

Bee kind - the pollinators are dependent on you and I

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Introduction

The term 'pollinators' refers to a wide variety of animals including insects, birds and mammals. They are involved in plant fertilization by transferring pollen from the stamen to the stigma, within and between flowers (About Pollinators, 2021). Pollinators are therefore vital to the provision of many ecosystem services that humans depend upon, for example pollinated crops.

According to the 2016 IPBES assessment report on pollinators and food production, there has been a significant decline in pollinator abundance and diversity worldwide, particularly in wild species, due to human activities. In Norway, the most active pollinators are bumblebees and flies, species that have also suffered a decline due to human activity. It is therefore our responsibility to protect these species.

We will show in this paper the importance and value of pollinators, the threats that are causing this decline, and present some of the solutions for dealing with these threats.

Importance of pollinators

Pollination is an important process since it helps different plants with their seed production (Tortland, 2013). Some plant species can pollinate themselves without the help of pollinators. However, pollinating is often the introductory reason for securing plant offspring. The reason is that almost half of all plants in the world are completely dependent on pollen from another plant to be able to germinate. This means seed production will not take place in such plant species if not helped by pollinators. In addition, most of the other half of plants that can pollinate themselves still prefer being pollinated by pollinators, due to the benefits this provides. Plants that are pollinated have a higher production rate of seeds, better seed quality, and avoid inbreeding. Two problems that might occur from inbreeding are early abortion of seeds, and inbreeding depression. Therefore, plants mainly want pollen from other specimens that are of the same species if they want the best result.

In Norway, only insects provide the service of pollination (Tortland, 2013). In addition, Norway is poor in the number of pollinating species compared to the rest of the world. The species of pollinators Norway includes different types of bees, beetles, flies, butterflies, and moths. Bumblebees is by far the most important pollinator in the Norwegian ecosystem. Second comes different types of flies, followed by honeybees as the third most important pollinator. The rest of the species follows in no specific order. However, the few species of pollinators in Norway play a major part in maintaining its ecosystem since a lot of the plants are dependent on them. It is estimated that around 80% of all flowers in Norway are being pollinated, where 50% of these are totally dependent on pollinators, and 80% benefit from it. The service these different types of plants give can differ, from giving a nesting spot to different insects, to being a source of nutrient to different animals.

One of the species that gains from this mutualistic relationship between pollinators and plants, are us humans (Steel, n.d). It is estimated that around 30% of the food Norwegians eat is directly, or in some capacity, dependent on pollinators. The types of food vary from vegetables and fruits, to nuts and edible flowers (PollinatorPartnership, n.d). Some of the food is grown in Norway, such as apples, cucumbers, and tomatoes. Other types of food are imported, such as coffee, chocolate, and bananas. Either way, the pollinators we have are important to our food production and would therefore be detrimental to our food security if they disappeared (Steel, n.d).

Threats

Land use change is one of the main factors to influence pollinators: by affecting nesting habitats and floral resources it endangers the codependency of pollinators and plants they pollinate. One of the main land use change threats is urban expansion: it has been shown that in urban areas plants that rely on pollinators are more pollen limited than in other landscapes showing the endangerment of this interaction between pollinators and plants relying on them (Bennett et al, 2020). In Norway, pollinators inhabit cultural landscapes such as coastal heath, marches, and meadows. These habitats are now in danger of disappearing due to change in agricultural practices, with transitions from having several small farms spread over the country to bigger, centralized farms using more intensified methods. When the fields are no longer being grazed or mowed, this leads to overgrown habitats that through succession start transitioning into forests, which results in there being less suitable habitats available for pollinators (Steel, n. d.)

In addition to land-use change, climate change is one of the main anthropogenic threats that puts pressure on insects (Polce et al, 2014). For instance, it can alter the plant-pollinator network and cause phenological or spatial mismatches between the two mutualistic interactors. A consequence of this could be temporal mismatches of when the flowers bloom and when the different pollinators emerge, which can result in lower plant reproductive success and service provision by pollinators. In terms of food security and the agricultural system, this can potentially affect the amount of harvested crop and result in lower crop yields.

Another important threat that pollinators are facing is alien species invasion: cross-border transport and international trade, causes an increased risk of introducing alien species (National pollinator strategy, 2018). Along with climate change, this can heighten the possibility that invasive alien species become established in their new habitat. For native species, the introduction of alien species can lead to negative consequences, such as increased competition, risk of hybridization, and introduction of new parasites and diseases.

To protect crops against damage caused by fungi, weed and insects, pesticides are used in agriculture (National pollinator strategy, 2018). The IPBES report from 2016 states that pesticides, especially insecticides, can affect the distribution and survival of pollinators. Since pesticides are used on the same crops and areas where pollinators forage, these chemicals can have both direct and indirect negative effects on pollinators. In addition to pesticides, pollinators are exposed to poisonous environmental toxins that are concentrated through the food chain and accumulate in the environment. Even though these chemicals are known to have a harmful effect on living organisms and have been detected in bee pollen and honey, little is known about how these specifically affect pollinators, hence, further research is needed.

Solutions

In response to declining bee populations, there has been significant research into methods of conservation. There is often a focus on the ecosystem service provided by a species in conservation efforts. However, this can lead to the protection of specific species and may not support the diversity of pollinators (Senapathi, 2015). Integrated management strategies outline the importance of protecting both wild and domestic pollinator species for agricultural pollination (Aebi et al, 2012). This should be implemented alongside land heterogeneity, to encourage plant and crop diversity. An example of this is the inclusion of semi-natural areas within croplands (Garibaldi et al, 2013). It is also recommended for strategies to be implemented at the landscape scale (Vasiliev & Greenwood, 2020).

The implementation of national policy is an effective method to protect pollinators, both on a national and international level. On a national level, Norway has already initiated different solutions to tackle the issues regarding pollinator conservation. Such measures are increased subsidies for wild pollinator conservation, a national surveillance program for pollinating insects, and joining an international UN initiative called “Coalition of the willing on pollinators”, which aim to increase international knowledge and understanding of pollinators (Prop. nr. 1 S (2019-2020)). The Norwegian government has also proposed a national pollinator strategy, which is made through cooperation between almost every major department. Though it has been criticized from both external and internal voices, believing it does not go far enough to protect pollinators in Norway (Regjeringen, 2020). The Norwegian government has in addition produced a conservation legislation titled ‘the Norwegian Nature Diversity Act’. Despite some criticism, these policies are a step in the right direction in the search for a viable strategy that could strengthen and incentivize meaningful change. Either by creating stricter laws that prohibit the use of certain chemicals, or boost incentives that make it profitable for companies to take the right choices when it comes to pollinator conservation.

There are numerous actions that can be taken by individuals to support the work of such policies. This includes planting diverse ‘bee gardens’ to create corridors between habitats, minimizing the use of chemical products in gardens, and supporting organizations and campaigns that work to protect pollinator species (The Bee Conservancy, 2021). The installation of ‘bee hotels’ creates above ground nesting sites for wild bee species (Maclover & Packer, 2015). These actions are particularly important to support pollinator populations in urban areas (Badlock, 2020). Another example of what you as an individual could do, is to lower the number of times you cut your lawn or leave certain parts of the lawn untouched and let it grow wild (NRK, 2020). Collectively the work of individuals can make a significant difference to the protection of pollinator species. Awareness and education of the threats facing these species is important to change behaviors and activities causing the decline.

Conclusion

Pollinators provide us with many ecosystem services, especially through agricultural production. It is therefore important that we tackle the threats that they may face. Such threats are land use change, climate change, alien species, use of pesticides and accumulation of environmental toxins in the food system. Humans are causing these threats, and hence have a responsibility to fix and prevent them. The solutions to face these problems are complex and varied, thus need to be handled from an individual, national and international scale. From an individual perspective you could become cautious about use of chemicals and support local charities that work to help pollinators thrive. While from a governing perspective, both stricter and more regulated laws are needed to hold people responsible for their actions, and to incentivize innovation. Norway has for instance implemented a national strategy that aims to maintain the diversity of pollinating species. Therefore, to conclude, everyone can do something to help, pollinators need you, so be kind to them.

References

Aebi, A., Vaissière, B.E., Van Engelsdorp, D., Delaplane, K.S., Roubik, D.W. and Neumann, P., 2012. Back to the future: Apis versus non-Apis pollination—a response to Ollerton et al. *Trends in Ecology and Evolution*.

Environment, Norwegian Ministry of Local Government and Modernisation, Norwegian Ministry of Transport and Communications, Norwegian Ministry of Defence, Norwegian Ministry of Education and Research and Norwegian Ministry of Petroleum and Energy

Garibaldi, L.A., Steffan-Dewenter, I., Winfree, R., Aizen, M.A., Bommarco, R., Cunningham, S.A., Kremen, C., Carvalheiro, L.G., Harder, L.D., Afik, O. and Bartomeus, I., 2013. Wild pollinators enhance fruit set of crops regardless of honey bee abundance. *science*, 339(6127), pp.1608-1611.

MacIvor, J.S. and Packer, L., 2015. 'Bee hotels' as tools for native pollinator conservation: a premature verdict?. *PLoS one*, 10(3), p.e0122126.

Norwegian Ministries (2018) *National pollinator strategy - A strategy for viable populations of wild bees and other pollinating insects*. M-0750 E, Impression 200, Oslo: Norwegian Ministry of Agriculture and Food, Norwegian Ministry of Climate and

NRK (2020) Bienes dag: – Norge har bedre grunnlag enn andre for å redde biene. Available at: [https://www.nrk.no/norge/bienes-dag - -norge-har-bedre-grunnlag-enn-andre-for-a-redde-biene-1.15021228](https://www.nrk.no/norge/bienes-dag--norge-har-bedre-grunnlag-enn-andre-for-a-redde-biene-1.15021228) (Accessed: 11.05.2021).

Ot.prp. nr. 1S (2019-2020). For budsjettåret 2020 under Klima- og miljødepartementet
Utgiftskapittel: 1400–1482 Inntektskapittel: 4400–4481 og 5578

Polce et. al (2014) *Global Change Biology*, 20, 2815-2828

PollinatorPartnership (no date) *Pollinator Friendly Cookbook*. Available at: <https://www.pollinator.org/pollinated-food> (Accessed: 8 May 2021)

Pollinator.org. 2021. *About Pollinators | Pollinator.org*. [online] Available at: <<https://www.pollinator.org/pollinators>> [Accessed 11 May 2021].

Regjeringen (2020) Nasjonal Pollenstrategi: Ein strategi for levedyktige bestandar av villbier og andre pollinerande insekt. Available at: <https://www.regjeringen.no/contentassets/3e16b8410e704d54af40bcb3e687fb4e/nasjonal-strategi-for-villbier.pdf> (Accessed: 06.05.2021).

Senapathi, D., Biesmeijer, J.C., Breeze, T.D., Kleijn, D., Potts, S.G. and Carvalheiro, L.G., 2015. Pollinator conservation—the difference between managing for pollination services and preserving pollinator diversity. *Current Opinion in Insect Science*, 12, pp.93-101.

Steel, C., *Humler og bier er utrydningstrua fordi leveområdene blir borte* (no date). Available at: <https://www.sabima.no/trua-natur/humler-og-bier/> (Accessed: 10 May 2021).

The Bee Conservancy. 2021. *10 Ways to Save the Bees - The Bee Conservancy*. [online] Available at: <<https://thebeeconservancy.org/10-ways-to-save-the-bees/>> (Accessed: 10 May 2021).

Totland, Ø. Hovstad, K. A. Ødegaard, F. Åstrøm, J. (2013) *Kunnskapsstatus for insektpollinering i Norge - betydningen av det komplekse samspillet mellom planter og insekter*. Available at: https://www.artsdatabanken.no/Files/13966/Kunnskapsstatus_for_insektpollinering_i_Norge (Accessed: 8 May 2021)

Vasiliev, D. and Greenwood, S., 2020. Pollinator biodiversity and crop pollination in temperate ecosystems, implications for national pollinator conservation strategies: Mini review. *Science of The Total Environment*, p.140880.