Can changing land management help deliver biodiversity benefits?

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Introduction

To enhance ecosystem services such climate change mitigation and food provision, policy is driving major changes in land management changes.

The James Hutton Institute is striving to determine, through several projects, what are the likely impacts of these changes on biodiversity. Integration of these projects has highlighted some important issues that need addressing, and here we outline four such issues with an example from recent research to illustrate each one. A key conclusion is the need for integrating multiple benefits from each land type.

1. Which aspects of biodiversity do we want to enhance?

Land management change is often beneficial to some groups of organisms while adversely affecting others. To illustrate this, we surveyed invertebrates at Forsinard Flows RSPB reserve, where the RSPB is restoring afforested peatland from commercial conifer forest, via restoration felling areas, into blanket bog. Fig. 1 demonstrates how peatland restoration increases diversity of some invertebrates, while decreasing or having no effect on others.

Which is best?



3. Land use change, biodiversity and opposing impacts on ecosystem services

A primary purpose of land use change policy is to enhance ecosystem services. For example, woodland expansion should increase biodiversity and help mitigate climate change by sequestering carbon. However, our research utilising an experiment whereby birch saplings were planted on heather in 2004 suggests that woodland expansion can also be associated with an increase in *Ixodes ricinus* ticks (Fig. 3), which are the vectors of *Borrelia burgdorferi*, the agent of Lyme borreliosis.

This illustrates how changing land use to improve one ecosystem service can damage another ecosystem service.



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2. Biodiversity benefits depend on the spatial scale measured



Suppose the management of the Blue patch of land produces 100 species, while the Red land produces only 20 species, but they differ from the Blue land.

Therefore, the Red farm could increase its biodiversity by changing to Blue management. This increases biodiversity at the FARM SCALE.

4. The "squeezed middle" land: exploring scenarios to achieve policy targets

Current policy aims to increase the human population, increase renewable energy, increase peatland, increase woodland, and improve food security, coupled with climate change that is predicted to increase the land capability for prime agriculture. This will clearly result in some land types needing to be reduced or "squeezed" down. Fig. 4 illustrates the current land cover and potential increases in woodland, peatland and arable which, in our hypothetical future scenario illustrated here, would necessitate a big squeeze in rough pasture. Multiple land use, such as agroforestry helps reduce this squeeze to a slight extent.



But total biodiversity over Scotland is greater with both Blue and Red land management. So if the Red changed to Blue management, this would **decrease biodiversity at the NATIONAL SCALE**.

Which are we trying to achieve?

Conclusion

In order to achieve policy targets of land use change under the effects of climate warming, population increase and renewable energy targets, changes in agriculture and forestry will be needed. A multiple-use landscape, such as mixing woodland with agriculture through agroforestry, will be essential if we are to avoid a substantial "squeeze" on land cover types that are currently not the highest priority in terms of economic or conservation value, such as upland rough pasture. For more robust modelling of future land use, we need more information on the details of land use change policies and how land capabilities for each different land use and habitat will be altered by climate warming.