Where would we be without pollinators?

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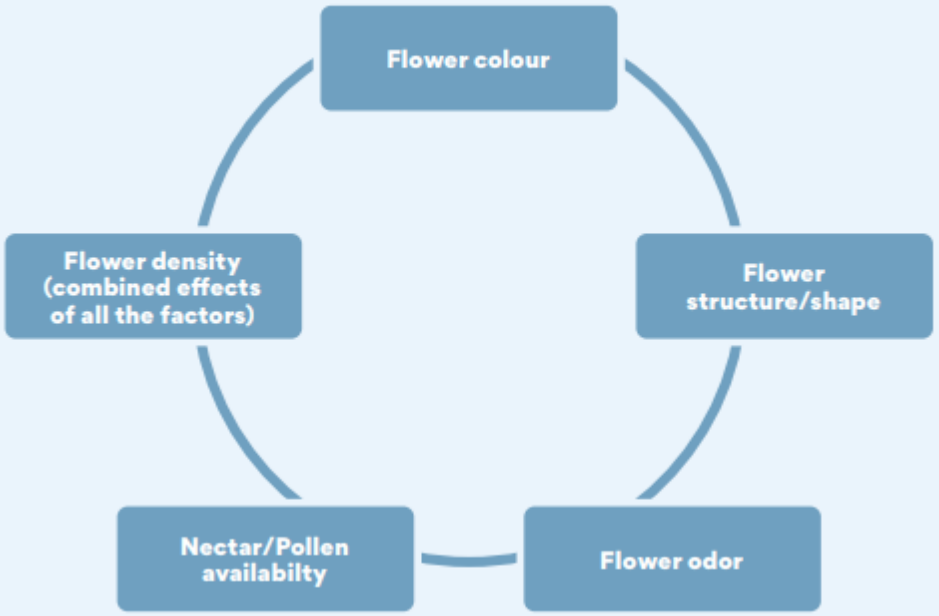
Introduction

Global food and nutrition security depends on the state of world pollinators, such as birds, mammals, and many invertebrates. Several hundred insect species play a major role in global crop pollination, mainly beetles, flies, moths, butterflies, wasps, ants, thrips and the most obviously recognisable pollinators, bees. Out of approximately 369,000 species of angiosperms (flowering plants), almost 90% interact with pollinators, with the majority not being able to reproduce in their absence [1].

Animals, particularly bees are responsible for the gemmate transfer between one or more variety of at least 66% of the estimated 1,500 crop species cultivated around the globe [2]. Around 75% of the world's most abundant food crops have increased fruit or seed set when animal pollinated, this results in a further economic benefit of at least €150 billion or around 10% of the value of annual world agricultural production [1]. These figures show the human reliance on the eco-system services provided by pollinators, whether in the form of food production, nutrition, societal implicates or economic prosperity.

Staple crops like cereals, often produce flowers which are wind pollinated, therefore their reliance on pollinators is minimal and most other crops can yield without pollination, for example, leafy greens, bulbs, tubers and root vegetables [2-3]. In the 20th century the development and popularisation of crops less reliant on pollinators has sparked interest in many fruits and vegetables, for example, bananas, tomatoes, citruses, many legumes and oil crops. On the other hand, most fruit plants are dependent on the gemmate shuffle, which magnifies the importance of pollination. From a food security perspective, large field agglomerations that pursue monocropping are not as pollinator dependant, as are for example, rural communities in the developing world, as these often rely on local food eco-systems, including the pollinators (especially as the ratio of animal pollinated plants increases from around 78% in the more industrialised temperate zones to over 94% in the less wealthy tropics), [1-3]. Nevertheless, the declining wild pollinator populations could have significant implications for global food supply, as around three quarters of cultivated crops rely on pollination to some degree, sometimes indirectly through initial seed cultivation, or by fertiliser production or animal feed. The absence of pollinators could result in a yield reduction of 100% in some crops but only 5% in others [4].

Figure 1: Factors influencing the insect visitation to flowers. Gardeners could use this to enhance their garden attractiveness to the pollinators.



Pollinator Shortage

This pollinator shortage has been on the horizon for quite some time, despite the efforts undertaken by scientists and food systems practitioners. Wild populations of pollinators are drastically dropping around the globe, yet there is a small increase in the number of managed bee colonies, which unfortunately, often become the victim of colony collapse disorder or the Varroa mite (see foot note 2 and figure 2), [5-6]. As a result, the environmental degradation and problems with managed pollination might still be compromising the production of pollinator-dependent crops like nuts, soybean, coffee, and many fruits, contributing to food insecurity in some specific areas [3-6].

Where crops fail or end up diminished due to pollinator absence, most growers will actively manage their pollination. The problems with pollinator populations have, for example, impacted pear production in China, where every year, tens of thousands of local people are recruited for the immense task of hand pollinating pear flowers [5-6]. Vanilla is a prime example of a premium food commodity that is purely hand pollinated. This task requires workers to physically, by hand, transfer the pollen from one flower onto another [6]. Vine crops from the *Cucurbitaceae* family, like watermelons, melons and pumpkins are very often pollinated with help from managed honey-bee colonies settled around the fields. A similar approach is undertaken at cocoa-tree farms through agroforestry where permanent bee colonies are settled by humans or the bees are transported on lorries, but only for the flowering period, similar to avocado and passion fruit production in many tropical countries.

This, however, could be contributing to the illusion of the lack of correlation between the declining populations of wild insects and some degradation in yields [4-6].

The problem of diminishing wild pollinators also impacts urban growers, allotment holders and small-scale farmers across Europe. Urbanisation is often associated with the decline of local biodiversity, this is due to habitat fragmentation, distribution and elevated levels of pollution, altered light and moisture levels and as a result of that, growers must sometimes rely on hand pollination [5].

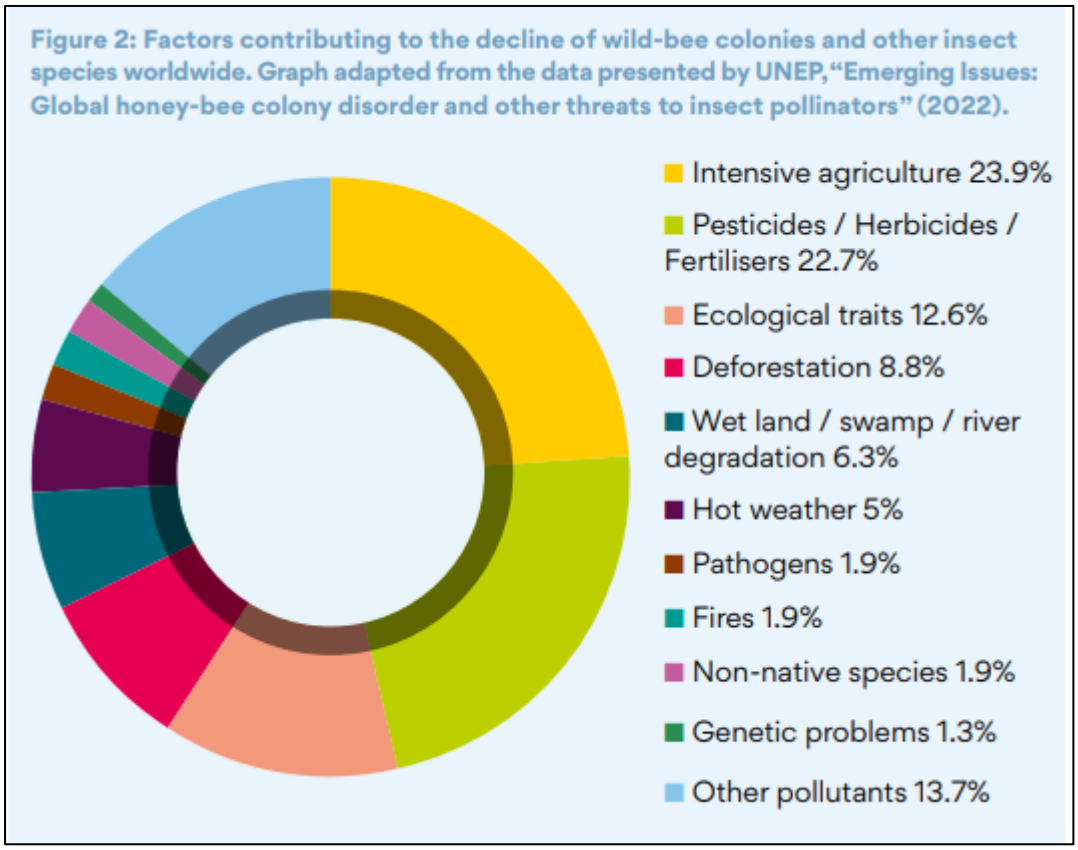


Figure 2: Factors contributing to the decline of wild-bee colonies and other insect species worldwide. Graph adapted from the data presented by UNEP, "Emerging Issues: Global honey-bee colony disorder and other threats to insect pollinators" (2022).

Reintroducing pollinators back to urban areas

Some efforts are being made to reintroduce insects back into towns and cities, often through the modification of local flora in parks and gardens, however this is often dominated by exotic horticultural varieties, potentially leading to an increase of foreign species of insects, which could further endanger the local environment.

Urban gardeners could also try to promote settlements of native pollinator species through the enhancement of flora, with native plants creating ecological habitats that fulfil the nesting habitats, sociality and behaviourally of the lost/ declined species of pollinators. The diversity of bee species for example, has been seen to correlate with the percentage of seminatural habitats in the area [3-5].

Similar principles could be undertaken by the larger, often commercial orientated food growers. Science suggests that land preservation and sustainable management practices

could generate a significant economic benefit to growers by promoting wild bee populations that enhance yield production [4]. Crop-pollinating insect species are often generalist and pollinate many native plants, however, restoring pollination services to agriculture could also benefit wild plants and thereby promote the conservation of biodiversity across the agri-natural landscape [2]. This could be achieved by increasing agrobiodiversity or intercropping. Furthermore, the conservation of wild insect habitats like meadows and especially the buffer strips of land separating fields from roads and fields' margins are essential to reducing insect degradation levels. Perhaps a more conscious use of pesticides as well as herbicides, for example, through the adoption of technology driven precision farming, could prove as advantageous for the local biospheres as for the farmers themselves. This has been observed at a fava bean (*Vicia faba* L.) farm in Australia, where a change in knowledge-oriented field management increased yield by 17%, purely through the maintenance of local wild bee habitats [4]. The benefits to farmers are not only limited to the increase in yield, but also the decrease of certain running costs, as a rich bank of insects around a field can significantly reduce the need for hand pollination or hive renting.

Conclusions

Food and nutrition security is known to be a complex chain of interacting factors that include economic values, infrastructure, science and social inequalities. In 2020, the World Economic Forum identified the decline of pollinators in the top five long-term global risks, due to the effects of a shift in crop cultivation from nutrient-rich food crops (e.g., fruits) to energy-dense, nutrient-poor commodity crops (e.g., wheat, soybean). Improving the state of world pollinators is an important factor in feeding populations and policymaking can be a very useful method for the ecologically orientated changes in the agricultural systems. However, more action is needed to reverse damage already done and individuals themselves could take up the challenge of creating insect friendly habitats, whether in their local areas, by maintaining meadows, lawns, shrubs, and trees or by incorporating more native species of plants, both perennial and annuals, into their gardens. Creating a rich biodiverse garden, with numerous species, with the combined flowering time of at least two seasons, is a stepping stone to attracting bees into gardens and providing them with a rich source of food, enabling colonies to multiply, survive winter and thrive in spring.

Foot notes:

Foot note 1: Flower fertilisation is on average higher for wind pollinated monocrops due to the abundance of coflowering conspecific plants.

Foot note 2: Colony collapse disorder is a natural phenomenon where the worker bees disappear from the managed beehives, leaving behind the queen, young larvae, and food. Varroa mite on the other hand, is a parasite that attacks and kills honeybees worldwide.

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