Boosting farm yields to restore habitats could create greenhouse gas 'sink'

January 4 2016

Credit: SC Department of Agriculture

New research into the potential for sparing land from food production to balance greenhouse gas emissions has shown that emissions from the UK farming industry could be largely offset by 2050. This could be achieved if the UK increased agricultural yields and coupled this with expanding the areas of natural forests and wetlands to match its European neighbours.

The new study suggests that by upping forest cover from 12% to 30% of UK land over the next 35 years—close to that of France and Germany, but still less than the European average—and restoring 700,000 hectares of wet peatland, these habitats would act as a carbon 'sink': sucking in and storing carbon.

This could be enough to meet government targets of 80% greenhouse gas reduction by 2050 for the farming industry. Agriculture currently produces around 10% of all the UK's damaging greenhouse gas emissions.

The new woodlands and wetlands would be more than just a carbon sink, say researchers. They would help support declining UK wildlife—including many species of conservation concern—provide more areas for nature recreation, and help to reduce flooding.

However, to make space for habitat restoration, and to meet rising levels of food demand, land sparing would depend on increases in farm yields, so that food needs can be met from less farmland.

The new study, published today in the journal *Nature Climate Change*, is the first to show that land sparing has the technical potential to significantly reduce greenhouse gas emissions at a national scale.

"Land is a source of greenhouse gases if it is used to farm fertiliser-hungry crops or methane-producing cattle, or it can be a sink for greenhouse gases—through sequestration. If we increase woodland and wetland, those lands will be storing carbon in trees, photosynthesising it in reeds, and shunting it down into soils," said senior author Prof Andrew Balmford, from Cambridge University's Department of Zoology.

"We estimate that by actively increasing farm yields, the UK can reduce

the amount of land that is a source of greenhouse gases, increase the 'sink', and sequester enough carbon to hit national emission reduction targets for the agriculture industry by 2050," he said.

The study originated from a workshop run as part of the new Cambridge Conservation Initiative, which convened leading experts and asked them to "look into their crystal balls", says Balmford. "We wanted to know what food yield increases they reckoned were achievable in the 2050 timescale across crop and livestock sectors," he said.

This included researchers from the Universities of California, Bangor, Aberdeen, East Anglia, the Royal Society for the Protection of Birds, Forestry Commission, Rothamsted Research, ADAS UK Ltd and Scotland's Rural College (SRUC).

The potential they identified included improving farm management and optimising breeding programmes to produce plants that are better at capturing soil nutrients, sunlight and water, and to produce more efficient animals that produce less methane.

The researchers then used these and other data to produce a series of modelled scenarios that projected long-term farm yields. Scenarios ranged from yield declines through to sustained yield growth that averaged 1.3% per year until 2050.

If yields rise, the area of farmland required for food production can decline—allowing countryside to be spared. By converting spared land back to natural habitats of woodland and wetland, which would have been a large portion of the UK's native land cover in the past, a carbon sink is created that the research suggests could come close to cancelling out agricultural emissions in just a few decades.

Dr Toby Bruce, co-author from Rothamsted Research, said: "The

current findings show the value of land sparing for reducing greenhouse gases. To allow this productivity needs to increase on the remaining land, for example, by minimising crop losses to pests, weeds and diseases or by improving crop nutrition."

Importantly, says Balmford, the research team did not allow themselves the 'get-out-of-jail-free card' of increasing food imports. Overall food consumption looks set to rise substantially—some 38%—in the UK by 2050, and the researchers locked into their future models the contribution that UK production makes to its food supply.

"We made sure we met expected production requirements in all our figures, and then explored the consequences of different ways of achieving them," he said.

However, it is not all or nothing, say the researchers, who conducted lots of sensitivity analyses around different ways of using spared land, and different levels of yield growth, consumer waste, and meat consumption—which has a disproportionate environmental footprint

"Reducing meat consumption appears to offer greater mitigation potential than reducing food waste, but more importantly, our results highlight the benefits of combining measures," said Balmford.

"For example, coupling even moderate yield growth with land sparing and reductions in meat consumption has the technical potential to surpass an 80% reduction in net emissions," he said.

Added Balmford: "We need to turn our minds to figuring out policy mechanisms that can deliver sustainable high yield farming that doesn't come at the expense of animal welfare, soil and water quality, as well as safeguarding and restoring habitats.

"The right incentives need to be provided to landowners to spare land. Subsidies under the EU's Common Agricultural Policy could be redirected so that landowners get paid properly for taking land out of food production and putting it into climate regulation.

"If we are serious about saving the planet for anything more than food production then the focus has to be on increasing yields and sparing land for the climate. We need to look objectively and dispassionately at every option we have for achieving that."

More information: The potential for land sparing to offset greenhouse gas emissions from agriculture, DOI: 10.1038/nclimate2910

Provided by University of Cambridge