

Science for Environment Policy

Pollinator-dependence an underestimated risk?

Researchers have found that crops which rely heavily on pollinators have lower yields compared to less pollinator-dependent crops. They also have slower growth in yields and less stable yields from year to year. The results highlight the importance of managing biodiversity to support ecosystem services, such as pollination, on which much modern agriculture depends.

Pollination, whether by managed hives of honeybees or by wild pollinators, is often a limiting factor for crop growth. Many crops depend on pollination in whole or in part, for instance, pollinators can increase productivity by around 75% for the 115 globally most important crops. However, the diversity of wild pollinators is declining, and this could have a detrimental effect on global food security.

Using a model of the effects of human and environmental resource availability on crop yields, the researchers made four predictions about the impact of pollinator dependence on global crop yields. Although the researchers concentrated on pollination, their model could be applied to any ecosystem service which limits crop growth.

They predicted that crops such as apples, cucumbers, pears and plums, which depend most on pollinators, would have lower average yields relative to the theoretical maximum yield of the crop, and slower increases in yield as farming practices improved. They would also have less stability in yields year to year, and faster growth to compensate for slower increases in yield. As a result, overall production would vary less than crop yield or cultivated area alone.

The researchers then compared their predictions to data on actual global crop growth from the Food and Agriculture Organization of the United Nations. The data, collected annually between 1961 and 2008, included yield and cultivated area for 99 different crops categorised according to how dependent on pollinators they were, from no dependence through to complete dependence.

As predicted, relative yields of pollinator-dependent crops were lower than for crops with less dependence on pollinators. The most pollinator-dependent crops also had the least stable yields, with a much greater annual fluctuation. Variations in pollen supply accounted for around half of the changes in yield between years, demonstrating that pollen supply does limit crop yields.

Likewise, significant pollinator-dependence reduced the effects of farming improvements on yields, slowing yield growth. In response, the cultivated area of pollinator-dependent crops increased more rapidly. Finally, the data confirmed that production levels did not increase as quickly with increased pollinator dependence as did yield or area alone.

However, six crops that were entirely dependent on pollinators, including brazil nuts, watermelon, cantaloupe, cocoa, vanilla and a group containing pumpkin, squash, gourd, marrow and zucchini, did not follow these trends. The researchers believe this was because these crops were hand-pollinated, indicating that greater yield growth could be achieved for other crops through more careful pollination management. Yield growth and stability would also benefit from active management of local biodiversity, specifically of wild pollinators and their habitats.

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