FINAL REPORT – SW SCOTLAND FHN

# Forest Habitat Networks Scotland
# Broadleaved Woodland Specialist Network for SW Scotland
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Ecology Division Forest Research

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This is an internal progress report to the FHN Scotland Steering Group describing the work carried out on the Forest Habitat Network (FHN) project for Scotland. The work is jointly funded by Forestry Commission Scotland, Scottish Natural Heritage and Forestry Commission GB.

The work has been agreed and orchestrated by the Project Steering Group.

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## INTRODUCTION

The national scale analysis of habitat networks in Scotland identified and mapped networks for woodland generalists, broadleaved woodland specialists and heathland generalists (Sing, L., 2005). This report aims to verify, and add, to the information on the forest habitat network in the south west Scotland region.

The methods in this analysis were used in the Highlands regional analysis (Moseley et al., 2005); this includes the Beetle (Biological and Environmental Evaluation Tools for Landscape Ecology) modelling approach (Watts et al. 2005 and Ray et al. 2005), and an assessment of woodland quality to define networks. The landscape ecology concept of focal species can be used to illustrate the spatial arrangement of existing woodlands and the potential dispersal of woodland species, Ray et al., (2005) and Watts et al., (2005).

## AIMS

To identify:

1. The quantity and location of the broadleaved woodland specialists networks in the SW of Scotland.

2. The quantity and location of high quality broadleaved woodland specialist networks.

3. Which species rely on these networks?

4. Where are the constraints to woodland expansion in the lowland areas of SW Scotland?

## METHODS

The study area is defined by the Unitary Authority boundaries (Figure 1). A 5km buffer has been applied to the external boundary. The study area is approximately 1.5 million hectares, of which 20,200ha is in England.


Figure 1. The area of analysis covering the 13 Unitary Authorities plus a 5km buffer.

## Woodland Types in SW Scotland

The UK BAP priority woodland types in the SW of Scotland are; upland mixed ash woodland, upland oak woodland, wet woodland, upland birch woodland and lowland mixed broadleaved woodland (Perks, A. 2000). Peterken reported that the river networks contain the main wooded areas of the Clyde Valley, containing: wet woodlands (*Salix* spp. *Betula pubescens* and *Alnus glutinosa* dominated) within the valleys, and *Quercus robur* on the floodplains; base rich ash-elm woods (NVC - W9) on lower slopes; and acid woodland of oak and beech (NVC - W17, *Q. petrea*) on the upper slopes (Appendix 1); beech and sycamore are naturalised within these woodlands (Peterken, 1999). Most of the woodlands are no more than 150m across, occupy steep valley sides and can be wider than they appear in plans (Peterken, 1999).

Dumfries & Galloway contains important examples of old sessile oak woodland and *Tilio-Acerion* forests (NVC - W8 & W9, mixed ash woodlands in ravines). Coniferous woodland is a broad habitat type for the Local Biodiversity Action Plan in Dumfries & Galloway but it is not a UK priority habitat; this report focuses on the broadleaved woodlands as the priority woodland habitats for conservation within the context of the wider forest landscape.

## Focal Species

The analysis in this report uses the generic focal species approach (Watts et al. 2005) to group woodlands that share several required habitat characteristics, and to model the permeability to dispersal of all non-habitat land cover components of the matrix. In view of the priority habitats in SW Scotland, this project employs the generic focal species, broadleaf woodland specialist; considered as moderately mobile, not sensitive to habitat patch size, and sensitive to woodland edge.

## Data used

1. National Inventory of Woodland and Trees (NIWT).
2. Scottish Semi Natural Woodland Inventory (SSNWI).
3. Forest Enterprise (FE) sub-compartment database.
4. Scottish Ancient Woodland from the Scottish Inventory of Ancient and Long-established Woodland Sites (v3) and the Scottish Inventory of Semi-natural Woodlands (v3).
5. Scottish Forestry Grant Schemes (to February 2006).
6. Forest Plan (as of February 2006).
7. Woodland Grant Scheme 3.
8. Landcover Matrix from the national analysis (Sing, 2005) based on LCS88, LCM2000 and the Ordnance Survey® Strategi ® (Forestry Commission License No: GD 100025498).
9. Lowland Zone from the national analysis (Sing, 2005 and Humphrey et al. 2005).
10. Elevation Mask from the national analysis showing areas above and below 500m, based on the Ordnance Survey 50 metre resolution Digital Elevation Model (DEM).
11. Unitary Authority boundaries.
12. LCS88
13. Natura 2000 SACs.
14. Ordnance Survey Strategi.

## Identifying Core Forest Areas

The identification of broadleaved woodland habitat (Sing, 2005) makes use of available data from the National Inventory of Woodland and Trees indicative forest type of broadleaved, Scottish Semi Natural Woodland Inventory tree-type of 80% broadleaved or broadleaved with a minimum canopy cover of 50%. No minimum habitat size has been applied, other than defining broadleaved woodland as the remaining core area after removing a 50m internal buffer.

## Data Preparation

Core areas of broadleaved woodland were identified in a GIS using the SSNWI and NIWT data. This produced polygons of contiguous areas of woodland identified as having an 80% or more broadleaved component and a 50% or greater canopy cover.

The woodland edge was removed as a 50m internal buffer from the core areas where the habitat did not connect with other woodland. The buffer was added to the non-habitat matrix with a permeability to dispersal cost of 1 (low value).

The matrix was modified by adding various landcover types which were identified from datasets 1 to 7 above; these datasets are likely to improve the classification of land use from the baseline of LCS88 or LCM2000 data. The Scottish Ancient Woodland Inventories do not list the woodland type of described features; woodland type was therefore identified from SSNWI and NIWT before combining the data in the landcover matrix.

Species dispersal was assumed to be more difficult through all matrix landcover types, and so at elevations above 500m the landcover permeability cost was doubled using the elevation mask; this adjusts the cost of movement for species in a harsher climatic environment. The lowland zone mask (Humphrey *et al*. 2005) was applied to vary the costs for farm and parkland wooded areas; this accounts for the expected higher biodiversity value of woods described as farms and parklands in the uplands where this land is more often managed as wood pasture (Ray, 2005).

Qualifying Woodlands for Biodiversity Value

A network can be defined in terms of its biodiversity value. In this analysis value is expressed by the quality of habitat in core areas. The method described in Appendix 2 was employed to assess the biodiversity value (Moseley *et al*. 2005). People familiar with the woodlands were asked to evaluate individual woodland blocks by broadly assessing the woodland structure, deadwood and field layer. Each woodland polygon assessed was categorised as good, moderate or poor in biodiversity quality. Good quality woodlands qualify as high biodiversity core areas. The information from the interviews has also been used to verify the data by confirming the core area broad habitat type. The large number of woodlands and the restricted resources of the project led to the exclusion of broadleaved woodlands <5ha from the assessment.

The method of gathering the interview information differed depending on the availability of interviewees. Some interviewees knew some or all of the woodlands personally, while others had management plans and surveys which they consulted or provided for assessments. Interviewees consisted of Forestry Commission woodland officers, Scottish Natural Heritage area officers and council biodiversity or tree officers.

Interviewees also suggested woodlands to add to the dataset; woodland polygons were added if the interviewee could identify woodland type and assess the biodiversity quality. Not all of the >5ha woodlands were known by interviewees or had survey/management plan information and these have therefore not been included in the qualified networks; the numbers of woodlands are listed in Table 1.

Comments on assessed woodlands were added to the database together with the assessment of biodiversity. Comments could be a list of main tree species and/or woodland name, or the name of the organisation who suggested the woodland if it was an addition.


Dumfries and Galloway had no woodlands assessed due to time limitations. A network of qualified (assessed) woodland was produced for the area of the unitary authorities shown in Figure 2.

Figure 2. Areas were some woodland has been assessed.

Table 1. Broadleaved woodland specialist core areas by Unitary Authority

| Unitary Authority | Total number of core areas | Number of ≥5ha core areas | Number of core areas assessed | Percent of core areas assessed from total number |
|---|---|---|---|---|
| Dumfries & Galloway | 8416 | 493 | na | na |
| East Ayrshire | 1725 | 85 | 40 | 2% |
| East Dunbartonshire | 434 | 12 | 24 | 6% |
| East Renfrewshire | 256 | 8 | 7 | 3% |
| Falkirk | 626 | 21 | 8 | 1% |
| Glasgow City | 397 | 11 | 11 | 3% |
| Inverclyde | 428 | 14 | 11 | 3% |
| North Ayrshire | 1042 | 64 | 22 | 2% |
| North Lanarkshire | 815 | 36 | 39 | 5% |
| Renfrewshire | 811 | 20 | 19 | 2% |
| South Ayrshire | 2078 | 123 | 43 | 2% |
| South Lanarkshire | 1568 | 43 | 34 | 2% |
| West Dunbartonshire | 670 | 23 | 14 | 2% |
| TOTAL | 19266 | 953 | 272 | 1% |

Note: there may be more woodlands assessed than there are >5ha woodlands as interviewees suggested some woodlands <5ha for inclusion.

Modelling Networks

The cost distance buffer 'Beetle' model was used to construct the forest habitat networks (Watts et al. 2005 and Humphreys et al. 2005). The permeability of each of the landcover types of the landscape matrix for broadleaved woodland specialists was applied to the model as a cost surface. The costs were developed from consultations with the steering group, the upland ecology group and expert users of the model.

Two dispersal ranges for the broadleaved woodland specialists have been identified following discussions with Duncan Ray and Darren Moseley in February 2006.

- moderately mobile species able to disperse 1000 metres.
- mobile species able to disperse 2000 metres.

The Beetle model was parameterised in the following four ways:

1. All the core areas as habitat and 1km maximum dispersal.
2. All the core areas as habitat and 2km maximum dispersal.
3. High biodiversity core areas as habitat and 1km maximum dispersal.
4. High biodiversity core areas as habitat and 2km maximum dispersal.

The model output identifies the networks. Restricted networks were produced using only the high biodiversity core areas as habitat and the other core areas were included in the landscape matrix with various costs (Appendix 4).

Broadleaved Woodland Specialist Species

A list has been compiled of species that use broadleaved woodland (Appendix 3). Information was gathered from the websites of organisations listed under sources and metadata in Appendix 3, and from discussions with Alice Broome; species conservation ecologist at Forest Research.

Constraints to Woodland Expansion in the Lowlands

Land cover types in the lowlands of Scotland were identified and mapped to show the main constraints to the expansion of broadleaved woodland. The LCS88 has been reclassed to general landcover types and mapped with the Special Areas of Conservation that are designated as lowland heath, grassland and mires. Urban areas and lochs have been identified from OS Strategi data. Forest areas are mapped as all of the woodland identified for the Beetle analysis.

**RESULTS & DISCUSSSION**

All Broadleaved Woodland Specialist Habitat

The total area of broadleaved woodland specialist habitat identified by the analysis is 25,000ha. 20,000ha of the total (80%) was removed from the habitat as a 50m edge effect. This is a greater proportion than the 74% removed in the national analysis. The broadleaved woodlands in SW Scotland are generally long and narrow, concentrated in the river valleys and in strips at the coast; this produces a greater edge effect than the national average.

Table 2 contains the statistics for the networks using all of the broadleaved woodland specialist habitat. The average size of the 1000m networks is 36ha; this is larger than the Scottish average of 27ha. There is no comparison available for the 2000m networks. The number of networks indicates that the region contains 16% of Scotland's 1000m networks. As a percentage of area; the networks are 22% of the 1000m national network. Note, these figures are approximate, since there has been some addition to the SW Scotland habitat by interviewees that is not included in the national network.

Table 2. Summary statistics for unqualified broadleaved woodland specialist networks

| Max. dispersal distance (m) | Number of networks identified | Total area of networks (ha) | Mean area of networks (ha) | Area of largest network (ha) |
|---|---|---|---|---|
| 1000 | 1273 | 46084 | 36 | 598 |
| 2000 | 990 | 80495 | 81 | 1636 |

The networks are mapped in Figures 3 and 4, and each network is a different colour.

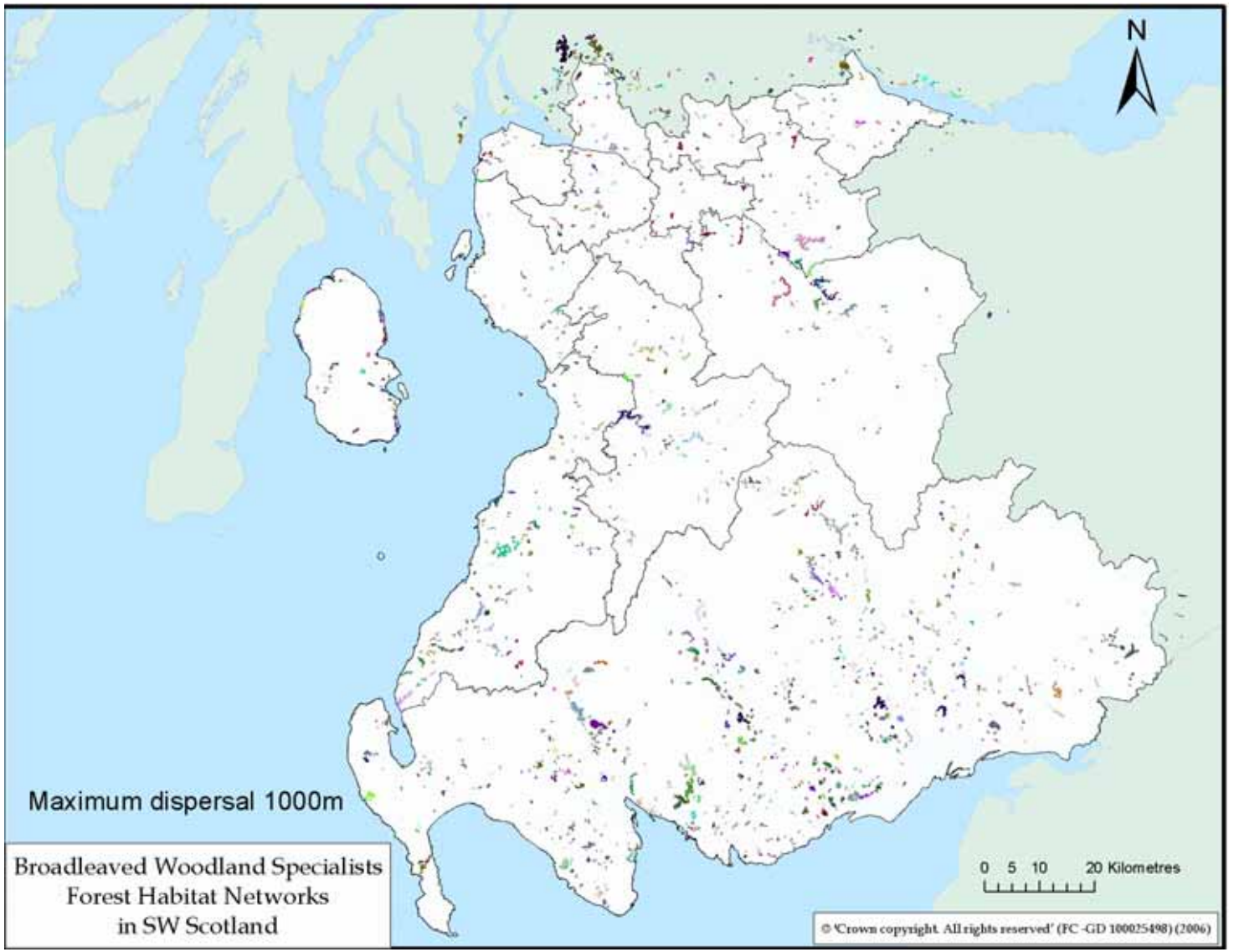


Figure 3. Broadleaved woodland specialist networks produced using a 1000m maximum dispersal.

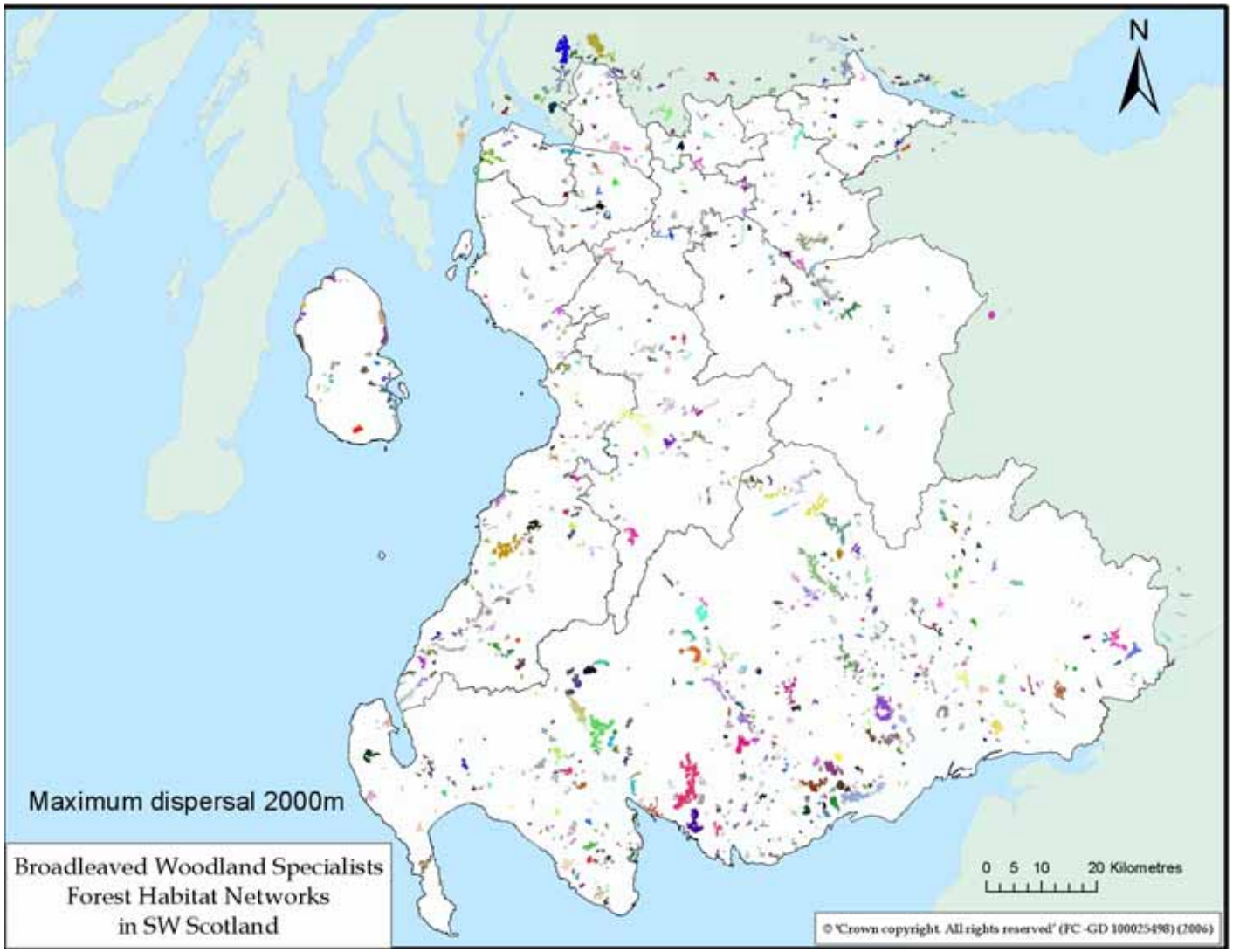


Figure 4. Broadleaved woodland specialist networks produced using a 2000m maximum dispersal.

Qualified Broadleaved Woodland Specialist Habitat

The total area of broadleaved woodland specialist habitat qualified as having a high biodiversity value is 1792ha. This does not include the 1,249ha of the total area, representing 70% of the area of broadleaved woodlands, which was removed from the habitat layer as lying within 50m of the woodland edge. The core woodland conditions were assumed only to apply 50m or more from a woodland edge.

Table 3 provides some metrics from networks associated with qualified habitat. The average size of qualified broadleaved woodland networks is larger than the networks where all broadleaved woodland habitat is included (see Table 2); the average is 64ha versus 36ha for 1000m networks and for 2000m networks the average is 115ha versus 81ha (Table 2). This appears to show that networks associated with high biodiversity quality habitat have larger and therefore more resilient core area habitat for broadleaved woodland specialists compared to all broadleaved woodland. However, the quality assurance analysis only identified woodlands greater than or equal to 5 ha, therefore all of the small woodlands have been excluded from the qualified habitat analysis. It certainly is true however that the identified qualified woodland networks, being larger and of higher value, should be more resilient to change and disturbance through time.

Table 3. Summary statistics for qualified broadleaved woodland specialist networks.

| Max. dispersal distance (m) | Number of networks identified | Total area of networks (ha) | Mean area of networks (ha) | Area of largest network (ha) |
|---|---|---|---|---|
| 1000 | 61 | 3886 | 64 | 461 |
| 2000 | 56 | 6444 | 115 | 654 |

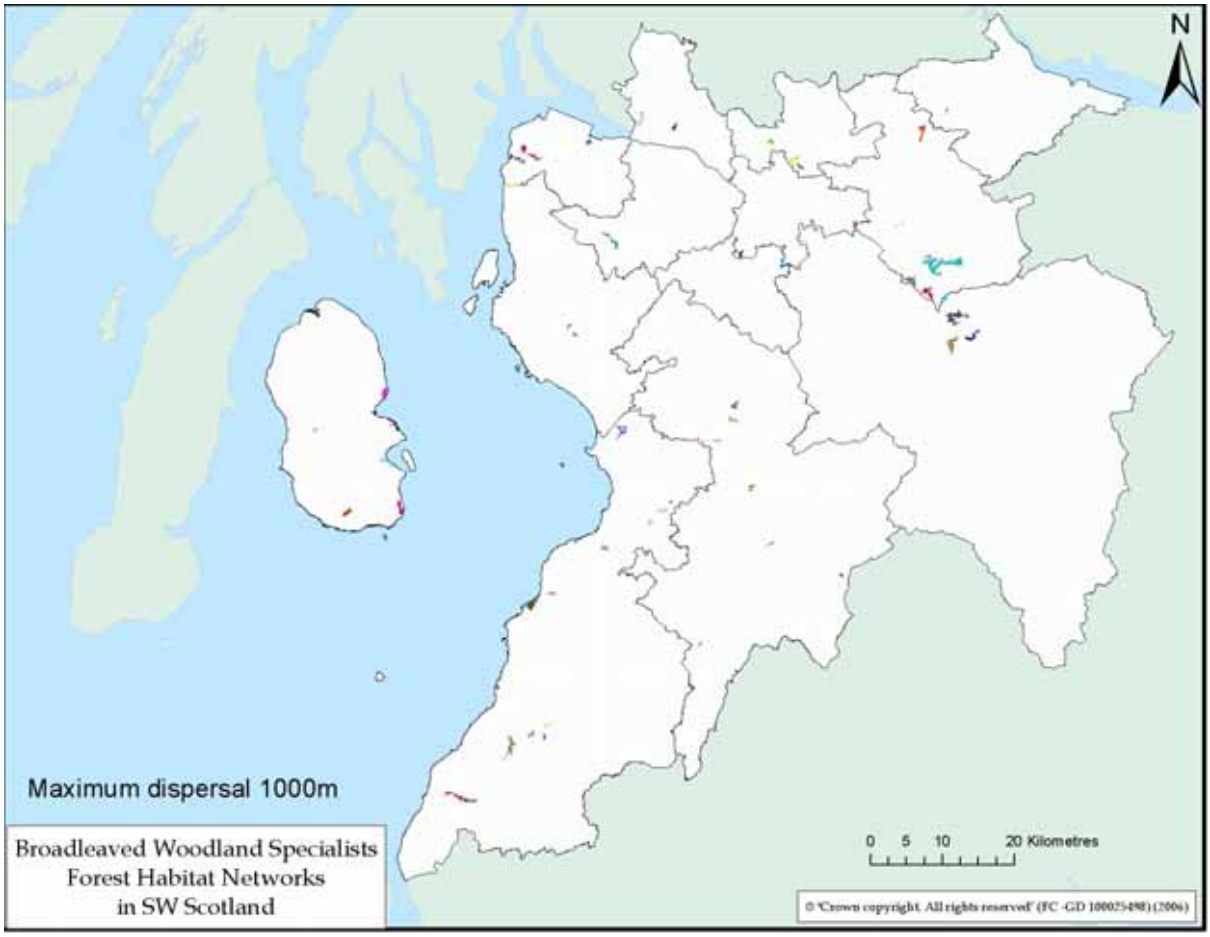


Figure 5. Qualified networks with 1000m maximum dispersal. Each individual network is identified by a separate colour.

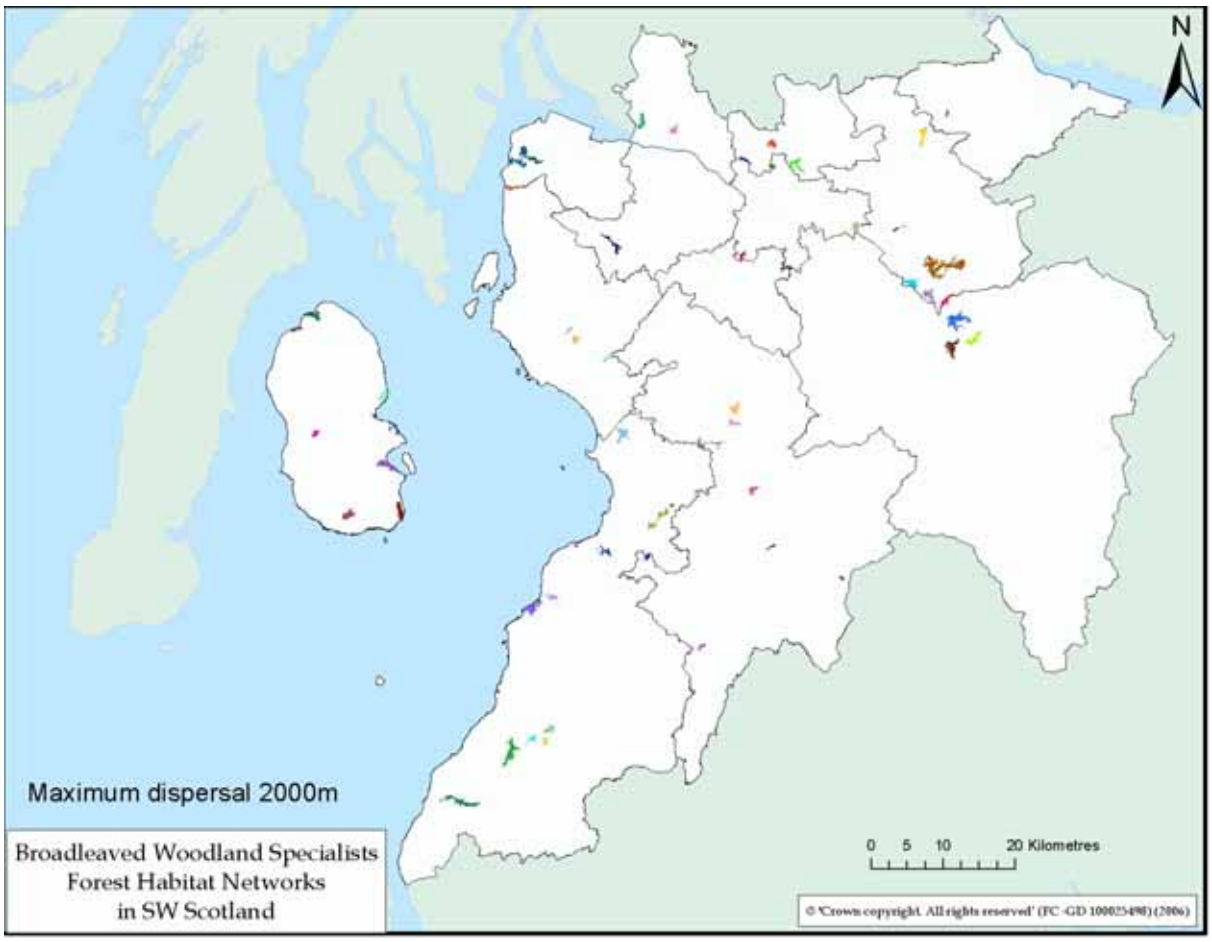


Figure 6. Qualified networks with 2000m maximum dispersal. Each individual network is mapped in a separate colour.

Table 3 (and also Table 2) provide data for a sensitivity analysis. For all broadleaved woodland networks and especially qualified broadleaved woodland networks, a comparison of the larger dispersal distance (2000m) against the lower dispersal distance (1000m) metrics shows a slightly larger number of isolated woodlands at 1000m, but a large increase (about 100%) in the total area of functional networks at 2000m. This reflects the permeability and nature of the surrounding matrix. South west Scotland is heavily wooded, albeit with large areas of conifers. The increase in dispersal distance shows that the broadleaved woodland components of the landcover matrix can be more easily connected in a functional way compared to less wooded and more intensively managed landscapes, e.g. the Buchan plane.

The qualified networks assessed as having a high biodiversity quality are dispersed throughout the region, Figures 4 and 5. The networks shown in Figures 3 and 4 could connect with a number of the qualified networks to reduce fragmentation if some of the habitat were improved through appropriate management.

Examples of Possible Use for Forest Habitat Networks

In Figure 7 two high biodiversity woodlands (red areas) create a network because focal species can disperse through the intervening landscape to reach both woodlands.

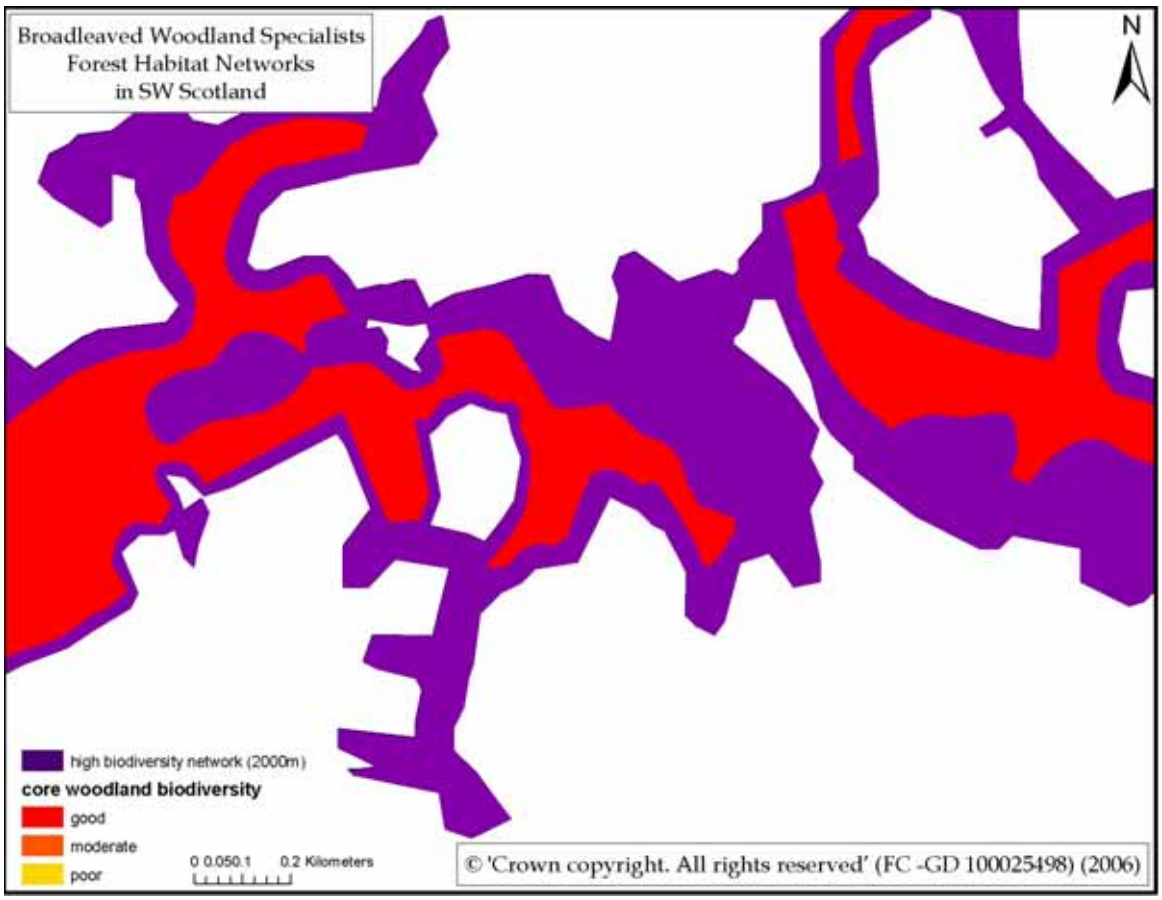


Figure 7. Woodland within one example network.

If the distance between woodlands is too great or the landscape more hostile (less permeable) the woodlands would not be functionally linked, as in Figure 8a. Guided by the network analysis, grant schemes should target management and woodland expansion to develop stepping stones between fragmented networks. The new or improved woodlands do not have to be contiguous with existing woodland. In theory, woodland species will disperse across small distances of the matrix between habitat patches, which in time will include the new and improved woodlands, thereby creating one network. As an example, Figure 8 shows how fragmented networks (Fig. 8a) could be functionally connected by woodlands expansion (Fig. 8b).

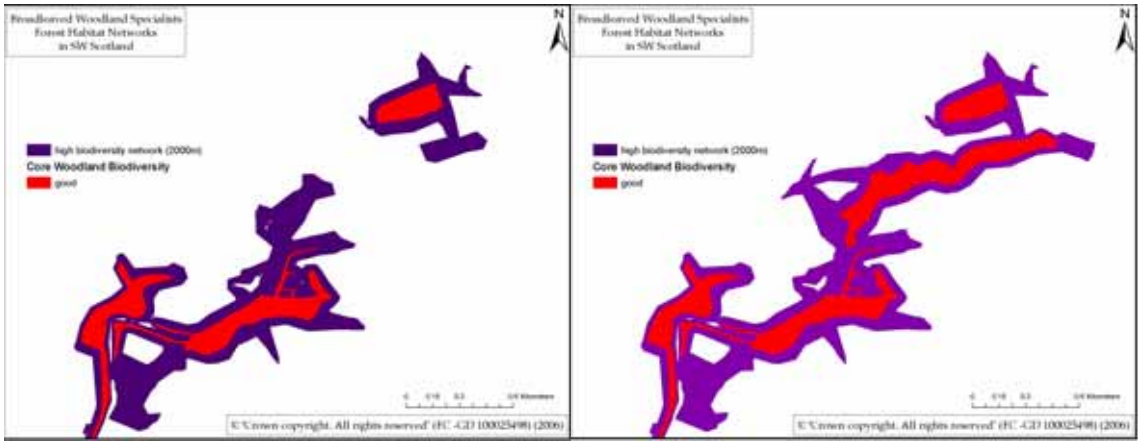

Figure 8a Woodlands with separate networks. Figure 8b Original woodland plus new woodland.

High biodiversity woodlands are the source areas of woodland biodiversity and should be protected by careful management and buffered with contiguous patches of new woodland. The quality assessment of woodlands enables the data to be split to identify high biodiversity networks as shown in Figures 5 and 6. As woodland condition and biodiversity quality improves, the analysis can be rerun to determine changes to the network.

The priority woodlands for conservation management can be identified by viewing all the potential habitat together with the networks. Management of the moderate and poor woodlands should be improved to increase their biodiversity value, and expanded to connect existing high biodiversity woodland, as demonstrated in Figure 9a & 9b. Management should include: reducing browsing to benefit tree regeneration and development of the field layer, removing pest species such as *Rhododendron ponticum* (L), opening gaps or planting appropriate species, increasing the deadwood supply. As woodland biodiversity value increases, the network expands.

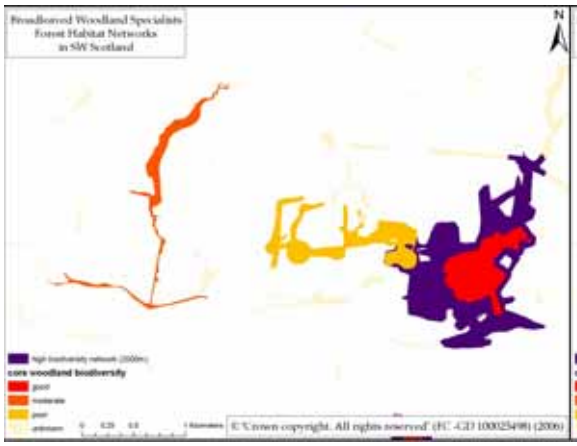


Figure 9a. Network when woodland is of poor to good quality.

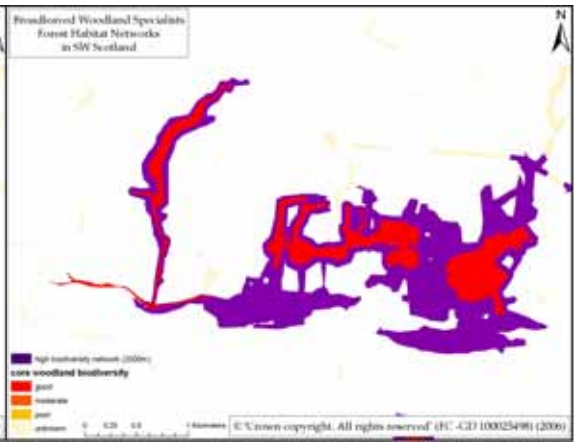


Figure 9b. Network when woodland is upgraded to good quality.

Many of the woodlands in SW Scotland are in areas of steep topography, e.g. in ravines, and the plan view of the data may not account for the true area that the woodland covers. When the 50m edge effect is applied much, if not all, areas of woodland are removed from the habitat layer in the analysis. The green areas in Figure 10 show woodlands narrower than 100m, and if some of these woodlands are actually wider than 100m, they should be included as habitat, and the network analysis re-examined. Polygon area could be evaluated by factoring in slope but the available data at 50m resolution is not detailed enough to allow an accurate area to be calculated. Field measurements of woodland width would ascertain if it should be included in the analysis.

In addition, the green areas could be targeted for buffered expansion to create interior conditions, thereby producing quality core habitat to become part of a network.

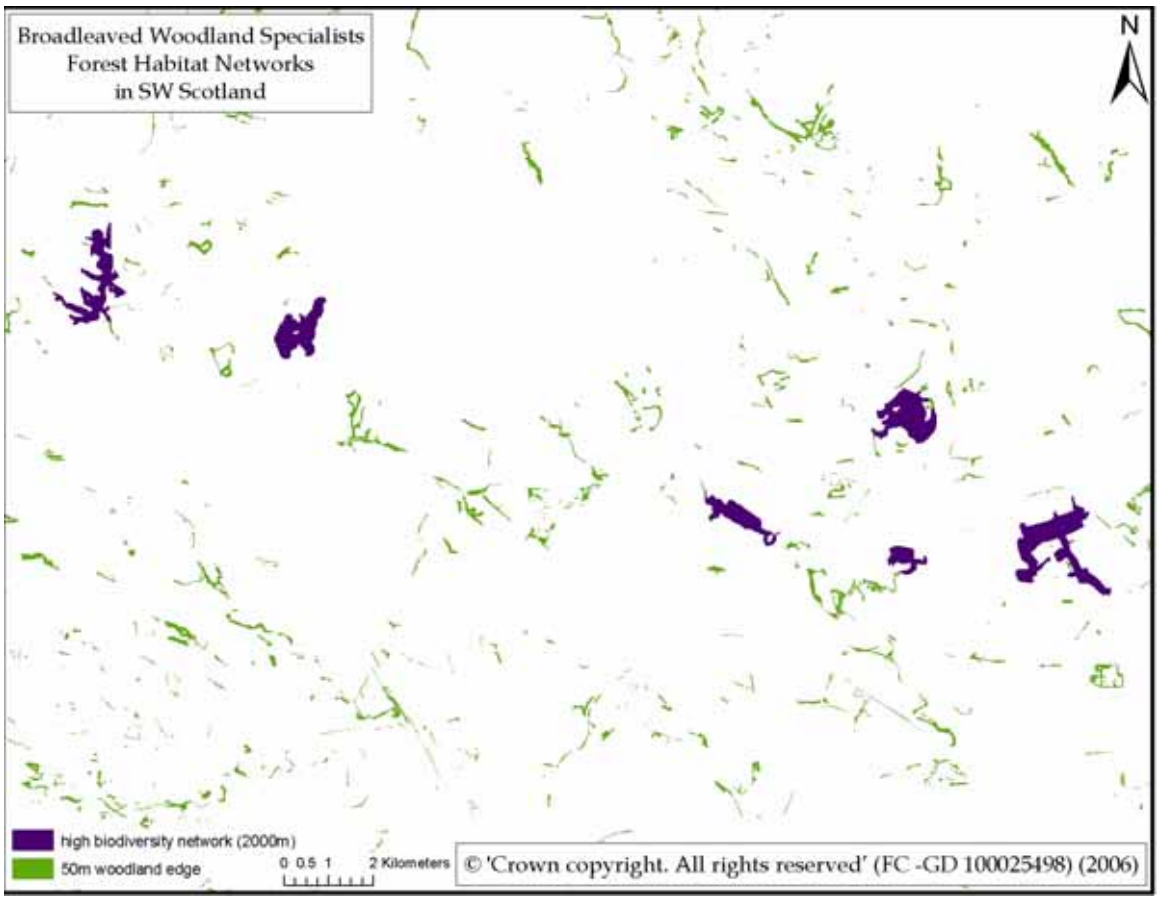


Figure 10. In this example there are few woodlands with interior conditions to create habitat for networks (purple), mostly the core areas are edge woodland (green).

Some broadleaved woodland specialist species found in SW Scotland

| Scientific Name | English Name |
|---|---|
| *Chrysosplenium alternifolium* | alternate-leaved golden saxifrage |
| *Epipactis youngiana* | Young's helleborine |
| *Epipactis helleborine* | broad-leaved helleborine |
| *Neottia nidus-avis* | birds-nest orchid |
| *Paris quadrifolia* | herb Paris |
| *Campanula latifolia* | giant bellflower |
| *Carex pendula* | pendulous sedge |
| *Circaea lutetiana* | enchanter's-nightshade |
| | |
| *Parus montanus* | willow tit |
| *Phylloscopus sibilatrix* | wood warbler |
| *Ficedula hypoleuca* | pied flycatcher |
| | |
| *Rimbachia bryophila* | agaric fungus |

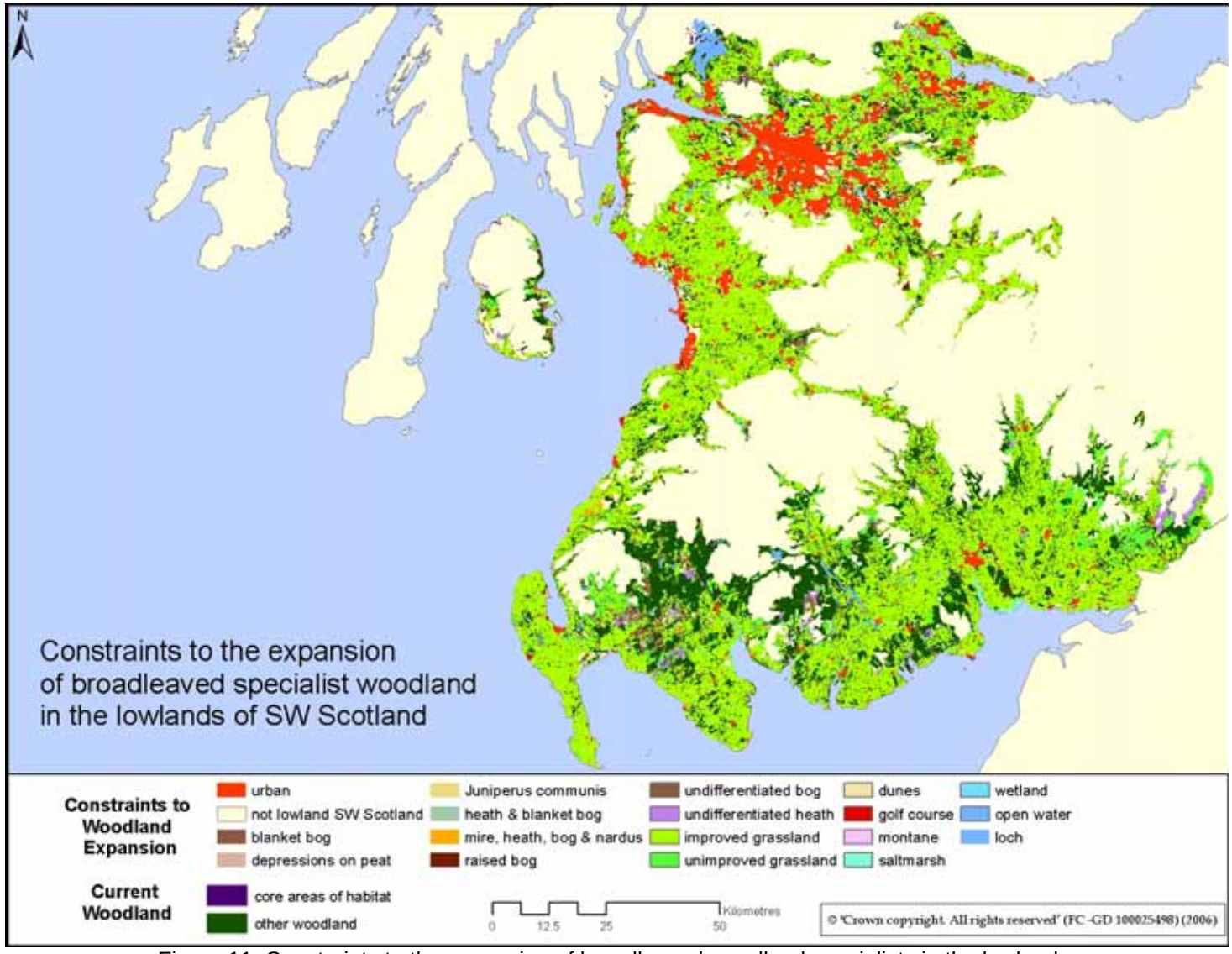


Figure 11. Constraints to the expansion of broadleaved woodland specialists in the lowlands.

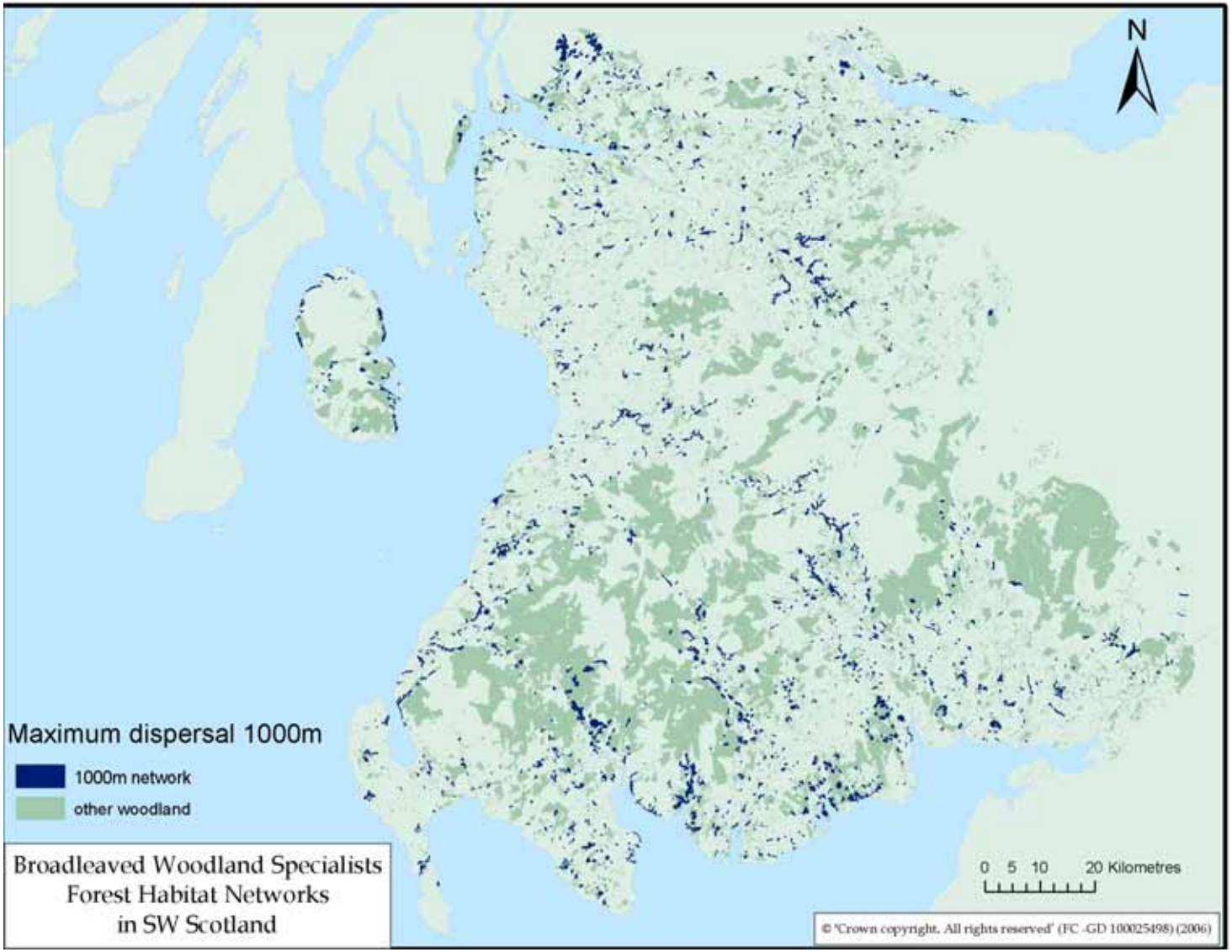


Figure 12. Opportunities for the expansion of broadleaved woodland specialist habitat through conversion of other woodland.

Some species require particular woodland types and would not disperse into all types of broadleaved woodland specialist habitat. For example the liverwort *Acrobolbus wilsonii* requires broadleaved woodland in ravines. If broadleaved woodland was expanded from the ravine to surrounding countryside, A. wilsonii may not disperse through the new woodland. However, expanding the woodland would buffer these habitats from the effects of surrounding land uses, such as nitrate runoff and chemical spray drift from farming.

The Nottinghamshire habitat action plan mentions wet woodlands colonising old mining subsistence and gravel pits (Palmer, 1999). This type of landscape is common in parts of the SW Scotland such as Renfrewshire and Ayrshire. The forest habitat networks in conjunction with a hydrological model or maps of rivers, streams and sink holes can assist in planning the expansion and defragmentation of these woodlands.

Birch regeneration was mentioned in some interviews as developing in areas previously used for mining. The GIS analysis identifies areas of birch regeneration as broadleaved woodland specialist habitat; these were assessed as poor to moderate due to the undeveloped structure, this may be changed to good habitat in the future as the structure develops.

The interviews for biodiversity provided confirmation of woodland type and quality for some of the woodlands. The core areas consist of ravine ash woods, wet woodlands, mixed broadleaved woodlands (often policy woodlands and shelterbelts) and birch regeneration. 5% of contiguous broadleaved woodland specialist areas are >5ha. Small amounts (1%) of the total broadleaved woodland specialist core areas have been assessed. Some of the vascular plant species listed in Appendix 3 were known by interviewees to exist in certain woodlands; the management surveys were another source of ground species information.

Woodland Expansion in the Lowlands; Constraints and Opportunities.

Figure 11 identifies the major land cover types in lowland SW Scotland as improved grassland, urban areas, and woodlands. The improved grasslands are agricultural areas; landowners may convert some areas to woodland using funds from the Scottish Forestry Grant Scheme (SFGS) or in future using the proposed Land Management Contracts. The BEETLE model has already been used with the Highland Conservancy Locational Premium Scheme to direct woodland expansion to places where it will have the greatest benefit securing functional connectivity in the landscape. The SFGS can also be used in urban areas in conjunction with the Woodlands In and Around Towns initiative (WIAT). WIAT is in place to manage existing urban woodlands. However, there are priorities for WIAT woodlands, such as recreation, which may conflict with maximising biodiversity, for example, removing deadwood for woodland-user safety. Woodlands that are not broadleaved woodland specialist habitat are classed as other woodland and will include mixed broadleaved/conifer and pure conifer which could be converted to broadleaf. Non-broadleaved specialist woodland in the SW of Scotland is identified in Figure 12; Figures 13 a&b illustrate where such woodland should be targeted for conversion to create habitat and functionally link the networks.

Figure 13a. The red crosses indicate other woodland that if converted to broadleaved could functionally link the networks in blue.

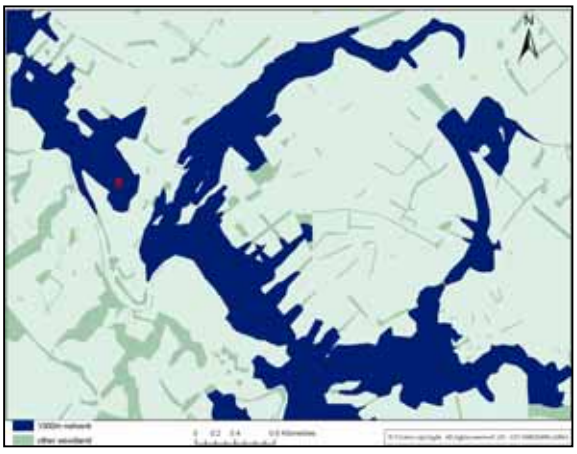

Figure 13b. Networks after the conversion of the other woodland marked in Fig.13a.

In Figure 13b the red cross indicates a converted area that did not link networks, however, the distance between the networks was reduced and less new woodland would be required to create a link.

**RECOMMENDATIONS**

- Use broadleaved woodland specialist networks to identify where to prioritise efforts.
- First, protect and consolidate high biodiversity woods with buffered expansion.
- Second, consider the management of lower quality woods to improve them.
- Third, introduce stepping stones to reduce woodland fragmentation.
- Consider conversion of conifer to broadleaved woods where it will reduce broadleaved woodland fragmentation.

The datasets exist as a valuable tool available for planning broadleaved woodland networks in the SW of Scotland. Within river valleys such as the Clyde and Stinchar there are many high biodiversity woodlands that are not functionally linked. To plan the buffered expansion of high biodiversity woods the datasets for qualified core areas, networks and constraints should be analysed in conjunction; this will allow for the identification and deliberation of opportunities and restrictions to woodland expansion and defragmentation.

The qualified data identifies known woodlands of various qualities. Management treatments may not be required in all parts of moderate-quality woodland to improve it to good-quality. The habitat around the Lugar Water in East Ayrshire was assessed as moderate quality woodland; however, within the woodland the habitat quality varied from good oak woodland structure to broadleaved mixed with conifers. Removing the conifers would improve the quality of the whole woodland. This woodland scored low for availability of deadwood; perhaps the true quantity of deadwood is unknown and could be surveyed or the woodland management could be adapted to leave more deadwood as it develops, thereby improving biodiversity.

Plans for new broadleaved planting can be evaluated by viewing them with the existing network data to measure their contribution towards consolidating networks. New planting should be positioned to functionally link existing networks, as demonstrated in Figure 8. Beetle analysis can measure and display the effects of these decisions on the networks.

<u>Possible Future Additions to the Output</u>

i Identify suitable wet woodland habitat with a model of hydrology.
ii Prepare a method for assessing woodland biodiversity in Dumfries and Galloway.
iii Calculate the potential cost of woodland expansion.

**ACKNOWLEDGEMENTS**

Woodland Officers: Ken Smith, David Robertson, Tommy McGrory provided an assessment of the Clyde valley woodlands. Peter Harrison of South Scotland conservancy and Peter Norman, Biodiversity Officer in Dumfries & Galloway Council, provided lists of contacts.

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Bruce Davidson and Nick Prower of East Ayrshire Woodlands,
Dianne Holman and Graeme Walker of SNH in Ayrshire,
Mark Smith of W. Dunbartonshire Council,
Keith Watson and Michele Kerry of Glasgow Council.

Caroline Peacock biodiversity officer for Falkirk Council provided woodland survey information from which assessments were made.

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APPENDIX 1.

A. Clyde Valley Woodland type constructed from Peterken (1999) p 30.

| Land Form | Species/Woodland type | NVC | Soil/landcovertype |
|---|---|---|---|
| Moorland | birch | W4 | upland mires |
| | alder | W7 | watercourses |
| | birch -Scots pine | W18 | mineral soils |
| Plateau | alder-birch mosaicked with oak-hazel-birch | W3/W4 W11, W17 | boulder clay – base poor & poorly drained |
| | alder-ash mosaicked with mineral soil alder & fen alder | W7 W5/6 | along water courses |
| Valley Slopes | elm-ash_hazel | W8, W10 | base rich sites |
| | elm-ash_rowan | W9 | drier base rich sites |
| | oak-hazel | W11 | dry, base-poor sites |
| | birch-oak | W17 | very dry, base-poor sites |
| | alder-ash-elm | W7 | flushes, springs, tributaries |
| Floodplains | alder-willow | W5/W6 | sloughs |
| | Alder-ash-elm | W7 | ridges, shoals, levees |

B. from Falkirk LBAP Broadleaved & Mixed Woodland Action Plan.

Estimated extent of UK priority woodland habitat types in the Falkirk area

| UK Key Habitat Type | Main NVC Types | Estimate of Area | Approx. No. of Sites | Key Sites |
|---|---|---|---|---|
| Wet woodland | W1, W2, W3, W4c, W5, W6, W7 | 120ha (65ha of which is woodland on raised bogs) | 16 (many as small wet areas in larger woodlands) (5 developing on raised bogs) | Carron Dams SSSI<br>Drumbowie Reservoir<br>Denny School Wood |
| Upland oak woodland | W10e, W11, W16b, W17 | 212ha | 30<br>(18 1ha-5ha<br>12 7ha-25ha) | Callendar Wood<br>Quarter Wood<br>Braes Wood<br>Dales Wood<br>South Glen<br>Muiravonside<br>Torwood Glen<br>Castle Glen<br>Wallacebank Wood |
| Upland mixed ash woodland | W8d-g, W9, W13 | 237ha | 31<br>15<4ha (mainly recent planting resembling mixed ash woodland)<br>16>4ha (mainly valley woodlands) | Carron Glen<br>Castlerankine Glen<br>Westquarter Burn<br>Carriden Woods |
| Upland birch | W4a, W4b, W10e, W11, W17 (where birch is >50% of canopy and oak <30%) | 132ha (including areas of birch scrub) | 30 (over 20 are less than 3ha many recent regeneration) | Castlecary Low Wood<br>North Drum Wood<br>Bly Wood |
| Lowland mixed broadleaves | W10a-d, W8a-d, W16 | 12ha | 7 | |

APPENDIX 2. Interview Method

The interview is designed to 'broadly' categorize the main species and quality of major woodland blocks. The scope, scale and resources of the FHN project do not permit a very detailed description of woodlands at the sub-compartment level. The interview and interpretation should focus on an overall score for woodland blocks.

Three factors of quality are considered in the survey, and in order for a high quality designation to be ascribed to a woodland block, the area should be well represented in each area. The three factors are: structure, deadwood and field layer composition, and together are used as a surrogate for biodiversity value.

1. Structure

1.a. A 'Good' structural composition will include: tree species mix suited to the site, multi-layer canopy, gaps in the canopy.

1.b. 'Moderate' composition will include: two of the factors described in 1.a.

1.c. 'Poor' composition will include one or none of the factors described in 1.a.

2. Deadwood

2.a. A 'Good' deadwood component will include the following elements in varying stages of decay: some standing deadwood – snags (and hung broken branches), sap runs, fallen deadwood.

2.b. 'Moderate' deadwood will include two of the elements described in 2.a.

2.c. 'Poor' deadwood will include one or none of the elements described in 2.a.

3. Field layer

3.a. A 'Good' field layer component will include roughly 50% cover or more of the woodland floor, a representative sample (5 or so) of plants associated with that woodland type, evidence of low deer browsing pressure

3.b. 'Moderate' will describe 20-50% field layer cover, a few representative plants 2-3, evidence of higher levels of deer browsing

3.c. 'Poor' will describe less than 20% field layer cover, with occasional or no representative plants, evidence of very high deer browsing.

Interviewees may also comment on woodland blocks for which management plans are in place that will lead to a significant improvement in the biodiversity quality. These woodlands should be flagged within the spatial database so that a separate analysis can be conducted to predict the contribution of woodlands as habitat sources in 50 years time.

A single overall quality score is agreed based upon structure, deadwood and field layer quality, set out in combinations shown in the table below:

| Overall Quality | Component Quality (from structure, deadwood & field layer) | | |
|---|---|---|---|
| | Good | Moderate | Poor |
| Good | 3 | - | - |
| Good | 2 | 1 | - |
| Moderate | 2 | - | 1 |
| Moderate | 1 | 2 | - |
| Moderate | 1 | 1 | 1 |
| Moderate | - | 3 | - |
| Moderate | - | 2 | 1 |
| Poor | 1 | - | 2 |
| Poor | - | 1 | 2 |
| Poor | - | - | 3 |

APPENDIX 3. Species associated with broadleaved woodland

| Species | Common Name | Habitat | Specialist/ Generalist | Source/Metadata |
|---|---|---|---|---|
| **Vascular Plants** | | | | |
| *Hyacinthoides non-scripta* | bluebell | Broadleaved woodlands (upland oakwood, mixed ashwood. Lowland beech & yew). | G | LBAP's & Draft Highland FN report |
| *Ulmus glabra* | wych elm | Broadleaved woodland | G | Falkirk LBAP |
| *Festuca altissima* | wood fescue | Tilio-Acerion /Broadleaved woodland - including woodland edge | G | Life project website (Clyde Valley) |
| *Epipactis youngiana* | Young's helleborine | Broadleaved woodland | S | Falkirk LBAP/ |
| *Epipactis helleborine* | broad-leaved helleborine | partial to full shade in mesic loam beneath hardwoods | S | Life project website (Clyde Valley)/NBN gateway |
| *Hypericum hirsutum* | hairy St Johns wort | damp grasslands and woods | G | Life project website (Clyde Valley) |
| *Chrysosplenium alternifolium* | alternate-leaved golden saxifrage | Wet (boggy) woods & mountain rocks on base rich soil | S | Life project website (Clyde Valley) / NBN gateway |
| *Neottia nidus-avis* | birds-nest orchid | Dark woodland (beech) | S | Life project website (Clyde Valley)/NBN gateway |
| *Lathraea squamaria* | toothwort | parasite on deciduous trees | G | Life project website (Clyde Valley) |
| *Eqiisetum hyemale* | dutch rush | Semi-shady to no-shade stream banks | G | Life project website (Clyde Valley) |
| *Paris quadrifolia* | herb_Paris | Moist, shady woods in rock crevices & shady ravines, usually on limestone | S | Life project website (Clyde Valley)/NBN gateway |
| *Stellaria nemorum* | wood stitchwort | damp deciduous woodland & streamsides | G | Life project website (Clyde Valley) |
| *Campanula latifolia* | giant bellflower | dark to semi-shade woodland (ancient woodland indicator) | S | Life project website (Clyde Valley) / W.Loth. FHN report/NBN gateway |
| *Melica uniflora* | wood melick | Deciduous woodland, shaded banks & hedgerows | G | Life project website (Clyde Valley) |
| *Carex pendula* | pendulous sedge | Damp, semi-shady woods on clay soil & shady streams | S | Life project website (Clyde Valley)/NBN gateway |
| *Mercurialis perennis* | dog's mercury | Tilio-Acerion | G | jncc website |

| Species | Common Name | Habitat | Specialist/ Generalist | Source/Metadata |
|---|---|---|---|---|
| *Phyllitis scolopendrium* | hart's-tongue | Tilio-Acerion | G | jncc website |
| *Dryopteris spp.* | buckler-ferns | Tilio-Acerion | G | jncc website |
| *Allium ursinum* | wild garlic | Tilio-Acerion | S | jncc website |
| *Circaea lutetiana* | enchanter's-nightshade | Tilio-Acerion (ancient woodland indicator) | S | jncc website/W.Loth. FHN report/NBN gateway |
| *Geum urbanum* | wood avens | Tilio-Acerion - including woodland edge | G | jncc website |
| Melampyrum sylvaticum | Small Cow -wheat | Broadleaved woodland – humid lightly shaded ravines. Dispersal 90cm. Small area requirement, open canopy. | S | Scottish Priority Species List & LBAP |
| | | | | |
| **Mammals** | | | | |
| *Erinaceus europaeus* | hedgehog | Broadleaved woodland | G | Falkirk LBAP |
| | | | | |
| **Birds** | | | | |
| *Parus montanus* | willow tit | damp stands of trees close to rivers, streams and gravel pits, preferring willows, birch and alder, as well as conifers. They also like undergrowth in clearings within old broadleaved woodland, and are sometimes found in tall, ancient, hedgerows, and even dry, scrubby bushes on chalk hills well away from any water | S | Life project website (Clyde Valley) |
| *Picus viridis* | green woodpecker | broadleaved woodland (occassionally conifers) | G | Life project website (Clyde Valley) |
| *Phylloscopus sibilatrix* | wood warbler | broadleaved woodland with closed canopies (beech woods and mature upland oakwoods for breeding) | S | Falkirk LBAP & RSPB |
| *Scolopax rusticola* | woodcock | Large tracts of moist woodland with open glades & rides | G | Falkirk LBAP & RSPB |
| *Milvus milvus* | red kite | Deciduous woodland with farmland & grassland nearby for breeding | G | D & G LBAP |
| *Ficedula hypoleuca* | pied flycatcher | Mature open deciduous woodland, especially oak woods on hillsides or valleys (also parks & gardens) | S | Draft Highland FHN report /RSPB |

| Species | Common Name | Habitat | Specialist/ Generalist | Source/Metadata |
|---|---|---|---|---|
| **Insects** | | | | |
| *Mycetophagus populi* | hairy fungus beetle | ancient broadleaved woodland, pasture woodland, isolated trees | G | Life project website (Clyde Valley) |
| *Mycetophagus picens* | beetle | ancient broadleaved woodland, pasture woodland, isolated trees | G | Life project website (Clyde Valley) |
| *Ctesais serra* | beetle | ancient broadleaved or pasture woodland, isolated trees | G | Life project website (Clyde Valley) |
| *Limnophila verralli* | cranefly | near small streams, usually in the shade of alders | S | W.Lothian FHN report |
| *Limonia trivittata* | cranefly | wet woodland on calcareous soils, esp. near rivers | S | W.Lothian FHN report |
| *Tipula psuedovariipennis* | cranefly | mainly calcareous woods | S | W.Lothian FHN report |
| *Carterocephalus palaemon* | chequered skipper butterfly | broadleaved woodland edges. scrub & bracken | G | Draft Highland FHN report |
| | | | | |
| **Lichens/fungi/liverworts/ mosses** | | | | |
| *Biatoridium monasteriense* | a lichen | Broadleaved species – elm, ash, elder. Ancient woodland | S | D & G LBAP / UKBAP website |
| *Lobaria virens* | a lichen | Established broadleaved woodland, particularly oak | G | Draft Highland FHN report |
| *Lobaria pulmonaria* | tree lungwort | Established broadleaved woodland, particularly oak | G | Draft Highland FHN report |
| *Rimbachia bryophila* | an agaric fungus | Broadleaved woodland (upland oakwood?) | | D& G LBAP SNH website |
| *Plagiochila spinulosa* | a liverwort | Broadleaved woodland | G | Falkirk LBAP |
| *Hydnellum spongiosipes* | velvet tooth fungus | Broadleaved woodland (particularly oak) | G | Draft Highland FHN report |
| Arthothelium macounii & Psuedocyphellaria nornegica | lichens | Hazel & Ash woodland, deciduous woodlands, w9 & w11 on west coast of Scotland. Sheltered and humid microclimate, small areas required. <50m dispersal? | S | Scottish Priority Species List |
| Acrobolbus wilsonii | a liverwort | Broadleaved wooded ravines where there is shelter, constant high humidity and reasonable light levels | S | Scottish Priority Species List & LBAP |

APPENIDX 4. Flow diagram of sources and rules to derive broadleaved woodland specialist data