes and land management will play an important role in the abundance and composition of pollinator communities, with effects on ecosystem functioning and resilience.

Direct drivers of the pollinator decline usually do not act in isolation, but in combination. Their interaction can produce **synergistic effects** exerting additional pressure on pollinator populations. Figure 3 illustrates potential avenues for single and combined impacts of these drivers.

Figure 3: Single and combined impacts of different pressures on pollinators and pollination (source: IPBES[6])



5. CURRENT ACTION AND CHALLENGES

5.1. Actions in EU Member States

There are a number of national and regional pollinator strategies in EU Member States. A recent report for the Commission[74] shows that there are at least six national or regional

[74] Underwood, E., Darwin, G. and Gerritsen, E., (2017), *Pollinator Initiatives in EU Member States: Success Factors and Gaps*, Report for European Commission under contract for provision of technical support related to Target 2 of the EU Biodiversity Strategy to 2020 — maintaining and restoring ecosystems and their services ENV.B.2/SER/2016/0018. Institute for European Environmental Policy, Brussels.

strategies or action plans addressing wild pollinator conservation in EU Member States. A number of others are planned or in preparation.

Belgium has the Federal Bee Plan 2017-2019[75], which aims to halt the loss of both wild and domesticated pollinators. However, it focuses on honeybees. There are no regional strategies focused on wild pollinators. Red lists of bees in Belgium are being prepared. Flanders has a butterfly monitoring network. The Federal Pesticide Reduction Programme (2013-2017) set up coordinated monitoring of the effects of pesticides on bees[76]. Awareness of wild pollinators in Belgium has increased in recent years, in particular since 2015 thanks to both public and non-governmental organisation (NGO) initiatives and campaigns.

France started implementing a national action plan for pollinators[77] in 2017. The *Plan de developpement durable de l'apiculture* (2013 -2018) also promotes pollinator habitats and addresses the impact of pesticides on honeybees. The Ecophyto II programme[78] aims to reduce pesticide use by 25 % by 2020 (and by 50 % by 2025), which is expected to ease the pressure on pollinators. Several initiatives[79] support research and monitoring of pollinators. France has also undertaken several awareness raising and collaboration initiatives such as the meadows award[80] or the LIFE project URBANBEES[81]. Other initiatives address the road network, sand quarries, electricity grids and urban areas.

Germany does not have a dedicated pollinator strategy at national level but pollinator initiatives take place under the national biodiversity strategy. NGOs recently developed a proposal for a national action plan for bees[82]. The Helmholtz Centre for Environmental Research (UFZ) has been monitoring butterflies since 2012. Several initiatives[83] have been launched to improve knowledge. The 'Deutschland summt!' initiative[84] (bee projects in German cities), the 'Wildbienenschutz' project[85] (on protecting wild bees), and others seek to raise awareness and improve collaboration on pollinators. The new government has announced the development of a national action plan to counter the disappearance of insects, which is now being prepared.

In **Ireland** and **Northern Ireland** pollinators are addressed by the All-Ireland Pollinator Plan[86] (AIPP). It was launched by a multi-stakeholder steering group and published by the National Biodiversity Data Centre (NBDC). It identifies 81 actions to make farmland, public and private land pollinator friendly, raise awareness of pollinators, support beekeepers, expand knowledge on pollinators and collect evidence to measure success. The AIPP has been used as a model for developing national pollinator plans in Norway and the Netherlands[87]. The NBDC also set up the All-Ireland Bumblebee Monitoring Scheme[88] in 2011.

---

[75] Le Plan fédéral Abeilles 2017-2019 at https://www.health.belgium.be/fr/le-plan-federal-abeilles-2017-2019
[76] Le programme fédéral de réduction des pesticides pour la période 2013-2017 at https://www.health.belgium.be/en/sustainable-use
[77] http://www.insectes.org/opie/pdf/3993_pagesdynadocs570e1d6156925.pdf
[78] http://agriculture.gouv.fr/sites/minagri/files/151022_ecophyto.pdf
[79] Examples are the Spipoll programme at http://www.spipoll.org/ and FlorArbeilles at http://www.florabeilles.org/
[80] http://www.concours-agricole.com/concours/les-prairies-fleuries
[81] http://www.urbanbees.eu
[82] https://www.bund.net/umweltgifte/pestizide/bienen-und-pestizide/bienenaktionsplan
[83] Examples are the BienABest at http://www.bienabest.de/index.php?id=59035, and the Institute for Bee Protection at https://www.julius-kuehn.de/bienenschutz/
[84] http://www.deutschland-summt.de
[85] https://www.wildbienenschutz.de/
[86] http://www.biodiversityireland.ie/wordpress/wp-content/uploads/All-Ireland%20Pollinator%20Plan%202015-2020.pdf
[87] http://www.biodiversityireland.ie/wordpress/wp-content/uploads/All-Ireland-Pollinator-Plan_progress-report-year-1_Dec-2016.pdf
[88] http://www.biodiversityireland.ie/record-biodiversity/surveys/bumblebee-monitoring-scheme/

The Netherlands adopted a national pollination strategy[89] in January 2018, which focuses on wild bee species. The 'Action Programme Bee Health'[90] also addresses the impact of pesticides on food supply and biodiversity. Butterflies and night moths have been monitored since 1990. The project 'Nederland Zoemt' launched in 2017 identified hundreds of local and regional pollinator initiatives throughout the country, such as information dissemination platforms[91], and several public awareness campaigns. These mostly bottom-up and multi-stakeholder approaches have brought in public and private partners such as beer brewers, road builders, mayors of municipalities, supermarket chains and drinking water companies.

While it has no specific pollinator strategy, different initiatives have taken place in **Slovenia**, and public interest in and awareness about pollinators is high. Pollinators are primarily protected by the conservation of their habitats. Natura 2000 sites currently cover 37 % of Slovenia, and other nationally protected areas cover 13 %. In 2014, the Slovenian Beekeeper's Association launched an initiative to declare 20 May as a World Bee Day. With the support of the Slovenian government, the proposal was adopted by the UN in 2017[92].

Spain is currently preparing a nationally coordinated initiative for wild pollinators. Several research[93] and awareness raising[94] initiatives are being carried out by research institutes. The national biodiversity database[95] contains species records of threatened pollinator species on the Spanish Red List, and the Spanish National Council for Research (CSIC) is currently updating the atlas of bee fauna in Spain. Butterfly abundance has been monitored in Catalonia since 1994[96].

In the **UK**, there are three regional pollinator strategies (England, Wales, and Scotland). The UK government funded a review of research on the status and value of pollinators in the UK, which informed these regional strategies. A pollinator-monitoring programme recently started (see Box 4). Butterflies have been monitored in the UK since 1976. The UK has also developed a national indicator of pollinator population change (see Box 4). Similar to the Wild Beeline initiative in the Netherlands, the B-Lines initiative[97] in the UK aims to create a network of wildflower-rich areas providing routes across the country for pollinators.

Box 4: UK pollinator monitoring scheme approach and pollinator indicator

The UK scheme combines three approaches for gathering information[98]:

1) Systematic sampling of pollinator diversity and abundance in 75 1 km^2 grid squares, varying in % of farm and semi-natural land cover, using a 1-person, 1-day protocol comprising pan trapping, flower-insect timed counts, floral abundance counts and rapid habitat classification, targeting 4 visits per site per year;

[89] https://www.rijksoverheid.nl/binaries/rijksoverheid/documenten/rapporten/2018/01/22/nationale-bijenstrategie-bed--breakfast-for-bees/DEF+webversie+Nat+Bijenstrategie_jan+2018.PDF
[90] https://www.rijksoverheid.nl/binaries/rijksoverheid/documenten/brieven/2013/11/11/actieprogramma-bijengezondheid/actieprogramma-bijengezondheid-1.pdf
[91] www.bestuivers.nl
[92] https://www.worldbeeday.org/en/
[93] Examples are Poll-Ole-GI SUDOE at http://pollolegi.eu/es/; BEEFUN project at https://bartomeuslab.com/beefun/; and Agripa at http://p-rta2013-00042-c10-00.agripa.org/entidades-participativas
[94] Examples are the Real Jardin Botanico at http://www.rjb.csic.es/jardinbotanico/jardin/index.php?Cab=6&SubCab=587&len=es&Pag=697; and the GEPEC at https://gepec.cat/informat_fauna_flora.php
[95] http://www.mapama.gob.es/es/biodiversidad/servicios/banco-datos-naturaleza/Eidos_acceso.aspx
[96] Catalan Butterfly Monitoring Scheme, http://www.catalanbms.org/
[97] https://www.buglife.org.uk/b-lines-hub
[98] Vanbergen, A. J., (2017), *"A Potential EU Framework for Pollinator Monitoring?"*, Presentation at KIP-INCA workshop 23 October 2017, DG Environment, Brussels.

2) Flower-insect timed counts carried out by volunteers in any urban or countryside location who observe insect flower visitation for a standard amount of time with online submission using the iRecord platform;

3) Support to the ongoing non-systematic collection of pollinator occurrence by volunteer expert taxonomists belonging to biological recording societies, with refinement and development of statistical models by scientists/statisticians to extract trend estimates and develop indices from these long-term datasets.

UK national indicator status of pollinating insects[99]

The indicator illustrates changes in pollinator distribution (bees and hoverflies) in the UK. The indicator is based on 389 species (147 species of bee and 242 species of hoverfly) of pollinator, and measures changes in the number of 1 km grid squares across the UK in which they were recorded in any given year — this is referred to as the 'occupancy index'.

5.2. Action at EU level

Like all biodiversity, pollinators know no borders. Species move freely across Europe and are affected by different pressures. The EU has already established a range of measures that are beneficial to all pollinators, notably under environment and health policies (in particular the Birds and Habitats Directives and EU legislation on pesticides) as well as under the common agricultural policy, the cohesion policy and the research and innovation policy. In addition, the EU supports domesticated pollinators by way of national apiculture programmes[100] and bee health efforts[101]. This section outlines key EU policies for pollinators.

The EU biodiversity strategy to 2020[102] aims to halt the loss of biodiversity and the degradation of ecosystem services in the EU by 2020. Pollinators play a vital part in this and benefit from various actions under the strategy, in particular (i) the full implementation of the Birds Directive[103] and Habitats Directive[104]; (ii) maintenance and restoration of ecosystems including through green infrastructure[105]; (iii) integration of biodiversity into agricultural policies; and (iv) combatting invasive alien species[106]. These actions help maintain and restore habitats for pollinators and mitigate direct threats like invasive alien species. However, the mid-term review of the strategy[107] in 2015 showed that insufficient or no significant progress has been made on these actions except for the invasive alien species. MAES (Mapping and Assessment of Ecosystems and their Services)[108] provides an integrated analytical framework and set of indicators for mapping and assessing the condition of ecosystems in the EU. It will enable an integrated assessment of the decline of pollinators, its impact on society and the economy, together with adequate policy responses. In this regard, KIP INCA[109] has produced a first experimental pollination account[110]. These accounts are

[99] http://jncc.defra.gov.uk/page-6851
[100] https://ec.europa.eu/agriculture/honey/programmes_en
[101] https://ec.europa.eu/food/animals/live_animals/bees/health_en
[102] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52011DC0244
[103] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32009L0147
[104] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:31992L0043
[105] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52013DC0249
[106] http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1417443504720&uri=CELEX:32014R1143
[107] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52015DC0478
[108] http://ec.europa.eu/environment/nature/knowledge/ecosystem_assessment/index_en.htm
[109] KIP-INCA is an EU project aiming to design and implement an integrated accounting system for ecosystems and their services. The accounts use datasets which are regularly produced at EU level, such as land cover data and agricultural statistics, http://ec.europa.eu/environment/nature/capital_accounting/index_en.htm
[110] Vallecillo S., *et al*., (2018), *"Ecosystem Services Accounting: Part I — Outdoor Recreation and Rrop Rollination"*, EUR 29024 EN; Publications Office of the European Union, Luxembourg.

based on pollinator distribution maps, the location of ecosystems that support pollinators, and the distribution of a selection of crops that are dependent on pollinators. The accounts use datasets which are regularly produced at EU level, such as land cover data and agricultural statistics.

The common agricultural policy (CAP) 2014-2020[111] provides opportunities to support pollinators in agricultural areas and wider rural countryside, including in Natura 2000 areas.

The cross-compliance[112] that links the granting of CAP support to the application of basic environmental requirements, such as the Habitats Directive and Birds Directive for biodiversity and good agricultural and environmental conditions[113] (GAEC 7 on retention of landscape features), may have positive effects on pollinators.

Under the first pillar[114], the greening practices accounting for 30 % of national direct payment envelopes reward farmers for respecting three mandatory practices that cover (i) crop diversification; (ii) maintenance of permanent grasslands including the protection of environmentally valuable permanent grasslands situated in Natura 2000 areas; and (iii) Ecological Focus Areas (EFAs)[115]. For pollinators, the most relevant are EFAs — in particular landscape features — and the permanent grasslands measure, in particular those designated as environmentally sensitive permanent grasslands.

Recent evaluations of the greening measures showed that the impact of these measures on pollinators is still unknown. While the EFAs were implemented on 10 % of the arable land falling under the obligation, uptake of the most beneficial measures for pollinators has been limited[116]. However, some positive examples do exist in several countries. Landscape features, multi-annual N-fixing forage crops and land lying fallow could be beneficial if their uptake is increased and appropriate management is followed. In 2017, the use of pesticides in on productive type of EFAs has been prohibited[117]. Furthermore, land lying fallow for melliferous plants (pollen- and nectar-rich plants) in EFAs has been introduced, offering more possibilities to strengthen the positive effects on pollinators[118].

Under the second pillar[119], rural development programmes can support measures that deliver positive effects on habitats for pollinators or reduce the impacts of pesticides. These measures include (i) non-productive investment support (e.g. for creating new hedges); (ii) agri-environment climate measures for creating a favourable environment for pollinators or promoting the sustainable use of pesticides (integrated pest management); (iii) support to Natura 2000 and to organic farming; (iv) knowledge transfer, education and training; (v) farm advisory services for farmers; (vi) cooperation measures; and (vii) the European Innovation Partnership[120].

The most relevant measures are agri-environment climate measures, Natura 2000 payments and organic farming. A number of rural development programmes have included measures specific to pollinators, mostly in the form of flower strips. Horizontal measures like advisory

[111] https://ec.europa.eu/agriculture/cap-overview_en
[112] https://ec.europa.eu/agriculture/envir/cross-compliance_en
[113] https://marswiki.jrc.ec.europa.eu/wikicap/index.php/Good_Agricultural_and_Environmental_Conditions_%28GAEC%29
[114] Supported by the European Agricultural Guarantee Fund (EAGF).
[115] https://ec.europa.eu/agriculture/direct-support/greening_en
[116] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52017DC0152
[117] https://eur-lex.europa.eu/eli/reg_del/2017/1155/oj
[118] Regulation (EU) 2017/2393, OJ L 350/34 of 29.12.2017
[119] Supported by the European Agricultural Fund for Rural Development (EAFRD).
[120] https://ec.europa.eu/eip/agriculture/en/european-innovation-partnership-agricultural

services, knowledge transfer, cooperation and LEADER[121] measures are also important to strengthen the above measures.

The EU legislative framework on pesticides, which deals with their approval and use, consists of two key components. Directive 2009/128/EC[122] provides for a range of actions to achieve a sustainable use of pesticides in the EU by reducing the risks and impacts of pesticide use on the environment, including pollinators. Member States were required to adopt national action plans by 2012 and review them at least every 5 years. In October 2017, a Commission report indicated insufficient progress in the implementation of the Directive[123]. It concluded among others that Member States should improve their plans significantly and establish more precise and measurable targets.

Under the provisions of Regulation (EC) 1107/2009, an active substance used in a plant protection product can only be allowed on the market if, following a comprehensive risk assessment, it is established that it has no unacceptable effects on honeybees and other non-target organisms. Following a request from the Commission, the European Food Safety Authority (EFSA) prepared and published a guidance document[124] in 2013 to strengthen the current risk assessment scheme for honeybees and added schemes for wild bees. In the same year, the Commission restricted the use of three neonicotinoid pesticides[125] and fipronil[126] after evaluations by EFSA[127] revealed that they pose a high risk to honeybees. In February 2018, the EFSA published the updated assessment[128], confirming that most uses of the three neonicotinoid pesticides represent a risk to wild bees and honeybees. The Commission's proposal to further restrict the use of three neonicotinoid pesticides was endorsed by Member States on 27 April 2018[129].

The EU Cohesion Policy 2014-2020 supports investments in growth and jobs and European territorial cooperation. Environmental sustainability is an integral part of its socio-economic objectives. The funds underpinning the policy (ERDF, CF and ESF)[130] provide opportunities to support pollinator habitats in urban areas as well as in the wider countryside. These can come in particular in the form of (i) investments in protecting and restoring nature and biodiversity; (ii) climate change mitigation and adaptation; and (iii) sustainable urban development. These can also support the conservation of pollinators at landscape scale by deploying green infrastructure. The cohesion policy can support territorial cooperation and joint actions on pollinators through Interreg[131] (for example SAPOLL[132]) and local actions through community-led local development[133].

The EU framework programme for research and innovation (Horizon 2020) aims to boost top level research in the EU that addresses major social, environmental and economic

[121] https://ec.europa.eu/agriculture/rural-development-2014-2020_en
[122] https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A32009L0128
[123] https://ec.europa.eu/food/sites/food/files/plant/docs/pesticides_sup_report-overview_en.pdf
[124] https://efsa.onlinelibrary.wiley.com/doi/epdf/10.2903/j.efsa.2013.3295
[125] http://eur-lex.europa.eu/eli/reg_impl/2013/485/oj
[126] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32013R0781
[127] EFSA Journal 2013;11(1):3067 [68 pp.], EFSA Journal 2013;11(1):3068. [55 pp.], EFSA Journal 2013;11(1):3066 [58 pp.] and EFSA Journal 2013;11(5):3158 [51 pp.].
[128] EFSA Journal 2018;16(2):5179 [59 pp.], EFSA Journal 2018;16(2):5178 [113 pp.] and EFSA Journal 2018;16(2):5177 [86 pp.].
[129] http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1519297055872&uri=CELEX:32018R0113
[130] Support through the European Regional Development Fund (ERDF), the Cohesion Fund (CF) and the European Social Fund (ESF).
[131] http://ec.europa.eu/regional_policy/en/policy/cooperation/european-territorial/
[132] http://sapoll.eu/
[133] http://ec.europa.eu/regional_policy/sources/docgener/informat/2014/community_en.pdf

issues and challenges. Through these investments, the programme can support research on pollinators. Actions under Societal Challenge 2 (food security, sustainable agriculture and forestry) and Societal Challenge 5 (climate action and the environment) are of particular relevance. A number of projects under Horizon 2020 are set to improve knowledge on pollinators, for example:

- 'Bee health and sustainable pollination'[134];
- 'Functional biodiversity — effective interplay of crop pollinators and pest predators'[135];
- 'Making European beekeeping healthy and sustainable'[136];
- 'Biodiversity in action — B — Capitalising on native biodiversity in farmland landscape'[137]; and
- 'Integrated health approaches and alternatives to pesticide use'[138].

The previous programmes supported the ALARM and STEP projects (see Box 2). Furthermore, the European Innovation Partnership 'Agricultural Productivity and Sustainability' can also promote innovation and knowledge transfer on aspects related to biodiversity, including high nature value.

LIFE[139], the EU programme for the environment and climate action, can offer funding opportunities to develop and demonstrate best practices and solutions for the conservation of pollinators, including an integrated approach. It can also help improve the knowledge base on pollinators (e.g. by developing the European Red List) and raise awareness. Recent examples of projects include Urbanbees[140] and PP-ICON[141].

In addition, a number of other EU policies such as climate action[142], the National Emission Ceilings Directive[143] and relevant trade and import rules[144] make important contributions to mitigating threats to pollinators (climate change, environmental pollution and diseases respectively).

5.3. Action at global level

In 2000, the Conference of Parties (COP) to the Convention on Biological Diversity (CBD) established an international initiative for the conservation and sustainable use of pollinators[145] (the International Pollinator Initiative). The Food and Agriculture Organization (FAO) facilitates and coordinates the initiative together with other relevant organisations within the programme of work on agricultural biodiversity. The initiative aims to promote coordinated worldwide action to:

- monitor pollinator decline, its causes and impacts on pollination services;
- address the lack of taxonomic data;

[134] http://ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/topics/sfs-16-2017.html
[135] http://ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/topics/sfs-28-2017.html
[136] http://ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/topics/sfs-07-2018.html
[137] http://ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/topics/sfs-01-2018-2019-2020.html
[138] http://ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/topics/sfs-04-2019-2020.html
[139] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2013.347.01.0185.01.ENG
[140] http://www.urbanbees.eu/
[141] http://www.pp-icon.eu/en/project
[142] https://ec.europa.eu/clima/index_en
[143] Directive (EU) 2016/2284 on the reduction of national emissions of certain atmospheric pollutants.
[144] https://ec.europa.eu/food/animals/live_animals/bees/trade_en
[145] COP decision V/5 — Agricultural biological diversity: review of phase I of the programme of work and adoption of a multiyear work programme, https://www.cbd.int/decision/cop/?id=7147

- assess the economic value of animal pollination and economic impacts of its decline; and
- promote the conservation, restoration and sustainable use of pollinator diversity in agriculture and related ecosystems.

The FAO has produced regular reports to summarise key contributions and outputs (in 2008[146], 2012[147], and 2014[148]). These reports show that the initiative has helped develop and implement national and regional pollinator initiatives[149], produced several guidance manuals, and accelerated work on risk assessment methods for pesticides.

At the 13th COP meeting[150] in December 2016, parties requested a review of the implementation of the initiative. The information and experience gathered in the first phase (2000-2015) of the initiative, as well as the findings of the IPBES report, have shaped the elements of a second plan of action for 2018-2030[151]. This will be discussed in the technical body of the CBD in July 2018.

At the same COP in 2016, the Dutch government launched the Coalition of the Willing on Pollinators[152] — a group of countries that already have or plan to develop a pollinator strategy[153]. The coalition has 21 signatories, of which 13 are EU Member States[154]. The members committed to share experiences and lessons learned, develop research on pollinator conservation, provide mutual support and collaborate.

5.4. Main challenges

Knowledge

While newly acquired knowledge in recent times — in particular thanks to the European Red List and STEP and ALARM projects — has significantly improved our understanding of the problem, considerable gaps still remain. As discussed in section 2, it is likely that the gaps conceal a problem that is far bigger than imagined. Moreover, the bulk of current knowledge comes from north-west Europe, while biodiversity hotspot regions like the Mediterranean are under-researched. The key prerequisite for effective EU action on pollinators is to fill these knowledge gaps. Systematic monitoring of pollinators and greater research into the causes and consequences play a key role in this. These will provide data and information on the full extent of the decline and apprise us of the most effective mitigation measures and their success. They will also apprise us of the current impacts that the decline has on the society as well as future risks. Good quality data would enable the development of robust indicators that would help to track EU progress towards the UN Sustainable Development Goals[155]. The

[146] https://www.cbd.int/doc/meetings/cop/cop-09/information/cop-09-inf-24-en.pdf
[147] https://www.cbd.int/doc/meetings/cop/cop-11/information/cop-11-inf-29-en.pdf
[148] https://www.cbd.int/doc/meetings/cop/cop-12/information/cop-12-inf-37-en.pdf
[149] These include: African Pollinator Initiative; Oceania Pollinator Initiative; European Pollinator Initiative; North American Pollinator Protection Campaign; Brazilian Pollinators Initiative; Iniciativa Colombiana de Polinizadores; Pollinator Partnership Action Plan (USA); Canadian Pollination Initiative; The National Pollinator Strategy for bees and other pollinators in England; All-Ireland Pollinator Plan; Plan national d'actions «France Terre de pollinisateurs» pour la préservation des abeilles et des insectes pollinisateurs sauvages; Dutch Pollinator Strategy, and the Swiss National Action Plan for Bee Health.
[150] https://www.cbd.int/conferences/2016
[151] https://www.cbd.int/sbstta/sbstta-22-sbi-2/sbstta-22-ipi-draft.pdf
[152] https://www.cbd.int/doc/decisions/cop-13/cop-13-dec-15-en.pdf
[153] https://promotepollinators.org/
[154] Austria, Belgium, Denmark, Finland, France, Germany, Luxembourg, Slovenia, Slovakia, Spain, the Netherlands, UK, Ireland.
[155] Monitoring of some pollinator species is already set to contribute to the process: the grassland butterfly index has been included in the 2018 review of the monitoring framework for the sustainable development goals,

research capacity will need to be strengthened to ensure adequate expertise to underpin these knowledge processes. The European Red List of Bees has shown that, next to pollinator decline, we are also witnessing a decline in bee experts.

Mitigation measures

While actions for maintaining and restoring pollinator habitats were not systematically researched, existing evidence suggests that their success is mixed; in general, they require better targeting and increased uptake. Better knowledge transfer between researchers and managers on the ground (for example farm advisory services) and increased investments to provide pollinators with habitats in rural and urban areas will be necessary. These will also help to alleviate the impact of climate change on pollinators by providing migration routes for species that cannot adapt. Instruments for reducing the risks to and impacts of pesticides on pollinators need to be further strengthened[122,124]. While some direct threats to pollinators from invasive alien species are known and can be tackled through direct action or awareness raising, further research is needed to better understand the complex patterns of their impact.

Collaboration and awareness raising

Exchange of knowledge and experience and joint actions between various stakeholders is key to developing cost-effective measures and maximising synergies. Such an integrated approach requires sufficient collaboration between scientists, policymakers, stakeholders and the general public. This is important in particular for landscape scale actions. While there are already a number of relevant platforms, the capacity needs to be further strengthened. The conservation of pollinators requires broad societal engagement. While the problem has already drawn considerable public attention, it will be necessary to further raise awareness and engage wider society as individuals and the private sector can lend decisive impetus to conservation actions.

---

http://ec.europa.eu/eurostat/documents/276524/7736915/EU+SDG+indicator+set+2018+-+public+web+version+with+cover+note/c86cd681-a537-4f0c-9680-197f04888f12