Planning for Lowland Habitat Networks in Scotland: a landscape-scale approach

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Introduction

A long history of intensive land use in the Scottish lowlands has resulted in the loss and fragmentation of semi-natural habitats and a reduction in biodiversity. Conservation policy and practice now seek to reverse the effects of fragmentation by combining site protection and rehabilitation measures with landscape-scale approaches that improve connectivity and landscape quality.

It is expected that the development of habitat networks will not only benefit biodiversity but also deliver a range of other environmental benefits, such as enhancing local landscape character, providing ecosystem services and creating more opportunities for public access and recreational enjoyment of the countryside. Until now, the emphasis in Scotland has been on planning forest habitat networks, but there is a growing interest in networks of non-wooded habitats and their integration in different landscape settings. This document provides examples of how such an approach could benefit landscapes in the Scottish Lowlands.

Landscape-scale planning and incentives

Over recent decades in the UK, a wide range of agri-environment measures has been introduced to address the loss of biodiversity by protecting, restoring and creating habitats for threatened or priority species. Examples include adapting cropping practice to benefit farmland birds, restoring semi-natural grassland and enhancing arable field margins. A recent review concluded that such measures have focused on individual habitats and ecosystems, with little consideration of how these interact at the landscape-scale or the overall consequences for biodiversity (see 'Further reading' Section for more details).

The Regional Proposal Assessment Committees (RPACs) have now highlighted the need for Rural Development Contract (RDC) grant applications to demonstrate ecological connectivity of habitats. As a result, some agri-environment measures are likely to be spatially targeted in the future. Strategic planners and land-use advisors need guidance on how to target measures to the right places, at both landscape and regional scales.

Development and application of the lowland habitat network approach

This document demonstrates the range of challenges faced and opportunities available when developing lowland habitat networks (LHNs) by discussing four themed examples:

1. The spatial targeting of incentives
2. The benefits of stakeholder engagement
3. Opportunities for floodplain management
4. Improving urban environments

Glossary

Habitat network: a configuration of habitat that allows species to move and disperse through a landscape (see www.forestresearch.gov.uk/habitatnetworks)

Ecosystem services: the beneficial functions, resources and processes supplied by natural ecosystems

Connectivity: the degree to which a landscape facilitates or impedes the movement of individuals between habitat patches

Functional connectivity: this is dependent on species' dispersal abilities, the size and spatial arrangement of habitat patches and the nature of land cover and land use in the intervening landscape matrix

Nodes: key features in the landscape where ecological processes persist and can be used as loci for restoration, e.g. a veteran tree

How the lowland habitat networks were assessed

Maps showing the distribution of land cover types were assembled in a Geographic Information System (GIS). Forest Research used the land cover data to evaluate habitat linkages across the region, using a landscape evaluation tool from the Biological and Environmental Evaluation Tools for Landscape Ecology (BEETLE) toolkit (see www.forestresearch.gov.uk/habitatnetworks). This tool examines the likelihood of types of habitat being *functionally connected* in the landscape, allowing species to move from one habitat to another. Such linked habitat areas may have a minimum viable size, be close to one another (but not necessarily contiguous), and are unlikely to have intensively managed land or other hostile matrix, such as urban areas or water, between them.

1 The spatial targeting of incentives

Habitat network modelling can inform the targeting of agri-environment incentives to meet the Scottish Rural Development Programme key delivery outcomes of biodiversity, landscape and adaptation to mitigate climate change. Below is an example, using semi-natural grasslands, of how these incentives could be targeted.

The northern brown argus butterfly *(Aricia artaxerxes)* was chosen as a surrogate for grassland species of limited dispersal, and semi-natural grassland habitat networks were modelled for an area in Fife. Although all fields adjoining the networks have the potential to enhance their extent and connectivity, many are intensively managed and lack the necessary ecological conditions. Two data sources were used to select locations ('nodes') where grassland ecological processes may persist and restoration may be most appropriate; these were historical records and coincidence mapping using the presence of grassland quality indicator plants selected from the *Common Standards Monitoring Guidelines for Lowland Grassland Habitats*, published by the Joint Nature Conservation Committee (JNCC) in 2004.

Fields identified using these nodes could be targeted for restoration (Figure 1) to reverse habitat fragmentation by recreating larger areas of grassland.

Sites could be spatially targeted for enhancement through Rural Development Contracts on the basis of a three-level priority system (in descending order of importance):

Core sites: High quality, often designated sites (e.g. Sites of Special Scientific Interest (SSSIs)), providing good examples of grassland communities of high conservation value (hatched areas in Figure 1). The priorities for these sites are protection, maintenance and the diversification of grassland communities.

Secondary sites: Sites that can be prioritised for the restoration of remnant habitat to consolidate existing high value areas. The main grassland networks (pale orange areas containing dark orange habitat areas in Figure 1) contain some designated grassland sites. The undesignated grassland habitat areas within these networks are good examples of how and where restoration might be targeted.

Tertiary sites: Sites requiring restoration of degraded habitat and/or creation of new habitat (yellow areas in Figure 1). The selection of such sites would be based on the occurrence of nodes, but they would not necessarily be linked to designated sites.
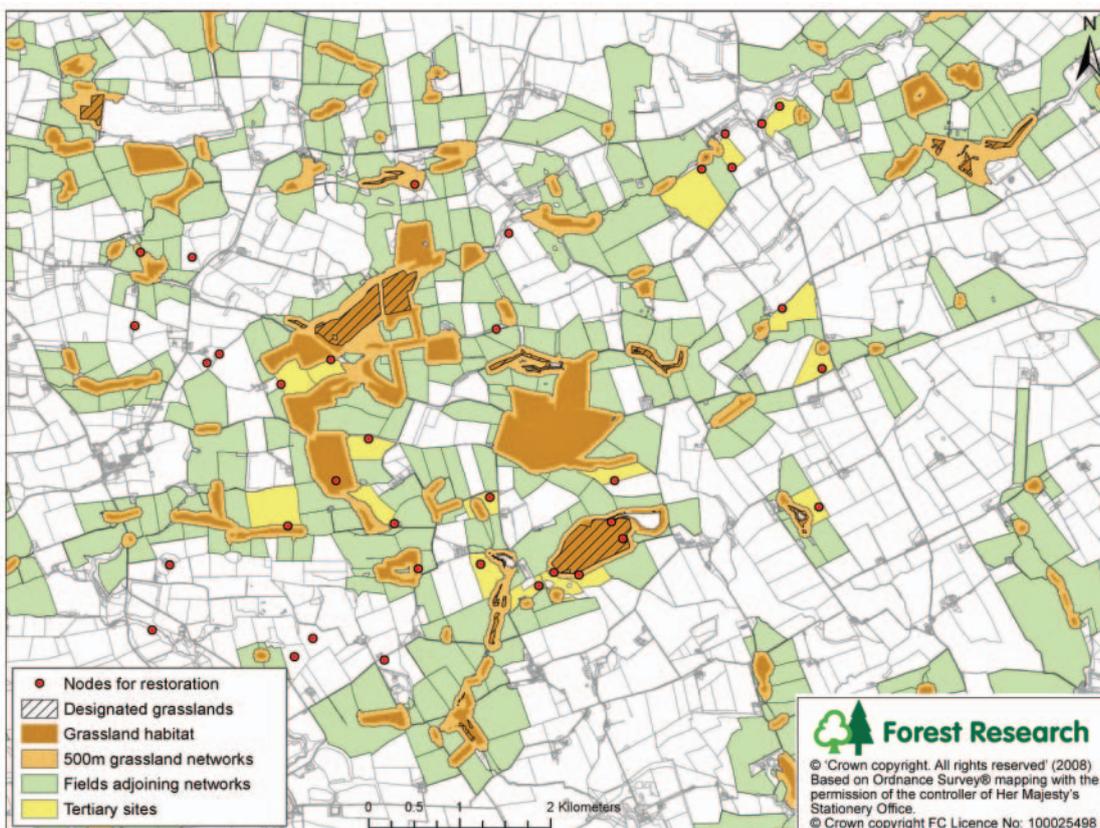

Legend:
- Nodes for restoration
- Designated grasslands
- Grassland habitat
- 500m grassland networks
- Fields adjoining networks
- Tertiary sites

0   0.5   1   2 Kilometers

Figure 1 Using habitat networks and nodes to select fields for agri-environment schemes in Fife

2 The benefits of stakeholder engagement

Stakeholder engagement is a key component of developing LHNs, since the process reveals valuable local knowledge about the complex factors affecting land management.

Case study: Tiree

Stakeholders advised on opportunities to develop lowland habitat networks on the isle of Tiree. For this case study, the stakeholders comprised: Scottish Natural Heritage, the Scottish Government Rural and Environment Research and Analysis Directorate (formerly the Scottish Executive Environment and Rural Affairs Department), Scottish Agricultural College, Royal Society for the Protection of Birds (RSPB) and the local biodiversity action plan officer. Development of LHNs is relevant to the future management of the island's agri-environment schemes under Rural Development Contracts.

Stakeholder views guided the development and assessment of habitat networks for two bird species: the corncrake *(Crex crex)* and corn bunting *(Miliaria calandra)*. Previous agri-environment measures for the corncrake may have been detrimental to other arable bird species, most notably the corn bunting, which is no longer present on the island as a result of the decline in cropping schemes. The habitat network analysis identified where the targeting of spring-sown crops in particular areas could encourage corn buntings to return, while not adversely affecting the corncrake population.

A Corncrake

Cattle grazing helps maintain the quality of the machair

Habitat quality is important to species such as the Northern Colletes bee

The opportunity to sustain both bird species in the same landscape through judicious targeting of incentives prompted further exploration of linked ecological and socio-economic issues. One example is the use of extensive cattle grazing to maintain the habitat quality of wet heathland and machair (coastal grassland), for species such as the Northern Colletes bee *(Colletes floralis)*. Machair quality is closely linked to levels of cattle grazing, since if dune grassland is allowed to become too rank or overgrazed, its habitat quality declines. There are agri-environment incentives to making cattle grazing economically viable. Currently, there is very little winter feed grown on the island, so using cattle requires the importation of feed from the mainland. However, increasing the amount of winter feed grown within the island's habitat networks would not only reduce feed importation costs, it would also benefit the corn bunting without compromising corncrake populations.

3 Opportunities for floodplain management

The effects of recent severe flooding in Scotland have increased interest in floodplain management, particularly the use of habitat restoration to mitigate flooding, while delivering ecological benefits. Wetlands and woodlands, managed at a landscape scale, can help to reduce and smooth flood peaks. The development and restoration of wetland and riparian networks within upland areas will maintain important nature conservation habitats and, by holding water, may help prevent urban flooding. The landscape-scale habitat network approach to management of wetland habitats can contribute to policy and practice, e.g. the mitigation of floods and droughts (Water Framework Directive), planning and flooding (Scottish Planning Policy 7) and River Basin Management Plans.

The wetlands of Strathspey support a diverse range of species, including the largest inland population of wading birds in the UK. A range of wetland species was selected to assess connectivity of the wetland habitats of the Strathspey floodplain and to represent wider wetland biodiversity. Improving connectivity would greatly benefit the habitats for a wide range of wetland species, many of which are of conservation concern.

Figure 2 and Box 1 illustrate the potential for increasing the robustness of wetland and grassland habitat networks, using a series of prioritised actions from 1 (high) to 5 (low). Restoring wet meadows, together with wet wood, carr and fens, would increase the connectivity of wetland habitats, begin to restore floodplain functionality and help consolidate the Strathspey floodplain.
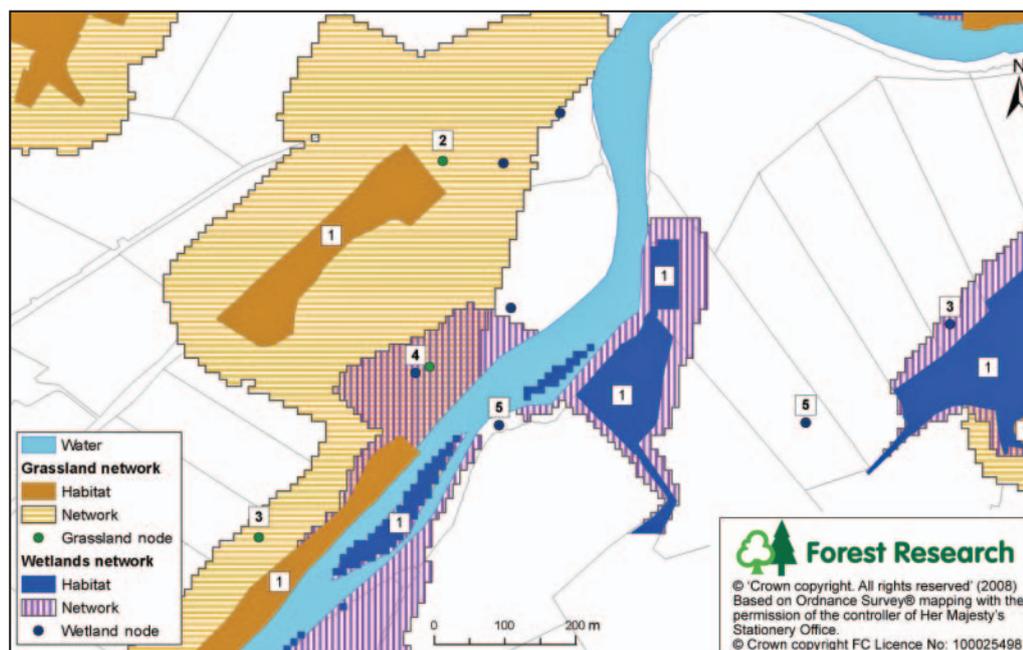

Figure 2 Prioritising habitat network improvement for wetland and grassland habitats and nodes within Strathspey; priorities range from 1 (high) to 5 (low)

Box 1 Priorities for habitat network restoration ranging from 1 (high) to 5 (low)

1. Maintain or achieve favourable condition, e.g. management of fen within wetland habitat network.

2. Restore habitat within representative networks, i.e. wetland node within wetland network.

3. Restore and expand fields with nodes partially within representative networks.

4. Restoration but with a choice of which habitat, e.g. both wetland and grassland nodes within an area where grassland and wetland networks overlap. This decision may be influenced by local or regional priorities and the views of the land manager.

5. Lower priority areas where restoration could contribute to connecting networks together, e.g. a wetland node outwith but between wetland networks.

4 Improving urban environments

While much of the focus for enhancing lowland biodiversity is within rural areas, urban landscapes can also contain strategically important habitats. Losses in habitat at crucial points could adversely affect the ability of species to disperse in response to climate change. It is important to identify these 'pinch points' so that planning decisions do not compromise maintenance and enhancement of key habitat networks.

Figure 3 illustrates lowland grassland habitat networks in part of Scotland's Central Belt, with individual networks (orange) grouped into larger strategic networks (mixed colours), where enhancement should be concentrated to protect and improve the robustness of the grassland habitats on the edge of Glasgow. Many of these grassland habitats do not fall within designated sites, and may therefore be vulnerable to future habitat loss. Planning decisions should take into account species requirements in terms of both habitat provision and dispersal opportunities.

National policy is now recognising the importance of improving networks of habitats 'to counter fragmentation and allow for changing patterns of species migration' (National Planning Framework 2). This may be delivered through mechanisms such as a Central Belt Green Network and the rehabilitation of brownfield sites. These networks are likely to be multifunctional, providing opportunities for public access and recreation within local green space, while enhancing ecosystem services and landscape character.
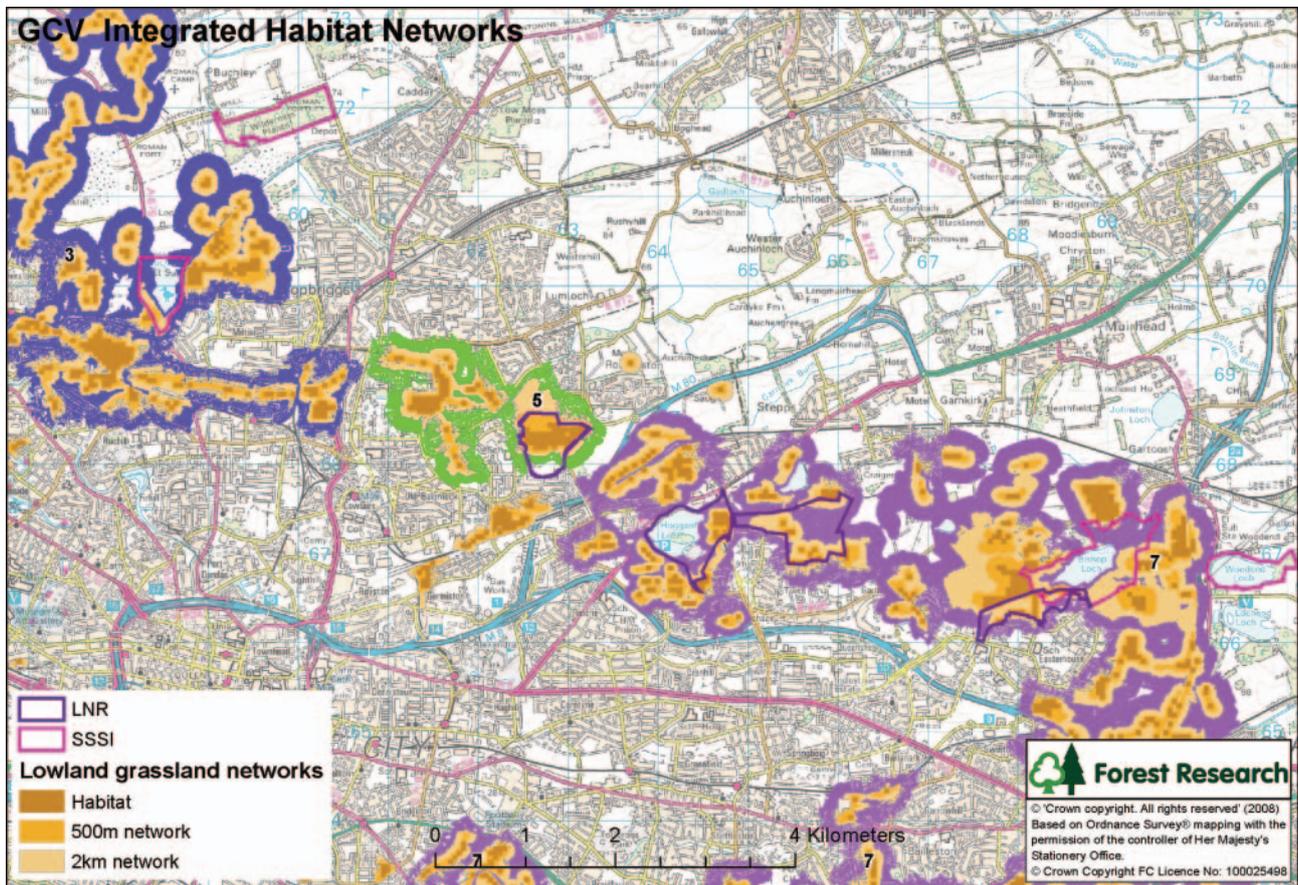

Figure 3 Consolidating existing sites of high conservation value (e.g. SSSIs) within peri-urban areas of the Central Belt using lowland grassland habitat networks

Recommendations

This document demonstrates the range of challenges faced and opportunities available when developing lowland habitat networks to benefit biodiversity, enhance local landscape character and provide ecosystem services. Recommendations to achieve these aims are as follows.

- BEETLE tools could be used to help to spatially target agri-environment schemes and incentives within regions, while also guiding actions for consolidating designated sites.

- BEETLE tools can also be applied to develop robust integrated habitat networks as part of local authority planning procedures and River Basin Management Plans.

- Engaging with local stakeholder groups is a vital part of the process of identifying and developing habitat networks.

- Local Biodiversity Action Plans and SNH Natural Futures provide appropriate scales and mechanisms for determining priorities within habitat networks and for informing the regional targeting of agri-environment incentives.

- The implementation of habitat networks requires the integration of local and national policy conservation priorities and planning mechanisms with habitat network modelling and 'on-the-ground' advice and execution. Guidelines that encapsulate this integrative process need to be developed and made accessible to land managers and advisors.

Further reading

This document is a synopsis of the Lowland Habitat Network report, which is available on the Forest Research website:
www.forestresearch.gov.uk/habitatnetworks

Other relevant publications include:

- Eycott, A.E., Watts, K., Moseley, D.G. and Ray, D. (2007). *Evaluating biodiversity in fragmented landscapes: use of focal species.* Forestry Commission Information Note 89, Forestry Commission, Edinburgh.

- Humphrey, J.W., Smith, M., Shepherd, N., Handley, P. (2007). *Developing Lowland Habitat Networks in Scotland: Phase 2.* Contract report to Forestry Commission Scotland, Forestry Commission GB, Scottish Natural Heritage and Scottish Executive Environment and Rural Affairs Department.

- Humphrey, J.W., Watts, K., McCracken, D., Shepherd, N., Sing, L., Poulsom, E.G. and Ray, D. (2005). *A review of approaches to developing lowland habitat networks in Scotland.* Scottish Natural Heritage Commissioned Report 104 (ROAME No. FO2AA102/2). Scottish Natural Heritage, Edinburgh.

- Watts, K., Humphrey, J.W., Griffiths, M., Quine, C.P. and Ray, D. (2005). *Evaluating biodiversity in fragmented forest landscapes: principles.* Forestry Commission Information Note 73, Forestry Commission, Edinburgh.

- Watts, K., Ray, D., Quine, C.P., Humphrey, J.W., and Griffiths, M., (2007). *Evaluating biodiversity in fragmented forest landscapes: Applications of Landscape Ecology tools.* Forestry Commission Information Note 85, Forestry Commission, Edinburgh.

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