

Impact of natural selection on nectar supply and demand

August 5 2021, by Stephanie Allen

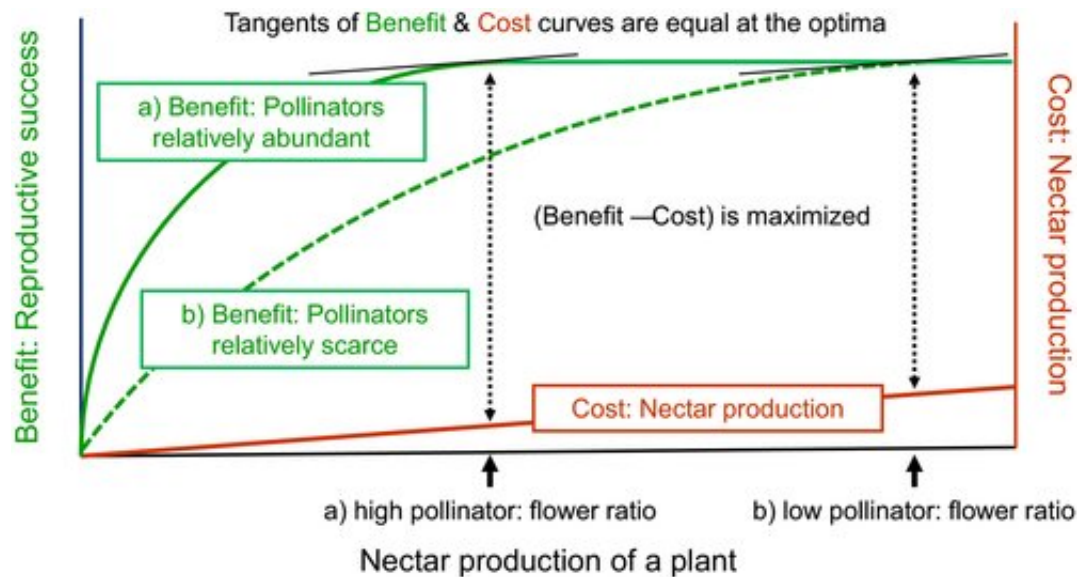


Figure 1: Reproductive benefit (e.g., number of ovules fertilized) and cost (e.g., number and/or size of potential seeds provisioned) of nectar production to an individual plant at times of pollinator abundance and scarcity (i.e., high and low pollinator to flower ratio). Plant reproductive success approaches a maximum as pollination increases (curves a and b). When pollinators are abundant and flower visitation rates are high (a), a plant reaches a given level of reproductive success at a level of nectar production that is lower than when pollinators are scarce, and flower visitation rate is low (b). Optimum nectar production occurs when the benefit minus the cost of nectar production is maximized, as shown by the vertical arrows. These are also the points when the tangents of the benefit and cost curves are equal. The cost curve is shown as a linear because secreting twice as much nectar should be twice as costly. Credit: DOI: 10.1111/ele.13823

New research by the Laboratory of Apiculture and Social Insects (LASI) at the University of Sussex shows that natural selection will cause flowers to produce less nectar when pollinators are abundant, and vice versa.

The research, published in the journal *Ecology Letters*, explains that, when pollinators are scarce, natural selection will cause plants to produce more nectar to outcompete other plants in attracting pollinators. But when pollinators are abundant, plants will be selected to produce less nectar as pollinators are easy to attract and will work for "low wages."

The research helps explain why [bees](#) and other insects have to work harder to collect nectar in the summer, when there are more pollinators on the wing.

Francis Ratnieks, LASI Director and Professor of Apiculture at the University of Sussex, said: "Flowers need to attract pollinating insects to reproduce by making seeds and by exporting pollen to other flowers. When pollinators are abundant a plant won't have to make much nectar to do this. But when pollinators are scarce more nectar will be needed to attract the pollinators in competition with other flowers."

The scenario is similar to high-tech companies and specialist workers. When the specialists are in short supply, companies need to offer higher salaries to outcompete other companies. But if specialist workers are abundant, lower pay can be enough.

Professor Ratnieks added: "What is intriguing is that competition among plants for pollinators combines with [natural selection](#) to cause positive feedback that exacerbates imbalances between supply and demand. Our study shows how complex nature really is."

LASI co-author Dr. Nick Balfour noted: "Why, if in spring pollinators

are scarce and nectar abundant with the reverse in summer, don't insects change their flight period to spring and plants their bloom period to summer? In fact, there are numerous evolutionary and ecological constraints that prevent or hinder this. For example, spring blooming plants cannot easily change to summer blooming and the life cycles of honey bee and bumble bee colonies means there will be more bees in summer than spring."

The findings have interesting implications for bee and pollinator conservation. For one thing, human interventions could help improve nectar balance, such as in the UK by the growing of summer blooming agricultural crops or garden flowers, and by encouraging summer blooming wild flowers.

Professor Ratnieks added: "At LASI, the [Sussex Plan for Honey Bee Health and Well Being](#) investigates the challenges facing honey bees and beekeeping, in particular foraging and food supply, as well as pests and diseases. Previous LASI research has shown that it is July and August when bees have to work harder to find food so it is in these months when people can really help bees. By ensuring there are bee-friendly [plants](#) available, such as marjoram, lavender and borage, in our gardens and greens spaces during the [summer](#), we can provide additional [nectar](#) at a time of shortage."

"The Sussex Plan has been kindly supported by Rowse Honey through their Hives for Lives program for over a decade, enabling us to study these topics which are vital for the long- term health of our bees and other pollinators."

Samantha MacNamara, Senior Brand Manager at Rowse Honey, said: "Our Hives for Lives program is all about supporting bees and beekeepers. We are proud to be the lead sponsor of LASI's Sussex Plan for Honey Bee Health & Well Being and contribute to a better

understanding of how to support these important creatures.

"We also work with two other Hives for Lives partners—the Bee Farmers Association (BFA) to run an apprenticeship scheme to inspire, recruit and train the next generation of young British bee farmers; and Bees for Development (BFD) to support communities in Ethiopia to earn an income from honey, offering a sustainable pathway out of poverty."

More information: Francis L. W. Ratnieks et al, Plants and pollinators: Will natural selection cause an imbalance between nectar supply and demand?, *Ecology Letters* (2021). [DOI: 10.1111/ele.13823](https://doi.org/10.1111/ele.13823)

Provided by University of Sussex

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