The truth about honeybees

Heard what Einstein said about humans having four years to live if the bees died out? Well he didn’t and we won’t, say Marcelo Aizen and Lawrence Harder

A MOVIE called Vanishing of the Bees opened in cinemas across the UK earlier this month. It’s a feature-length documentary about the “mysterious collapse” of the honeybee population across the planet – a phenomenon that has recently attracted a great deal of attention and hand-wringing.

The idea that bees are disappearing for reasons unknown has embedded itself in the public consciousness. It is also a great story that taps into the anxieties of our age. But is it true? We think not, at least not yet.

First, the basics. Pollination by bees and other animals – flies, butterflies, birds and bats – is necessary for the production of fruits and seeds in many wild and cultivated plants. More than 80 per cent of the planet’s 250,000 species of flowering plants are pollinated by animals.

Agriculture is a large-scale beneficiary of these pollination services, so claims that pollinators are in decline have triggered alarm that our food supply could be in jeopardy, that we may be on the verge of a global “pollination crisis”.

Claims of such a crisis rest on three main tenets: that bees are responsible for the production of a large fraction of our food; that pollinators are declining worldwide; and that pollinator decline threatens agricultural yields. Numerous scientific papers, many media stories and even a European Parliament resolution in 2008 present each of these as an uncontested truth. But are they?

Our analysis of data from the Food and Agriculture Organization of the United Nations reveals a different perspective on the pollination crisis – one that is less catastrophic than that depicted in the movies (Current Biology, vol 18, p 1572, and vol 19, p 915).

The first tenet – that bees are responsible for the production of a large fraction of our food – is simply untrue. Pollinators are important for many crops, but it is a myth that humanity would starve without bees.

About 70 per cent of the 115 most productive crops, including most fruits and oilseeds, are animal-pollinated. These account for nearly 2.5 billion tonnes of food a year, about a third of global agricultural production. However, few of these crops depend on animal pollination completely, owing largely to their capacity for self-pollination.

On top of that, production of many staple foods does not depend on pollinators at all: carbohydrate crops such as wheat, rice and corn are wind-pollinated or self-pollinated. If bees disappeared altogether, global agricultural production would decrease by only 4 to 6 per cent.

What of pollinator decline? Claims of global bee disappearance are based on collections of (often extreme) regional examples, which are not necessarily representative of global trends. These examples tend to come from parts of Europe and North America where little natural or semi-natural habitat remains.

Stocks of domesticated honeybees, the most important crop pollinator of all, have also decreased considerably in the US and some European countries in recent decades. However, these declines have been more than offset by strong increases in Asia, Latin America and Africa. Indeed, the number of managed honeybee hives worldwide has increased by about 45 per cent in the past five decades.

There have also been scare stories about “colony collapse disorder” and the spread of Varroa mites in the US and Europe. Again, these are real phenomena, but they are short-term blips rather than the driving forces of long-term trends. Instead, the long-term declines seem to be consistent with the economic dynamics of the honey industry, which seems to be shifting to developing countries in search of cheaper production.

Finally, does a low abundance of pollinators significantly affect agricultural productivity? It is true that a lack of pollinators, especially bees, can limit the yield of many crops and wild plants. It is also true that the yields of many pollinator-dependent crops have
grown more slowly than that of most non-dependent crops. However, contrary to what we would expect if pollinators were in decline, the average yield of pollinator-dependent crops has increased steadily during recent decades, as have those of non-dependent crops, with no sign of slowing.

Overall, we must conclude that claims of a global crisis in agricultural pollination are untrue.

Pollination problems may be looming, though. Total global agricultural production has kept pace with the doubling of the human population during the past five decades, but the small proportion of this that depends on pollinators has quadrupled during the same period. This includes luxury foods such as raspberries, cherries, mangoes and cashews. The increased production of these crops has been achieved, in part, by a 25 per cent increase in cultivated area in response to increased demand for them.

This expansion may be straining global pollination capacity, for two reasons. Demand for pollination services has grown faster than the stock of domestic honeybees, and the associated land clearance has destroyed much of the natural habitat of wild pollinators.

The accelerating increase of pollinator-dependent crops therefore has the potential to trigger future problems both for these crops and wild plants. These problems may grow as decreasing yields of raspberries, cherries and the rest prompt higher prices, stimulating yet more expansion of cultivation. So although the current pollination crisis is largely mythical, we may soon have a real one on our hands.

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One minute with...

Jeff Greason

One of the leading lights of the private space industry argues that NASA must keep investing in human space exploration

What can NASA do to improve?

NASA should have a technology road map that outlines how to modernize propellant for the handling and storage of propellant in space. It doesn’t have a plan saying, “These are the capabilities we have today, these are the capabilities we want tomorrow, and how are we going to get there from here?”

Which cutting-edge technologies should NASA develop first?

The very first element would be a technology for going to the Moon and Mars. If we had such a “gas station” it would significantly increase the number of missions that we could send to deep space. If you use chemical rockets, you want to be able to manufacture propellant at your destination. That saves a huge chunk of initial mass because you don’t have to take the propellant with you to get you back to Earth. Then there’s a whole bunch of ideas for advanced space propulsion. An ion engine called VASIMR is a perfect example.

What surprised you most in your work with the White House’s Augustine Committee?

We hoped to find a way for NASA to do great and wonderful things within their current budget but we really didn’t. And it wasn’t for lack of trying. Over the long term, if you’re not going to make the budget go up, and you want to do something great, you have to lower the fixed costs.

What can NASA do to cut costs?

There was one option which involved relying on expendable launch vehicles – the Delta IV and Atlas V rockets – the cost of which would be shared with the Department of Defense. That does have the potential to change the fixed costs of the human space flight programme.

Is NASA still capable of inspiring achievements like the Apollo moon landings?

It’s easy to say, and I’ve said it myself, that we just don’t have the NASA we used to have, so we can’t do the things we used to do. But whatever is wrong or right with NASA, the quality of the people isn’t a problem. NASA has really good, motivated people. One contributing factor could be that we’re not asking them to do the right job. But the bigger question is, do we really want to spend whatever it takes, hundreds of billions of dollars, all so we can race to plant a flag for reasons of national pride?

But you don’t think we should discontinue human space exploration?

I think one of the most important findings that we made on the Augustine committee is that there is an underlying reason why we should be doing human space exploration, which is that we ought to extend human civilisation beyond this planet, and that is an incredibly important human endeavour. Stephen Hawking calls for moon and Mars colonies. To my mind, I can’t see why we wouldn’t do it. It’s the only way to create a future in which humans can live somewhere other than Earth. Robots will help, but you don’t learn how to live in places by just sending robots.

Interview by David Shiga