



Forestry Commission

The Native Woodland Resource in the Scottish Highlands

Neil A. MacKenzie and Robin F. Callander



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A Review of Current Statistics

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Front cover: Letterewe woodlands, Wester Ross. These native woodlands occupy the north shore of Loch Maree and consist mainly of oak and birch with some Scots pine on the rocky crags. One of the largest native oakwoods in the Highlands, they have had a long history of management and use, including the supply of charcoal for Scotland's first known iron ore furnace (circa 1610) and the production of oak timber for shipbuilding and construction during the 19th century. They are now a Site of Special Scientific Interest.

Back cover: The natural distribution of Scotland's main native forest types prior to the major effects of human intervention. (Adapted from D.N. McVean and D.A. Ratcliffe, *Plant communities of the Scottish Highlands*, HMSO, London, 1962, with modifications by Walker and Kirby, 1989.)

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Summary

This report provides a summary account of the present extent, distribution, composition and condition of the native woodlands in the Highlands. The results are based on a review of all available survey information and show that the native woodland resource in the Highlands is substantially greater than has been previously recognised.

The overall area of native woodland is 210 754 hectares. This consists of equal proportions of natural and planted origin native woodland. There is a minimum of 104 876 hectares of natural origin native woodland. This is a 35% increase on the area recorded by the only previous review in 1987 and there are clear indications that the full extent of these native woodlands is still significantly under-recorded.

The most common tree species in natural origin native woodlands is birch, followed by Scots pine and then oak. The distribution of these native woodlands is particularly concentrated in some Highland districts but, throughout the Highlands, most are in poor condition with little evidence of constructive management.

There are 106 320 hectares of planted origin native woodland. Nearly all of this consists of Scots pine managed in planted forests. The distribution of planted origin pine is very similar to that of natural origin pine and is concentrated in the eastern and central Highlands.

The overall native woodland resource in the Highlands represents 35% of the total woodland area in the region. This follows a progressive decline in the proportion of native woodlands since the beginning of this century when most woodlands in the Highlands were composed of native species.

However, analysis of recent trends shows both a major reduction in native woodland losses and a steep increase in the natural regeneration and planting of native species. Forestry Commission statistics for the Woodland Grant Scheme show that native species have accounted for the majority of the new woodland established in the Highlands during recent years.

Chapter 1

Definition of the resource

Introduction

This report reviews all the main surveys dealing with native woodlands in the Highlands and provides an account of the present extent, distribution, composition and condition of these woodlands. The review was commissioned to assist the work of the Forestry Commission's Advisory Panel on Native Woodlands in the Highlands. The Panel was established in 1992 to provide an expert forum to advise the Forestry Commissioners on matters relating to the promotion of native woodlands in the Highlands.

The review updates and expands on the only previous review of existing information on native woodlands in the Highlands (MacKenzie, 1987). As a result of the new survey data that have become available since 1987, this report shows that the native woodland resource in the

Highlands is substantially greater than has been previously recognised.

MacKenzie's 1987 report led to increased recognition of the importance of the native woodland resource in the Highlands, both in terms of its scale and distinctive character. This new report confirms and enlarges on that importance and is being published to make its results more widely available.

The Highlands

The Highlands are that part of Scotland to the north of the Highland Boundary Fault and the west of the eastern edge of the Grampian Mountains, excluding the Northern and Western Isles. This natural region is covered by 17 local authority districts (Figure 1.1), some of which also contain Lowland areas (districts 10-14). As

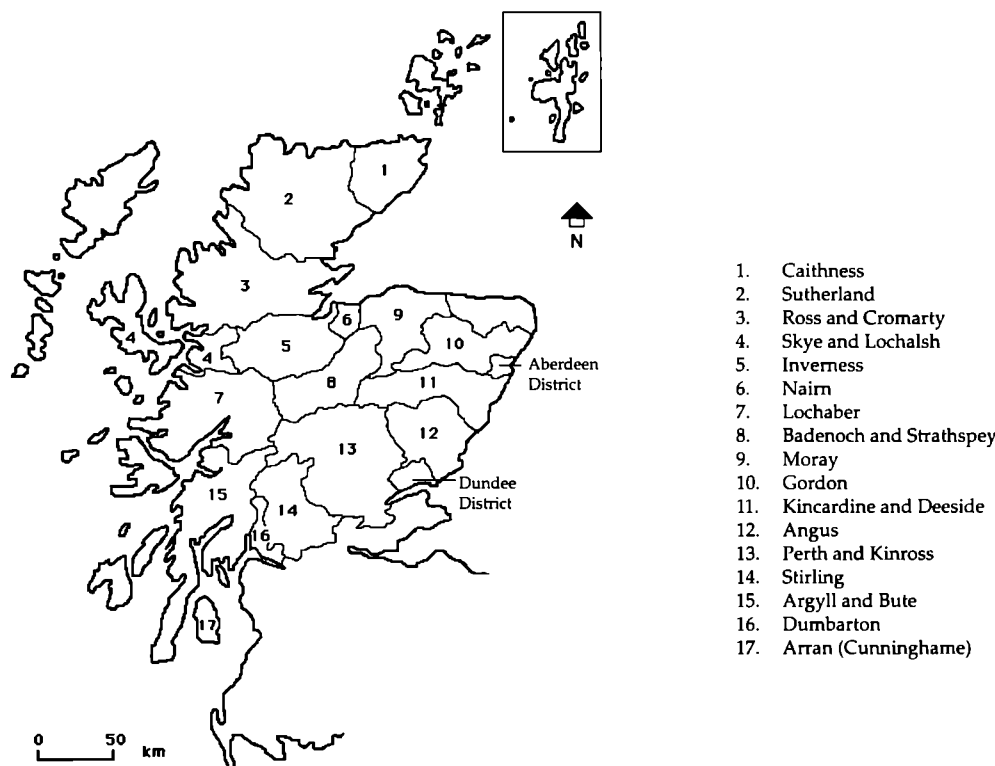


Figure 1.1 Local authority districts in the Highlands

most native woodland statistics are available at the level of local authority districts, these 17 districts are taken to equate with the Highlands for the purposes of presenting data in this report. The 17 districts cover 5 081 700 ha or 69% of the area of mainland Scotland and the Inner Hebrides, and over 22% of the land area of Great Britain.

Native woodlands

The native woodlands in the Highlands are those woodlands which consist wholly or largely of tree species native to the region. These are the native species, listed in Table 1.1, that became established in the Highlands by natural means following the end of the last Ice Age.

The native woodlands in the Highlands are of two main types:

- *Natural origin native woodlands:* woodlands composed of trees which have had a continuous history of natural regeneration throughout the post-glacial period.
- *Planted origin native woodlands:* woodlands composed of native tree species where either the current or a previous generation of the trees has been planted.

Natural origin native woodlands are often referred to as genuinely native woodlands because they are the direct descendants of the region's original natural forest cover. These woodlands, while naturally occurring, are also classified as semi-natural because their habitat character is considered in all instances to have been modified by the activities of Man.

Table 1.1 Trees and shrubs native to the Scottish Highlands

Alder	<i>Alnus glutinosa</i>
Ash	<i>Fraxinus excelsior</i>
Aspen	<i>Populus tremula</i>
Birch, downy	<i>Betula pubescens</i>
Birch, silver	<i>Betula pendula</i>
Blackthorn	<i>Prunus spinosa</i>
Cherry, bird	<i>Prunus padus</i>
Cherry, wild (gean)	<i>Prunus avium</i>
Elder	<i>Sambucus nigra</i>
Elm, wych	<i>Ulmus glabra</i>
Hawthorn	<i>Crataegus monogyna</i>
Hazel	<i>Corylus avellana</i>
Holly	<i>Ilex aquifolium</i>
Juniper	<i>Juniperis communis</i>
Oak, pedunculate	<i>Quercus robur</i>
Oak, sessile	<i>Quercus petraea</i>
Pine, Scots	<i>Pinus sylvestris</i>
Rose, dog	<i>Rosa canina</i>
Rose, guelder	<i>Viburnum opulus</i>
Rowan	<i>Sorbus aucuparia</i>
Whitebeam	<i>Sorbus rupicola</i>
	<i>Sorbus pseudofennica</i>
	<i>Sorbus arranensis</i>
Willow, goat	<i>Salix caprea</i>
Willow, grey	<i>Salix cinerea</i>
Willow, eared	<i>Salix aurita</i>
Yew	<i>Taxus baccata</i>

Note Some of these species are rare or have a restricted natural distribution in the Highlands (e.g. yew, elder, guelder rose and the rock whitebeam, *Sorbus rupicola*) while *Sorbus pseudofennica* and *S. arranensis* are found only on Arran. Other small shrubs like gorse, broom, dwarf birch and additional willow species and their hybrids could also have been included in this list. (See Beckett and Beckett (1979) or Peterken (1981) for further information on the distribution of native species.)

Natural and planted origin native woodlands are usually relatively easily distinguished in the field. However, there are some areas of pine and of oak where even research into historical documents only allows the origins of the woodland to be determined 'on the balance of probability'.

Chapter 2

Existing sources of information

Extent and distribution

There is no site-related or sample woodland survey which is sufficiently comprehensive to provide an accurate assessment of either the overall extent of native woodlands in the Highlands or the distribution of this resource between local authority districts in the region. Therefore all attempts to provide an overall account of the resource have to try to integrate different surveys.

These various surveys often employ different methodologies and have different aims and objectives. There are four key variables which need to be considered when using such survey data as a basis for calculating the extent of the native woodland resource.

1. *Time scale.* The data from the different surveys may have been collected at relatively separate times. For example, in the case of the surveys analysed for this report, between 2 and 15 years ago. Earlier surveys or surveys which were known to be out of date were not included.

2. *Minimum size.* The minimum size of the woodland covered by the surveys usually differs between surveys. For example: the Forestry Commission (FC) Census (1979-82) excludes woods under 0.25 ha; the Ancient Woodland Inventory excludes woods under 2 ha and most Scottish Natural Heritage (SNH) field surveys exclude woods under 5 ha. The data used in this report will therefore exclude most woods under 0.25 ha in the woodland area totals and most woods under 2 ha in the genuinely native woodland area totals.

3. *Site or sample survey.* Surveys may be site related, covering all woods within a specified set of criteria; or they may be a sample survey representing the main types of woodland and extrapolated to provide an estimate of the total woodland in a given area. Most SNH surveys

relate to individual sites while the last FC Census (1984) was a sample survey. Both types of survey were used to compile the area data in this report.

4. *Degree of coverage.* In addition to the minimum size criterion the degree of coverage varies in other ways. The FC Census, the Ancient Woodland Inventory, other SNH surveys and the Ordnance Survey all contain limitations on the detail, type and quality of their respective surveys of woodland. This report, therefore, will also reflect these differences.

All four variables affect the comprehensiveness of every survey to a greater or lesser degree and, consequently, the area totals given in this report are all minimum figures.

The FC Census (1984) does not separate the planted or natural origin woods or identify the non-native component in such woods. Most SNH surveys of natural origin woodland omit underplanted woods or woods with a significant component of non-native species. Some woods are also omitted due to lack of time or a refusal of permission to visit them. The main objective of many SNH regional surveys was to assess woodland for their suitability as Sites of Special Scientific Interest (SSSI) and, although most semi-natural woods were surveyed, existing SSSIs were sometimes excluded, so there are inconsistencies in the level of coverage for some districts.

Further information on SSSIs is only available in the citation files located at SNH regional offices or centrally from Coredata. Coredata is part of an SNH computer database which records information on SSSIs within each local authority district. Thus, the total area of woodland (classified to semi-natural broadleaves, conifers, mixed and scrub) in each SSSI can be extracted. However, as every SSSI has not been habitat mapped to Phase 1 standard, or included on the

database, the extent of Coredata coverage varies for each district. In addition, woodland surveyed by the upland survey team is recorded on a separate database and not on Coredata. This review used Coredata to supplement field survey coverage where other information was scarce.

Many field surveys also use current Ordnance Survey (OS) maps as a basis for initial selection of woodlands and this can itself lead to woodlands being excluded. OS maps themselves omit woodlands and, as the revision period for the OS may be at intervals of 20 years or more, some maps can be significantly out of date. MacKenzie (1988) estimated that 6% of the area of genuinely native woodland in a survey of 1877 ha had been omitted from the current OS 1:25 000 edition. The FC Census (1984) recorded 21 995 ha of unmapped woodland in North, East and West Conservancies. This woodland was not included in the census totals because there was insufficient information about the species composition, but much of this total is likely to have been native woodland. The FC Census may therefore have under-represented the native species component by about 3%.

The main source of information for total woodland and for planted origin woodland is the FC Census (1984), but, as the data were collected between 12 and 15 years ago, subsequent regeneration and planting are not taken into account in the regional statistics. The main source for data on the extent of natural origin woodland is the Ancient Woodland Inventory (AWI). Both main data sources are not directly comparable because of the differences associated with the key variables but it is assumed that the FC Census will have included most of the natural origin woodland.

The assessment of the natural origin woodland is further complicated by the limitations of the Ancient Woodland Inventory. This was a desk study based on the OS 1:25 000 maps but utilised field survey reports, aerial photographs and other sources to qualify map data where appropriate and provided additional information was available. Site assessments based solely on the appearance of woods on the OS maps may include some woods which are of planted origin. The Inventory may also have included some woods not on the OS map if identified by field survey as important for nature conservation. However, some woods may have been omitted, particularly recent regeneration, if they were not considered important for nature conservation.

The Inventory was not intended to be a comprehensive survey of all genuinely native or semi-natural woodland over 2 ha (Walker and Kirby, 1989) and cannot therefore be relied upon as a realistic assessment of the resource. Some recent studies suggest that significant areas of genuinely native woodland may have been omitted. For example:

- In a survey of 435 ha of birchwoods in Strathclyde 75% of the woodland area was excluded from the Inventory (Stewart, 1993).
- In a survey of 8998 ha of pine–birch woodland on Deeside about 40% was excluded (Callander and MacKenzie, 1991).
- In a field survey of the semi-natural woods of Nairn 39% was excluded (Hepburn, 1991).
- In a map survey of semi-natural woods over 0.1 ha in Perth and Kinross, and Angus districts 37% was excluded (Taylor and Hogarth, 1993).

Roberts *et al.* (1993) attempted to ascertain the area of woodland over 2 ha which had not been included in the Inventory. They calculated that the Inventory had under-represented the area of genuinely native or semi-natural woodland in Scotland by 30%.

Therefore, in order to improve the coverage of the AWI for some districts, alternative and more comprehensive survey data, where available, were used to replace the AWI total for semi-natural woodland.

Species composition

There is no site-related survey which is sufficiently comprehensive to provide an accurate assessment of the species composition or types of native woodland in the Highlands. The FC Census is the main source for the distribution of the native woodland resource into species for each Highland district. The census is, however, a sample survey and area totals for each species are not related to a site or to a woodland type. The native component in mixed broadleaves or scrub conifer was not identified and the census did not differentiate between natural origin and planted origin woodland.

The only sources of information on the composition of genuinely native woodland are those field surveys which classified the woodland or which provided a Phase 1 type site description.

One of the main difficulties in providing district totals for the main woodland types in the Highlands, based on field survey material, is the variety of classification systems used in each survey. These vary from the detailed floristic surveys of the National Vegetation Classification (Rodwell, 1991) and the Stand Type surveys of the Peterken system (Peterken, 1981) to canopy cover, from Phase 1 surveys which employ a variety of site descriptions ranging from a % estimate of the main species (e.g. FC 1947-49 Census; Bunce *et al.*, 1979) to a broader classification of semi-natural conifers, broad-leaves or dominant species (e.g. Grampian Regional Council, 1985).

Many of these classifications are incompatible with other systems unless an arbitrary analysis or simplification is carried out which involves altering the classifications to the lowest common denominator. However, analysis of this nature was beyond the scope of this report and therefore the list of areas given in Appendix 1 is, firstly, to provide an indication of what proportion of the AWI totals have been validated by field survey and, secondly, to use more comprehensive area data to replace some district AWI totals.

Field survey data on the native pinewoods (references in Appendix 1) have been used to differentiate the natural origin and the planted origin pine by subtracting the former total from

the total FC Census (1984) estimate of Scots pine in the Highlands.

Structure and condition

There are no district field surveys which aim specifically to assess the age structure and condition of the native woodland resource. A few sample surveys have been completed in parts of the Highlands (MacKenzie, 1988; Stewart, 1993), there is a sample survey in progress in Tayside (Tayside Native Woodland Initiative) and there are a small number of site surveys (MacKenzie, 1989, 1991a,b; 1992a,b,c). Other sample surveys such as the one by Highland Regional Council (1985) assessed the structure and condition of all woodland in the region, including native species. The FC Census provides a detailed age class analysis of individual species, but only for high forest trees which account for just 35% of the native broad-leaved resource.

Several district field surveys of genuinely native woodlands carried out by SNH, particularly the Field Survey Unit, assess age structure and regeneration (e.g. MacIntosh, 1988; Tidswell, 1990) in semi-quantitative terms but most other SNH surveys make a subjective assessment or provide very limited information. Phase 1 habitat surveys, including those of SSSIs, only rarely consider structure and condition.

Chapter 3

The native woodland resource

Extent

The FC Census (1984) records that 210 754 ha or 35% of the total woodland area in the Highlands consists of native species. This overall native woodland resource therefore occupies over 4% of the Highland land area, compared to the 12% occupied by all the woodland in the region.

Analysis of other surveys suggests that this native woodland resource consists of a minimum of 104 876 ha natural origin native woodland and 106 320 ha planted origin native woodland. These two main types of native woodland therefore each account for 50% of the native woodland resource (Figure 3.1). (Natural and planted origin totals do not sum exactly to the native species total as the data are sourced from different surveys.)

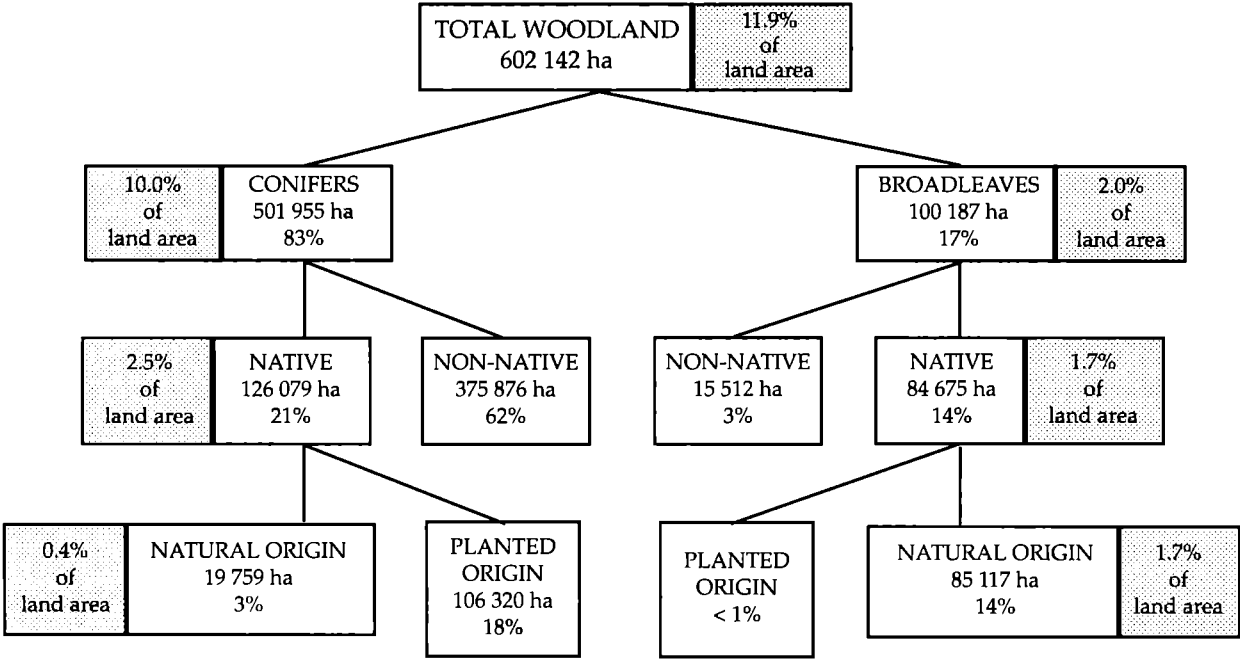


Figure 3.1 Extent of native woodlands in the Highlands. Sources: FC Census (1984); Ancient Woodland Inventory; FC Caledonian Pinewood Inventory (1994); Forest Enterprise; Bain (1987); Callander and MacKenzie (1991); Hepburn (1993); MacKenzie (1989, 1991a, 1991b, 1992a, 1992b); Taylor and Hogarth (1993)

Notes

- 1. All planted totals exclude new planting after 1982.
- 2. Woodland % expressed as % of total woodland.
- 3. Mixed broadleaves have not been included as the FC Census did not record the species composition. This category is mainly planted policy woods which may contain some native species but the proportions are unknown.
- 4. The natural origin total for broadleaves is greater than the total for all native broadleaves because the data source (AWI and other) contains a more comprehensive coverage in some districts and because it may also have included some planted woods.

The total here of 104 876 ha for genuinely native woodland is broadly comparable to the estimate in Roberts *et al.* (1993), which was also based on the FC Census and the AWI although the analyses were different. Roberts *et al.* did not identify the Highlands separately but, in the 5 regions and 38 districts which overlap with the Highlands, their estimates for semi-natural woodland based on the FC Census and AWI/

FC Census were 133 021 ha and 120 161 ha respectively.

The total for genuinely native woodland is a minimum total because, as previously described in Chapter 2 in the section Extent and distribution, the full extent of these woodlands is still clearly significantly under-recorded. At present, 71% of this estimated minimum total has been confirmed by field survey, as identified in Appendices 1 and 2.

The extent of native woodlands in the Highlands is set in a Scottish and GB context in Tables 3.1 and 3.2. Table 3.1 illustrates the disproportionate amount of Scotland’s native woodland resource contained within the Highlands. In the British context (Table 3.2), this native woodland resource represents 10% of Britain’s total woodland area, and accounts for 30% and 18% respectively of Britain’s woodland area composed of native species and of genuinely native woodland.

Table 3.1 The highland native woodland resource in the Scottish context. Sources: Ancient Woodland Inventory; FC Caledonian Pinewood Inventory (1994); FC Census, 1979-82 (District and Conservancy totals); Scottish Office (1991); other field surveys as listed in Appendix 1

	Highlands	Lowlands	Scotland
Total land area (ha)	5 081 700	2 239 800	7 321 500
% of Scotland’s land area	69	31	100
Total woodland area (ha)	602 142	301 197	903 339
% of Scotland’s woodland area	67	33	100
Total area of native species (ha)	210 754	28 881	239 635
Native species as % of total woodland	35	10	27
% of Scotland’s native species area	88	12	100
Total area of natural origin woodland (ha)	104 876	16 681	121 557
Natural origin as % of total woodland	17	6	13
% of Scotland’s natural origin area	86	14	100
Natural origin as % of total native species area	50	58	51
Planted origin as % of total native species area	50	42	49

Table 3.2 The native woodland resource in the British context. Sources: Ancient Woodland Inventory; FC Census, 1979-82 (Conservancy and District totals); Kirby, personal communication (1994); Locke (1987)

	England	Wales	Scotland	GB
Total land area (ha)	13 043 927	2 076 402	7 321 500	22 441 829
% of GB land area	58	9	33	100
Total woodland area (ha)	929 027	237 432	903 339	2 069 798
% of GB woodland area	45	11	44	100
Total area of broadleaves (ha)	545 106	69 467	145 597	760 770
% of total woodland area	59	29	16	37
Total area of conifers (ha)	383 321	167 965	757 742	1 309 028
% of total woodland area	41	71	84	63
Total area of native species (ha)	399 774	53 635	239 635	693 044
% of total woodland area	43	23	27	33
% of GB native species area	58	8	34	100
Total area of natural origin woodland (ha)	415 679	60 808	121 557	598 044
% of total woodland area	45	26	13	29
% of GB natural origin area	70	10	20	100

Composition

Scots pine is the most common native tree species in the Highlands, accounting for 126 079 ha or over 60% of the native woodland resource. This area of Scots pine also represents 25% of the total area of coniferous woodland in the Highlands.

Differences in methodologies between the main woodland surveys mean that it is difficult to ascertain accurately the proportions of Scots pine and native broadleaves that are of natural and planted origin. However, it appears that almost 99% of the native broadleaved woodland is of natural origin, with the main area of doubt being the origins of some oakwoods.

Scots pine therefore accounts for virtually all the planted origin native woodland in the Highlands, with 19 759 ha or 16% of the total pine resource being considered genuinely native. (Some self-sown pine, e.g. on Deeside and in Strathspey, is of mixed origin (genuine, planted or unknown). The current list of genuinely native pine in the FC Caledonian Pinewood Inventory amounts to 16 046 ha.)

Birch is the most common native broadleaf tree species in the Highlands, accounting for 64% of all native broadleaved woodland and 51% of all broadleaved woodland in the region (Figure 3.2). While native broadleaved woodland is 40% of the overall native woodland resource, it also represents 85% of the total area of broadleaved woodland in the Highlands.

Thus, the genuinely native woodlands in the Highlands consist of 80% native broadleaves and 20% Scots pine.

Distribution

The distribution of the overall native woodland resource in the Highlands is shown by local authority district in Figures 3.3 and 3.4, which are based on the statistical information given in Appendices 3 and 4.

The extent of each district covered by native woodland ranges from less than 1% to 15%, with Nairn having the highest density (Figure 3.3). The proportion of all woodland in each district that consists of native species ranges from 10% to 79%, with Badenoch and Strathspey having the highest percentage (Figure 3.4).

The districts that contain the highest densities of the native woodland resource also tend to be the districts with the highest proportions of their total woodland area consisting of native species. Five contiguous districts (Kincardine and Deeside, Badenoch and Strathspey, Nairn, Inverness, Ross and Cromarty), each with over 50% of their woodlands consisting of native species, account for over half the overall native woodland resource in the Highlands.

Scots pine is the main conifer in three districts and a significant component in six others (Figure 3.5), while native broadleaves account for 69% or more of all broadleaves in all districts and over 90% in eight of them (Figure 3.6). Birch is the most common native species in six districts where it exceeds pine.

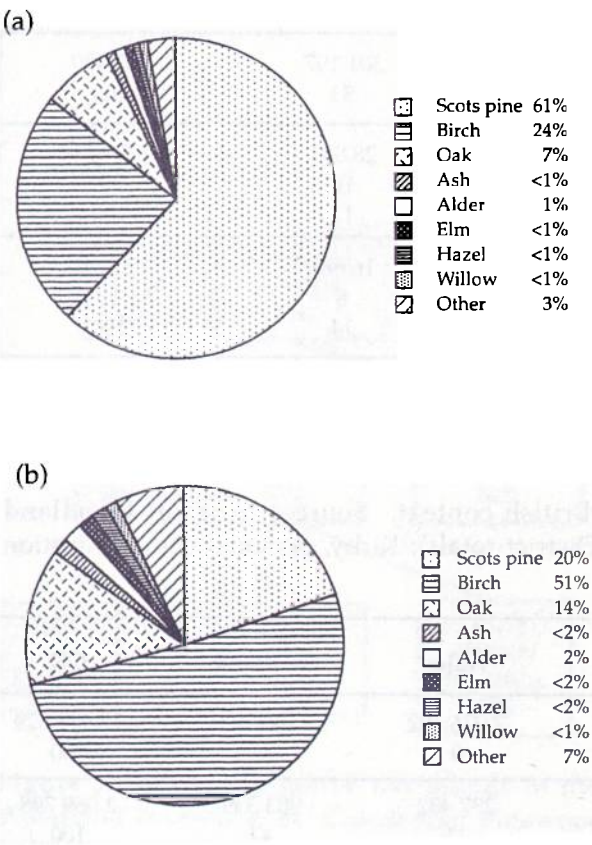


Figure 3.2 Species composition of native woodlands in the Highlands: (a) overall native woodland resource; (b) natural origin native woodlands. Other: refers to undefined areas of species which were not listed in the principal species categories and includes rowan, alder, willow, cherry, hazel, hawthorn, and some non-native lime and horse chestnut. Source: FC Census (1984)

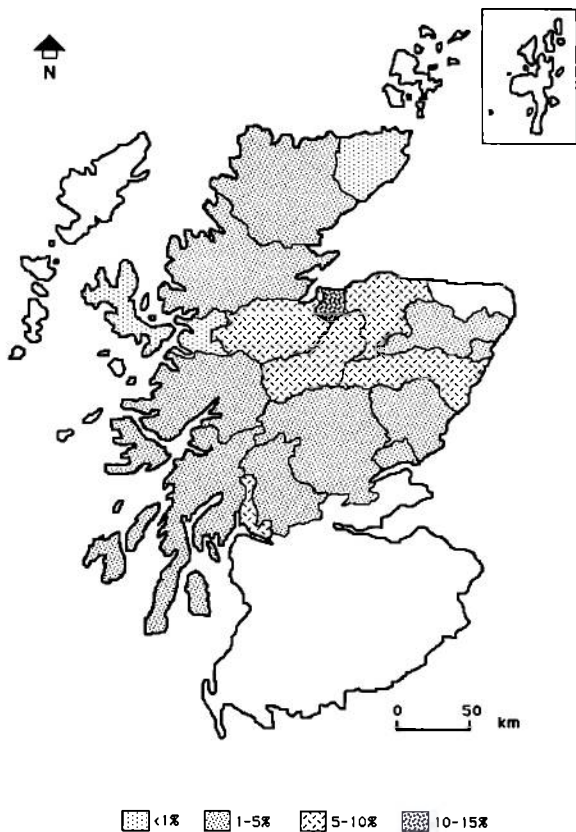


Figure 3.3 Area of native species as % of land area in each Highland district

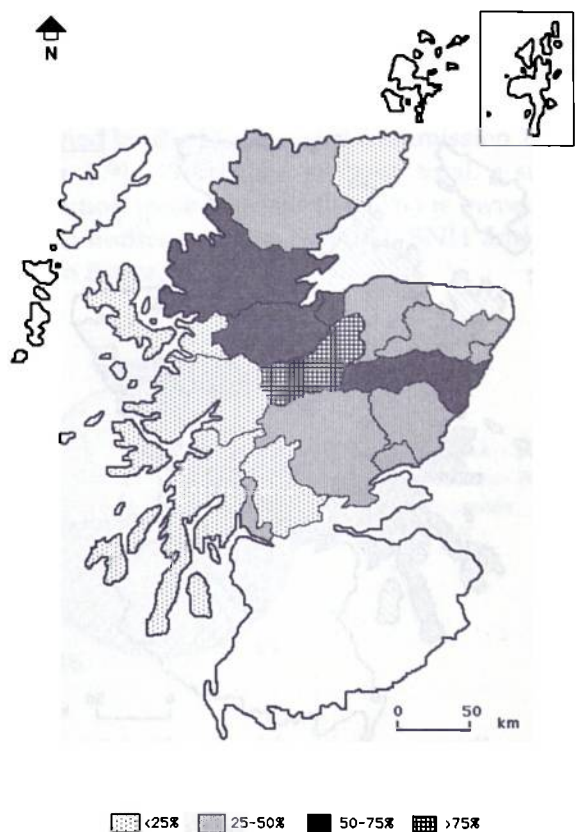


Figure 3.4 Area of native species as % of woodland area in each Highland district

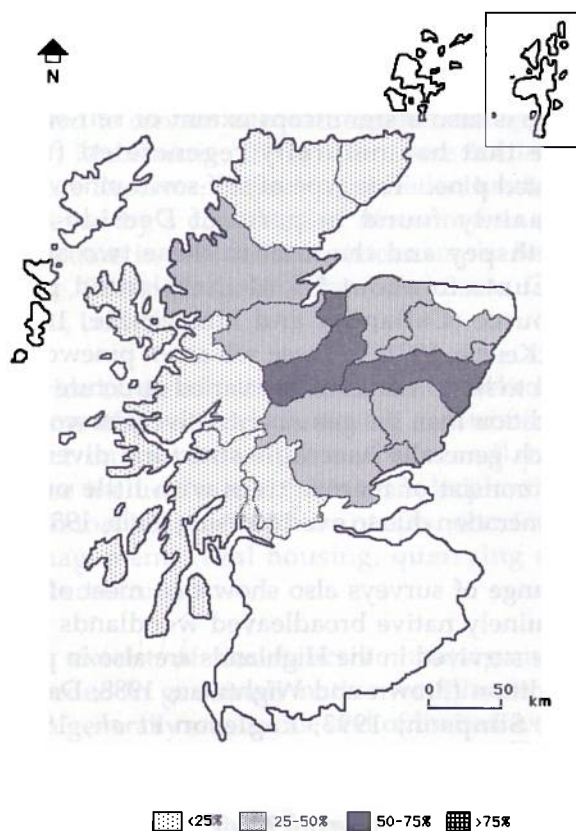


Figure 3.5 Area of native conifers as % of conifer area in each Highland district

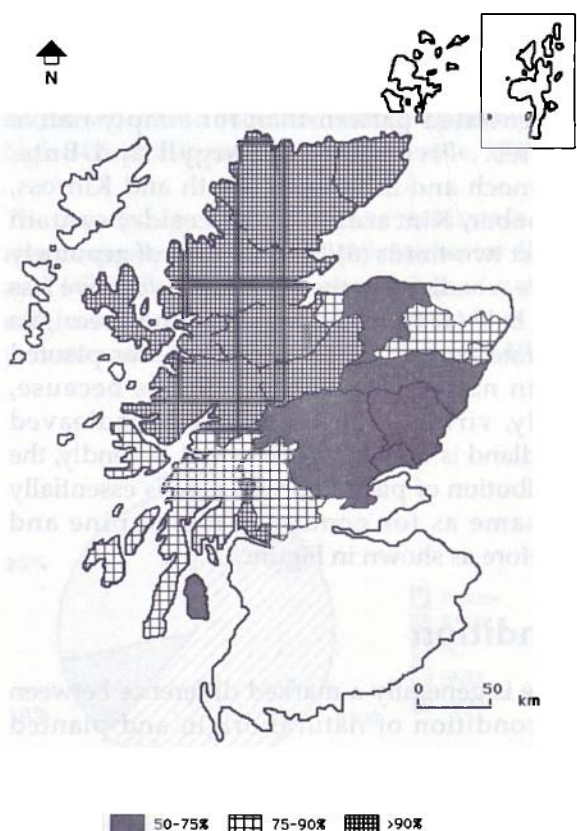


Figure 3.6 Area of native broadleaves as % of broadleaf area in each Highland district

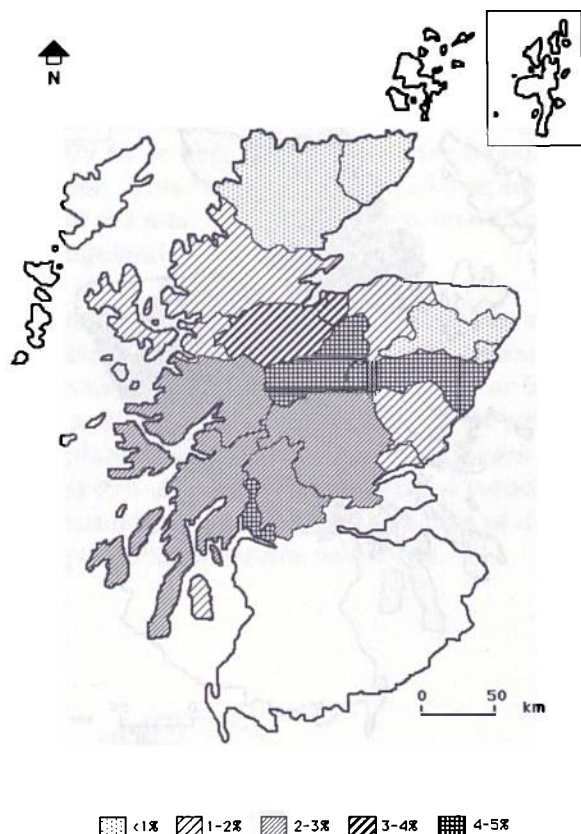


Figure 3.7 Area of genuinely native woodland as % of land area in each Highland district

The distributions of genuinely native woodlands as a percentage of land area and of total woodland in each district are shown in Figures 3.7 and 3.8 respectively. These reflect a more concentrated pattern than for simply native species. Five districts (Argyll and Bute, Badenoch and Strathspey, Perth and Kinross, Lochaber, Kincardine and Deeside) contain almost two-thirds (61%) of the area of genuinely native woodland in the Highlands, yet have less than half (43%) of the region's land area. No separate figures are produced here for planted origin native woodlands. This is because, firstly, virtually all the native broadleaved woodland is of natural origin and, secondly, the distribution of planted origin pine is essentially the same as for genuinely native pine and therefore as shown in Figure 3.5.

Condition

There is generally a marked difference between the condition of natural origin and planted origin native woodlands in the Highlands. Nearly all the planted origin native woodlands consist of Scots pine and most of this pine is in conventional plantations managed primarily for commercial timber production. The FC Census (1984) records a number of parameters for the

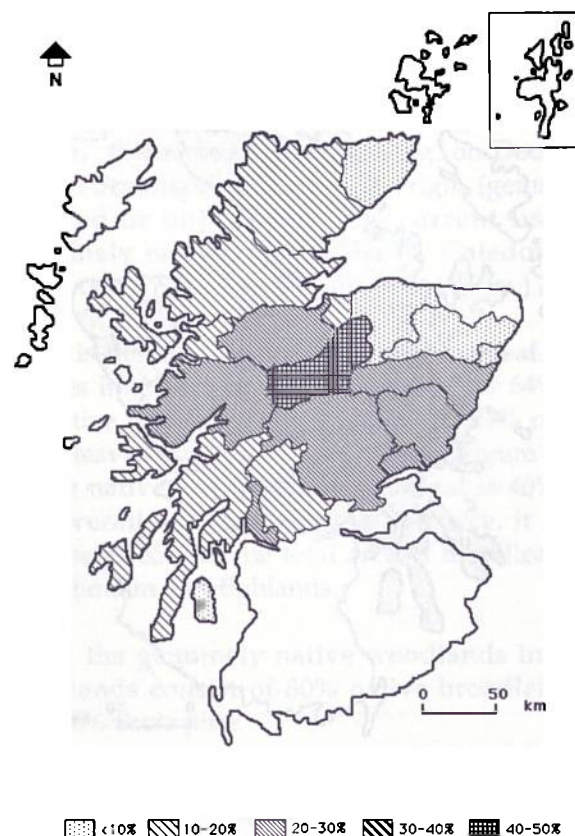


Figure 3.8 Area of genuinely native woodland as % of woodland area in each Highland district

condition of these plantations under 'High Forest Scots Pine'.

However, in addition to the plantation pine, there is also a significant extent of self-sown pine that has naturally regenerated from planted pine. This type of self-sown pinewood is mainly found in parts of Deeside and Strathspey and the total in these two areas amounts to about 5% of the planted pine resource (Callander and MacKenzie, 1991; MacKenzie, 1991a). These self-sown pinewoods tend to have a much more varied structure and condition than the genuinely native pinewoods, which generally have little structural diversity and consist of mature trees with little or no regeneration due to overbrowsing (Bain, 1987).

A range of surveys also show that most of the genuinely native broadleaved woodlands that have survived in the Highlands are also in poor condition (Brown and Wightman, 1988; Dargie and Simpson, 1993; Eagleson *et al.*, 1988; Gallacher, 1993; Halcrow, 1987; Lusby, 1982, 1983; MacKenzie, 1988; MacKintosh, 1988, 1990; Stewart, 1993; Tidswell, 1988, 1990). High levels of browsing are seen as the principal factor that is directly causing the poor condition of these woodlands.

Most natural origin native woodlands in the Highlands are unenclosed and therefore open to browsing by deer, sheep and cattle or a combination of these animals. Browsing by rabbits and hares can also be important, with goats particularly significant in areas like the east side of Loch Lomond. In the 10 Highland districts which have been surveyed recently, for example, browsing by deer and livestock was recorded in 50-90% of all the genuinely native woods, and in six of these districts the surveys indicated that the survival of over half the woods was under threat as a consequence of inadequate natural regeneration due to over-browsing (Brown and Wightman, 1988; Dargie and Simpson, 1993; Eagleson *et al.*, 1988; Gallacher, 1993; Halcrow, 1987; Lusby, 1982, 1983; MacKenzie, 1988; MacKintosh, 1988, 1990; Stewart, 1993; Tidswell, 1988, 1990).

The only evidence of expansion through natural regeneration tends to be limited to a few specific sites or localities, with no indication of a regional trend. Watson and Hinge (1989), Callander and MacKenzie (1991) and MacKenzie (1991a) record extensive pine and birch regeneration in parts of Deeside, Donside and Strathspey. This has generally been due to low deer numbers and limited muirburn, with much of the pine coming from trees of planted origin. Elsewhere, small scale exclosures have successfully promoted natural regeneration in some woods. For example, 31 exclosures in genuinely native pinewoods were all considered to contain adequate regeneration (Bain, 1987; MacKenzie, 1992a). In some National Nature Reserves, natural regeneration has been achieved by a combination of exclosures and reductions in deer numbers (for example: Beinn Eighe, Creag Meagaidh, Glen Strathfarrar, Glen Tanar, Loch Sunart).

A wide range of factors other than overbrowsing are also recorded as having a detrimental effect on natural origin native woodlands. These include casual felling, underplanting, invasion by non-native species, wayleave management, rural housing, quarrying and road construction.

The extent of constructive management recorded in genuinely native woodlands has been generally small scale and of limited scope, although Forest Enterprise has started to remove non-native species from relatively extensive areas where former genuinely native woodland can be restored (Forest Enterprise, 1992, 1993).

Ownership

Of the native woodland resource in the Highlands 72% is in private ownership and 28% is owned by the FC (Forestry Commission 1984; Figure 3.9). Within the 'private' total, a small proportion (probably less than 5%) is owned by public bodies such as SOAFD, SNH and the Crown Estate.

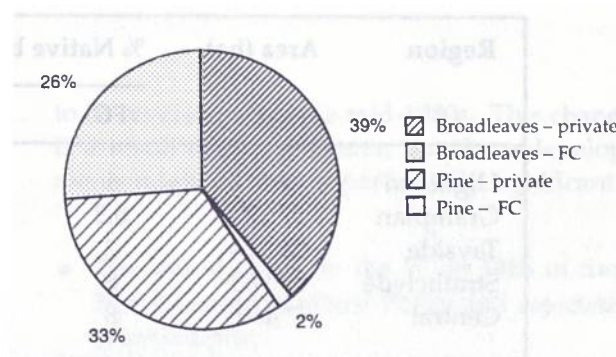


Figure 3.9 Ownership of the overall native woodland resource in the Highlands. Source: Forestry Commission (1984)

Approximately 95% of the native broadleaved resource (which is essentially all of natural origin) is in private ownership. A significant proportion of the native broadleaved resource is also within either an agricultural or crofting tenancy. There are limited data on this, but a sample survey of 1877 ha of natural origin native woodland recorded a disproportionately high 24% within tenancies (MacKenzie, 1988).

The ownership of the Scots pine resource is split more equally between the private sector (56%) and FC (44%), while the ownership of natural origin or genuinely native pinewoods is 72% private and 28% FC/SNH/HIE (Figure 3.10).

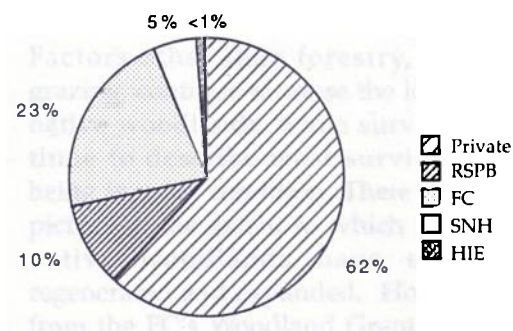


Figure 3.10 Ownership of the genuinely native pinewoods

The pattern of the overall native woodland resource is broadly similar across all local authority regions that include parts of the Highlands (Table 3.3). While the overall split of ownership of native broadleaves and pine is

similar to the ownership of all woodlands in Scotland, 86% of broadleaves and 47% of conifers are in private ownership (Forestry Commission, 1993).

Table 3.3 Ownership of the overall native woodland resource in five local authority regions. Source: Forestry Commission (1984)

Region	Area (ha)	% Native broadleaves		% Scots pine	
		FC	Private	FC	Private
Highland	99 317	1	37	30	32
Grampian	57 221	0.3	24	29	47
Tayside	26 924	2	38	26	34
Strathclyde	27 963	8	76	4	12
Central	7 469	8	61	17	14

Chapter 4

Recent trends in the resource

Background

At the beginning of this century, nearly all the woodlands in the Highlands were still composed of native species, with larch the only non-native species established on any scale. By the end of the Second World War, native species had declined to less than two-thirds of the woodland area in the Highlands (Forestry Commission, 1952) and by the 1980s, the proportion was down to only one-third (Forestry Commission, 1984).

This decline reflects, in part, that the major expansion this century in the total forest area in the Highlands has relied very largely on non-native tree species. However, the decline also reflects, firstly, the loss of a major proportion of all the natural origin native woodlands that survived in the Highlands at the beginning of this century and, secondly, the replacement of Scots pine with non-native conifers in many existing plantations.

There appears to be general agreement that between 25% and 50% of the natural origin native woodlands in the Highlands at the end of the Second World War had been destroyed by the 1980s (Bain, 1987; Forestry Commission, 1984; MacKenzie, 1987; Parr, 1979; Walker and Kirby, 1989).

During the same post-war period, the use of Scots pine in plantations also declined sharply. By the 1950s and 1960s, the use of Scots pine had become a minority of all conifer planting in each of the FC's four conservancies. By the 1970s, the use of Scots pine had fallen below 50% even in traditional local strongholds of pine such as Highland Deeside (Callander and MacKenzie, 1991).

Current period

The long decline this century in the native woodland resource in the Highlands has started

to be reversed since the mid-1980s. This change is a result of many factors, but three developments might be seen as particularly significant:

- The introduction by the FC in 1985 of their Broadleaved Woodland Policy and associated grant scheme.
- The changes in forestry incentives that resulted from the 1988 Budget.
- The introduction by the FC of new incentives and guidelines for native pinewoods in 1989/90.

There are clear indications that the loss of genuinely native woodlands due to forestry has largely stopped since 1985 (FC Broadleaves Policy Review in 1991) while, in the post-war period up until then, forestry appears to have accounted for around 87% of the losses (MacKenzie, 1988). In contrast now, in some instances, most notably by the Forest Enterprise in their Caledonian Forest Reserves, a start is being made to try to restore the remnants of some of the genuinely native woodlands that were considered destroyed by non-native plantations (Forest Enterprise, 1992, 1993).

Factors other than forestry, notably overgrazing, continue to cause the loss of genuinely native woodlands, while survey reports continue to describe most surviving woods as being in poor condition. There is also no clear picture of the extent to which these genuinely native woodlands have started to be regenerated and expanded. However, statistics from the FC's Woodland Grant Scheme (WGS) for their Highland Conservancy do show a steep increase over recent years in both the natural regeneration and planting of native species (Appendix 6).

Tables 4.1 and 4.2 show the increase in broadleaves from less than 5% of new planting before March 1988 to over 50% in 1992/3. Thus, broadleaves have accounted for 32% (7353 ha) of all planting (23 572 ha) in Highland Conservancy during the last 5 years. Full details of the composition of these broadleaves are not available, but it appears that the overwhelming majority are native species. For example, Table 4.3 gives details of the broadleaves species for approved applications for the

whole of Scotland since June 1991, when such data started to be entered into the FC's database. Non-native species and the 'other broadleaves' category only accounted for 6% of the total, with native species explicitly 63% and 'mixed broadleaves' (considered very largely native) another 31%. Thus more than 90% of the broadleaves total may well consist of native species and it is significant that both the native species and mixed broadleaves were 37% and 35% respectively by natural regeneration.

Table 4.1 Grant aided restocking, new planting and natural regeneration in FC Highland Conservancy, 1988-1993

Year to 31 Mar	Broadleaves (ha)			Conifers (ha)			Overall total (ha)
	Restock	New planting and natural regeneration	Total	Restock	New planting and natural regeneration	Total	
1987/88		(121)			(4758)		
1988/89	157	395	552	592	3985	4577	5129
1989/90	385	972	1357	478	2660	3138	4495
1990/91	743	944	1687	768	3043	3811	5498
1991/92	510	1032	1542	684	2272	2956	4498
1992/93	188	2027	2215	190	1547	1737	3952

Table 4.2 Broadleaves as a % of grant-aided new planting and restocking in FC Highland Conservancy, 1988-1993

Year to 31 Mar	Total restock (ha)	Broadleaves as % of restock	Total planting (ha)	Broadleaves as % of new planting	Overall total (ha)	Broadleaves as % of total
1987/88	-	-	4879	3	-	-
1988/89	749	21	4380	10	5129	11
1989/90	863	45	3632	27	4495	30
1990/91	1511	49	3987	25	5498	31
1991/92	1194	43	3304	31	4498	34
1992/93	378	50	3574	57	3952	56

Table 4.3 Areas of broadleaved species approved for new planting under the Woodland Grant Scheme in Scotland, June 1991-December 1993

	Planting (ha)	Natural regeneration (ha)	Total (ha)
Birch	1278	1543	2821
Oak	783	45	828
Alder	583	8	591
Ash	491	11	502
Rowan	351	58	409
Cherry	322	0	322
Woody shrubs	274	26	300
Willow	263	34	297
Aspen	64	0	64
Hazel	53	4	57
Native broadleaves	629	1194	1823
Total	5091	2923	8014
Mixed broadleaves	2535	1388	3923
Other broadleaves	115	37	152
Non-native broadleaves	583	16	599
Grand total	8324	4364	12688

The proportion of new planting of broadleaves on Forest Enterprise land has not been as significant over the same period but there has been an increase since 1992 (Tables 4.4 and 4.5).

The composition of the main category, 'mixed broadleaves', is unknown although most broadleaved planting and restocking in the Highlands is considered to be of native species.

Table 4.4 Restocking and new planting on Forest Enterprise land in the Highlands, 1987-1993

Year to 31 Mar	Broadleaves (ha)			Conifers (ha)			Overall total (ha)
	Restock	New planting and natural regeneration	Total	Restock	New planting and natural regeneration	Total	
1987	126	161	287	1727	4519	6246	6533
1988	181	165	346	2214	3964	6178	6524
1989	205	88	293	2192	3119	5311	5604
1990	172	133	305	1938	2873	4811	5116
1991	139	73	212	1769	2029	3798	4010
1992	205	124	329	1792	1445	3237	3566
1993	289	144	433	1679	792	2471	2904

The use of Scots pine has also increased markedly in recent years. The big change has been the increase under the FC's Native Pinewood Grants, where the area grant aided has doubled each year since these grants were introduced in 1989/90 (Table 4.6). Forest Enterprise report that in their North Region Scots pine is 'holding its own' in their planta-

tions (Regional Director correspondence, 1993). On Forest Enterprise land in the Highlands, however, the proportion of Scots pine has remained below 10% of the total area of new conifer planting and restocking over the past 5 years (e.g. in 1993 6% of the 2471 ha of conifers planted consisted of Scots pine).

Table 4.5 Broadleaves as a % of new planting and restocking on Forest Enterprise land in the Highlands, 1987-1993

Year to 31 Mar	Total restock (ha)	Broadleaves as % of restock	Total planting (ha)	Broadleaves as % of new planting	Overall total (ha)	Broadleaves as % of total
1987	1853	7	4680	3	6533	4
1988	2396	8	4129	4	6524	5
1989	2397	9	3207	3	5604	5
1990	2110	8	3006	4	5116	6
1991	1908	7	2102	3	4010	5
1992	1997	10	1569	8	3566	9
1993	1968	22	936	15	2904	15

Table 4.6 Native pinewood scheme (grant paid) Highland Conservancy, 1991-1994

Year to 31 Mar	Restocking (ha)		New planting (ha)		Natural regeneration (ha)		Total (ha)
	Broadleaves	Pine	Broadleaves	Pine	Broadleaves	Pine	
1990/91							(528)
1991/92	63	43	63	654	31	100	954
1992/93	65	16	845	781	258	10	1975
1993/94 (to 8/2/94)	66	400	398	431	10	153	1458
Totals	194	459	1306	1866	299	263	4387

Thus, considering the year to 31 March 1993, the most recent year for which statistics are available for Highland Conservancy, native species accounted for more than 75% of the total area (3952 ha or 30% of Scotland total) upon which first instalment establishment grant was paid (Tables 4.7 and 4.8). In addition, 1975 ha or 50% of the total area was under Native Pinewood Grants.

There are no data available on the genetic origins of the stock used for the c.2240 ha of the native species area that was planted (as opposed to natural regeneration) in Highland Conservancy. If all of this area was planted at the minimum density required by the FA for full grant (1100 stems ha⁻¹) then 2.5 million native trees will have been used.

Table 4.7 Woodland Grant Scheme statistics (grant paid) for Scotland and Highland Conservancy, 1992-1993 (to 31 March 1993)

	Restocking (ha)		New planting (ha)		Natural regeneration (ha)		Totals	
	Conifers	Broadleaves	Conifers	Broadleaves	Conifers	Broadleaves	Conifers	Broadleaves
Scotland								
Total areas	1677	717	5864	3888	199	1016	7740	5621
Native pine	43	71	1234	1428	84	276	1361	1775
Highlands								
Total areas	190	188	1433	1255	114	772	1737	2215
Native pine	16	65	781	845	10	258	807	1168

Table 4.8 Total area of new planting, restocking and natural regeneration (grant paid) under Woodland Grant Scheme for Scotland and Highland Conservancy, 1992-1993 (to 31 March 1993)

	Broadleaves		Native pine		Other conifers		Total conifers		Total all species (ha)
	Total (ha)	%	Total (ha)	%	Total (ha)	%	Total (ha)	%	
Scotland	5621	42.1	1361	10.2	6379	47.7	7740	(57.9)	13 361
Highlands	2215	56.0	807	20.4	930	23.5	1737	(44.0)	3952

Robinson and Ryder (1988) recorded that in 1987, 92% of the stock in Scottish nurseries was of non-Scottish origin. However, 1707 ha or 76% of the 2240 ha planted with native species

was under the Native Pinewood Grants and that carries the presumption that all the pine and most of the broadleaves (63% of the 1707 ha) were of appropriate local origins.

Chapter 5

Conclusions

The compilation of the statistics for this summary account of the native woodland resource in the Highlands has involved the same range of difficulties as the last review (MacKenzie, 1987). These include having to use a wide range of different survey sources, often with widely separate survey years and different methodologies.

However, since MacKenzie (1987), an important amount of new survey data has become available, particularly through additional SNH District Field Surveys and completion of the provisional Ancient Woodland Inventory.

Analysis of all the data now available shows that the native woodland resource in the Highlands is substantially greater than previously recognised. The results in this report increase the estimated minimum area of genuinely native woodlands in the Highlands to 104 876 ha – a 35% increase on the 1987 total of 77 623 ha – and with clear indications that these natural origin woodlands are still under-recorded in the Highlands.

In addition, since MacKenzie (1987), the loss of genuinely native woodlands appears to have been largely stopped and, while most are still recorded as in poor condition, there has also been a major increase in the natural

regeneration and planting of native woodlands in the Highlands during the last 5 years.

In the year to 31 March 1993, native species accounted for over 75% of all planting and natural regeneration under the FC grants in their Highland Conservancy, with over half of the total area under the FC's Native Pinewood Grants. Similar statistics are anticipated for the year to 31 March 1994.

This report has incorporated, in comparison to MacKenzie (1987), data on the planted origin as well as natural origin native woodlands. Planted origin native woodlands account for 106 320 ha or 50% of the overall native woodland resource and currently consist almost entirely of Scots pine. However, in the year 1992/3, approximately 1.5 million native broad-leaves were planted under grant just in the FC's Highland Conservancy.

The inclusion of planted origin as well as the genuinely native or semi-natural native woodlands in this report, reflects the greater recognition of the existing and potential value of some types of planted origin native woodlands. This is leading to the development of an integrated perspective on the management of the overall native woodland resource, which safeguards and enhances the genuinely native woodland resource while promoting the environmental and other values of all native woodlands.

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Appendix 1

Main areas of semi-natural woodland confirmed by field survey or site description

District	Broadleaves (ha)	Scots pine (ha)	Total (ha)	Woodland classification	Survey reference	Remarks
Caithness	302	-	302	Site description, Phase 1	Coredata; SSSI citations Ferreira (1979)	About 90% of semi-natural woodland is within SSSIs. No woodland survey of district.
Sutherland	3 808	208	4 016	Site description, Phase 1	Ferreira (1979), 1980, 1981, 1982, 1983, 1984, 1986, 1987, 1988); Coredata; SSSI citations	Ferreira surveyed an estimated 1879 ha of selected woodland sites outwith SSSIs; reports include site description and map but no classification or area data.
Ross and Cromarty	4 236	826	5 062	Peterken Stand Type, Phase 1, Site description	Lusby (1982, 1983); Eagleson <i>et al.</i> (1988); NCC (1978); Coredata; SSSI citations	Lusby surveyed 46 woods (about 1040 ha), including 2 SSSIs in Wester Ross; Eagleson <i>et al.</i> surveyed 1895 ha, excluding SSSIs, in Easter Ross; NCC (1978) provide site descriptions of some SSSIs; Letterewe SSSI surveyed to NVC (Pennington, 1991) and for condition and structure (MacKenzie, 1992b).
Skye and Lochalsh	2 464	118	2 582	Peterken Stand Type, Phase 1	Halcrow (1987), Christie (1989)	Halcrow and Christie surveyed 2064 ha of broadleaved woodland, including some SSSIs, in Skye, Raasay and Lochalsh.
Inverness	5 551	3 144	8 695	Peterken Stand Type, Phase 1, Site description	Ridgill <i>et al.</i> (1985); Yost <i>et al.</i> (1986); Eagleson (1987); Coredata	Inverness District Woodland Survey (in 3 reports, plus a review by Eagleson, 1989) surveyed about 4400 ha of mainly broadleaved woodland, including some SSSIs. Glen Strathfarrar SSSI surveyed by MacKenzie (1989, 1991, 1992a).
Nairn	1 411	-	1 411	NVC	Hepburn (1991)	29 woods surveyed including SSSIs; report in preparation. Smith (1980-83) also surveyed 12 woods (739 ha) using Peterken Stand Type.
Lochaber	8 029	1 362	9 391	NVC	MacIntosh (1990)	148 woods surveyed, including SSSIs and some pinewoods.
Badenoch and Strathspey	4 438	6 074	10 512	NVC	Tidswell (1988)	83 broadleaved woods, including SSSIs, were surveyed.

Appendix 1 (continued) Main areas of semi-natural woodland confirmed by field survey or site description

District	Broadleaves (ha)	Scots pine (ha)	Total (ha)	Woodland classification	Survey reference	Remarks
Moray	3 030	20	3 050	Phase 1, Peterken Stand Type, NVC	Grampian Regional Council (1987); Smith (1980-83); Hepburn (1991)	GRC habitat survey is the most comprehensive; Smith surveyed 48 woods (1435 ha) using Peterken Stand Type and Hepburn surveyed 29 woods (971 ha) using NVC. SSSIs included.
Gordon	1 714	8	1 722	Phase 1, Peterken Stand Type, NVC	Grampian Regional Council (1987); Smith (1980-83); Hepburn (1991)	GRC habitat survey is the most comprehensive; Smith surveyed 13 woods (286 ha) using Peterken Stand Type and Hepburn surveyed 30 woods (852 ha) using NVC. SSSIs included.
Kincardine and Deeside	4 765	6 498	11 263	Phase 1, Peterken Stand Type	Grampian Regional Council (1987)	GRC habitat survey is the most comprehensive; Smith (1980-83) surveyed 10 woods (265 ha) using Peterken Stand Type; Brown and Wightman mapped 5036 ha of birch in Deeside and Donside; Watson and Hinge (1989) surveyed 26 084 ha of tree regeneration (established and non-established woodland) in the Dee and Don catchment; Callander and MacKenzie (1991) mapped 6498 ha of established pine woodland in Highland Deeside; MacKenzie (1992c) surveyed 1697 ha of established pine woodland in Highland Deeside.
Angus	1 295	-	1 295	NVC	Tidswell (1990)	42 broadleaved woods, including SSSIs, were surveyed.
Perth and Kinross	1 855	1 240	3 095	Merlewood national site classification, Site description	Gregory (1974); Stewart (1993)	Gregory surveyed 24 oakwood sites (1113 ha) by sampling vegetation and providing a site description of a further 113 sites, although areas given for only 23 sites (302 ha) in report; survey includes some woods in Stirling district; Stewart assessed structure and condition of 440 ha birchwood in Strathtay. A sample survey of structure and condition by Tayside Native Woodland Initiative is in progress. There is no comprehensive field survey of woodland in Perth and Kinross District.

Appendix 1 (continued)

Main areas of semi-natural woodland confirmed by field survey or site description

District	Broadleaves (ha)	Scots pine (ha)	Total (ha)	Woodland classification	Survey reference	Remarks
Stirling	2 318	113	2 431	Site description, Phase 1, NVC	Gallacher (1993); Dargie and Simpson (1993)	There are 2318 ha of woodland within SSSIs; the Loch Lomond Woodland Survey surveyed 772 ha of broadleaved woodland, using NVC, within Loch Lomond Park; an NVC survey of a further 230 sites (about 2680 ha) is in progress.
Argyll and Bute	10 373	260	10 633	NVC	MacIntosh (1988)	213 woods, including SSSIs were surveyed: woods on Scarba, Colonsay and some mainland sites, e.g. Glasdrum NNR, were omitted.
Dumbarton	1 463	–	1 463	NVC	Dargie and Simpson (1993)	The survey of 2235 ha semi-natural woodland within Loch Lomond Regional Park recorded 772 ha in Stirling District (see above) and the remainder in Dumbarton District; a report is in preparation.
Arran	no information	–		Phase 1, some Phase 2	SNH	Most woodland has been surveyed to Phase 1 standard and some to Phase 2 but no area data or report are available.

Survey references for Scots pine: Bain (1987); Callander and MacKenzie (1991); FC Caledonian Pinewood Inventory (1994); Forest Enterprise (1992); MacKenzie (1989, 1991a, b, 1992a, b, d).

Appendix 2

The main woodland classifications used in district field surveys

District	Area (ha)			
	NVC	Peterken Stand Type	Other	Phase 1
Caithness	–	–	–	302
Sutherland	–	–	1 879	2 137
Ross and Cromarty	218	2 935	–	1 909
Skye and Lochalsh	–	2 064	–	518
Inverness	–	4 400	1 358	2 937
Nairn	1 411	–	–	–
Lochaber	8 029	–	–	1 362
Badenoch and Strathspey	4 438	–	–	6 074
Moray	971	740	–	1 339
Gordon	852	56	–	814
Kincardine and Deeside	–	265	1 697	6 172
Angus	1 295	–	–	–
Perth and Kinross	–	–	1 855	1 240
Stirling	772	–	–	1 659
Argyll and Bute	10 373	–	–	260
Dumbarton	1 463	–	–	–
Arran	–	–	–	^a
Total	29 822	10 460	6 789	26 723
%	40	14	9	37

Other = Merlewood classification; structure and condition surveys and detailed site descriptions.

^a Phase 1 surveys have been completed but data are not available.

The area of Phase 2 surveys (e.g. NVC) for each district is a minimum figure as there are a number of individual site surveys (mainly SSSIs) for which data are not available, except in the respective citation files.

Appendix 3

The woodland resource in the Highlands

Sources: land area (including inland water): Scottish Office (1991); woodland data: FC Census 1979-82 (district totals); semi-natural woodland data: Ancient Woodland Inventory and others (see Appendix 1)

District	Land area (km ²)	Total woodland area (ha)	% Land area	Total native species area (ha)	% Native conifers of all conifers	% Native broadleaves of all broadleaves	% Native spp. of land area	Total semi-natural (ha)	% Semi-natural of land area	total woodland	total woodland
Caithness	1 806	4 679	2.6	880	6	90	0.5	303	0.2	18.8	6.5
Sutherland	6 077	34 027	5.6	11 063	24	93	1.8	4 164	0.7	32.5	12.2
Ross and Cromarty	5 173	41 901	8.0	21 732	43	92	4.2	6 421	1.2	51.9	15.3
Skye and Lochalsh	2 730	15 074	5.5	2 464	5	94	0.9	2 747	1.0	16.3	18.2
Inverness	2 911	47 720	16.4	24 027	43	92	8.3	9 911	3.4	50.3	20.8
Nairn	425	9 475	22.3	6 259	60	89	14.7	1 411	3.3	66.0	14.9
Lochaber	4 648	54 835	11.8	11 012	8	92	2.4	13 373	2.9	20.0	24.4
Badenoch and Strathspey	2 366	27 574	11.7	21 698	73	93	9.2	11 362	4.8	78.7	41.2
Moray	2 244	44 871	20.0	20 486	43	69	9.1	3 050	1.0	45.7	6.8
Gordon (incl. Aberdeen)	2 407	32 584	13.5	11 118	28	77	4.6	1 909	0.8	34.1	5.9
Kincardine and Deeside	2 567	40 346	15.7	21 990	51	71	8.6	11 263	4.4	54.5	27.9
Angus (incl. Dundee)	2 281	15 611	6.8	7 363	41	73	3.2	3 154	1.4	47.2	20.2
Perth and Kinross	5 362	54 847	10.2	19 493	26	75	3.6	12 579	2.3	35.5	22.9
Stirling	2 245	32 006	14.3	5 421	6	79	2.4	5 160	2.3	16.9	16.1
Argyll and Bute	6 613	122 254	18.5	13 232	2	81	2.0	15 276	2.3	10.8	12.5
Dumbarton ^a	526	7 749	14.7	2 766	5	91	5.3	2 257	4.3	35.7	29.1
Arran (Cunninghame)	436	7 097	16.3	741	2	73	1.7	536	1.2	10.4	7.6
Total	50 817	592 650	11.7	201 745	25	83	4.0	104 876	2.0	34.0	17.7

^a Native species area for Dumbarton District is an estimate as the FC Census amalgamated this District with Clydebank, Inverclyde and Renfrew Districts. All FC totals exclude 'clumped' woodland (9492 ha) which are not available in the District tables of the FC Census.

Appendix 4

The native woodland resource in the Highlands: species composition (areas in ha)

Sources: FC Census 1979-82; FC Caledonian Pinewood Inventory and other references in Appendix 1

District	Scots pine		Birch	Oak	Ash	Alder	Hazel	Willow	Elm	Other broadleaves ^c	Total
	Planted origin	Natural origin ^b									
Caithness	220	–	483	79	12	20	20	1	8	37	880
Sutherland	7 084	208	2 722	509	66	113	115	3	40	203	11 063
Ross and Cromarty	13 847	826	5 195	853	126	215	219	5	72	374	21 732
Skye and Lochalsh	593	118	1 309	200	28	56	56	1	16	87	2 464
Inverness	14 117	3 144	4 948	868	116	206	209	5	71	343	24 027
Nairn	4 541	–	1 202	285	29	49	50	1	17	85	6 259
Lochaber	2 332	1 362	5 321	917	131	221	228	7	83	410	11 012
Badenoch and Strathspey	8 137	6 074	5 531	883	134	230	235	6	79	389	21 698
Moray	17 701	20	1 818	494	63	69	6	84	66	165	20 486
Gordon (incl. Aberdeen)	7 790	8	2 088	603	60	78	8	94	80	309	11 118
Kincardine and Deeside	9 971	6 498	3 775	945	111	142	15	171	141	221	21 990
Angus	5 100	–	1 246	516	73	79	1	16	47	285	7 363
Perth and Kinross	9 990	1 240	4 365	2 119	316	256	2	51	175	979	19 493
Stirling	1 578	113	1 646	1 203	100	43	77	7	121	533	5 421
Argyll and Bute	1 681	260	5 991	2 396	267	192	306	27	358	1 754	13 232
Clydebank ^a	321	–	1 430	693	79	41	74	8	119	510	3 275
Arran (Cunninghame)	101	–	331	138	16	8	15	1	25	106	741
Total	105 216	19 759	49 401	13 701	1 727	2 018	1 636	488	1 518	6 790	202 254

^a Clydebank: comprises the Districts of Clydebank, Inverclyde, Renfrew and Dumbarton, which have been amalgamated in the FC Census. Totals therefore differ slightly from those in the text and in Appendix 3.

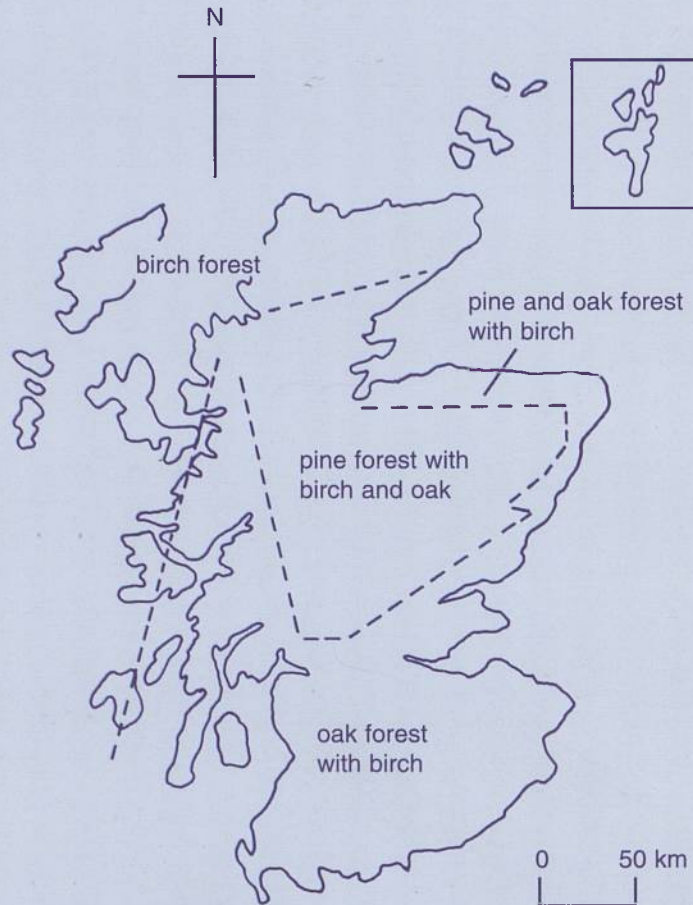
^b Natural origin pine: includes some areas of self-sown pine, mainly in Strathspey and Deeside, which are of mixed, planted or unknown origin.

^c Other broadleaves: refers to undefined areas of species which were not listed in the principal species categories and includes rowan, alder, willow, cherry, hazel, hawthorn and some non-native lime and horse chestnut.

Abbreviations used in the text

AWI	Ancient Woodland Inventory
FA	Forestry Authority
FC	Forestry Commission
FE	Forest Enterprise
HIE	Highlands and Islands Enterprise
NCC	Nature Conservancy Council
NVC	National Vegetation Classification
OS	Ordnance Survey
RSPB	Royal Society for the Protection of Birds
SOAFD	Scottish Office Agriculture and Fisheries Department
SNH	Scottish Natural Heritage (formerly NCC)
SSSI	Site of Special Scientific Interest
WGS	Woodland Grant Scheme

The natural distribution of Scotland's main native forest types prior to the major effects of human intervention. The remnants of Scotland's natural woodlands and also planted origin native woodlands reflect a similar pattern today. Scotland's existing native woodlands are important as a unique natural habitat and for the many other environmental, economic and social benefits they provide.



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