Current land use policies risk accelerating farming's environmental impact

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Unless researchers and policymakers assess the overall, global effects of farm policy and land use interventions, poor decisions that are not supported by scientific evidence risk exacerbating problems of biodiversity loss, climate change and environmental degradation, warn conservation scientist Professor Andrew Balmford and environmental economist Professor Ian Bateman.

In a recent co-authored article in *Nature*, we point out that while governments worldwide are increasingly adopting policies intended to lessen farming's environmental impact – including agri-environment schemes, rewilding and organic agriculture – a corresponding failure to account for the wider effects of reduced food production, particularly through increased food imports, may mean these actions accelerate global biodiversity loss and climate impact.

When the scientific evidence points to the critical importance of making space for the conservation and restoration of natural habitats by being as productive as possible on land that is farmed, why is there such a disconnect between the science and the policy?

In response to the biodiversity and climate crisis, the United Kingdom, European Union, Japan, Mexico and many other countries are increasingly devoting resources to what appear superficially to be more environmentally friendly ways to use land.

Much of the focus is on 'land-sharing' approaches to increase farmland biodiversity, such as reduced pesticide and fertiliser use, more diverse cropping regimes, and creating small-scale habitats such as unsprayed field margins and small patches of woodland.

But while these interventions can increase the populations of relatively common animals and plants, land-sharing generally does little for more specialised or vulnerable species that need larger areas of unfarmed habitat to thrive, including in the UK, for example, many birds, invertebrates, plants and fungi dependent on old-

growth forest. In fact, in Europe, farmland biodiversity has continued to decline despite the widespread roll-out of land-sharing policies.

At the same time, the yield-lowering effect of land-sharing policies drives up the need for imports, which means more harm to biodiversity and natural habitats further away. This produces perverse outcomes because the areas to which food production is displaced are typically more biodiverse. For example, according to one study, EU crop imports in the 25 years to 2014 caused more than 11 million hectares of habitat destruction in biodiverse countries such as Brazil and Indonesia.

Rewilding policies, in which large contiguous areas of farmland are taken out of production, can benefit species that are locally vulnerable or endangered, and of value to national biodiversity. But as with land-sharing, unless people are prepared to eat less, or yields are increased on other farmland, the removal of land from productive agriculture will increase demand for food imports and so damage biodiversity elsewhere.

Other policy interventions seek to increase the share of organic farming. Both the EU and Japan have committed to converting one quarter of farmland to organic production, by 2030 and 2050 respectively. But organic farming drastically lowers food yields on a given area. Estimates suggest that a wholesale switch to organic farming across England and Wales would cut food-calorie output by 40%. If the EU or Japan meets its organic targets, the resulting increase in demand for food imports would massively increase pressure on biodiversity elsewhere in the world.

Fortunately, an alternative policy approach, known as ‘land sparing’, could bring significant benefit to both local and global biodiversity. This involves lumping unfarmed habitat patches together into larger and potentially better-connected blocks, while increasing yields on land still in production.

The scientific evidence, gathered from intensive field studies on five continents, indicates that most species fare much better if habitats are left intact, which means reducing the space used for farming by adopting high-tech, lower impact ways to make farmed areas as productive and high-yielding as possible.

An array of techniques – involving new technologies but also working closely with smallholders - can help producers raise crop and livestock yields sustainably, including genomic selection and gene editing in plant and animal breeding, vertical farming, greater access to improved pasture and veterinary care in livestock production, and using native plants to redistribute pests away from crops.

Field studies in many countries, covering more than 2,000 species of bird, plant and insect, have all concluded that, for the same overall food output, high yield farming combined with land sparing results in larger populations of most wild species than other approaches.

Other research has also shown that adopting a land sparing approach in the UK would cost the taxpayer half as much to deliver the same biodiversity benefits, and produce 20% more food, than land sharing, while at the same time delivering significantly greater co-benefits, such as the removal and storage of greenhouse gases, and the provision of more space for recreation.

Figuring out how to feed, clothe and power 10 billion people without causing mass species extinction and wrecking the climate is this century's greatest challenge. The scientific evidence in support of land sparing is compelling. So why is it not the dominant policy approach today?

The political influence of large landowners interested in maintaining the status quo (12% of farms receive 50% of all taxpayer subsidies) is one widely cited factor.

But the push to locally benign but globally harmful policies may, we argue, be down to a more fundamental and much less recognised issue: the tendency for policymakers to focus on local measures of the impact of interventions often focused on a single outcome while overlooking system-wide impacts.

Historically, part of the challenge has been a lack of available scientific data and understanding of these broader economic and environment effects. But over the past five years or so, there has been more research aimed at designing tools which allow policymakers and others to understand the wider consequences of land use change.

For example, the Natural Environmental Valuation Online tool, developed at Exeter University, combines data from multiples sources to show how a particular land use change will contribute to our Net Zero commitments, benefit biodiversity and improve access to recreation, as well as its impact on domestic food production, which can then be linked to land use, climate and biodiversity impacts globally.

The UK Government has committed to publish a land use framework in 2023. The stakes are too high for policymakers to continue to ignore the promise of land sparing when so much scientific research indicates that it is more effective than many of the strategies currently being deployed.

This issue has become even more urgent since the adoption last December of the Convention on Biological Diversity goal of protecting 30% of the planet's land and oceans by 2030. What land will be put aside – in fragments or in consolidated blocks, how it will be managed and how humanity's growing demand for food and other agricultural products will be met elsewhere will in large part determine the biodiversity consequences of this hugely ambitious commitment made by world leaders.

Unless policymakers assess the overall, global effects of interventions aimed at addressing biodiversity loss, climate change and environmental degradation, poor decisions that are unsupported by the data will at best under-deliver, and at worst exacerbate these existential threats.

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