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# Loch Maree

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## Highlights

The pollen records preserved in the sediments on the floor of Loch Maree and in the bogs on its islands provide a valuable record of Holocene vegetational changes in an area of high ecological importance. In particular, they allow important insights into the development of the native pinewoods.

## Introduction

Loch Maree is a long (20 km), narrow (1.63.7 km) and deep (in excess of 110 m) loch situated north-west of Kinlochewe in Wester Ross. The sediments preserved on the floor of the loch and in several bogs and small lochans on the islands of Eilean Subhainn and Eilean Dubh na Sroine provide important pollen records of the Holocene vegetation history of this area. The Loch Maree woods, including Collie na Glas-Leitire on the south side of Loch Maree, the islands at the north-west end of Loch Maree, and the Letterewe oakwoods on the north side of Loch Maree are internationally important (Ratcliffe, 1977) because of the abundance of *Pinus sylvestris*, a tree that today is characteristic of the eastern Highlands and is rare or absent in much of north-west Scotland. The Loch Maree pine populations are distinct in terms of their monoterpene and isoenzyme loci and 'show little genetic affinity between contemporary Scottish and continental European populations' (Kinloch *et al.*, 1986). This suggests that these pine populations may have had a history that differs from those elsewhere in Scotland. Further, the Letterewe woods are also significant as the northernmost extensive semi-natural oakwood in Scotland. The vegetation history of this ecologically unique area is thus an important and integral part of its overall conservation importance, and has been investigated through pollen analytical studies of a sediment core from Loch Maree Hotel Bay [NG 919 709] by Birks (1972b).

Kerslake (1982) has also studied three pollen profiles from islands in the loch. These islands support fine stands of pine woodland, alternating with a range of mire communities and small lochans, and provide a 'natural experiment' in vegetational history, in that by being isolated and difficult to reach, they are less likely to have been influenced by grazing and by human disturbance than the mainland. The site on Eilean Dubh na Sroine [NG 909 720] is a small lochan on a rocky island that supports almost continuous pine woodland today. Subhainn Lochan [NG 923 721] lies within a mosaic of pine woodland and blanket mires on Eilean Suhainn; Subhainn Bog [NG 922 726] represents an area of deep peat and was studied to elucidate the history of peat development on the same island as Subhainn Lochan. An interesting feature of these island sites is the occurrence of Lateglacial sediments, in contrast to their absence in Loch Maree itself. However, these Lateglacial sediments have not been studied in detail.

## Description

From the site in Loch Maree Hotel Bay, Birks (1972b) recovered a 5.42 m long core from below 29 m of water. The sediments comprised 4.67 m of organic muds overlying clays and silts (Figure 6.19). Six radiocarbon dates were obtained (Figure 6.19) and these form an internally consistent series. The pollen record has been divided into five local pollen assemblage zones (Figure 6.19).

## Interpretation

The radiocarbon dates indicate that organic sedimentation began at about 9500 BP. The pollen stratigraphy shows a dominance of *Juniperus communis* with some *Empetrum* and herbs, such as *Rumex acetosa*, in the early Holocene. This was replaced at about 9000 BP by *Betula* and, to a lesser extent, *Corylus*. At the 8300 BP level, small but consistent amounts of *Quercus* and *Ulmus* pollen are found suggesting the local occurrence of these trees, perhaps on the Letterewe side of the loch. The most important feature, however, is the rapid and early expansion of *Pinus sylvestris* at

about 8250 BP. This is one of the earliest occurrences of pine known in Scotland (Birks, 1989). The source of this early arrival is unknown (Kinloch *et al.*, 1986; Birks, 1989). At that time pine was present in southern Ireland and parts of southern and central England. Glacial survival or long-distance seed dispersal are the most plausible hypotheses (Birks, 1989). The pollen record provides strong support for the unique history of the Loch Maree pine populations that has been inferred by Kinloch *et al.* (1986) from biochemical evidence.

After 8000 BP *Pinus sylvestris* formed extensive open woodlands with abundant *Pteridium aquilinum*, other ferns and *Calluna vulgaris*. However, the extent of these began to decline from about 6500 BP, perhaps because of climatic change or soil degradation (Birks, 1972b). At about this time *Alnus* expanded, presumably in wet areas by streams and rivers and around the loch. As elsewhere in north-west Scotland (Birks, 1977, 1988; Bennett, 1984; Gear and Huntley, 1991), *Pinus* underwent a major decline in the Loch Maree area at about 4250–4000 BP, probably because of increased oceanicity and moisture, which restricted its survival and regeneration to well-drained, steep, blocky slopes where blanket bog could not develop. The pollen record suggests that the present mosaic of pine, birch and oak woods, all spatially and ecologically separated today, of blanket bogs and moorland, and of alder stands had largely developed by about 4000 BP. Indeed there have been virtually no regional pollen-compositional changes in the last 4000 years. Anthropogenic impact appears to have been low in the area throughout the last 5000 years.

The Eilean Dubh na Sroine profile (4.28 m of sediment, seven radiocarbon dates) shows an early Holocene expansion of *Betula* and *Corylus* at about 9000 BP, along with *Pinus sylvestris*. This is the earliest known occurrence of pine in Scotland (Birks, 1989) and is about 800 years earlier than suggested by the Loch Maree regional profile. Almost no change occurred on the island throughout the Holocene, except for the arrival and expansion of *Alnus glutinosa* at about 6500 BP and the arrival of *Myrica gale* at about 3800 BP and its expansion at 3200 BP. Alder was never important on the island, whereas *Myrica gale* became locally prominent in damp areas within the pine forests, in soligenous stream-side mires, and in moist areas near the lochan. The vegetation of the island has largely been pine–birch–juniper woodland for over 8000 years.

The sequence from Subhainn Lochan (7.38 m of sediment, nine radiocarbon dates) shows a later arrival and expansion of *Pinus* at about 7800 BP. The early and middle Holocene vegetation was *Betula* woodland with some *Corylus*, *Juniperus*, and *Salix*. *Pinus* was never dominant, and it declined to modern values at about 4000 BP, paralleled by an expansion of *Myrica gale* at 3800 BP, suggesting the spread of blanket and soligenous mires at this time.

The Subhainn Bog profile (6.25 m of sediment, nine radiocarbon dates) shows that the site was originally a shallow lake and that *Sphagnum* peat began to form there at about 8000 BP. Early Holocene vegetation consisted of open birch–hazel–willow communities. Pine expanded at about 8000 BP and was locally important until 3800 BP, when it declined markedly. At this time plants of wet blanket-mires expanded (for example *Menyanthes trifoliata*, *Rhynchospora alba*, *Narthecium ossifragum*), suggesting an increase in surface wetness of the bog. As pine was growing on the bog until this time, this profile provides direct evidence that increased waterlogging was the cause of the decline in pine. Interestingly, at this time *Myrica gale* expanded on the gentle slopes around Subhainn Lochan, presumably in response to regional hydrological changes. However, on Subhainn Bog *Myrica* did not expand until about 1700 BP.

The available pollen data from Loch Maree and its islands provide a detailed picture of the regional and local history of the pinewoods in the area. Pine grew on a range of soil types, including acid mor humus and peats overlying lake sediments. Over the region as a whole, pine declined at about 4250 BP with the onset of a steady rise in *Calluna*, grasses and sedges, suggesting the regional spread of blanket-bog and soligenous mires. At a local scale there has been considerable variation in the onset of peat development depending on local topography and hydrological thresholds. The Loch Maree area provides strong support for the hypotheses that blanket-bog development was an entirely natural process in this extreme oceanic environment and that the widespread and spectacular pine decline of north-west Scotland was a response to a major climatic change at about 4250–4000 BP (Birks, 1988; Gear and Huntley, 1991).

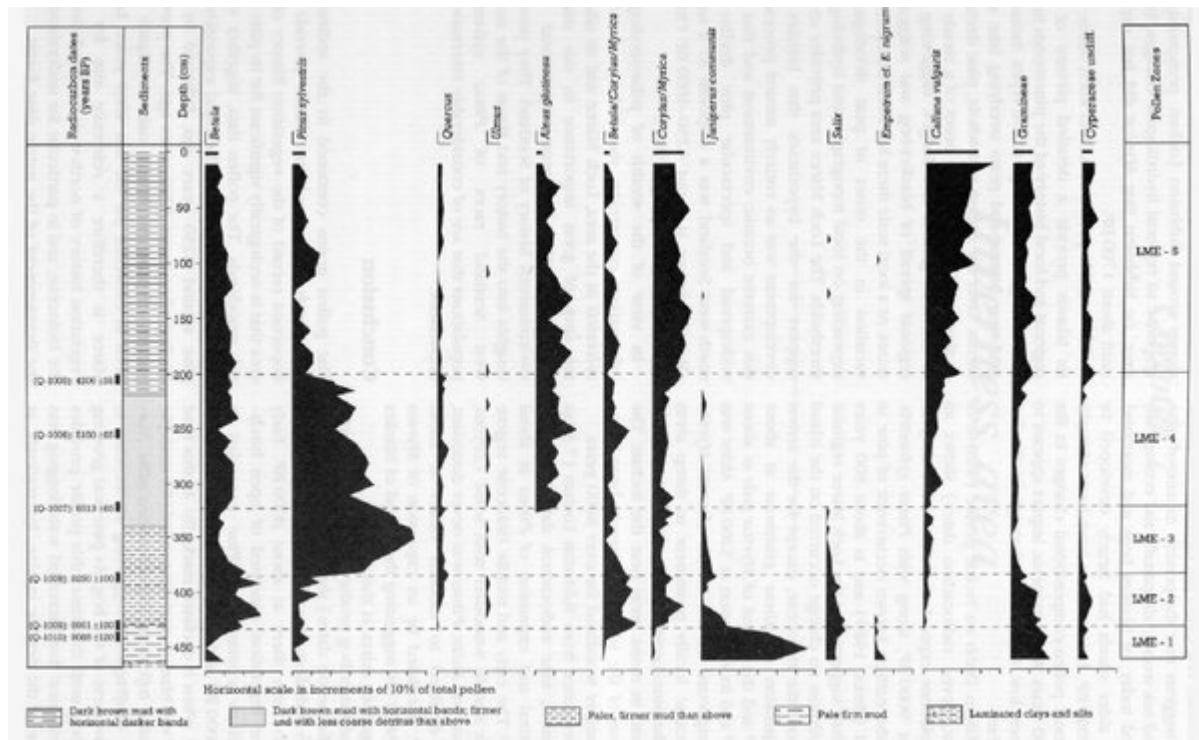
In view of the wealth of palaeoecological information concerning the history of *Pinus sylvestris* in the area, Loch Maree and its islands are sites of great importance in our understanding of the Holocene vegetational and environmental history of Scotland. They provide insights into the history and status of the northwest Scotland races of *Pinus sylvestris*,

populations that are of considerable international importance.

## Conclusion

The pollen grains contained in the sediments from Loch Maree and its islands provide an important record of the vegetation history of an area that is ecologically significant for its pine and oak woodlands. The pollen data, together with radiocarbon dating, show the rapid expansion of pine around 8250 years ago, followed by its decline after about 4250 years ago. The present pattern of pine, birch and oak woodlands has been in existence for the last 4000 years. Loch Maree is therefore a reference site for the vegetation history of north-west Scotland during the Holocene, and in particular for understanding the development of the native pine forest.

## References



(Figure 6.19) Loch Maree: relative pollen diagram, showing selected taxa as percentages of total pollen (from Birks, 1972b).