Forestry Commission Scotland

Native Woodland Targets and Forest Habitat Networks in Scotland

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Summary

This report has used modelling methods to estimate the potential contribution which could be made to the various native woodland targets in Scotland (expansion, restoration, condition improvement) by focussing action in habitat networks based around existing high conservation value woods.

This report includes:

- maps of potential habitat network areas based around woods of probable high conservation value, showing the potential native woodland types;
- network model options are included to allow targeting within broad networks suited to widely dispersing species (moderate biodiversity gain) and narrower networks that are more suited to slow-colonising species (high biodiversity gain);
- FCS Conservancy breakdowns of estimated potential areas within the networks for each priority woodland type and each target type;
- potential conservancy shares of the national HAP targets for 2005-2015, based on the conservancy share of the estimated national total potential areas for each priority woodland type.

Background

Habitat Action Plan targets for native woods in Scotland were revised in 2006 as part of a UK wide review of UK Biodiversity Action Plan targets. Targets have been identified for each priority woodland type and as a total for all native woodland, see Table 1.

The Scottish Forestry Strategy includes action to help meet the targets as a priority and calls for native woodland work to be prioritised mainly to areas where they will help develop Forest Habitat Networks.

Table 1: Summary of HAP targets 2005-2015 for Scotland (kha)

2005-2015 targets	Pine	Oak	Ash	Wet	Mixed	Birch	Total
Expand	7.4	7.2	4.0	4.1	4.5	13.3	40.5
Restore	1.6	1.9	0.9	1.0	0.5	3.1	9.0
Condition	17.1	9.3	3.3	3.3	5.0	15.9	54.0

Pine= native pine woodlands;Oak=Upland oakwoods; Ash=Upland mixed ashwoods; Wet=Wet woodlands; Mixed=Lowland mixed deciduous woodland; Birch=Upland birchwoods.

In the 2007-08 Scottish Forestry Strategy Implementation Plan one of the key actions was to:

> ‘develop and publish a regional breakdown of native woodland Habitat Action Plan targets and maps of priority areas contributing to habitat networks’.

Forest Research has carried out this work to a specification prepared by FCS.

This report aims to provide advice to help target action, including an indicative regional breakdown of the Scottish national targets.

Methods

Landcover data

The landcover matrix dataset prepared for the Forest Habitat Networks project was used as the starting point for this work (Moseley et al, 2005). The data is a combination of LCS88, LCM2000 and Ordnance Survey Strategi®. The following habitat types were removed from the analysis as they will not be available for woodland expansion: open habitat designations, urban areas and water.

Forest Habitat Networks

The analysis used the 'generic focal species' approach and BEETLE model (Watts et al, 2005) to model networks of functionally connected woodland areas based on assumptions about the permeability of the landscape to dispersal by a range of species. Two sets of habitat networks have been modelled:

- A broad forest habitat network based on a 1km maximum dispersal. These are based on core areas of high conservation value woods mapped from one or more of the following datasets: National Inventory of Woodlands and Trees (NIWT) woodland within a designated site, Caledonian Pinewoods Inventory (CPI) core or planted areas, ancient semi-natural woodland, Plantations on Ancient Woodland Sites(PAWS), Long-established woods of Planted Origin (LEPO), and areas from the Scottish Semi-natural Woodlands Inventory (SSNWI) with over 80% naturalness and canopy cover over 20%, (Ray and Grieve, 2006). The 1km maximum distance is suited to woodland and edge species which can disperse fairly widely.

- A narrow forest habitat network with core areas as above, and a 250 metre maximum dispersal. This network is more suited to woodland species with lower dispersal abilities, such as ancient semi-natural woodland plants.

The permeability values assumed for each landcover type for both the 1km and 250m networks were the same.

We also modelled a pinewood specialist 250m forest habitat network based more narrowly on core areas of potential pinewood. These were identified from NIWT (semi-natural coniferous indicative forest type), SSNWI and new planting records (Moseley et al, 2005). However the overlap of this with the main 250m network (above) was very strong, and we decided to drop this analysis as it did not add value.

Model predictions of priority woodland types

Priority woodland types are the native woodland types agreed as priority habitats under the UK BAP. In Scotland these include native pinewoods, wet woodlands, upland oakwoods, upland ashwoods, upland birchwoods and lowland mixed deciduous woodland (see Table 1 for targets).

The priority woodland data layer (referred to as the woodland HAP layer), is a combined dataset derived from the Native Woodland Model (NWM) in the upland region (SNH, 2004) and Ecological Site Classification (ESC) (Pyatt, Ray et al. 2001; Ray 2001; Ray 2003) priority woodland types for the lowland region. The Native Woodland Model does not cover the lowland region. (Jones, Gray et al. 2002). The models both predict the most likely priority native woodland type for any area based on National Vegetation Classification (NVC) and HAP classifications.

The Native Woodland Model output has limitations as it is based upon low resolution soil data mapped at a scale of between 1:50,000 and 1:250,000. This is fine for strategic purposes but not useful for site-based planning. In particular smaller areas of unusual or locally rare soil types are often unmapped and included in a dominant soil type. This could potentially underestimate the areas of wet woodlands and ashwoods that are often confined to small areas. ESC too relies on the same low resolution soil data, but has the advantage of also being a useful tool for site-based planning, where local soil and plant information is available (Ray and Broome 2003).

Native pinewoods: adjustments to the model predictions

Two adjustments were made to the model for areas predicted as native pinewood.

Model predictions for native pinewood-type woodland which were outside the range of semi-natural native pinewoods (Forestry Commission Practice Guide 7) were re-allocated to a (80%/20%) complex of upland birchwood and upland oakwoods (20%).

Secondly the model appears to significantly over- predict oak and oak/birch woods on poor soils near the Moray coast, largely because of the poor resolution of the soil data in the area. Using this expert knowledge, the model was adjusted to re-assign some areas predicted as suitable for oak and birch woods to native pinewoods. Rules were applied to identify oak/birch woodlands occurring on humus-iron podzols on the Moine and the Old Red Sandstone lithologies. These were converted to pinewoods for the area shown in Figure 1.

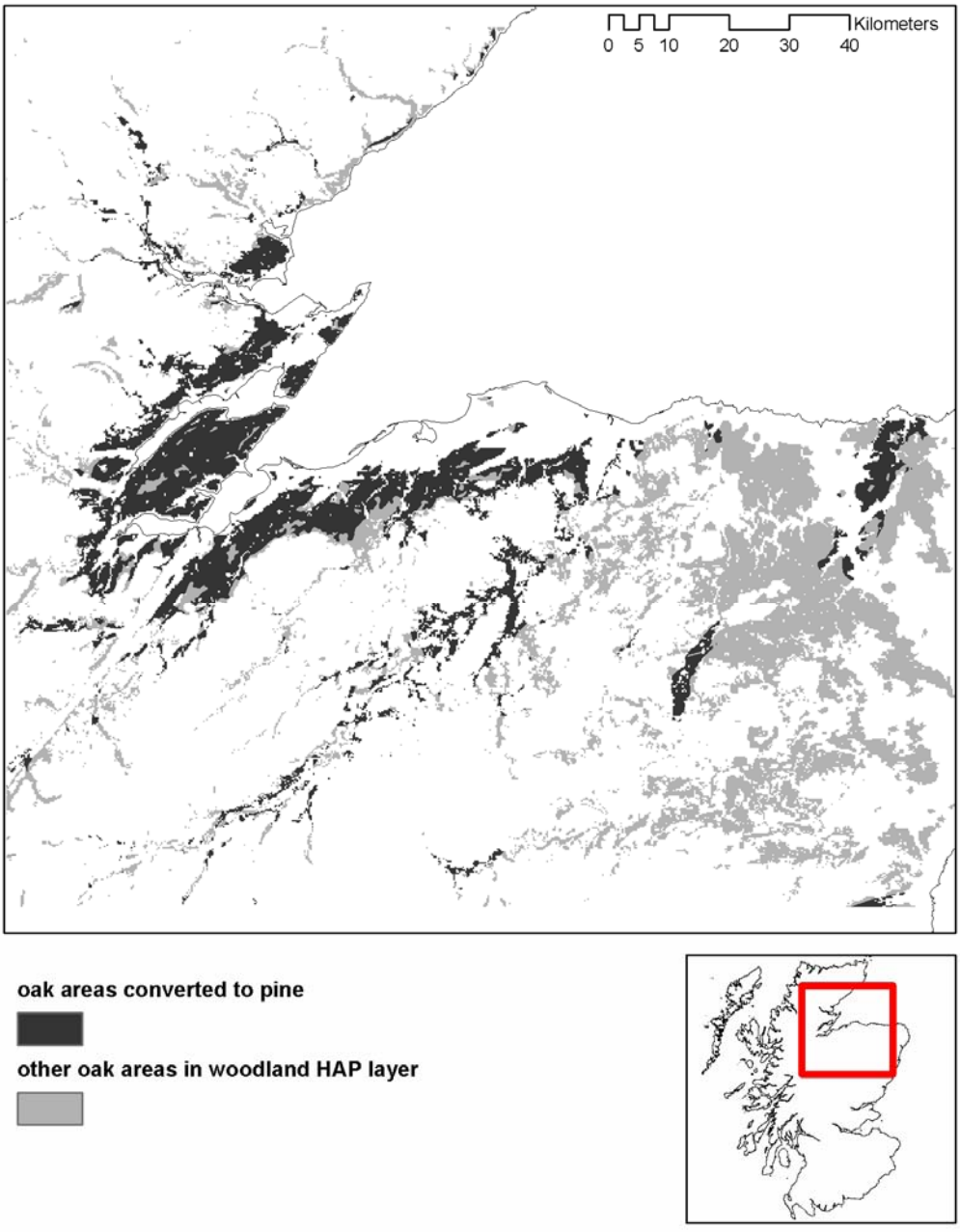

Figure 1. Area of predicted oak/birch woodland on poor soils developed from Old Red Sandstone and Moine lithology around the Moray Firth where model output was changed to suitable for pinewoods.

Assigning areas to targets

Areas of predicted native woodland type were assigned to the relevant type of HAP target.

Expansion

Expansion targets can be met by creating new native woodlands or by conversion from non-native wood other than ancient woods. Areas counted were those with:

- potential for new native woodland expansion = areas not currently wooded
- potential for conversion to native woodland = areas that are currently conifer woodland*, not on ancient woodland sites and are less than 80% semi-natural based on SSNWI.

*Areas of known planted Scots pine in the pinewoods zone in Grampian, Highland and Perth and Argyll have been separated out and allocated to condition improvement targets.

The analysis does not include areas of young trees recorded in NIWT and so may be underestimating the conversion potential slightly, although young woodlands grant- aided under FC grant schemes were included in the analysis.

The analysis was not able to identify non-native broadleaved woodland and so the potential conversion area may be underestimated (see Table 3).

The suggested regional HAP targets were derived from the regional share of the total potential expansion area, but these were weighted so that 80% of the target is based on the potential expansion area and 20% on the potential conversion area. This weighting was intended to reflect the relatively low proportion of the current conifer resource which may become available for conversion through felling by 2015.

Restoration of PAWS to native woods

The areas with the potential for native woodland restoration were assessed from the landcover dataset as wooded land not classed as broadleaved, (ie areas of conifer, mixed and other woodland) which are also planted ancient woodlands (PAWS). The GIS dataset records 59 000 hectares of PAWS, divided between landcover types as shown in Table 2.

Table 2: Distribution of landcover classes across Planted Ancient Woodland Sites (hectares)

Landcover	Area
Broadleaved woodland	7525
Conifer	*39741*
Mixed woodland	*6523*
Other woodland	*3418*
Non woodland	1850
Total	59057

Areas of semi-natural conifer on PAWS which are within the pinewood zone were excluded. They have been included in the potential condition improvement target area, on the basis that they are likely to be native pinewoods. This left approximately 45kha of PAWS classed as potentially suitable for restoration.

The area of potential restoration was calculated for both 1km and 250m networks though by definition the PAWS sites formed part of the core sites and so network width makes little difference to the values. We used the 250m network values to calculate the regional target shares.

Condition improvement targets

Since there is currently no digital dataset available to show the distribution or extent of native woodlands, the area has been estimated to include:

- semi-natural woods estimated from SSNWI;
- ancient broadleaved woods from NIWT and the Ancient Woodland Inventory;
- Scots pine in Grampian, Highland, and Perth and Argyll Conservancies which were separated from the expansion area (see above). These were identified from the data on Scots pine gathered by Moseley et al (2005).

SSNWI native woodland areas include those with a semi-natural component of at least 80%. Normally a canopy cover threshold of 20% is used but in this study the 10-49% canopy cover and 'developing canopy' classes were also included as the SSNWI dataset is now almost 20 years old.

This method should capture most native woods of high conservation value. It excludes the mainly planted broadleaved and mixed woods that are below the SSNWI 80% semi-naturalness threshold and outside ancient woodland sites.

Although the analysis will underestimate the total area of current native woods, it is unlikely that this would bias the proportions of priority habitat types.

Results

Potential areas to meet overall targets

The potential areas for each network size that is theoretically available for each type of target has been calculated and summarised in Table 2.

(NB These are theoretical maximum available areas as only urban, water and open designated areas have been filtered out.)

Table 3: Summary of areas identified with the potential for native woodland targeting for each network assessed (ha and % of network)

Forest habitat network	Total network area	Potential expansion area	Potential restoration area	Potential condition improvement area	Area with unknown potential for NW target
1km woodland network	1 154 093	583 814 51%	45 518 4%	269 056 23%	255 705 22%
250m woodland network	759 233	325 309 43%	45 508 6%	251 075 33%	137 342 18%

The 'area with unknown potential for meeting native woodland targets' includes other broadleaved woodland within the network which is not known to be native or not, and so it cannot be allocated to condition improvement or conversion targets.

Expansion target

1km networks

Potential new native woodland expansion area

Table 4: Area of the 1km woodland network which is not currently wooded and therefore has the potential for native woodland expansion (ha)

Conservancy	Pine	Oak	Ash	Wet	Mixed	Birch	Total
Central	0	24097	3707	1343	13104	201	42452
Grampian	503	12352	3724	1319	15273	6063	39234
Highland	9620	12563	3884	8680	2819	16198	53764
Perth & Argyll	1134	52073	11128	11066	32795	11122	119318
South Scotland	0	18349	8947	2585	11417	549	41847
TOTAL	11257	119434	31390	24993	75408	34133	296615

Potential conversion area by Conservancy

Table 5: Area of the 1km woodland network currently conifer (with Scots pine removed where mapped), potentially suitable for conversion to native woodland (ha)

Conservancy	Pine	Oak	Ash	Wet	Mixed	Birch	Total
Central	0	7089	2314	1096	3365	1481	15345
Grampian	12752	10120	7036	2393	12254	25054	69609
Highland	22355	7571	2770	8558	2025	24698	67977
Perth & Argyll	6161	35165	9873	20722	8953	15717	96591
South Scotland	0	9479	4810	10250	7347	5791	37677
TOTAL	41268	69424	26803	43019	33944	72741	287199

Indicative regional expansion target

Table 6: Regional shares of the national expansion target within the 1km network (ha). Shares are calculated proportionately based on the regional distribution of the potential maximum areas suitable for expansion (80% weighting) and conversion (20% weighting)

Region	*Pine*	*Oak*	*Ash*	*Wet*	*Mixed*	*Birch*	*Total*
Borders	*0*	*1362*	*450*	*185*	*748*	*145*	*2890*
Grampian	*1266*	*783*	*576*	*220*	*984*	*3134*	*6962*
Highland	*5217*	*761*	*481*	*1241*	*178*	*5687*	*13565*
Perth/Argyll/ Fife	*917*	*3204*	*1428*	*1863*	*1879*	*3826*	*13117*
SW Scotland	*0*	*1091*	*1066*	*590*	*711*	*508*	*3965*
TOTAL	*7400*	*7200*	*4000*	*4100*	*4500*	*13300*	*40500*

250 metre networks

Potential expansion area by Conservancy

Table 7: Area of 250m woodland network which is not currently wooded and therefore has the potential for native woodland expansion (ha)

Conservancy	Pine	Oak	Ash	Wet	Mixed	Birch	Total
Central	0	9300	1265	592	6004	71	17232
Grampian	1809	4518	1478	524	6160	1117	15606
Highland	5670	5568	1586	3481	1191	5594	23090
Perth & Argyll	1382	29864	6520	5950	17696	5612	67024
South Scotland	0	5968	2965	801	3810	164	13708
TOTAL	8861	55218	13814	11348	34861	12558	136660

Potential conversion area by Conservancy

Table 8: Area of 250m woodland network currently conifer (with Scots pine removed where mapped), and potentially suitable for conversion to native woodland (ha)

Conservancy	Pine	Oak	Ash	Wet	Mixed	Birch	Total
Central	0	5471	1504	709	3124	597	11405
Grampian	13649	8131	5863	1907	11378	17136	58064
Highland	18916	4620	1472	3696	1836	15272	45812
Perth & Argyll	2719	24412	5481	7571	7716	7044	54943
South Scotland	0	6249	3034	2611	5163	1368	18425
TOTAL	35284	48883	17354	16494	29217	41417	188649

Indicative regional expansion target

Table 9: Regional shares of the national expansion target within the 250 metre network (ha). Shares were calculated proportionately based on the regional distribution of the potential areas suitable for expansion (80% weighting) and conversion (20% weighting)

Conservancy	*Pine*	*Oak*	*Ash*	*Wet*	*Mixed*	*Birch*	*Total*
Central	*0*	*1139*	*362*	*204*	*724*	*128*	*2556*
Grampian	*2185*	*699*	*649*	*265*	*961*	*3135*	*7894*
Highland	*4352*	*718*	*431*	*1167*	*176*	*5463*	*12307*
Perth & Argyll	*863*	*3840*	*1739*	*2078*	*2094*	*4280*	*14894*
South Scotland	*0*	*804*	*820*	*385*	*544*	*294*	*2848*
TOTAL	*7400*	*7200*	*4000*	*4100*	*4500*	*13300*	*40500*

Restoration target

1km woodland networks: potential restoration area

Table 10: Area of 1km woodland network with potential for native woodland restoration (ha)

Conservancy	Pine	Oak	Ash	Wet	Mixed	Birch	Total
Central Scotland	0	562	178	13	537	135	1425
Grampian	469	424	510	26	387	2100	3916
Highland	3827	2936	490	2519	210	12700	22682
Perth & Argyll	475	5545	2253	1960	522	2448	13203
South Scotland	0	1841	749	284	1314	104	4292
TOTAL	4771	11307	4180	4802	2970	17488	45518

250 metre woodland networks: potential restoration area

Table 11: Area of 250m network suitable for native woodland restoration, by Conservancy (ha)

Conservancy	Pine	Oak	Ash	Wet	Mixed	Birch	Total
Central Scotland	0	562	178	13	536	135	1424
Grampian	433	430	510	26	387	2129	3915
Highland	3581	2985	490	2519	210	12896	22681
Perth & Argyll	506	5537	2251	1959	522	2421	13196
South Scotland	0	1841	749	284	1314	104	4292
TOTAL	4520	11354	4178	4801	2969	17686	45508

Indicative regional restoration targets

Table 12: Regional shares of the national restoration target, calculated proportionately based on the regional distribution of the potential area suitable for restoration within the 250m network (ha)

Conservancy	*Pine*	*Oak*	*Ash*	*Wet*	*Mixed*	*Birch*	*Total*
Central Scotland	*0*	*94*	*38*	*3*	*90*	*24*	*249*
Grampian	*153*	*72*	*110*	*5*	*65*	*373*	*779*
Highland	*1268*	*499*	*106*	*525*	*35*	*2260*	*4693*
Perth & Argyll	*179*	*926*	*485*	*408*	*88*	*424*	*2511*
South Scotland	*0*	*308*	*161*	*59*	*221*	*18*	*768*
TOTAL	*1600*	*1900*	*900*	*1000*	*500*	*3100*	*9000*

Condition improvement targets

1km woodland network: potential areas for condition improvement

Table 13: Area of the 1km woodland network suitable for native woodland condition improvement (ha)

Conservancy	Pine	Oak	Ash	Wet	Mixed	Birch	Total
Central Scotland	0	13260	1708	972	8659	465	25064
Grampian	5039	10596	4453	1573	132	10080	40873
Highland	17933	28858	5166	7794	3327	30316	93394
Perth & Argyll	682	37679	11604	6339	14544	9192	80040
South Scotland	0	11876	5211	2818	9195	585	29685
TOTAL	23654	102270	28142	19496	44857	50637	269056

250 metre woodland network: potential areas for condition improvement

Table 14: Area of 250m woodland network suitable for native woodland condition improvement (ha)

Conservancy	Pine	Oak	Ash	Wet	Mixed	Birch	Total
Central Scotland	0	12466	1560	933	8171	354	23484
Grampian	4392	10391	4339	1306	8965	9615	39008
Highland	14605	27354	4888	6810	3178	26562	83397
Perth & Argyll	694	36022	11065	5816	14457	7812	75866
South Scotland	0	11692	5160	2795	9100	573	29320
TOTAL	19691	97925	27012	17660	43871	44916	251075

Indicative regional condition improvement targets

Table 15: Regional share of national condition improvement target, based on the regional distribution of the total area within the 250m network suitable for condition improvement (ha)

Region	*Pine*	*Oak*	*Ash*	*Wet*	*Mixed*	*Birch*	*Total*
Borders	*0*	*1184*	*191*	*174*	*931*	*125*	*2605*
Grampian	*3814*	*987*	*530*	*244*	*1022*	*3404*	*10000*
Highland	*12683*	*2598*	*597*	*1273*	*362*	*9403*	*26916*
Perth/Argyll	*603*	*3421*	*1352*	*1087*	*1648*	*2765*	*10875*
S Scotland	*0*	*1110*	*630*	*522*	*1037*	*203*	*3503*
TOTAL	*17100*	*9300*	*3300*	*3300*	*5000*	*15900*	*53900*

Discussion

The analyses in this report indicate at a conservancy scale the proportions of each priority woodland type and approximate total areas that are theoretically suited to expansion of native woodlands within broad or narrow forest habitat networks based around high conservation value woodlands.

This has been used to suggest indicative regional targets for each priority woodland type for the period of the current Scottish Forestry Strategy (to 2015), based on the Conservancy share of the modelled areas. It is suggested that Conservators and Regional Forestry Forums use these figures as a starting point for regional targets and then adjust them in the light of any better information or regional priorities. In the case of expansion the figures for the 1km network might be the more realistic basis to calculate regional targets (Table 6), though the figures are little different for the 250m networks.

There are numerous assumptions and imprecisions in the models and the method that call for caution when applying the results to any particular site and the maps should therefore be interpreted with care. For example:

- The core woodlands dataset can only approximate the current areas of native and ancient woods: the Native Woodlands Survey of Scotland will provide a reality check over the next few years.

- The Native Woodland Model and ESC predictions have not been systematically validated by comparing predicted and actual woodland types, though some validation work was done.

- The habitat network model assumptions about dispersal and permeability are not yet validated against known characteristics of a range of species (this is expensive research work that is getting underway but will need to be confined to relatively few examples).

- The area actually available or suitable for native woodlands will be much less than the theoretical model figures; for example where the presence of other priority habitats or species of open ground may make woodlands undesirable.

Despite these points however, the maps of 1km and 250m forest habitat networks should be particularly helpful as a basis to guide native woodland expansion (by new planting or conversion of non-native woods) to develop forest habitat networks centred around high biodiversity value core woods, in line with the Scottish Forestry Strategy.

In the 1km network the maximum suitable area for expansion (Tables 4 and 5) is estimated at 585kha whilst the target until 2015 is 40.5k.This suggests that even if a high proportion of the networks is not actually available, there should be scope for achieving quite a high proportion of the target from within the network.

Locating new native woodland within the inner 250m network should generally provide higher benefits for biodiversity by encouraging colonisation by species with more limited dispersal ability. This should therefore attract a higher priority for grant support, other things being equal, than locations in the outer network.

Where other forest habitat network plans have been developed locally and agreed with stakeholders these would take precedence over this analysis, however.

Similarly the maps should also help to target measures for restoration and improving condition within the core woodland areas which will help to develop these high conservation value networks.

Next steps

The maps linked to this report are currently in pdf form. FCS will explore whether these can be made available as GIS datasets to enable FCS and other users to access them and combine with other information layers.

Conclusions

The analysis in this report provides a basis for developing regional shares of the Scottish UKBAP targets for expansion, restoration and improving condition of native woods, and for focussing efforts to help develop native woodland networks of high conservation value, in line with the Scottish Forestry Strategy.

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