Land Use and Disease Risk

Lucy Gilbert[1], Paul Bessell[2], Ian Hutchinson[3], Harriet Auty[3], Theo Pepler[3], Lisa Boden[4]

University of Glasgow[1], Roslin Institute[2], SRUC[3], Global Academy of Agriculture and Food Security[4]

epic Centre of Expertise on Animal Disease Outbreaks

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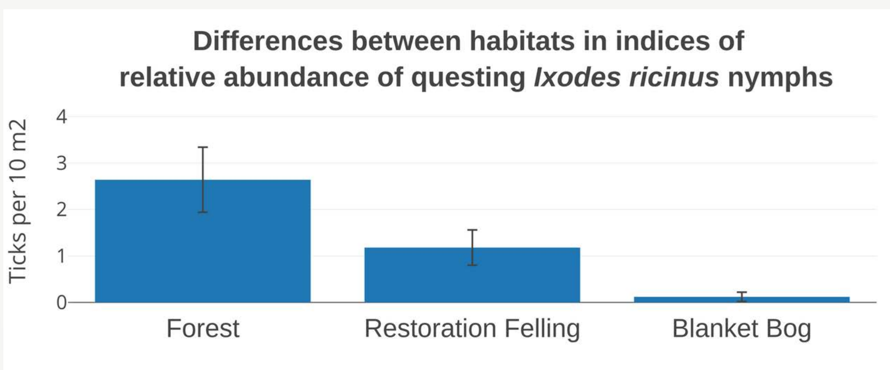
EPIC, the Scottish Government funded Centre of Expertise on Animal Disease Outbreaks, provides scientific evidence to support policy makers in the prevention of, preparation for and eradication of important animal disease outbreaks. The incursion and onward spread of several diseases which EPIC scientists study can be critically influenced by environmental and climatic factors.
Should land managers be financially rewarded for activities such as disease surveillance which benefit not only local livestock but the national herd? Is disease risk reduction an influencing factor in landscape management decisions?

Here we describe 4 examples of EPIC scientists' work which addresses the interaction between land use and disease risk.

Can restoration of afforested peatland regulate pests and disease?

- A major land use change targeted for regulating climate and biodiversity is peatland restoration. This will cause changes in vegetation and, potentially, keystone species such as large herbivores, which are the main hosts to *Ixodes ricinus (L.)* ticks, the most important vector of disease-causing pathogens in Europe.
- Large-scale surveys of *I. ricinus*, vertebrate herbivores and vegetation were conducted in adjacent areas of forest, bog and areas felled 5–13 years previously.
- Questing tick abundance was greatest in forest and almost absent from blanket bog, with intermediate numbers in felled areas, where ticks were more abundant in young than old felled areas.



- The likely mechanisms for these variations in tick abundance were deer habitat preferences (bog was the least preferred habitat).
- Felling conifer forest to restore peatlands could produce a dramatic decline in tick abundance throughout the restoration process, with implications for disease risk. Therefore, a further ecosystem service of peatlands in addition to climate, biodiversity and water regulation is regulating pests and disease. Deer management and procedures that speed up the restoration process are likely to enhance the effect during the intermediate stages.

Ref: Gilbert, L. 2013. Can restoration of afforested peatland regulate pests and disease?

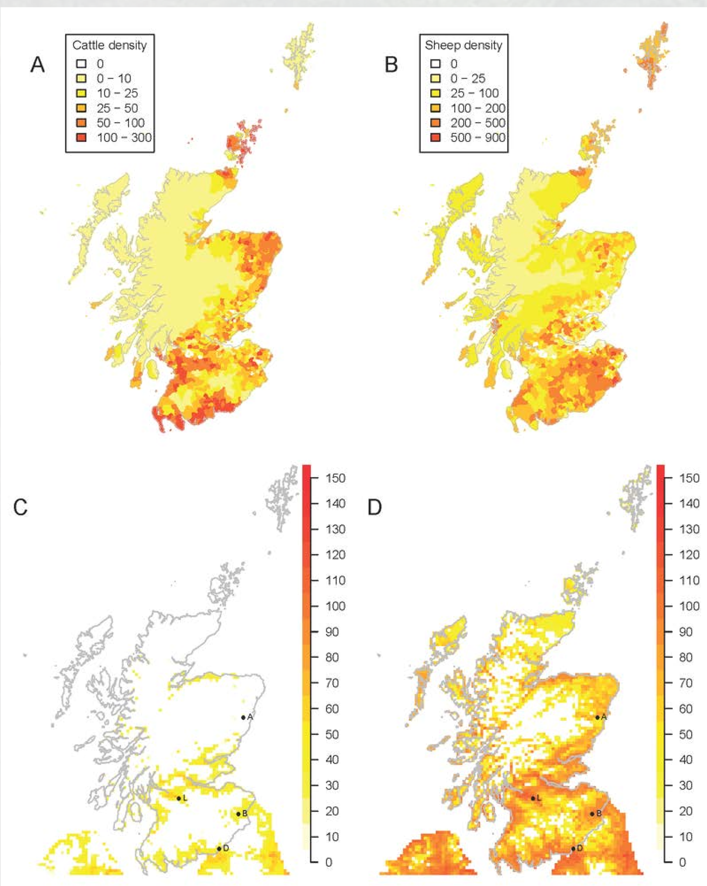
Modelling potential disease spread in British Deer

Deer density estimates and tracking data from five Cairngorm deer herds were used to simulate deer herd locations. The map below represents estimates of pairwise herd contact probability (direct and indirect) based on location and spread to generate a red deer network.

- Disease spread within clusters is more likely than spread between clusters.
- The areas occupied by the six deer species in Great Britain overlap in ways which might allow jumps of disease pathogens across the country in ways which would not otherwise occur.
- Man-made barriers to restrict deer movement could help to fragment the tightly linked red deer cluster in Scotland.
- Modelling UK deer networks could help inform strategies for surveillance and control of cervid TSE, in case of a disease incursion.

Ref: Pepler *et al.*, manuscript in preparation

Modelling the role of landscape and climate in the spread of midge-borne diseases in Scotland.



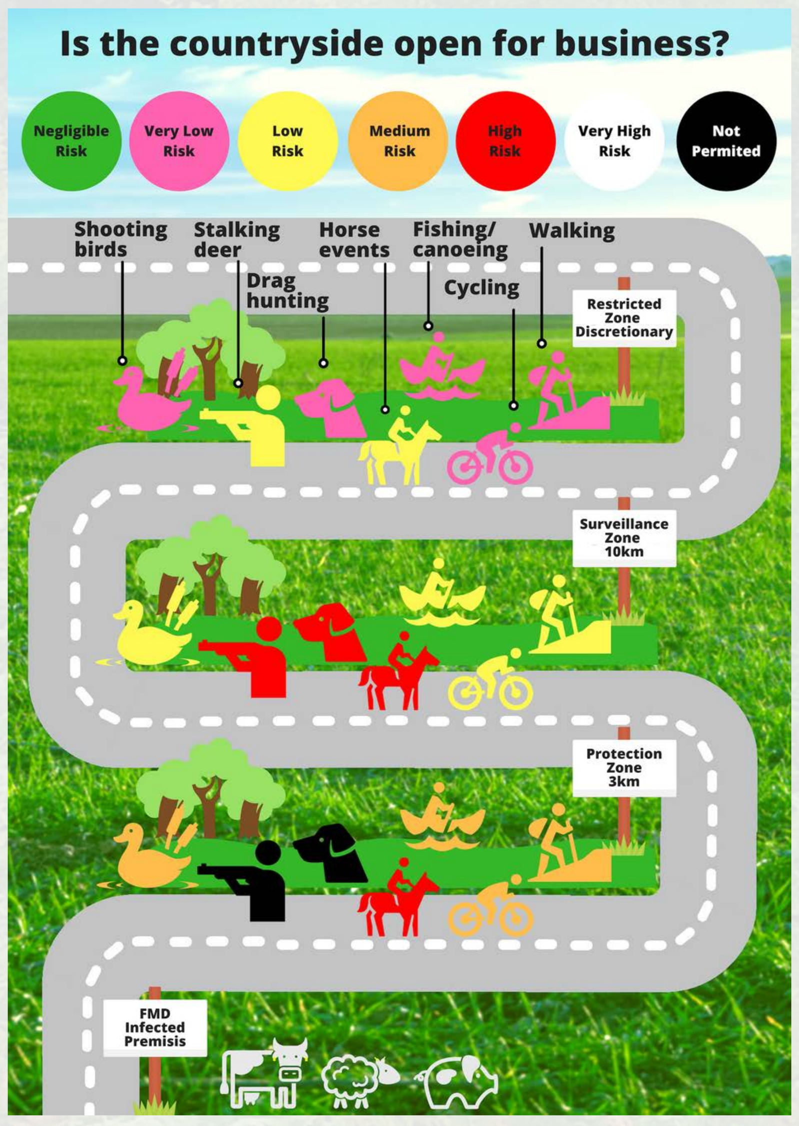
Distribution of cattle (A) and sheep (B) and the number of days with R0 above zero under "normal conditions" (C) and in a "worst case" (1 degree warmer) scenario (D).

Climate, landscape and vegetation affect the risk of vector-borne disease introduction and spread. This means the risks posed to Scotland differ from the remainder of the UK, whilst changing as the climate changes.
Bluetongue virus (BTV) is carried by midges (*Culicoides spp*) and principally affects sheep. Cattle can also be infected but often remain largely asymptomatic. The BTV disease spread model takes into consideration the effect of environmental factors such as precipitation, land cover type, host density and amount of vegetation at each surveillance site.

- Marginal temperature changes (a 1 degree increase in temperature) greatly increase the risk to Scotland.
- The habitat for BTV transmitting midge species is optimal in the South of Scotland where temperatures are warmest.

Ref: Bessell *et al*., 2016. Assessing the potential for Bluetongue virus 8 to spread and vaccination strategies in Scotland.

Restricting access to the countryside during a Foot-and-Mouth outbreak



- During an FMD outbreak people carrying out leisure activities in the countryside may come into contact with FMDV or with susceptible livestock. There is a risk that FMDV will spread via people or other fomites and cause further disease outbreaks.
- EPIC's qualitative veterinary risk assessments have been used to assess risks posed by different types of leisure activities are used by Scottish Government to make decisions about recreational rural access in an outbreak..

Ref: Boden *et al.*,2014. Working at the science policy interface.

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