Improving forest HABITAT NETWORKS with new woodland PLANTING SCHEMES

Biodiversity in Britain's forests declined in the past due to a number of factors, not least the effects of habitat fragmentation and a reduction in habitat quality caused by edge effects associated with intensive land management. Whilst new woodland planting schemes have been beneficial in terms of increasing woodland cover, they have rarely been spatially targeted to restore connectivity. This has resulted in many new schemes being located too distant from existing woodlands to contribute to reducing woodland fragmentation. **Darren G. Moseley** and **Duncan Ray** and **Kevin Watts** of Forest Research, Northern Research Station, report.

Fig 1. Woodland and open landscape forming a forest habitat network in Glen Affric.

Forest Habitat Networks (FHNs) are intended to reverse this decline by linking and expanding habitats to make them capable of sustaining greater biodiversity (Fig 1). In developing FHNs, we have placed the emphasis on functional connectivity: landscape connectivity that is defined by processes such as species movement and dispersal between patches (Watts et al. 2005).

It is possible to have high functional connectivity in a physically fragmented landscape, that has low structural connectivity, as long as the wider landscape components support the particular ecological process. Spatial modelling has been used to identify these functional networks in a practical way and thereby support a forestry 'locational premium' scheme. The approach tests woodland expansion options and indicates their potential to reduce woodland fragmentation in the landscape.

HIGHLAND LOCATIONAL PREMIUM SCHEME (HLPS)

As part of a Scotland-wide project, FHN regional analyses were completed for Highland towards the end of 2005. Practical implementation of the networks to improve biodiversity was quickly seized upon by Forestry Commission Scotland Highland Conservancy. In January 2006, the launch of a locational premium scheme was announced with the aim 'to achieve a targeted expansion of FHNs in Highland to improve forest diversity and biodiversity and to increase the ability of forest species and habitats to adapt to climatic changes'. (Forestry Commission 2006).

HIGHLAND LOCATIONAL PREMIUM TOOL

Forest Research was asked to develop a methodology from its suite of methods

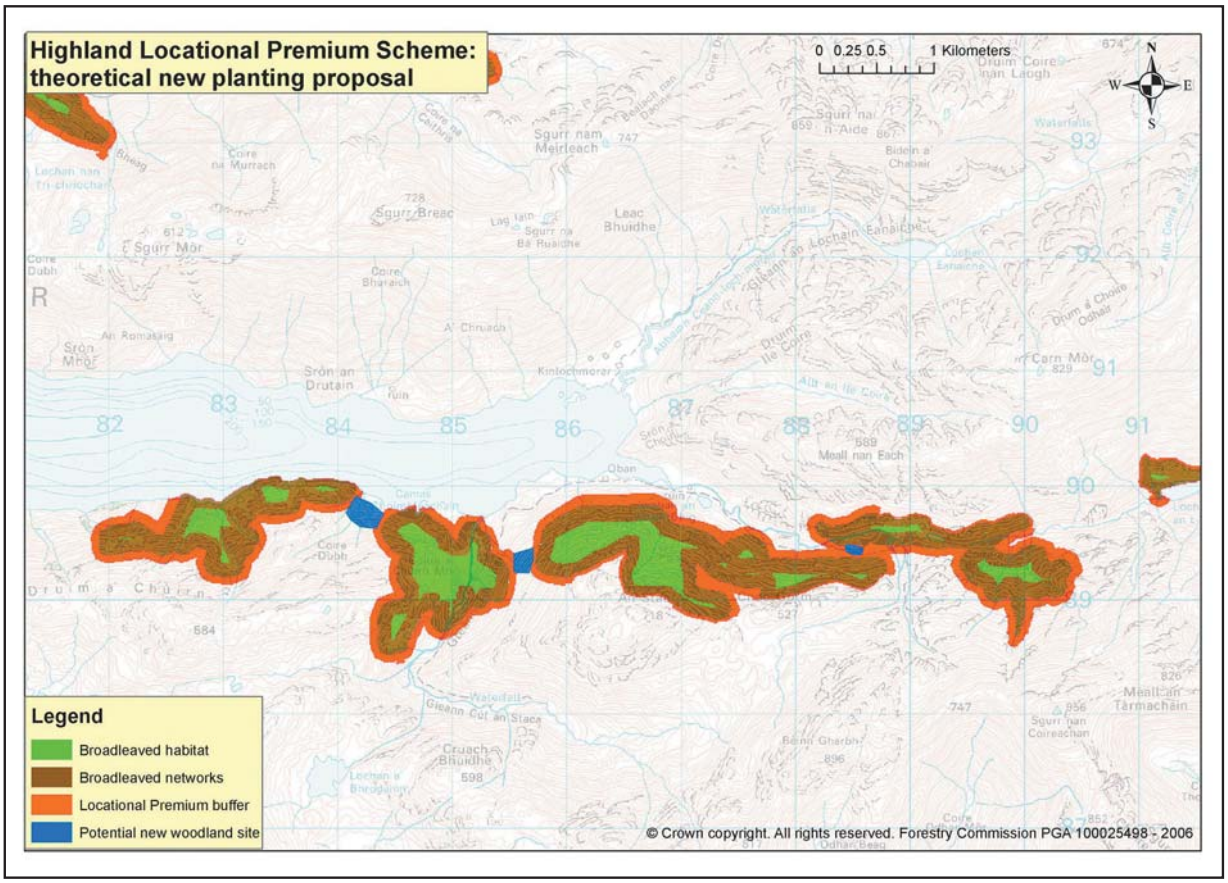

Fig 2. Hypothetical new planting schemes (blue) overlap the locational premium buffer surrounding the existing broadleaved specialist networks, indicating that these will join the existing four fragmented networks into one larger functionally connected network.

called Biological and Environmental Evaluation Tools for Landscape Ecology (BEETLE) (Watts et al. 2005). This involved the following steps:

Potential areas where woodland expansion proposals could link together networks were identified by creating a buffer, representing landscape permeability, around the existing networks (Fig 2). Schemes outside this area were excluded, as it was assumed unlikely that that they would be close enough for dispersal events to occur between the existing and potential habitat.

A tool was constructed to analyse the contribution made towards connectivity between the new planting scheme and existing networks for pinewood or broadleaved woodland specialists (see section below for further explanation) (Fig 3).

The analysis tool first checked there was sufficient internal forest habitat to support species that are sensitive to woodland edge. It then performed a network analysis using two different generic focal species, pinewood specialists and broadleaf specialists, to determine whether the proposed new scheme would succeed in functionally connecting the two

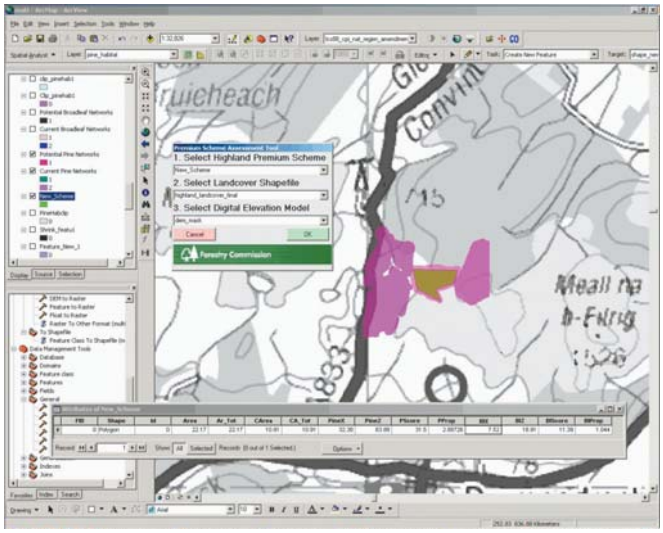

Fig 3. The GIS-based Highland Locational Premium Scheme tool, showing the assessment tool interface, output table, and existing networks connected into one new network by the planting scheme.

woodlands (Fig 4). The tool operated within a Geographic Information System (GIS) and produced map outputs and statistics showing network connectivity formed by the proposal.

This analysis quickly allowed potential applicants to determine whether their proposal intersected the buffer and, if so, provided a basis for beginning the consultation process with Highland Conservancy. Providing this first criterion was met, applicants were invited to apply for grant aid through the usual Scottish Forestry Grant Scheme (SFGS) procedure and their proposal was then discussed at one of a series of surgeries with a woodland officer. The procedure was automated for speed

Table 1. Scoring system developed with Highland conservancy to award locational premium.

"New habitat score" (i.e. total area of habitat in new network (ha) minus largest area of habitat in existing networks (ha))	**"Proportionality"** (i.e. "new habitat score" divided by area of new woodland planted (ha))	**Size of new woodland eligible for premium (ha)**	**Comment**
5	1.5	None	If these minimum scores are not reached, then the scheme is not eligible
5-50	≥1.5	Up to 20	Premium payable on up to 20 ha of new woodland planted, but proportionality means that 'new habitat score' needs to be one and a half times as big as new area planted*
50-200	≥3	Up to 50	Premium payable on up to 50 ha of new woodland planted, but proportionality means that 'new habitat score' needs to be three times as big as new area planted*
200+	≥4	Up to 100	Premium payable on up to 100 ha of new woodland planted, but proportionality means that 'new habitat score' needs to be four times as big as new area planted*

*** The size of the new woodland eligible for premium will be based on an amount that contributes towards the Forest Habitat Networks. This will be agreed with the Woodland Officer during the consultation.**

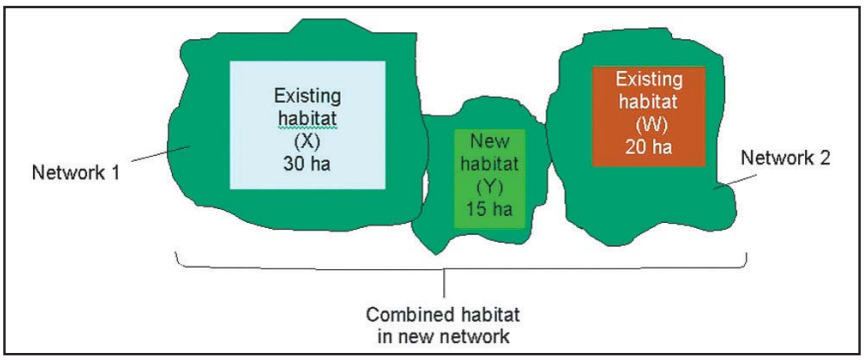

Fig 4. A representation of how a new planting scheme is scored for eligibility to the Highland Locational Premium Scheme. New habitat (Y) is added into the landscape matrix, resulting in functional connectivity between existing habitat patches W and X. A score and figure for proportionality are then derived.

and simplicity, but is quite transparent and open to public scrutiny.

A table also provided information necessary to determine the contribution the proposal would make to the existing networks and allowed the analyst to calculate how much locational premium the proposed scheme would be eligible for using a scoring system (Table 1).

The scoring system examined the amount of habitat linked together by the proposed scheme, not the amount of network, to avoid bias towards schemes adjacent to semi-natural types of habitat (relatively more permeable to woodland species dispersal) over schemes adjacent to more modified and managed habitat (relatively less permeable to woodland species) (Table 1).

The scoring was also weighted, to encourage small schemes that link together larger networks, rather than unnecessarily large schemes that would link small networks. This approach allowed the amount of grant aid to be used carefully to achieve more benefit for woodland biodiversity.

Highland Birchwoods were appointed to facilitate the HLPS and have been steadily processing applications with Forestry Commission Scotland (FCS), through a series of one-to-one meetings with applicants and land agents. This directed approach to new planting will help to address woodland fragmentation by increasing the functional connectivity of woodland and increase the amount of habitat in the landscape.

MODELLING APPROACH

The approach uses the BEETLE landscape ecology habitat network analysis model. Central to the use of BEETLE for evaluating habitat networks is the concept of generic focal species. Focal species are considered to represent the wider elements of the woodland community and key ecological processes. In a habitat network analysis, the focal species can be a real or 'virtual' species or a range of species that use the habitat, e.g. woodland.

As an example, specific focal species of broadleaved woodland could include a great spotted woodpecker, red squirrel, wood anemone, or bluebell. Of these species wood anemone and bluebell could be

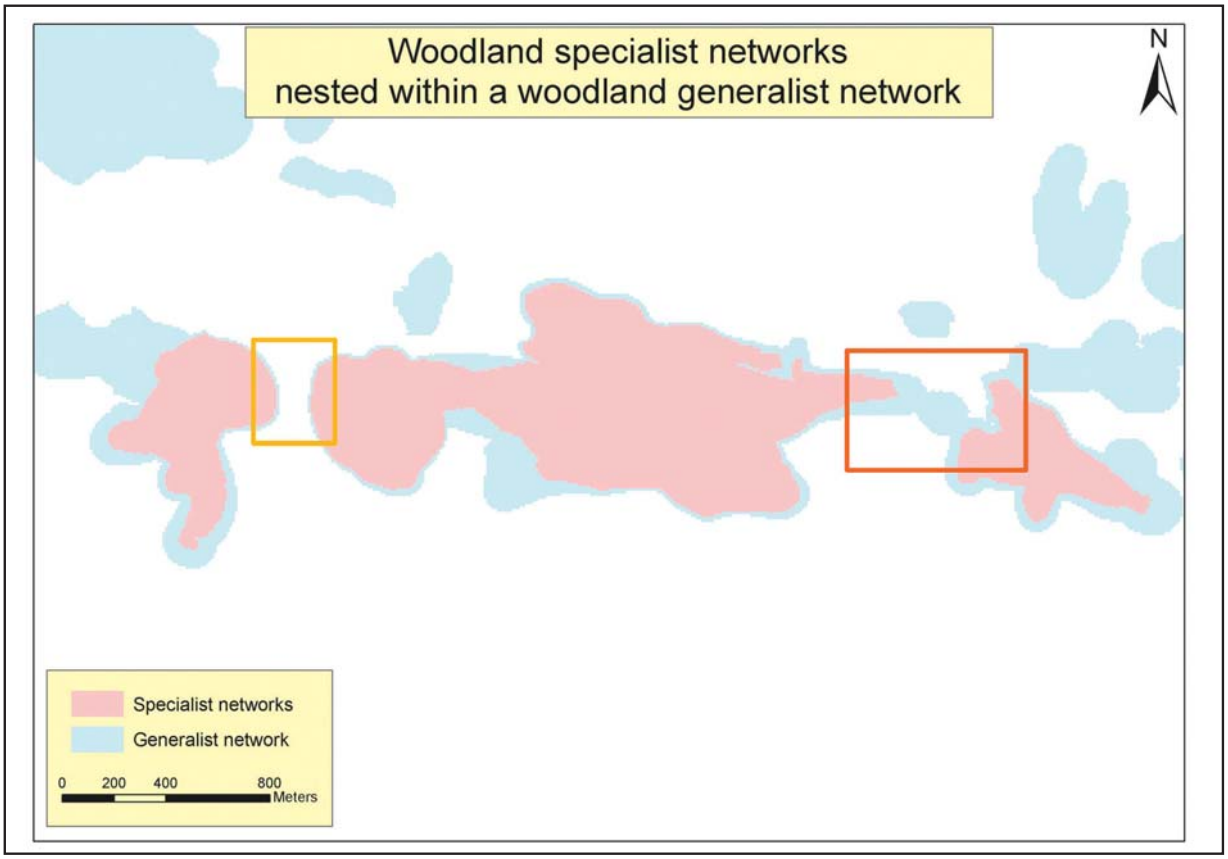

Fig 5. Example of where a woodland specialist network can be expanded through restructuring existing woodland (area highlighted by the red box) and where open habitat may be converted into a more semi-natural open habitat to functionally connect existing networks (area highlighted by the orange box).

considered specialists, and the woodpecker and red squirrel, generalists. Each of these species has different area requirements and differing dispersal abilities.

It would be time consuming to build a landscape model for each species, and rather difficult as little is known about the ecological relationships of so many species. It has therefore been necessary to consider a number of generic focal species, e.g. pinewood specialists and woodland generalists, thereby allowing us to focus on the landscape processes rather than individual species requirements.

BEETLE is used to test the landscape pattern against generic focal species profiles selected through discussion with local forest managers. The networks produced from the analyses are used to inform local and strategic forestry decisions. In particular, the approach enables improvements in the functional connectivity of woods in the landscape to be assessed and planned and, consequently, improvements to targeted to benefit woodland biodiversity (Fig 5).

Other applications of BEETLE

There is potential for the creation of networks for most habitats and species. Initially, we have focussed on the identification and development of FHNs, as these have considerable biodiversity interest, as the habitats have undergone extreme fragmentation in the past. In developing FHNs we have also recognised the need to consider important non-woodland habitat, and avoid fragmentation of this when restoring connectivity.

The approach detailed here is just one of many being used to improve FHNs. Others include: consolidation and expansion of high quality woodlands; restoration through livestock exclusion of degraded woodlands to increase high quality woodland networks; conversion of plantation woodlands to increase semi-natural woodland components; and examination of the broadleaved woodland specialist networks to identify potential threats posed by grey squirrel movement into red squirrel priority woodlands.

ACKNOWLEDGEMENTS

We are grateful to FCS Highland Conservancy for their support and interest in the development of FHNs in the region, and Highland Birchwoods who acted as agent dealing with applications for the HLPS.

FOOTNOTE

The HLPS proved to be very popular. The final allocation for funding was made in September 2006, comprising 25 new planting schemes, covering just over 1,000 ha. This will link 50 networks, comprising approximately 13500ha of existing network area.

For further information regarding forest habitat networks see www.forestresearch.gov.uk/habitatnetworks or contact darren.moseley@forestry.gsi.gov.uk

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