1. The nature and development of the forests since the last ice age

Many tourists travelling through the Scottish landscape regard much of the treeless scenery as natural and do not expect to see extensive forests. The problem is that extensive forests grow at the same latitudes in North America and Scandinavia which suggests that the Scottish climate should be suitable for extensive tree growth. This chapter investigates the question why large parts of Scotland are not densely forested at present by putting this in the long historical context of the past 12,000 years. The first part of the chapter considers the physical environment of Scotland and how this impacts on the potential and distribution of tree growth. The second half of the chapter discusses the long history of forest decline caused by a combination of natural and human influences from the last glaciation up to the late 18th century. It looks at evidence for the abuse, use and careful management of the forests throughout the ages, which we need to understand the perceptions and practices that shaped Scottish forestry and forest policy during the 19th and the 20th century.

The physical environment

The main physical factors determining the suitability of an environment for tree growth are aspect and altitude, climate, in particular wind exposure, and soil quality and the water balance. Most of the high ground in the United Kingdom is found in Scotland, and to a lesser extent in northern England and Wales. The highest mountains are situated in the west of Scotland and on the Cairngorm plateau of the Central Highlands. The relief of Scottish Highlands north and west of the Highland line\(^1\) tilts roughly from the north-west to the south-east, with the highest mountains in the north and west and rolling agricultural lands in the south and east. The Southern uplands of Scotland is an area characterised by a series of hills, many over 300 metres, with hills over 800 metres in the southwest, divided by broad valleys.

Scotland has a maritime or oceanic climate that is cool, with a low annual temperature range and high rainfall. This has a strong influence on the altitude at which trees will grow. The potential maximum altitudinal tree line in Scotland varies across the country and it is estimated that the tree line at it highest is somewhere between 620 and 650 metres in the Cairngorms. The tree line declines

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\(^1\) The Highland line is the boundary between the highland and lowland Scotland and follows roughly the geological feature of the Highland Boundary Fault.
to about 520 metres in the northwest Highlands, 460 metres in the Western isles and is close to sea level in the most exposed areas of the northwest coast. In southwest Scotland the tree line is approximately at 460 metres but is estimated to reach 800 metres in parts of Southern Scotland. These are estimates of the upper limits of possible tree growth in Scotland but in practice most woodlands and plantations are found below 500 metres. Put in a global perspective, this in an anomalously low tree line and it is thought to be due to the harsh climate experienced in the Scottish uplands in combination with the growth of blanket peat and grazing pressures.²

In all regions of Scotland wind exposure is a limiting factor for both agriculture and forestry.³ Because of the dominance of westerly winds the west coast is most vulnerable to strong winds but high slopes and mountain summits are also windy places. The orientation of valleys is another important factor with regard to wind exposure. Valleys with a west–east orientation are more vulnerable to wind exposure than valleys with a north–south orientation. It is therefore harder to predict which parts of the country are most vulnerable to wind exposure but we can make some generalisations. The west coast and the highest mountains are more vulnerable to high wind exposure that limits tree growth than the more sheltered eastern parts of the country, and inland areas are also less susceptible to strong winds than the coastal zone.⁴

Scotland’s relief distribution is also reflected in the annual rainfall pattern with the highest annual means in the west, and declining towards the east (Map 1.1). This is caused by the fact that the mountains in the west catch much of the rain that comes with the prevailing westerly winds from the Atlantic.⁵ It is no coincidence that the general soil distribution in Scotland roughly follows the relief and rainfall pattern (Maps 1.2 and 1.3). Four dominant soil types can be identified in Scotland: podzols, gleys, brown earth and peaty soils.

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3 Wind exposure is not necessarily a limiting factor to natural woodland. Dwarfism is a successful adaptation to wind stress. An example of this is dwarf birch and willow growing in the Highlands.
Podzols are usually associated with the wetter types of heath and with moorland vegetation. They are characteristic of any location where aerobic conditions prevail and water can percolate freely through the upper part of the soil profile. Because of the high rainfall and low evaporation levels in these areas, iron, aluminium and other minerals are washed down from the topsoil into the deeper soil layers, where the minerals precipitate to form clearly visible and very hard iron ‘pan’ which in turn prevents proper drainage. This is the so called iron-humus podzol, but the typical podzol found in more elevated and wetter locations is the iron podzol, in which the layer of organic material thickens until true peat forms, creating peaty podzols. Peaty podzols are widespread throughout the Highlands and Southern Uplands and found at all elevations from sea level to the summit of the Cairngorms. Under natural circumstances this soil is not of much value to forestry due to poor drainage and the iron pan that prevents root systems from developing properly. Podzols are generally of low fertility and are physically limiting soils for productive use.6

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Map 1.2: Relief distribution in Scotland.


Map 1.3: Generalised soil types of Scotland.

Source: Goudie and Brunsden, *The Environment of the British Isles*, p. 149, with permission from the authors.
1. The nature and development of the forests since the last ice age

Gleys are widespread throughout the east coast, the Central Belt and the Scottish Borders and are found at all elevations. Gley soils develop under conditions of intermittent or permanent waterlogging. They result from the absence or very low levels of oxygen when iron compounds are changed chemically from their normal red and brown colours, to grey or green. Gleys are often confined to low lying sites or in depressions with poor drainage or where the soil is dense and water is prevented from moving through it. Under natural conditions gley soils support hygrophilous plant species and when cultivated they are used for rough grazing and forestry.  

The brown forest soils are amongst the most fertile soils to be found in Scotland and used extensively for agriculture. Under natural conditions brown forest soils were formed on permeable parent materials under broadleaf forest conditions which promote the rapid decomposition of plant material and consequent recycling of plant nutrients. Brown forest soils are mainly restricted to the warmer, drier climate of eastern areas around Aberdeen, in Fife and the Lothians and parts of southwest Scotland.

The soils of the Western and Northern Isles, the northern and central Highlands and elevated areas of southwest Scotland are influenced to a large extent by a moist and cool climate. The low temperatures and waterlogged conditions cause organic material to decompose slowly so that it accumulates in layers up to several metres thick to form peat. Many upland and low waterlogged areas of the West Highlands and northern Scotland are covered with blanket peat, which under semi-natural conditions provides grazing of low quality but has no other modern agricultural value, including forestry. In the central Highlands and Southwest Scotland the same conditions exist on some elevated slopes and high plateaus.

Historically the formation of blanket peat is regarded as one of the most important landscape transformations during the Holocene in Scotland. Peat layers all over the Highlands contain the remains of tree trunks and stumps that testify

8 Brown earth is called brown forest soil in Scotland.
10 Until the 18th century the peatland supported a diverse economy, based on exploitation of the plant and scrub species that will grow there, and for the wildlife (birds’ eggs, wildfowling etc).
12 The Holocene is the present geological epoch that started at the end of the last ice age 10,000 years ago and that continues to the present day.
to this transformation. These tree remains indicate that large parts of Scotland were once covered with forests where there are no forests today. Until recently it was thought that the remains of these trees were the victim of invaders like the Romans, Vikings and later the English who felled these forests for timber, charcoal or for military reasons. It gave rise to the ideas that Scotland was once entirely covered with a pine and oak dominated Great Wood of Caledon that fell victim to invaders and that the forests were ruthlessly exploited for timber, charcoal production or burnt and cut down for military reasons. But pollen analysis and carbon dating has shown that the remains of trees found in the peat were not felled in historical times but are over 4000 years old. These trees, mainly Scots pine (*Pinus sylvestris*), were the victims of one of the most dramatic climatic and environmental changes that Scotland experienced since the last ice age, as will be explored in the next section.

**Figure 1.1**: Four-thousand-year-old tree remains at Loch an Alltan Fheàrna, Sutherland, northern Scotland.

Photo: Chris Zierleyn.

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Development and distribution of vegetation

The history of Scotland’s modern forests began when the final phase of the last ice age, the so-called Loch Lomond Stadial, came to an abrupt end about 11,400 years ago (9400 BC). By the end of the last ice age most of Britain was a tundra landscape, an almost treeless vegetation type characteristic of the Arctic region. This landscape looked very much like that found in present day Lapland, Alaska and northern Siberia, with many herbs, low shrubs such as willow, dwarf birch and juniper. Over the course of just a few decades the climate warmed to temperatures probably greater than today, making Scotland suitable for the growth of forests of trees. When the temperature rose, trees such as hazel, birch, willow, pine and aspen relatively quickly replaced the tundra vegetation. Once established, the newly formed woodlands changed rapidly in appearance when the hardy pioneering species were joined by late succession species, migrating more slowly, lagging behind the climate change. These trees spread from the European continent, which was still joined to the British Isles by a land bridge, and through southern England. The process was gradual and deciduous trees such as oak, elm and alder arrived in Scotland only between 8,500 and 8,000 years ago (6500 and 6000 BC). Scots pine, the only conifer species that established itself in Britain after the last ice age, first appeared, surprisingly, in the northwest of Scotland around 9,000 years ago (7000 BC). It probably came from isolated populations in a now drowned ice-free area to the west of mainland Scotland. From there it spread across the Highlands as far South as the northern tip of Loch Lomond and Rannoch Moor. The pinewoods of South-west Scotland probably originated from populations invading from Ireland.

The Scottish forests reached their fullest extent around 6,000 years ago (4000 BC) during the so-called Mid-Holocene Climate Optimum. Four broad woodland categories can be distinguished, which roughly follow the spatial distribution of modern natural woodland types. A mix of birch and hazel shrubs dominated the Outer Hebrides, the Northern Isles and Caithness and Sutherland. Woodlands in the Highlands were predominantly made up of pine and birch while the coastal areas of the west and east were mainly composed of a broadleaf mix of birch, hazel and oak. The southern part of Scotland was mainly composed of oak, hazel and elm dominated woodlands that covered all of the lowlands and much of the uplands.

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15 Throughout this chapter we use the Before Christ (BC) dating convention used by many historians. This does not refer to radiocarbon years but to calibrated calendar years.
17 Smout et al., The Native Woodlands, pp. 25-26; J.H. Dickson, ‘Scottish Woodlands’, p. 73.
18 Richard Tipping, ‘Form and Fate’, pp. 11-12.
This characterisation of the type of woodland and its spatial distribution was not as uniform as the descriptions suggest. The composition of forests is never uniform, and is made up of a varying mix of species and undergrowth and changes constantly over time due to climate variations and the fact that plant communities are dynamic. Huge variations also exist over short distances due to variations in topography, microclimate and soil quality. Nor should we think of these ancient forests as a closed canopy of trees covering Scotland from north to south and east to west. The precise extent of the woodland cover is difficult to estimate but an educated guess based on palynological investigations suggest that at least 60 per cent of the Scottish land mass was under some form of forest vegetation.19

1. The nature and development of the forests since the last ice age

<table>
<thead>
<tr>
<th>Cultural period</th>
<th>Year/period</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mesolithic 8000–4000 BC</td>
<td>9400 BC</td>
<td>End of last ice age</td>
</tr>
<tr>
<td></td>
<td>8000–4000 BC</td>
<td>Humans become active agents in the Scottish environment using crude land management techniques such as fire.</td>
</tr>
<tr>
<td></td>
<td>7000 BC</td>
<td>Scots Pine established.</td>
</tr>
<tr>
<td></td>
<td>6500–6000 BC</td>
<td>Arrival of deciduous trees such as oak, elm and alder.</td>
</tr>
<tr>
<td>Neolithic 4000–2500 BC</td>
<td>4000 BC</td>
<td>Woodland clearance for agriculture starting in the Western Isles and North of Scotland.</td>
</tr>
<tr>
<td></td>
<td>2800 BC</td>
<td>Onset of woodland clearance for agriculture in the southern half of Scotland.</td>
</tr>
<tr>
<td></td>
<td>3000–2400 BC</td>
<td>Climate cooling and collapse pine forests.</td>
</tr>
<tr>
<td>Bronze Age 2500–700 BC</td>
<td>ca. 2200 BC</td>
<td>Woodland clearings become larger and more permanent.</td>
</tr>
<tr>
<td>Iron Age 700 BC–400 AD</td>
<td>Romans</td>
<td>Intensification of agricultural activity and further woodland clearing.</td>
</tr>
<tr>
<td></td>
<td>80–400 AD</td>
<td>Arrival of Romans in Scotland. About half of the original woodland vegetation had been cleared. Scotland under 25% wood cover.</td>
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</tbody>
</table>

Table 1.1: Major events in the history of Scotland’s woodlands during prehistory.

Source: Author’s research.

The maximum extent was possibly reached during a warmer and drier period between 5,200 and 5,000 years ago (3200–3000 BC) when Scots pine advanced from its heartland and colonised the then dryer peat bogs in the north and west. Between 3000 and 2400 BC the climate turned wetter and cooler and in response the water table started to rise, drowning the root systems of the pines. As a result populations of pine trees collapsed all across Scotland, leaving large parts of country without big trees. This was a climate-induced deforestation that happened just at the same time that agriculture began in Scotland. Some have suggested that the coming of agriculture, animal grazing in particular, contributed to the formation of blanket peat and the demise of the pine forests. This view is now much in doubt and it is thought that when early farming communities settled in the uplands from the later Neolithic period (app. 2000–3000 BC) many parts of the uplands were already buried under a blanket of peat in much the same way that they appear today.

Prehistoric deforestation

Together with the forests and the varied animal species associated with it was another arrival that was to have a lasting impact on Scotland’s forests: *Homo sapiens*. When human settlers moved into Scotland after the last glaciation they arrived in a birch-hazel woodland environment that was in many places gradually replaced with a more diverse and richer forest environment. The glaciers left behind a landscape of lochs and rivers, of hill-land, glen and mountain in which a diverse and mixed vegetation developed. This created rich resources and increased opportunities for humans to exploit them, including hunting, food gathering, and utilisation of stone and wood for tools and to build shelter. During this period of post-glacial settlement, called the Mesolithic (Middle Stone Age, 8000 - 4400 BC), humans became significant active agents in the environment, initiating processes of environmental change. Activities such as hunting, fishing and the first attempts to control watercourses and wild life disturbed the balance of vegetation. Based on his work in the North York Moors, geographer Ian Simmons has suggested that Mesolithic peoples altered their landscape through fire. This was a distinctive technique that marked them out from their predecessors and by doing so they created a more predictable environment for themselves.\(^{22}\)

Burning grasses, heather and other vegetation rejuvenated environments over a period of 5-6 years, attracting game, especially if open areas were maintained near water sources. Fire also promotes the spread of under storey plants with edible fruits or berries. Even today, gorse, heather and the stubble of arable fields are burned as a means of land management in Scotland. However, it is taught that regular burning is a also a contributory factor in the creation of degraded upland environments with impoverished vegetation diversity, decreased forest cover and propensity to water-logging. In short, Mesolithic hunter-gatherers were very likely capable of altering and manipulating entire ecosystems. It was, however, a gradual process of a clearing here and burning there, but the repeated nature of these activities and a rising population resulted in a patchwork of open spaces and forest some 4,000-6,000 years ago (2000-4000 BC). This mosaic landscape is something that Simmons views as ‘the most important environmental legacy of the British Mesolithic peoples’.\(^{23}\)

In Scotland there is not much evidence that this kind of land management was practiced. However, it is not inconceivable that Mesolithic peoples used fire

\(^{22}\) James Innes, Jeffrey Blackford and Ian Simmons, ‘Woodland Disturbance and Possible Land-use Regimes During the Late Mesolithic in the English Uplands: Pollen, Charcoal and Non-pollen Palynomorph Evidence from Bluewath Beck, North York Moors, UK’, *Vegetation History and Archaeobotany*, 19 (2010) 5-6, 439-452.

\(^{23}\) I.G. Simmons, *An environmental History of Great Britain from 10,000 Years Ago to the Present* (Edinburgh: Edinburgh University Press, 2000), pp. 43, 45.
to manipulate their environments, in particular in the Southern Uplands of Scotland, which is in many ways very similar to environments found in the north of England. But it must be kept in mind that distinguishing between natural and human agency in vegetation changes is difficult. It has been suggested that hunter-gatherer penetration of Scotland’s inland and upland areas away from the major river valleys is likely to have been too ephemeral to have caused detectable changes to the vegetation cover during the Mesolithic period.  

With the dawn of the Neolithic period (c.4000 BC), which signals the arrival of agriculture, evidence of forest clearance becomes more widespread and less ambiguous. Woodland clearance in the west and on the Western Isles started early in the Neolithic between 6,000 and 4,200 years ago (4000 BC and 2200 BC), depending on the location. On the Isle of Arran forest clearance started around 2600 BC and parts of the Isle of Skye were treeless by about 600 BC. The Orkney Isles off the north coast of Scotland were entirely cleared by 3,000 years ago and the woodlands never recovered.

The west and north of Scotland seems to have been affected by woodland decline earlier than the more southern and eastern parts of Scotland. That was probably due to the fact that there was less forest vegetation to start with due to climate constraints. We must also keep in mind that this part of the country is very sensitive to climate fluctuations and that woodland clearance is almost certainly the result of an interaction of human and natural processes.

In the eastern Highlands Tipping has suggested that ‘low-intensity grazing pressures sustained over long periods of time’ effectively led to a serious decline of the woodlands long before the Romans arrived. In the southern half of Scotland the onset of clearance for agriculture started sometime around 4,800 years ago (2800 BC) when semi-permanent areas for pasture and crops were established. These clearings appear to have been small and were maintained for a few decades or perhaps a century. Later, in the early Bronze Age, around 4,200 years ago (2200 BC), clearings became more permanent and persisted for hundreds of years. The Iron Age saw an intensification of agricultural activity from about 500 BC in the Southern uplands. This intensification coincided with a period of increased woodland clearance in other regions of Scotland.

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25 Tipping, Form and Fate, p. 24.
26 Ibid., p. 30.
27 Smout et al., The Native Woodlands, pp. 30-31; Tipping, Form and Fate, p. 33.
### Table 1.2: Major events in the history of Scotland’s woodlands during the historic period.

Source: Author’s research.

By the time the Romans entered what is now Scotland in 80 AD, it is estimated that about half of the original woodland vegetation had been cleared. This means that about 25 per cent of the land was under some form of woodland cover, but there were large geographical differences.\(^28\) The Highlands were much more wooded than the Lowlands, the Western and Northern Isles and the Southern uplands. The furthest extent of the Roman occupation closely followed the Highland Boundary Fault and included much of the arable district in southern and central Scotland that is classified today as first class agricultural land.\(^29\) Here the Romans entered a largely cleared agricultural landscape while

\(^28\) Smout *et al.*, *The Native Woodlands*, p. 32

the Highlands were much more wooded than they are at present. The latter was not of much interest to the Romans because it did not produce the grain that they needed in order to feed the troops. Over all the direct occupation of the southern part of Scotland by the Romans did not last more than 40 years, spread out over three periods between the first and third centuries AD. But the empire successfully dominated the country beyond the fixed frontiers for most of this time, employing raids, bribery and the establishment of client states. The extent of the indirect Roman pressures on the woodlands is unknown but it is very likely that they bought wood from the beyond the established borders from areas under their influence.

The direct impact of Roman presence on the woodlands appears to have been limited to the close vicinity of their forts and other military installations, which required large quantities of wood. 30 For example, it is thought that the legionary fortress at Inchtuthil near Dunkeld required over 100 hectares of wood for its walling and other structures. Regrowth would have readily occurred after the Romans had left, provided that grazing pressures were low. 31

The Medieval period to the 19th century

By the early Middle Ages there are indications that the amount of woodland on the east coast in Fife and further north in Aberdeenshire increased. It has been suggested that these localised increases are related to the Roman invasion and that local populations were either wiped out or compelled to abandon the area. However, in other parts of the country, for example in the Borders and the western Cheviots there are indications that from the early 5th century grassland increased in a partly wooded landscape, and has persisted ever since due to grazing pressures. 32

By the end of the first millennium most wildwood had gone, except from the remoter parts of the Highlands. Forest cover had shrunk to perhaps as low as 20 per cent of the Scottish land surface. With the shrinking forests, habitats of many animals came under pressure and large mammals such as aurochs, beaver, boar or red deer were disappearing fast. Most remaining woodlands were small and probably intensively managed as coppice. Archaeological evidence suggests

31 Smout et al., *The Native Woodlands*, p. 32.
32 Ibid., pp. 34-35.
that most rural houses and barns as well as town houses were constructed of turf, wattle, and thatch using wooden frames obtained from readily accessible coppice woods.\textsuperscript{33}

On the other hand more prestigious buildings such as churches, castles and the houses of richer merchants in towns contained large oak and pine timbers. During the 12th century many nascent towns were granted burgh status and this was followed by a flurry of building activity that may have resulted from the prosperity that their new status brought. In many of these new buildings the burgesses used locally sourced oak from mature woodlands which suggests that there was not yet a severe timber shortage in Scotland at that time. However, this is deceptive because timber for such high status sites was often sourced from protected reserves to which the owners had access, either through ownership or royal grants.\textsuperscript{34} These wood resources were limited and not accessible to most of the population and as a result major problems of supply already existed before 1200. Excavated evidence from Perth shows a gradual increase in the use of scrub and hedgerow species in domestic buildings during the 13th century. This trend suggests that local sources of structural timber were increasingly exhausted due to overexploitation.\textsuperscript{35} In response to these timber shortages the import of fuel-wood and building timber from outside the burgh’s hinterland was encouraged by special protections granted by King William I (1165-1214) in 1205 to anyone bringing ‘\textit{ligna vel materiem}’ (wood and timber) to Perth and that prohibited anyone to trouble people bringing those commodities to the burgh.\textsuperscript{36}

Further evidence of a lack of wood in eastern Scotland is fact that wood was being moved over long distances. In 1178 King William failed to grant Arbroath Abbey any nearby woodland but granted instead Trustach Wood which is nearly 55 kilometres away near Banchory on Deeside as its closest source of building-timber.\textsuperscript{37} The same story was repeated when Earl David, brother of King William, founded Lindores Abbey in 1195, and no local timber resources were granted. Instead the monks received grants for access to building-timber and firewood 30 kilometres to the west in Strathearn. In addition they were granted the right to collect ‘dry’ or ‘dead’ wood for fuel and broom, a hundred loads of hazel rods for making sleds, and one hundred long alder rods for

\textsuperscript{37} Cosmo Innes and Patrick Chalmers (eds.), \textit{Liber S. Thome De Aberbrothoc; Registrorum Abbacie De Aberbrothoc} (Edinburgh: Bannatyne Club, 1848), nos. 65, 66, pp. 43-44.
making hoops, in the woods of ‘Tulyhen’ in Glen Garry in northern Atholl, 70 kilometres north-west of the abbey. In the 1450s, Perth was able to get some wood for constructing carts from Birnam Wood 25 kilometres to the north on the bishop of Dunkeld’s land, but by 1500 the bishop himself had no good timber source closer to Dunkeld than the Black Wood of Rannoch almost 50 kilometres away in the central Highlands.

Map 1.5: Distances to wood resources of monasteries and towns in eastern Scotland during the Middle Ages (distances in kilometres).

Source: Author’s research.

In the west of Scotland there is also evidence of the availability of wood resources throughout this period in contrast to eastern and central parts of Scotland. It is known that there was sufficient supply of timber for the construction of Highland galleys for the local chiefs and in particular the Lords of the Isles. The maintenance of the fleet on which their power was based presupposes the availability of mature local woodland resources.

38 J. Dowden, (ed.), The Chartulary of the Abbey of Lindores 1195-1479 (Edinburgh: Scottish History Society, 1903), XXIV, pp. 27-28; LXXIII, p. 79; CXI & CXII, pp. 133-137.
40 Smout et al., The Native Woodlands, pp. 41-42.
Despite the existence of these significant areas of oak and pine woodlands in the Highlands and the west, these were beyond the effective reach of most consumers in the lowlands, who became increasingly dependent on imports of foreign timber. Over much of the Lowlands large timber became an increasingly scarce resource during the course of the 14th and 15th centuries. Few buildings constructed after about 1450 contain oak identifiable as native and increasingly timber beams for the construction of churches and other large buildings were imported. From at least the 1330s Scottish burghs on the East Coast were increasingly obtaining their timber from the Baltic and so-called Estland Boards were being imported from Poland-Lithuania into Berwick and Dundee.41

The shortage of large construction timber affected royal construction projects most, such as the castle and palace at Stirling, where timber needs were met through imports. Ordinary people were much less affected by the lack of large timber because their needs were met with the products of the native woods which were managed through the sustainable practices of coppicing and pollarding. The local farmer and cottar only needed small wood for construction, tool making and fuel. The use of the woodlands for wood pasture, providing shelter and grazing for domestic stock was also extremely widespread. In some sense there was not a general shortage of wood, but just a lack of locally produced large straight timbers necessary for major construction projects or shipbuilding.42

It is therefore not surprising that various attempts were made by the crown to improve timber production in Scotland by protecting the forests. For example, in 1503 the Scottish parliament exclaimed that ‘the woods of Scotland are utterly destroyed’43 and passed two Acts to deal with the problem. Felling and burning were outlawed and in the second Act landowners were instructed to plant at least one acre (0.4 hectares) ‘where there are no large woods or forests’.44 The twin measures of halting deforestation and encouraging reforestation were repeated in legislation in the next two centuries reflecting concern and problems familiar across Europe. In Scotland, as elsewhere, monarchs and their agents were nervous about being unable to get their hands on the timber supplies needed to build castles and forts and maintain navies, which were seen as essential for the national economy and security. Further measures followed at intervals, but none was successful in reversing the long history of forest contraction. The
1. The nature and development of the forests since the last ice age

...problem lay in enforcement and in translating the aspiration of forest protection into action on the ground because local interests in traditional forest use made the enforcement of forest laws by local lairds almost impossible.\(^\text{45}\)

**The commercial exploitation of native woodlands**

During the 17th and 18th centuries there was an intensification of exploitation of the native woodlands. This section will briefly discuss the management and exploitation of the oakwoods for charcoal production and leather tanning and the management of the native pinewoods. The chapter concludes with an assessment of the extent of the woodlands and forests in Scotland by the end of the 19th century.

The commercial exploitation of the oakwoods of western Scotland started in the early 17th century and was fuelled by an influx of external capital from the Lowlands, England and Ireland. In 1611, Sir George Hay from Perthshire, in partnership with capitalists from the Sussex Weald, were granted the right to construct iron works at Loch Maree, exploiting the local woods as a source of charcoal. This operation was short-lived and ceased in 1630 due to exhaustion of the local wood resources.\(^\text{46}\)

\(^{45}\) Mather, ‘Forest Transition Theory’, p. 84.

It took over a century before the oakwoods again attracted industrial scale iron making when a sophisticated blast furnace and forge was established at Glen Kinglass in 1725. This furnace operated only for a dozen years before it was closed down due to the commercial incompetence of its operators. This was a taste of things to come and in 1753 Richard Ford and Company of Furness in Lancashire opened the Lorn furnace at Bonawe on Loch Etive. A couple of years later in 1755 Craleckan furnace on Loch Fyne was established by Henry Kendal and Richard Latham and partners, also of Furness. Over time six blast furnaces operated in western Scotland, all of which had been attracted by a cheap and abundant supply of charcoal. The amount of wood needed to sustain the iron works was quite significant. Lorn furnace at Bonawe produced 700 tonnes of iron by the end of the 18th century and it has been estimated that at least 8,000-10,000 hectares of oakwood per annum were needed to supply the furnace with fuel. Wood was sourced from a remarkably wide area of the west coast and Islands; some woods were more than 60 kilometres away (Map 1.6).47

Under commercial pressures mixed semi-natural woods were turned into highly profitable oak coppice monocultures. During the 18th century the main estates in the region were organising woodland into hags or felling coups, cropped on a 20-30-year rolling programme. Each hagg was fenced to keep cattle and sheep out, and the ‘spring’ from each coppice stool was reduced to a smaller number of shoots than would occur naturally, to give stronger growth. From an ecological point of view the oakwoods were artificially kept in a state of immaturity and structural uniformity and the later stages of stand development were eliminated. This management regime lasted through into the 1800s and played an important role in the survival of the Atlantic oakwoods.48

By the early 1800s iron making on the west coast was in decline and Craleckan blast furnace closed in 1813 while Bonawe continued at a lower level of production until 1876. Notwithstanding, this period is the high water mark of coppice management in the Atlantic oakwoods of western Scotland, fuelled by a demand for tanning bark by a growing shoe and leather industry. Landowners quickly switched to tanbark production because it was usually worth twice the value of charcoal in a coppice rotation. As a result many landowners considered a combination of tanbark and spoke wood (used for wheels) sufficient justification for managing their woods regardless of the demands of the iron industry. But this was not to last and after the 1860s it became clear that traditional coppice management would no longer be profitable. This was caused by foreign competition and the invention of cheaper chemical substitutes for oakbark tannin. By the beginning of the 20th century the commercial exploitation of the oakwoods of Western Scotland had all but ceased.49

During the 17th and 18th centuries interest in the commercial use of the native pinewoods of the Highlands also increased and wood from young native pine trees was increasingly used in buildings. This coincided with the creation of new plantations by Scottish landowners for profit and ornament. At the same time, the native pinewoods of the more remote parts of the Highlands were being exploited by outside speculators of which the York Building Company is the best known. One of the features of this activity appears to be the high rate of business failure, generally before much sustained felling had taken place. For example, the York Building Company went out of business before any substantial felling had taken place.\(^{50}\) The company had purchased woodlands in the Cairngorm Mountains and as a result of its failure the pinewoods survived

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\(^{50}\) Smout, ‘The Pinewoods and Human Use’, p. 344.
1. The nature and development of the forests since the last ice age

into the 20th century. Note that the failure of the York Building Company had little to do with the timber trade but the end result was good for the forests they had purchased.

In the first half of the 19th century, the impact of commercial exploitation of the native pinewoods increased when local lairds took the management of their estates over from outside speculators in order to increase the revenue from their estates. There was substantial felling in the native pinewoods of the Highlands driven by high timber prices, particularly during the Napoleonic wars. This episode of felling was partly replenished with the creation of non-native conifer plantations by lairds all over the Highlands, in the latter half of the 18th and early 19th centuries. The most extensive of these plantations were the woods created by the Dukes of Atholl, who planted millions of trees on their estate in Perthshire. However, by 1850 timber prices had dramatically fallen and lairds responded in three ways: most abandoned active forest management altogether and turned to sport (hunting) as the main source of income from their estates. In addition, large areas of land were cleared of old-established settled populations or abandoned to facilitate the introduction of large-scale sheep farming and millions of sheep were introduced in the Highlands, a process that had started in the last quarter of the 18th century. A minority of landowners concentrated on modern forestry plantations of pine and non-native conifer species, which became the core on which the Forestry Commission estate would be built in the 20th century. As a result of these developments, the felling of native semi-natural pines declined dramatically, which allowed natural regeneration of the pine stands where sheep grazing was not too intense.  

What was the extent of the woodlands by the early 19th century? By around 1800, the forest had probably contracted from a historical maximum of 50-60 per cent to as little as nine per cent of the Scottish land area. During the 17th and 18th centuries, the rate of decline may have been checked as better management was established in some of the remaining woods, but in any case it would have slowed as the forest area contracted and was increasingly concentrated in the remoter areas. Increased coppice management of oakwoods for charcoal and tan bark also contributed to the slowing of forest cover decline. There is even evidence that these woodlands expanded during the 18th and 19th centuries and that the survival of the Atlantic oakwoods can be attributed to its commercial management and exploitation. Nevertheless, during the 19th century the area of woodland in Scotland declined even further. Semi-natural woods were partly replaced by plantations but many ancient woods disappeared because of increased grazing pressure caused by the large number of sheep that were introduced in the Highlands during this period. In addition the rising popularity of deer and grouse shooting required an open landscape and

Conquering the Highlands

forestry was abandoned on many estates in favour of sport. As a consequence the woodland cover fell to a historic low of about six per cent by the beginning of the 20th century.\footnote{Smout et al., The Native Woodlands, pp. 67-69.}