

Farming and the fate of wild nature

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Chocolate-backed Kingfisher. Credit: Lars Holbech

Farming is the greatest extinction threat to birds, mammals, plants and insects, and widespread land clearing, irrigation and chemical treatments have profoundly affected wild species and habitats the world over. But why should we care about biodiversity when the necessity of meeting an expected doubling of global food demand is only decades away?

The stark reality, as conservation scientist Professor Andrew Balmford explained, is that [biodiversity](#) is not a luxury, it's a necessity for human life: "As well as being a vital source for many people of food and fuel, wild nature is crucial for every one of us in mitigating climate change, regulating water flows, and buffering people from the impact of storms and floods."

"World agriculture developed and flourished during a period of climate stability," he added. "We don't yet know how our current agricultural systems will be affected by climate change but my guess is that they will be more sensitive than we realise. For me, this uncertainty underscores the importance for the future of farming of agriculture having least possible impact on what remains of nature."

Professor Balmford, who helps lead the Conservation Science Group in the Department of Zoology, advocates thinking smart from the start. "It's vitally important to integrate biodiversity

concerns into the inevitable expansion in agriculture, especially in developing countries and regions where crop farming is likely to increase the most," he said, "and to do this at an early stage, not when it's too late to save remaining wild habitats and the species that depend on them."

A dual challenge

From the moment that humans first began transforming land from wild nature, we have been a direct competitor with biodiversity, as a great many studies measuring the rate of species extinction in relation to land development have shown.

However, as Professor Rhys Green, also from the Department of Zoology, explained: "It's now not enough to count how many species are disappearing or to understand why ecosystems are collapsing. We need to work out what kinds of farming provide the food we need yet give the best prospect for minimising biodiversity losses."

The real question therefore is what can be done to tackle both problems in tandem? Professor Green, together with Professor Balmford and others, came up with a model (published in *Science* in 2005) that, when the right data are collected, can be used to answer this question. They looked at the impact on biodiversity of two potential solutions - land sparing and land sharing - and asked, theoretically, which would be best for wild nature.

"With land sparing, the idea is to farm the productive region as intensively as possible, without damaging areas away from farmland, and then to set aside other land for wild nature," explained Professor Green. "With land sharing, agricultural practices encourage wildlife through retention of hedgerows, patches of native vegetation and fewer pesticides. This usually means lower yields and therefore more land is needed to grow a given amount of produce."

"The argument for land sparing is rarely made by conservationists - it's more commonly advocated in

the agriculture literature," he added. "Yet our mathematical model suggested that land sparing might allow more species to persist."

In search of data

To find out if land sparing was indeed a better option for productivity and wildlife required a combination of data that had never been collected before.

Measurements were needed of the abundance of individual species in matched landscapes that vary only in the degree of agricultural development - from wild nature, through wildlife-friendly farming, to high-yield intensive farming - as well as, crucially, of the agricultural yield of these same landscapes.

"We know quite a lot about the impact of different landscapes on wildlife, but this can be misleading without information on yields as well," said Dr. Ben Phalan, who for his graduate studies spent 15 months in Ghana surveying wildlife and measuring agricultural yields and profits, while fellow graduate student Malvika Onial did the same in northern India.

Although agricultural change is an important driver almost everywhere, the research focused on developing countries because these regions are home to some of the largest concentrations of biodiversity and also to the most rapid changes in human populations and agricultural practices.

"By quantifying how species are affected by increasing yield, we can work out whether it's better to spread farming out over a larger area to dilute its impact or to concentrate production in existing croplands, allowing the protection of natural habitats such as rainforest," said Dr. Phalan.

More recently, the team has also begun to look at other regions of the world such as more-developed countries.

Smarter thinking

"Inevitably, there will be unease about advocating high-intensity food production," added Professor Balmford. "It will be important to look carefully at

practices that have impact beyond the farm - use of fossil fuels, fertilisers, water abstraction, pollution, social concerns and so on. But our studies suggest that if we want to reconcile biodiversity and food production then we might well be better separating them than trying to integrate them on the same land."

The first steps in using the information to inform future agricultural practices have already begun. Dr. Phalan has embarked on a broad-sweep analysis of the tropics to identify where croplands are expanding most and where there is likely to be greatest conflict with conservation priorities.

This project is a collaboration between the Department of Zoology, BirdLife International, the Royal Society for the Protection of [Birds](#) (RSPB) and the UNEP World Conservation Monitoring Center - all of which are members of the Cambridge Conservation Initiative (see panel) - with vital seed funding provided by the Isaac Newton Trust.

"The new project is a chance to understand how to resolve trade-offs between conservation and agriculture, and to make wise choices about where and how we [farm](#)," explained Professor Balmford. "Only then can we hope to meet increased food demands at the least cost to the other species with which we share our planet."

Provided by University of Cambridge

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