Chapter (non-refereed)

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The composition of woodlands in Cumbria

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3.1 Introduction

In pre-historic times, Cumbria was almost completely covered with woodland which, as described by Satchell (see page 2), was progressively and selectively cleared by man for agricultural purposes. These factors have led to patches of woodland being left on land with the lowest value for agriculture. The remaining, or ancient, woodland is often on steep slopes and shallow soils, so it is difficult to appreciate the original woodland composition across Cumbria as a whole. The area of woodland probably reached its lowest point towards the end of the 17th century, but since then it has been increasing; much of this increase has been relatively recent and is coniferous in character. The expansion of woodland cover has provided shelter for deer which have increased in the last 50 years. Whilst there are no comparable records for other woodland animals (eg birds), their numbers also have probably increased, at the expense of moorland species, as has occurred elsewhere in Britain.

The primary environmental influence in Cumbria is the climate, which is relatively mild even in winter, with high rainfall throughout the year, reaching a maximum in winter. This oceanic climate determines the overall composition of the flora and fauna in the area. Another general influence is the island status of Britain, which has restricted immigration of species, in comparison with other mountainous areas in Europe. At a local level within the county, it is usually the soil nutrient and moisture status which is critical in determining the vegetation composition, but this is overridden in upland areas by the influence of altitude, which restricts the distribution of some species.

3.2 The role of woodland in Cumbria

Cumbrian woodlands are important for many reasons, including the following.

i. **Amenity.** The woodlands of the Lake District are a vital part of the amenity of the area and are particularly important in visual terms. The old plantations around Windermere add very considerably to the scenery: it is only the large new coniferous plantations which are often considered deleterious to the landscape.

ii. **Wildlife.** Woodlands are very important for their wildlife, both animals and plants. Some important woodlands are protected as Sites of Special Scientific Interest and National Nature Reserves.

iii. **Timber resource.** A separate aspect of conservation is the use of Cumbrian woodlands as a source of timber. In the 17th and 18th centuries, the supply of timber was vital to the maintenance of an industrial base in Britain, although this is now of less importance.

3.3 Composition by area

According to the most recent Forestry Commission (FC) census (Table 1), the county has 54 450 ha of woodland, which amounts to about 8% of the county, whereas Great Britain overall has approximately 9% woodland. Cumbria is, therefore, comparable to the rest of Britain, rather than to Europe, where only Holland and Eire have less forest. The ownership and pattern of management in Cumbria are similar to the rest of Britain, although there is probably a higher proportion of coppice, as opposed to high forest, than in many counties. In the past, the practice of coppicing was very much more common in Cumbria than it is now.

Table 1. Area of woodland in Cumbria, by forest type, 1980 (Forestry Commission 1984)

Forest type	Area (ha)	% of total
Mainly coniferous high forest	35 340	65
Mainly broadleaved high forest	13 806	25
Coppice-with-standards	89	<1
Coppice	134	<1
Scrub	4 196	8
Cleared	885	2
Total	54 450	100

Table 2 gives the proportion of forest occupied by the principal species. Sitka spruce (*Picea sitchensis*) is now the most important component of the conifer high forest, largely due to recent planting, whilst the traditional coniferous plantation tree was Scots pine (*Pinus sylvestris*). Oak (*Quercus* spp.) predominates in the broadleaved high forest, but it may be surprising that ash (*Fraxinus excelsior*) forms such a large proportion; this reflects the importance of the limestone areas in the south of the county. Sycamore (*Acer pseudoplatanus*) and beech (*Fagus sylvatica*), both of which are introduced, also cover large areas and play a significant part in the ecology of the county. The scrub category is dominated by birch (*Betula* spp.), whereas in the 1947 census it was mainly oak, reflecting a change in definition made by the FC between the two dates. In 1947, conifers occupied only 56% of the overall woodland area of Cumbria, whereas by 1980

Table 2. Area of high forest in Cumbria, by principal species, 1980 (Forestry Commission 1984)

Species		Area (ha)	% of total
Scots pine	*Pinus sylvestris*	4 452	9.1
Corsican pine	*Pinus nigra*	315	0.6
Lodgepole pine	*Pinus contorta*	1 837	3.7
Sitka spruce	*Picea sitchensis*	16 856	34.3
Norway spruce	*Picea abies*	4 020	8.2
European larch	*Larix decidua*	1 621	3.3
Japanese and hybrid larch	*Larix kaempferi* and *Larix* × *eurolepis*	3 148	6.4
Douglas fir	*Pseudotsuga menziesii*	654	1.3
Other conifers		885	1.8
Mixed conifers		1 561	3.2
Total conifers		35 349	71.9
Oak	*Quercus* spp.	3 892	7.9
Beech	*Fagus sylvatica*	1 221	2.5
Sycamore	*Acer pseudoplatanus*	1 235	2.5
Ash	*Fraxinus excelsior*	1 115	2.3
Birch	*Betula* spp.	2 508	5.1
Poplar	*Populus* spp.	79	0.2
Sweet chestnut	*Castanea sativa*	5	<0.1
Elm	*Ulmus* spp.	329	0.7
Other broadleaves		906	1.8
Mixed broadleaves		2 507	5.1
Total broadleaves		13 797	28.1
Total		49 146	100.0

this percentage had increased to 72. This increase is due in part to the large new plantings of conifers, particularly in the north of the county, but also to the conversion of broadleaved woodlands to conifers.

Table 3 indicates the change from the early 19th century, when broadleaved planting predominated, through to the present day when most planting is of conifers, a trend which seems likely to continue. When interpreting Table 3, it is important to bear in mind that conifer rotations are shorter than broadleaved rotations. The economic pattern of recent years has led to a predominance of coniferous plantings, because of their higher financial return. On the other hand, in recent years there has been a decline in the conversion of broadleaved woodland to coniferous forest because of the high cost of management.

Table 3. Area (ha) of high forest in Cumbria in 1980 by planting year class (Forestry Commission 1984)

Planting year class	Mainly coniferous	Mainly broadleaved	Total
Pre–1861	30	808	838
1861–1900	485	3 014	3 499
1901–1910	358	1 346	1 704
1911–1920	401	546	947
1921–1930	1 737	661	2 398
1931–1940	3 550	1 485	5 035
1941–1950	4 350	1 469	5 819
1951–1960	7 654	3 156	10 810
1961–1970	8 731	1 096	9 827
1971–1980	8 044	225	8 269
Total	35 340	13 806	49 146

The Lake District Special Planning Board (1978) undertook a survey to determine changes in the area of broadleaved woodland in the Lake District National Park. A total area of 11 600 ha comprised broadleaved woodlands greater than 0.5 ha, and over 1100 ha of woodland which was broadleaved about 30 years ago is now predominantly coniferous. A further 390 ha of broadleaved woodland (over 2 ha in area) no longer exists at all. This loss is partly compensated for by 300 ha of new broadleaved woodland, although it is important to point out that this is an underestimate, because of increases in area around the margins of old woodlands. Regeneration was recorded in only 9% of the sample woodlands, and generally consisted of different species from those of the main crop. The replacement of oak by other species is likely to be part of a natural cycle, particularly as oak will not regenerate in its own shade. In addition, the charcoal industry probably favoured oak, as explained by Satchell (see page 8).

In the 1960s, much concern was expressed about the lack of tree regeneration in the Lake District. Since then, however, areas have been found where vigorous natural regeneration is occurring. There is little doubt that heavy grazing pressure is the primary limiting factor for regeneration; ungrazed sites with a wide range of soil, altitude and ground conditions have been found with regeneration. Locally other factors (eg exposure or waterlogging) may be important. The species composition of surrounding trees is an important factor in determining the type of regeneration.

The Nature Conservancy Council (Whitbread 1985) surveyed ancient woodland in Cumbria and, although there were some problems with identifying the boundaries of these woodlands, the figures confirm the decline of broadleaved woodlands. In 1920 there were 16 545 ha of ancient woodlands, and by 1985 this figure had declined by 4%, to 15 880 ha. However, only 10 518 ha of this area are now semi-natural, about 32% of the original woodlands having been planted

with conifers. The loss of broadleaved woodlands is, therefore, not necessarily due to any inherent lack of regenerative capacity, but is a result of their replacement with conifers or other exotics by man. Only 2.3% of the county consists of ancient woodlands, emphasizing the scarcity of this resource.

3.4 Vegetation composition of coniferous woodland

The vegetation of coniferous plantations is often ignored by botanists, because it does not have the intense interest of traditional woodlands. Whilst these coniferous forests are, by any method of comparison, poorer than traditional oak forests, there is still much of interest in their wildlife and vegetation. A common view of coniferous woodland is of young Sitka spruce with a scattering of mosses on the ground and no other species beneath the canopy. Whilst this is true in many new forests (eg Kershope and Spadeadam), the plantations of the central Lake District are more variable, because the terrain is rocky and areas of unplantable land are scattered through the forest. However, even in the extensive forests, there are still areas where the crop has failed or where rides or tracks are present; here, relict moorland vegetation remains. On some sites in the central Lake District, the better soils allow longer rotations, and thus a mature woodland flora develops. Many of the complex woodland vegetation types seen in conifer forests in the west of North America and in Scandinavia do not occur in Britain, either because the local vegetation has not had time to adapt to the new conditions of dense shade or because suitable species have not yet evolved or been introduced.

Brown, Pearce and Robertson (1979) have shown the effects of converting traditional broadleaved woodlands to conifers, and Hill (1979) has described the changes that take place as coniferous forest develops following afforestation. The early stages of the conifer rotation are important because there is extensive growth of the existing ground vegetation, following its release from grazing pressure, providing habitats for birds such as the pheasant (*Phasianus colchicus*) and the long-eared owl (*Asio otus*). Mature conifers are also important landscape features and provide cover for wildlife. Although the blanket coverage of dense forests may generally be considered deleterious to flora and fauna, their opening up by felling increases the variability present, both in forest structure and vegetation composition.

3.5 Vegetation composition of broadleaved woodland

Maps of the distribution of individual woodland species are shortly to be produced in the *Flora of Cumbria*, but Halliday (1978) already provides a great deal of information. A wide range of purely descriptive texts is also available on the vegetation of Lake District woodlands (eg Tansley 1949; Yapp 1953). However, for the present purposes, the quantitative framework used is that of Bunce (1982), where random sample plots in woodlands throughout Britain were classified using multivariate statistical analysis. Thirty-two woodland vegetation types were defined within this classification, 22 of which are found in Cumbria.

Vegetation types 1 to 8 are characterized by lowland calcareous species, such as dog's mercury (*Mercurialis perennis*), hart's-tongue fern (*Phyllitis scolopendrium*) and spindle (*Euonymus europaeus*). Such species are at their northern British limit in south Cumbria, whereas other species of this group, eg oxlip (*Primula elatior*) and stinking iris (*Iris foetidissima*), are not found as far north as Cumbria. Thus, only three of these eight vegetation types are present in Cumbria, and these are mainly in woodlands in the south of the county. The intermediate lowland vegetation types, 9 to 16, are often associated with stream banks or enriched areas, typical species being primrose (*Primula vulgaris*), dog's mercury and bramble (*Rubus fruticosus*). These vegetation types are much more variable than types 1–8 because they also have elements from more acidic soils. Six out of eight of these types are represented, being present in the upland/lowland margins of the county. They may also be found by streamsides on the low fells (eg Rusland) or even in gorges in the uplands (eg Borrowdale). In the latter case, they are the result of local enrichment. The lowland acidic vegetation types, 17 to 24, are the most abundant in the county and are widespread throughout the majority of woodlands. They may even be present in limestone woodlands where acid drift overlays the limestone. These types include a range of cover species from bracken (*Pteridium aquilinum*) and bramble, through to wavy hair-grass (*Deschampsia flexuosa*), and even bilberry (*Vaccinium myrtillus*) and heather (*Calluna vulgaris*). Seven of these eight vegetation types are represented in Cumbria, the absent one being typical of clayey or very acidic soils in south-east England. The extreme upland types, 25 to 32, are often very variable and have a wide range of species present. Again, seven of the eight vegetation types are present in Cumbria, mainly in upland woods at the

head of dales such as Borrowdale. The absent vegetation type is an extreme type, typical of exposed areas of north-west Scotland.

Cumbria, therefore, has a wide variety of woodland vegetation types, covering virtually the whole range found in Britain, from the calcareous lowlands to the very acid, exposed, upland conditions. This reflects the inherent variability of the Cumbrian environment.

Woodlands are combinations of different vegetation types and may be compared by analysing the range of vegetation types present in each (Bunce 1989). Using this approach to compare Cumbria with the rest of Britain demonstrates that Cumbria is in an intermediate position, containing elements from both north and south. However, the affinity is rather more towards Scotland than lowland England.

Two important vegetation components deserve attention.

i. **Bryophytes:** the mild moist climatic conditions have led to Cumbrian woodlands having an exceptional flora of mosses and liverworts. The Borrowdale woods, for example, contain some of the finest assemblages in western Europe. Many of these species are difficult to identify, but nevertheless are of great botanical importance.

ii. **Lichens:** some of the more sensitive species are present in Cumbria woodlands because of the relatively pollution-free atmosphere.

3.6 Cumbrian woodlands in a European context

The distribution of individual species can be used to explain the wider affinities of Cumbrian woodlands.

The bluebell (*Hyacinthoides non-scripta*) is present throughout Cumbria. However, this species is particularly important in a European context because it is found on the mild oceanic fringe of western Belgium, western France and Spain. It therefore indicates the oceanic nature of woodlands in Cumbria. Although oceanicity is the dominant climatic influence on Cumbrian woodlands, other species indicate some similarity with continental climates. Scots pine colonizes peat mosses in Cumbria as it does in Scandinavia. On the Cumbrian mosses, the ground vegetation is dominated by cross-leaved heath (*Erica tetralix*), cranberry (*Vaccinium oxycoccus*) and bilberry, whereas in Scandinavia other dominant species are found, although the vegetation has a similar form. Another example of similarity is with woodlands of western Belgium and central Germany, but this similarity decreases as one moves progressively away from the oceanic margins. However, in France it is not until one approaches the Mediterranean, about 550 miles from the Atlantic coast, that the woodlands appear markedly different. The species composition of the canopy, which includes sessile oak (*Quercus petraea*), holly (*Ilex aquifolium*) and hazel (*Corylus avellana*), remains the same, but the ground flora species are replaced by more continental species. Further south, the Pyrenees form a major barrier to species migration, isolating the Spanish woodlands.

3.7 Sites of particular ecological significance

The most important Cumbrian woodlands in the national context are the high-altitude woods of the Lake District, the highest woodlands in England and Wales. Keskadale and Birkrigg woods lie between 400 m and 500 m above the Newlands valley, and are described by Yapp (1953). They are predominantly oak woods, low grown and windswept. Their ground vegetation is, however, more typical of upland grassland than woodland, so it is their altitudinal position which is important. Another site, which is not so well known, is at Mungrizedale and lies between 490 m and 520 m. Although similar to Birkrigg in tree composition, there is much heather and bilberry in the ground vegetation, in places only several centimetres high, its height no doubt being controlled by grazing.

Another exceptional series of sites are the coastal mosses in the south and north of the county. Here the peat has built up out of reach of the calcareous groundwater, to a situation where the soil is pure peat and receives nutrients only from rainfall. The ground vegetation, therefore, consists of species which favour very acid soils. Around the margins of these mosses, Scots pine was planted in Victorian times and is now colonizing the bog surfaces. As the tree roots dry out the bog, pine and also birch spread aggressively into the bog centre, modifying the heath vegetation until it becomes woodland.

Throughout the central Lake District, there are fragments of lake margin woodland, which are best preserved where there has been little recreational use. Elterwater has one of the best examples of marginal woodland, with birch, alder (*Alnus glutinosa*) and willow (*Salix* spp.), leading to yellow iris (*Iris pseudacorus*) and canary grass (*Phalaris canariensis*) nearer the wa-

ter. Another good example is on the north shore of Bassenthwaite Lake. These remnants represent a woodland type which was formerly extensive, before man cleared and drained such areas for agriculture.

Other important woodlands virtually unaffected by man's activity are the gill woodlands, which may reach 600 m above sea level. At the valley floor, the gills have typical oak woodland species, such as wood sage (*Teucrium scorodonia*), buckler-fern (*Dryopteris dilatata*) and male-fern (*Dryopteris filix-mas*). With increasing altitude, oak declines gradually and is replaced by birch, rowan (*Sorbus aucuparia*) and willow. The ground flora also changes, to species more characteristic of open birch woodland of the north-west of Scotland, such as bog asphodel (*Narthecium ossifragum*) and yellow saxifrage (*Saxifraga aizoides*). A study recently carried out in Langdale (R G H Bunce unpublished) shows that the boundaries of these two types of woodland probably follow the original natural boundary between oak and birch. The gills thus represent a relict flora which can be used to indicate the old boundaries in the original woodland cover. Comparable vegetation is seen on the high cliffs.

Finally, there is the dwarf shrub heath of the higher mountains, composed of shrubs such as juniper (*Juniperus communis*) and willow, which represents the altitudinal limit of woodland vegetation in the Lake District.

3.8 The future

The future development in woodlands is not easy to predict. The control of planting in many areas in the Lake District, through the influence of the National Park Authority, prevents the establishment of any large new areas, at least in the central Lake District. In this area, small amenity plantings, as are currently being made by the National Trust in Langdale, are likely to be found.

In north Cumbria, large new plantations are likely to continue the trend of the last 20 years. With increasing pressure on the world's forests, several other areas around the National Park are likely candidates for these new plantations, such as the Shap Fells and the foothills of the Pennines. Elsewhere, the current concern about the excess of agricultural land may well lead to small local plantings, but this is unlikely to be a significant factor in the county as a whole, in terms of area, although it may well affect the scenery.

Conservation will continue to be an important issue. Upland sites where the lack of regeneration through grazing is a problem contrast with the lowland peat mosses where the colonization by trees is removing heather from the ground vegetation. In these cases, management objectives need to be clearly defined before an appropriate course of action is adopted.

The maintenance of cultural artefacts could also be an important local influence on woodland management. Considerable interest has recently been expressed about the way in which woodlands were used in the past and in the re-introduction of ancient industries, such as charcoal burning and the making of swills.

3.9 Conclusion

Changes in the broadleaved woodlands of Cumbria over the last 50 years have, on balance, not been significant: conversion to coniferous species has not occurred on a large scale. The afforestation of open land with conifers, large areas of which are now reaching harvestable age, is contributing to Britain's timber industry.

Within Cumbrian woodlands, there are still many unresolved problems of both scientific and practical importance.

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