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Bumblebees pollinate urban gardens better than agricultural land

A recent study has found that bumblebees in Saxony-Anhalt, Germany are more successful at pollinating urban areas than agricultural land. Urban areas also had higher flower diversity and more potential nesting areas for bees compared to agricultural areas. However, the abundance of bee parasites was also higher in urban areas, although this was not found to negatively impact on pollination. This demonstrates the value of urban green spaces as habitat for pollinators.

Land use changes are one of the main causes of biodiversity loss, including of pollinator species. Urbanised areas and intensively managed agricultural land have reduced floral diversity and nesting habitat for pollinators compared to natural habitats. Pollinators are also threatened by parasites, which can reduce population numbers and change individual behaviour. Bumblebees for example are attacked by a range of parasites such as the parasitic fungus *Nosema bombi* and the gregarine (a microscopic worm-like internal parasite) *Crithidia bombi*, which affect colony reproduction and foraging performance. However, land-use change can also lead to potential benefits for pollinators if it supports re-naturalisation, i.e. if it brings natural or semi-natural elements into an intensively used landscape. For example, flower-rich gardens can provide enhanced habitats for bees and other insect species in urban areas.

This study investigated the combined effects of differing land use (specifically looking at urban areas and agricultural land) and parasites on the ecosystem service of pollination. The researchers selected nine field sites in Saxony Anhalt, Germany, with differing degrees of surrounding urban and agricultural land use. Four plant species used by pollinators — red clover (*Trifolium pratense),* white clover *(Trifolium repens),* starflower (*Borago officinalis*) and white mustard (*Sinapis alba*) — were grown in insect-free greenhouses and then placed at the field sites. Following field experiments, the plants were returned to the greenhouse and seeds were counted to provide a measure of pollination success. Insect visitors and the length of time insects spent on flowering parts of the plants were also recorded during the experiments. The number of different flower species (species richness, an indicator of floral resources) and the percentage of bare soil (an indicator of available bee nesting habitat) were also recorded. Bumblebees at the sites were collected and the presence of *Crithidia* and *Nosema* parasites were determined from DNA analysis.

The researchers modelled the information gathered regarding surrounding land use, flower visitation rates, flower abundance and the number of parasites to explore the relationships between these different variables.

The researchers found both bumblebee abundance and pollination of wild flowers was higher in urban than rural agriculture sites. This may be due to higher availability of nesting resources and higher local flower species richness, which were related to insect visitation and pollination rates. This indicates the importance of local habitat quality and surrounding land use for pollinator species.

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Source: Theodorou, P., Radzevičiūtė, R., Settele, J., Schweiger, O., Murray, T.E. & Paxton, R.J. (2016). Pollination services enhanced with urbanization despite increasing pollinator parasitism. *Proceedings of the Royal Society B*, DOI: 10.1098/rspb.2016.0561.

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Of the 314 bumblebees sampled, 19% were infected with *Crithidia*, which was more commonly found than *Nosema* (6%). Parasitism was also higher where bumblebees were more abundant — i.e. in urban areas — and in male bumblebees. This is possibly because higher host populations increase the transmission of parasites between individuals. However, this relative parasite abundance did not appear to outweigh the increased pollination success in urban areas.

The study demonstrates the value of particular types of urban areas over agricultural areas as habitat for pollinators, which has positive knock-on effects for important ecosystem services. However, to provide these benefits, urban areas must contain suitable semi-natural habitats, such as gardens with high numbers of flowering species and areas of semi-bare ground where ground-nesting bee species can nest. Urban parks and other green infrastructure can also be managed to encourage pollinator biodiversity.