

Examining responses of larger mammals to secondary woodland creation in central Scotland (in collaboration with the WrEN project)

Results found by Veronica Furey and Imogen Schwandner, under supervision of Kirsty Park

This study was undertaken with the help of the Reforesting Scotland's bursary, as undergraduate dissertations for the degrees BSc in Environmental Science and BSc in Biology and Conservation at the University of Stirling. It was part a collaboration with the WrEN Project, a long-term large-scale natural experiment that aims to understand the response of biodiversity to woodland creation to inform policymakers in the UK and elsewhere. With this study, we aimed to assess the response of large mammals to woodland restoration, by determining which site or landscape-level attributes of the woodlands were more beneficial for biodiversity. Site-level attributes include characteristics of the woodland per se, such as age, size or edge characteristics of the patch; whereas landscape-level attributes measure connectivity between patches and characteristics of the landscape through proportion of other woodlands surrounding the target patch or the total length of hedgerows around the patch. We specifically focused on the mammal species red fox (*Vulpes vulpes*), roe deer (*Capreolus capreolus*), red deer (*Cervus elaphus*), badger (*Meles meles*), pine marten (*Martes martes*), stoat (*Mustela erminea*), european hare (*Lepus europaeus*), european rabbit (*Oryctolagus cuniculus*), red squirrel (*Sciurus vulgaris*) and grey squirrel (*Sciurus carolinensis*). These species were grouped in different categories (fox, deer, mustelids, rabbits and hares), according to the data we collected, to make the statistical analysis feasible. The study was undertaken using camera traps, during a four month period, in 29 sites. The study sites surveyed were located in central Scotland, and all woodland patches were ≥ 1 km from each other. They also ranged from 30 to 160 years old, 0.5 to 4.41 ha in size, and were between 0 and 531 m away from the nearest woodland. The landscape in which these sites were located was dominated by 70% of agricultural land.

This study was novel in considering the effects of such a wide range of site and landscape-level attributes on large woodland mammals, in the context of woodland habitat creation in the UK. We found that camera traps used to study large mammals is a successful a surveying tool. Ten different species of large woodland mammals were identified across the study sites, and the rates of woodland usage by each species was used to determine the effectiveness of different restoration approaches. Nevertheless, we have noticed that this surveying method can lead to confusion between species detectability and woodland use by the species.

Different models including site-level, landscape-level or combining both were tested using GLMs (Generalised Linear Models) in R version 3.6.3. Modelling species response in terms of presence in the woodlands against a range of site and landscape-level variables confirmed the importance of planning woodland restorations at the landscape scale. The results found varied according to each species. Few site-level parameters had an influence on the species of interest, among those tree density and the amount of semi-natural habitat along the edges of the woodland. Neither woodland age nor area showed a positive influence on the species of interest. At the

landscape-level, this study confirmed the prevailing importance of the amount of habitat in the landscape compared to measures of connectivity.

For mustelids and rabbits, it was found that site-level models were more influential than landscape-level models in determining species presence, but combined models performed better. For deer, it was found that landscape-level models had a negative influence on the presence of these species on woodlands, yet the combined model was best at describing variation in activity. For foxes, hares and grey squirrels the landscape-level models were more influential than combined models when determining species presence in woodlands.

In conclusion landscape-level parameters outweigh site-level characteristics, and increasing the amount of habitat seems more important than focussing on connectivity per se. In order to maximise biodiversity benefits for large mammals, we suggest land managers, policy makers and woodland conservationists to focus on the following:

Woodland creation efforts should focus at the local scale on:

1. Creating buffers of semi-natural habitat (~20m) around the edges of woodlands, thus providing mixtures of habitats and ecotones to benefit species with mixed habitat requirements;

And focussing largely on improving the surrounding landscape by:

2. Increasing habitat amount at smaller scales, creating woodlands within close proximity to another (500 m);
3. Increasing connectivity by creation of more habitat, thus reducing pressure on resources (this can be varied types of semi-natural habitats including different woodland types).

We hope that this study will be of use for future conservation and restoration projects, helping our woodlands grow and their biodiversity to thrive in newly created and restored habitats.