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# Loch Ashik, Loch Cleat and Loch Meodal

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## Highlights

The detailed pollen records from the sediments in these loch basins provide evidence of the vegetational history of Skye during the Holocene and allow important insights into the pattern of woodland development. The latter shows major regional variations unique at the scale of the island.

## Introduction

The Isle of Skye, on which these three sites are located, is unique within the Inner Hebrides today because of its great geological and topographical diversity, its botanical richness (Birks, 1973), its wide range of present-day plant communities (Birks, 1973), and its critical geographical position in relation to the boundaries of McVean and Ratcliffe's (1962) reconstructed Holocene potential woodland zones of Scotland (Williams, 1977; Birks and Williams, 1983). The sites of Loch Ashik, Loch Cleat and Loch Meodal are scientifically important because they provide detailed and extensively radiocarbon-dated Holocene pollen records and vegetational histories for three strongly contrasting ecological regions (*sensu* Birks, 1973) on Skye today. The regions are the Kyleakin area in the east (Loch Ashik, [NG 691 232]), the Tertiary basalt country of northern Skye (Loch Cleat, [NG 416 742]), and the sheltered Sleat peninsula in the south (Loch Meodal, [NG 656 113]).

Although each site is important individually from the viewpoint of vegetational and environmental history, the three sites are of even greater scientific importance when their individual pollen records are compared (Williams, 1977; Birks and Williams, 1983). The three sites provide important evidence for marked vegetational differentiation within Skye throughout the Holocene. Nowhere else in Scotland can this remarkable range of forest history and vegetational differentiation be found within such a small area.

Because of the importance of the three sites when considered together, their combined importance is reviewed after the individual site accounts.

## Loch Ashik

### Description

Loch Ashik is situated at an altitude of 40 m OD, 4 km east of Broadford and occupies a small depression within the local Torridonian sandstone. It is 175 m long and 125 m wide and is surrounded by blanket bog and soligenous mires. The immediate area is treeless today, although birch woods with some hazel, rowan, oak and holly occur on steep slopes 5 km to the east. At Gleann na Beiste, 6.5 km to the north-east of Loch Ashik, fossil pine stumps occur within the blanket peat. These stumps have a radiocarbon date of  $4420 \pm 75$  BP (Q-1309). This is the only known locality for dated pine stumps on Skye (Lewis, 1906; Birks, 1975), although stumps of comparable age also occur on western Lewis and Harris (Bennett, 1984; Wilkins, 1984).

The vegetational history of Loch Ashik and its surrounds was reconstructed from pollen analysis of cores obtained from the marginal fen on the western side of the loch. The stratigraphy (Figure 11.17) consists of 1.5 m of herbaceous sedge peat underlain by 2.85 m of fine-detritus (organic) mud. Below this is 0.55 m of silty, fine-detritus mud of early Holocene age underlain by 0.75 m of silts and silty muds of Lateglacial age (see above). Ten radiocarbon dates (SRR-804 to SRR-813) are available from the fine-detritus and silty, fine-detritus muds to provide a chronology for the Holocene pollen record of Williams (1977).

### Interpretation

After an early Holocene phase of juniper scrub and grassland, birch and hazel expanded at about 9600 BP to form fern- and tall, herb-rich woods with willow and rowan. Elm and oak were probably present in small amounts after about 9000 BP. *Calluna* heath, species-poor grassland and bog appear to have also been present near Loch Ashik as early as 9000 BP, presumably as a result of podsolization and paludification of the predominantly acid soils derived from the underlying Torridonian sandstone. At 6300 BP alder expanded rapidly at the expense of willow and hazel (Bennett and Birks, 1990). In contrast to southern and northern Skye there is no palyno-logical evidence at Loch Ashik for any human interference at 5000 BP. A second and very important contrast is the expansion of *Pinus* pollen between 4600 BP and 3900 BP at Loch Ashik (Birks, 1989). This may reflect the local growth of pine on dried peat surfaces in eastern Skye, a widespread phenomenon in north-west Scotland at that time (Birks, 1975; Birks 1988, 1989; Gear and Huntley, 1991), as at Gleann na Beiste.

The sharp decline in *Pinus* pollen at Loch Ashik correlates with the widespread demise of pine throughout north-west Scotland at about 4000 BP (Birks, 1972b, 1975; Birks, 1977, 1988; Bennett, 1984; Gear and Huntley, 1991) and the widespread development and expansion of blanket bog with *Calluna vulgaris*, *Sphagnum* and *Narthecium ossifragum*, of acid grasslands, and of heaths around Loch Ashik. The reasons for this widespread and dramatic decline of pine in north-west Scotland, eastern Skye, and parts of Lewis are not fully understood (Birks, 1988). A combination of rapid climatic change and human activity may have initiated the replacement of pine on flat and gently sloping ground by treeless blanket bog. There is, however, independent chemical evidence from the Inverpolly area (Pennington *et al.*, 1972) that suggests a major change to a more oceanic climate with increased precipitation and stronger winds at about 4000 BP. Such an abrupt change would have caused waterlogging, encouraged the expansion of blanket bog, and inhibited the regeneration of pine by reducing the number of good seed years (Birks, 1972b).

By 2700 BP bog and heath were widespread near Loch Ashik and woodland, mainly of birch, was rare and presumably restricted, as today, to steep slopes where blanket bog could not develop. This situation has continued to the present day, suggesting that the modern bog-dominated landscape is of considerable antiquity.

The Holocene pollen record of Loch Ashik (Williams, 1977; Birks and Williams, 1983) indicates that pine was locally abundant between 4600 BP and 3900 BP and that the vegetational history of eastern Skye has affinities with parts of Wester Ross, in McVean and Ratcliffe's (1962) 'predominant pine forest zone'. In contrast, pine appears to have been absent from southern and northern Skye during the Holocene. Loch Ashik is thus of considerable palaeoecological importance in illustrating the extremely localized geographical distribution of *Pinus sylvestris* during the Holocene and the local, but very rapid, extinction of pine close to the limits of its natural geographical range (see also Gear and Huntley, 1991).

## Loch Cleat

### Description

Loch Cleat occupies a rock basin 200 m long and 100 m wide at about 40 m OD on the west side of the northern tip of the Trotternish peninsula near Duntulm. The solid geology is predominantly Palaeogene dolerite sills and Jurassic sedimentary rocks. To the south there are the westerly dipping, Palaeogene basalt lavas that form the impressive Trotternish ridge with its steep, east-facing scarp slope. The vegetation of the area near Loch Cleat today is predominantly grassland, meadow and bog. Small areas of birch, hazel, willow and rowan scrub occur locally on sheltered, steep, block-strewn slopes.

Organic sediments up to 9.4 m thick, underlain by 1.85 m of minerogenic sediments of presumed Lateglacial age, occur at the western edge of Loch Cleat (Figure 11.18). These organic sediments consist of 2 m of herbaceous sedge peat overlying 7.07 m of fine-detritus mud. There are 0.33 m of silty, fine-detritus mud overlying the basal minerogenic sediments. Ten radiocarbon dates (SRR-932 to SRR-941) are available from the organic sediments. A detailed pollen diagram for these sediments has been prepared by Williams (1977; see also Birks and Williams, 1983) (Figure 11.18).

### Interpretation

The early Holocene (10,000–8900 BP) vegetation was juniper, willow and birch scrub with abundant grasses, ferns and tall herbs. This was replaced at about 8900 BP by birch, hazel and willow scrub with rowan and *Prunus padus*. Species-rich grasslands and tall herb communities continued to be locally frequent. Low pollen values of *Quercus*, *Ulmus* and *Pinus* throughout the Holocene at Loch Cleat and at other sites in northern Skye (Vasari and Vasari, 1968) indicate that none of these trees was ever an important component of the local vegetation (Birks, 1989), in contrast to southern Skye (Loch Meodal) where elm and oak were frequent, and eastern Skye (Loch Ashik) where oak, elm, and pine were present locally. Alder arrived at Loch Cleat at about 6300 BP but, in contrast to eastern and southern Skye, it was never abundant in northern Skye (Bennett and Birks, 1990).

The pollen record at Loch Cleat reveals a marked increase in herbaceous pollen types (mainly grasses, *Potentilla* type, Chenopodiaceae and Cruciferae) at 5000 BP along with the first appearance of cereal type and *Plantago lanceolata* pollen. At the same time there is a large decrease in the pollen values of birch and hazel, suggesting clearance of scrub and the local development of arable and pastoral agriculture. The pollen spectra suggest that between 5000 BP and 700 BP the landscape of northern Trotternish was mainly treeless, with patches of scrub probably restricted to steep, rocky slopes that were difficult to clear. There are abundant Iron Age archaeological remains in the area, such as brochs and duns, the ages of which are unfortunately not known.

In the last 700 years there has been widespread clearance of the remaining areas of birch and hazel scrub to produce the virtually treeless landscape of northern Skye today. Cereal-type pollen is present in significant amounts, suggesting extensive cereal cultivation in this part of northern Skye. With its fertile soils, northern Skye was noted for its cereal crops and the parish of Kilmuir, in which Loch Cleat is situated, was referred to as the 'granary of Skye' (MacSween, 1959).

The pollen record from Loch Cleat provides the most detailed record of the Holocene vegetational history currently available for the basalt areas of northern Skye. The landscape of this area is virtually treeless today with a few stands of birch and hazel scrub confined to steep, sheltered, coastal cliffs and to ravines. McVean and Ratcliffe (1962) suggest that northern Skye lies within the 'predominant birch forest' zone. The pollen stratigraphy at Loch Cleat (Williams, 1977) confirms this suggestion and shows that only birch, hazel and willow scrub developed near the site, even in middle Holocene times. The pollen record also shows that oak, elm, pine and alder were never important components of the Holocene vegetation of northern Skye, in contrast to southern and eastern Skye (Williams, 1977; Birks and Williams, 1983). This history contrasts markedly with southern and eastern Skye. Loch Cleat is thus important because of its detailed and well-dated pollen record, its contribution to the reconstruction and understanding of Holocene forest history of western Scotland, and its record of land-use history over the last 5000 years.

## Loch Meodal

### Description

Loch Meodal is located 5 km south-east of Ord in the Sleat peninsula, in a gently sloping area at an altitude of 105 m OD. The loch is 500 m long and 400 m wide. The landscape is one of variable relief, with the underlying Torridonian and Lewisian rocks frequently cropping out as rocky knolls. Gentle slopes and depressions are covered by blanket peat, *Calluna vulgaris* heath, or species-poor grassland. Areas of birch, hazel and oak woodland occur nearby in the Ord Valley, between Ord and Tokavaig, and by Loch na Dal (Birks, 1973). An extensive fen has developed at the northern end of Loch Meodal, where organic sediments up to 7.9 m have accumulated (Figure 11.19). These are underlain by 0.3 m of minerogenic sediments of possible Lateglacial age. The organic sediments consist of 1–2 m of herbaceous peat overlying 6.4–5.4 m of fine-detritus mud. There is a narrow (0.1 m) layer of sandy, fine-detritus mud overlying 0.4 m of silty, fine-detritus mud. The basal sediments are sand, silt and gravel, at least 0.3 m thick. The pollen record of these sediments has been studied in detail by Birks (1973; basal 1.20 m) and by Williams (1977; upper 7.70 m) (Figure 11.19). Eleven radiocarbon dates (Q–961, Q–1301 to Q–1310) have been obtained from the Loch Meodal sediments.

### Interpretation

The presumed Lateglacial vegetational history, as reconstructed by pollen analyses of the basal 1.2 m of sediment (Birks, 1973) is as follows. The earliest vegetation was acid dwarf-shrub heaths with abundant *Betula nana* and herb-rich grasslands. At an inferred age of about 12,200 BP juniper and willow scrub developed. This was replaced by open birch woods with aspen and abundant ferns. Subsequently, the extent of woodland decreased, and *Betula nana* heath expanded, presumably in response to the climatic deterioration associated with the Loch Lomond Stadial.

In the early Holocene (9700 BP) birch and hazel rapidly expanded with some aspen and willow, abundant ferns and tall herbs (Williams, 1977). From about 9000 BP oak and elm may have been present in small amounts within the predominantly birch-and-hazel-dominated landscape. Alder expanded rapidly at about 6500 BP to form mixed birch–hazel–alder woods with some oak, elm, ash, rowan and holly. The oak pollen values are lower than at comparable times on the adjacent mainland, for example the Morar peninsula (Williams, 1977), suggesting that the natural northern limit of predominant oak during the middle Holocene lay near southern Skye. Although oak was certainly present in Sleat, it was never a prominent component of the natural woodland cover. As on the adjacent mainland, *Pinus* was absent in the forests of southern Skye, in contrast to its abundance in parts of Wester Ross (Birks, 1972b; Birks, 1977, 1989) and in eastern Skye (Williams, 1977).

Forest clearance in Sleat began at about 5200 BP. By 4200 BP the landscape was still mainly wooded, but bogs, heaths and acid grasslands became frequent. There was little vegetational change between 2700 BP and 300 BP except for the spread of *Calluna vulgaris* at about 1600 BP. In the last 300 years there has been extensive forest clearance, a large decrease in the extent of heather moor and a massive spread of acid grassland, resulting in the lightly wooded landscape near Loch Meodal today. This widespread forest destruction and spread of grassland may have resulted from the onset of cattle breeding after AD 1650, reaching its peak at about AD 1750 (Williams, 1977). The woodlands surviving in southern Skye are clearly natural relics of the former forests of Sleat.

The Holocene forest history of Loch Meodal has greatest affinities with sites on the adjacent mainland in the 'predominant oak forest with birch' zone of southern and western Scotland (McVean and Ratcliffe, 1962), such as the Morar peninsula and the Loch Sunart area. The main difference between the pollen sequences from the mainland and from Loch Meodal is that oak was rarer in southern Skye than on the mainland.

Loch Meodal is of considerable scientific importance in the reconstruction of Lateglacial and Holocene vegetational history. First, it is situated within the Sleat peninsula of southern Skye and thus lies near the northern limit of McVean and Ratcliffe's (1962) potential 'predominant oak forest with birch' zone (Birks and Williams, 1983). Its detailed pollen stratigraphy shows that the site has been near important distributional limits of two major forest trees (birch and oak) during the last 12,000 years. It also illustrates that very marked vegetational differentiation has existed within Skye and between Skye and the adjacent mainland since the Late Devensian (Birks, 1973; Williams, 1977; Birks and Williams, 1983). Second, southern Skye supports today the largest areas of natural or seminatural woodland on Skye. These birch and birch–hazel woods, often with some oak, elm, ash, alder, holly, rowan and willow, are rich in several internationally rare and biogeographically important, warmth-demanding Atlantic species of ferns, bryophytes and lichens. Many of these species are growing at or near their northernmost known world localities (see Birks, 1973). The Holocene vegetational history of this area, as reconstructed at Loch Meodal (Williams, 1977) is thus of considerable importance in understanding the status of the existing woodlands in Sleat and in elucidating the development of the present ecological landscape of southern Skye. Third, the site contains sediments of Holocene and possible Lateglacial age that have been studied in some palynological detail by Williams (1977) and Birks (1973), respectively. The Lateglacial vegetational history may show that southern Skye was the northernmost known area of tree-birch growth during the Lateglacial Interstadial.

## **Holocene forest history; an overview**

The Holocene forest history of Skye (Williams, 1977; Birks and Williams, 1983) corresponds closely with the present-day distribution of natural or seminatural woodland stands on the island (Birks, 1973). Southern Skye has the most woodland today, eastern Skye has woodland confined to slopes that are too steep for blanket-bog development, whereas in northern Skye trees only grow in sheltered, rocky sites. This pattern may reflect climatic differences within Skye, with

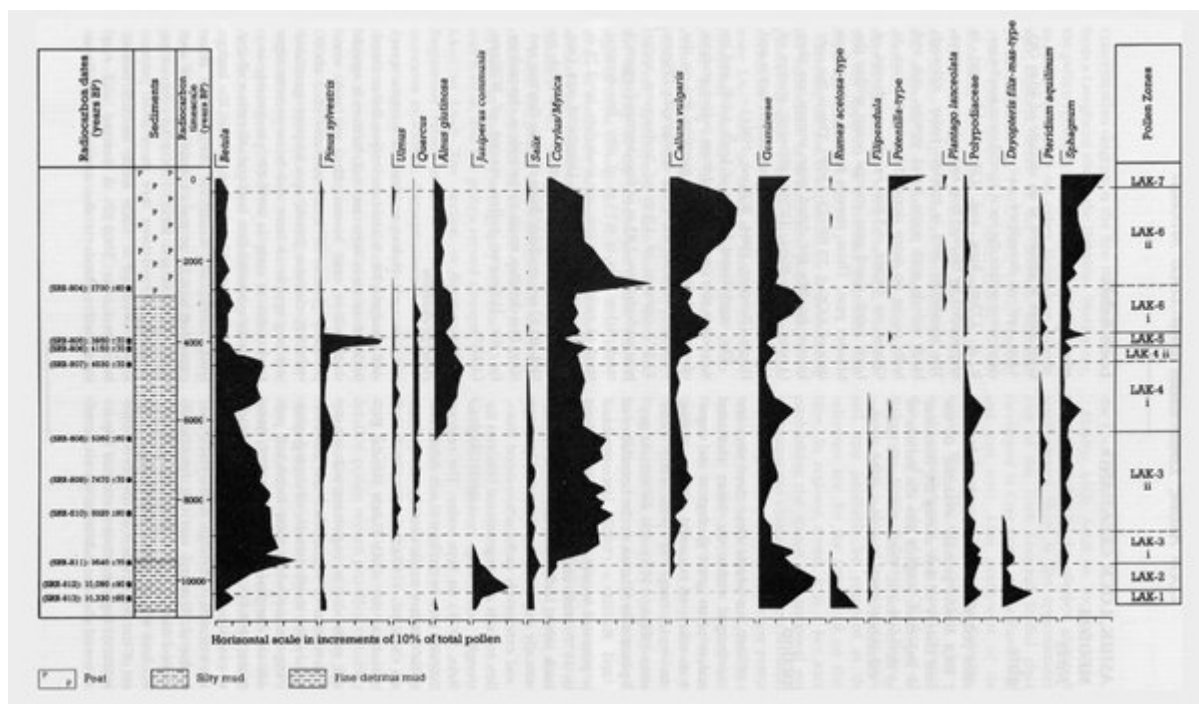
southern Skye being the mildest and most sheltered part today. The pollen records from Loch Meodal, Loch Cleat and Loch Ashik illustrate the very considerable variation in the Holocene vegetational history and forest composition of Skye (Table 11.1). The vegetational history of southern Skye has its closest affinities with the adjacent mainland of the Morar peninsula. Northern Skye corresponds, in its vegetational history, to sites on the mainland further north such as in northern Wester Ross and West Sutherland (see Loch Sionascaig, Cam Loch and Lochan an Druim). Eastern Skye has affinities with parts of Wester Ross (see Loch Maree) where pine was a major component of the forests for a comparatively short period within the Holocene. Nowhere else in Scotland or elsewhere in north-west Europe can such a range of variation in forest composition and vegetational history be found within such a small area.

Loch Meodal, Loch Ashik and Loch Cleat are three sites of great importance in the reconstruction and understanding of the Holocene forest history of Scotland. Each site has considerable scientific importance. Their importance is even greater, however, when the three sites are considered together. In combination, they provide a unique palynological record of forest history and fine-scale vegetational differentiation. They are of international importance in providing palaeoecological insights into past geographical patterns of forest composition, and into the dynamic nature of Holocene vegetational history.

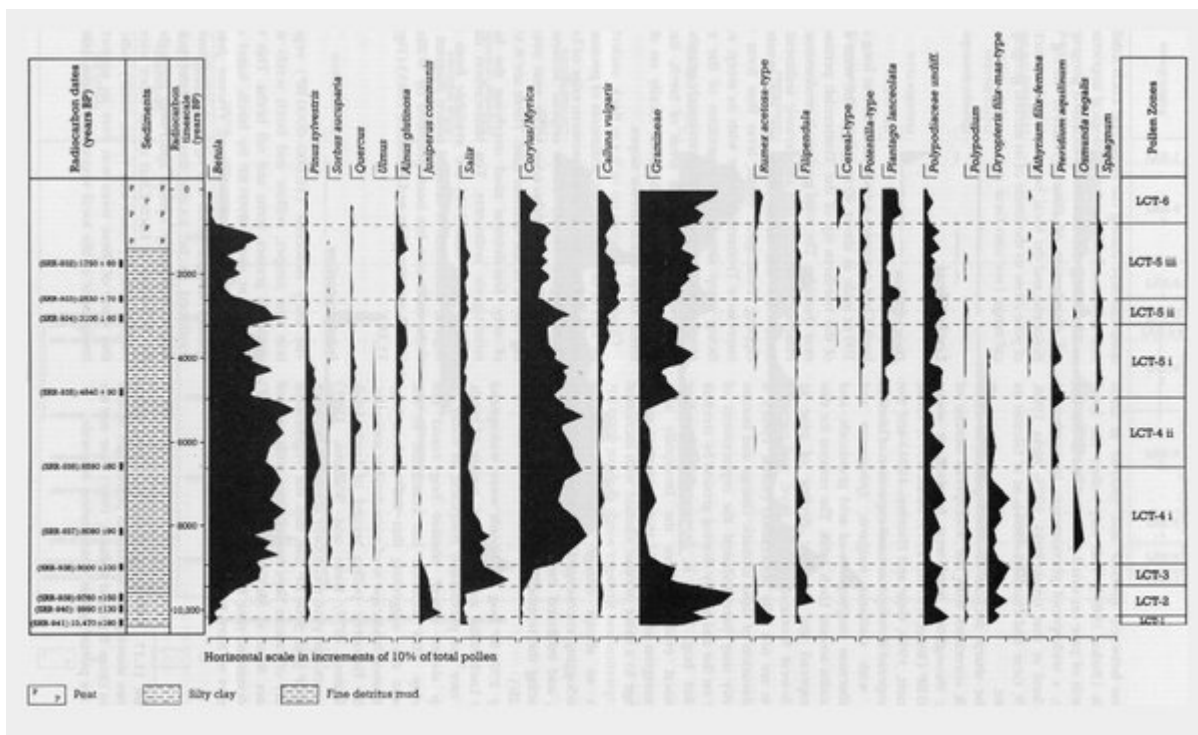
## Conclusion

Together these sites are important for the evidence they provide of the history of vegetation and forest development on Skye during the Holocene (the last 10,000 years), which occupies a critical geographical location in relation to the main woodland zones that occur in Scotland today. The detailed pollen records from each site indicate major regional differences in the vegetational history of the island. Such variations are unique within an area of this size and are of great importance in understanding the geography and dynamics of Holocene vegetation.

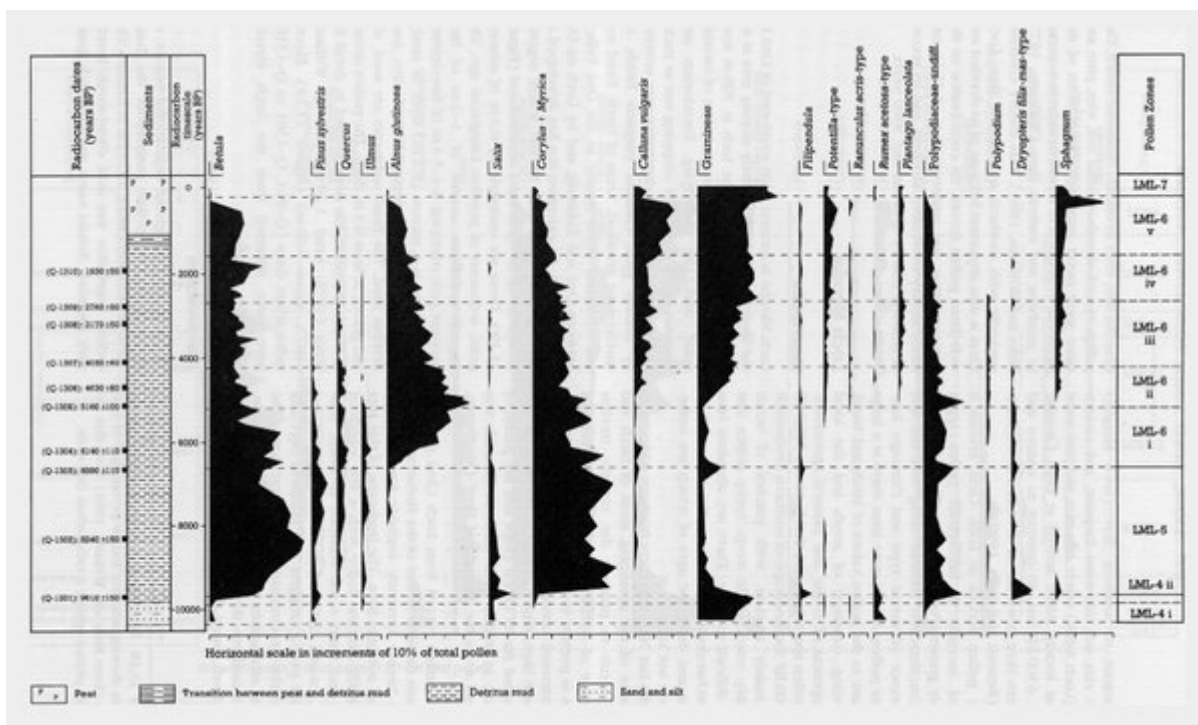
## References



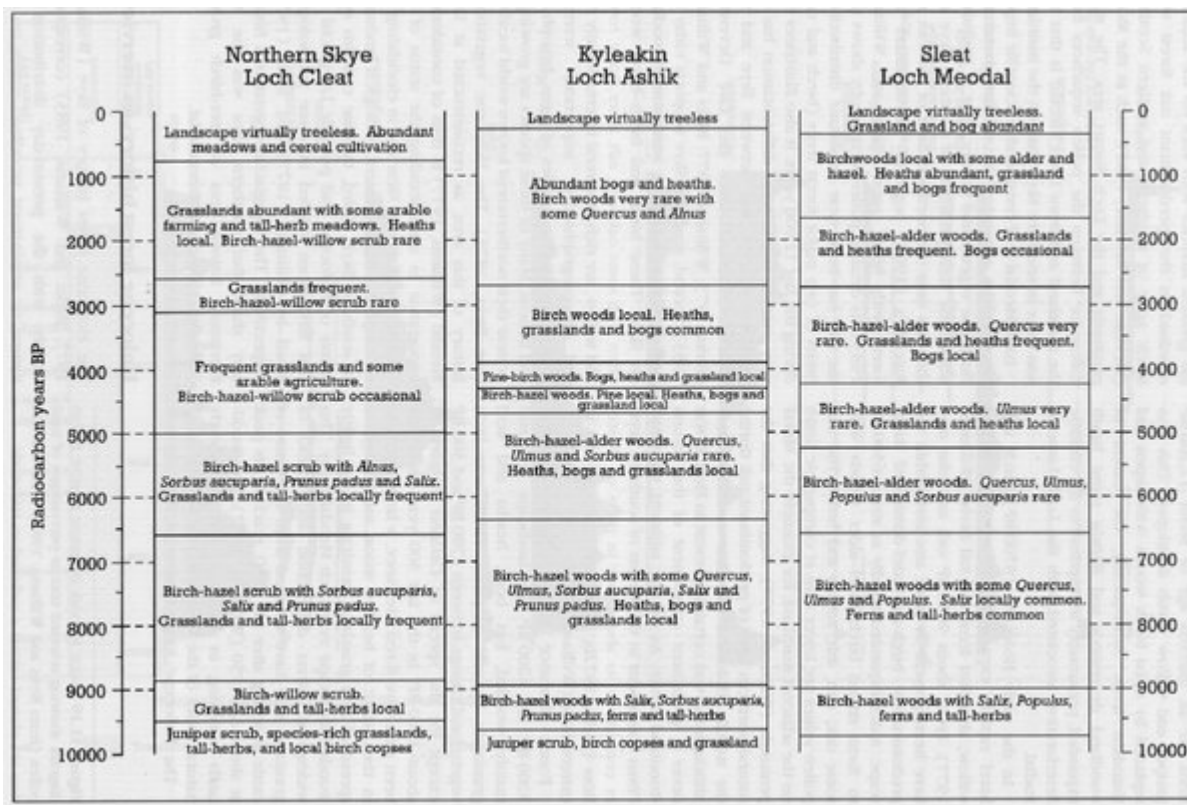
(Figure 11.17) Loch Ashik: Holocene relative pollen diagram showing selected taxa as percentages of total pollen (from Birks and Williams, 1983). Note that the data are plotted against a radiocarbon time-scale.



(Figure 11.18) Loch Cleat: Holocene relative pollen diagram showing selected taxa as percentages of total pollen (from Birks and Williams, 1983). Note that the data are plotted against a radiocarbon time-scale.



(Figure 11.19) Loch Meadal: Holocene relative pollen diagram showing selected taxa as percentages of total pollen (from Birks and Williams, 1983). Note that the data are plotted against a radiocarbon time-scale.



(Table 11.1) Generalized comparison of the inferred Holocene vegetational history of the Isle of Skye based on the pollen records from Loch Cleat, Loch Ashik and Loch Meodal (from Birks and Williams, 1983)