

THE LANDSCAPE OF THE SCOTTISH HIGHLANDS AND ISLANDS

A PICTORIAL GUIDE

James Fenton

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Farewell to the mountains high covered with snow,
Farewell to the straths and green valleys below,
Farewell to the forests and wild-hanging woods,
Farewell to the torrents and loud-pouring floods.

My heart's in the Highlands, my heart is not here,
My heart's in the Highlands a-chasing the deer,
A-chasing the wild-deer, and following the roe,
My heart's in the Highlands wherever I go.

'My Heart's in the Highlands', Robert Burns

From the lone shieling of the misty isle
Mountains divide us, and a waste of sea,
Yet still the blood is strong, the heart is Highland,
And we in dreams behold the Hebrides.

Canadian Boat Song, anonymous

Across the moorlands, past the mountains,
O'er the rivers, beside the new streams,
Something tells me that I'm going home.

'Going Home', Runrig
[copyright to be agreed]

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Introduction

The Highlands and Islands of Scotland, the subject of this book, is an area renowned for its scenery. It is land of lochs and glens, a land of dramatic hills and wide-open heather moors, a land of distant, wind-swept islands, a land of red deer and Highland cows; and a land imbued with history: clans, castles, battles, standing stones, tartan, bagpipes. It is perceived as remote, wild land, distant from the populous south.

The cities and towns of Britain, in which most people live, with their surround of rolling hills and fertile farmland, is a very different place from the rocky Highlands and Islands. Indeed, to most visitors, from home or abroad, the Highland and Islands represent an almost alien environment where everything is different.

The aim of this book, therefore, is to explain what people will be seeing as they travel around the area: the book interprets the landscape. There are books containing many excellent aerial photographs of the Scottish landscape, but most people do not see Scotland from the air. This book, in contrast, aims to explain what can be seen when travelling along the roads.

‘Landscape’ is in some ways a difficult concept. It is what we have around us: the shape of the land, what is growing on it, and the structures we see. But what we see is filtered through what we know; for example, if we see the Highlands as A wild, untamed landscape, we appreciate it as wilderness. But if we know that in many areas people were removed from the land to make way for sheep during the notorious ‘Highland Clearances’, we may see the land very differently. There is, in fact, some truth in both these perspectives, but in practice it is very difficult to be fully objective; to prevent our prejudices and opinions from colouring what we see.

This book aims to be as objective as possible, although, inevitably, the author’s view will creep in from time to time. Fundamentally, the book describes and explains what you are seeing. This is an ambitious thing to aim for, because landscapes are infinitely variable. The Highlands and Islands in particular, with their complex geology, and steep climate gradients east to west and north to south, contain a very wide range of landscapes in what, globally at least, is a relatively small area.

The book cannot show all the different landscape types which are present, but hopefully it illustrates enough to demonstrate the full range of the variability. But it does show all the main features of the landscapes

of the area, which should enable you to understand what you are seeing even in locations which are not illustrated.

Note that the book only covers rural locations, and does not include townscapes or industrial buildings. Nor does it cover in detail the geology of the area or the processes which have given rise to the shape of the hills, glens, islands, coasts and rivers – that is, the geomorphology of the region: there are other books which do this. Instead, the book concentrates on what is visible on the surface of the land.

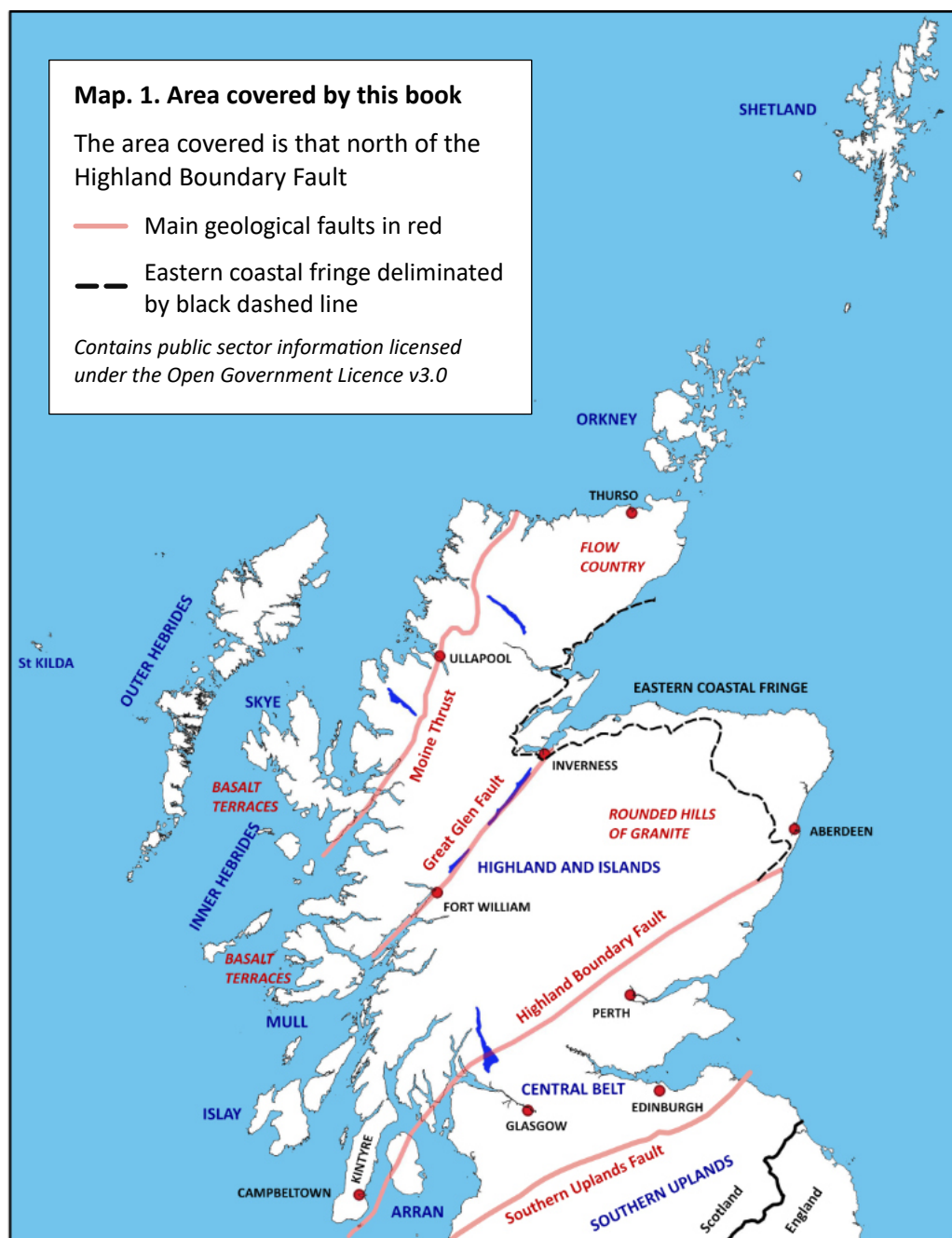
Layout of the book

Every left-hand page has a photograph of a particular landscape, and the right-hand page has smaller photographs of the individual elements or features which make up that landscape. It should be noted that the small pictures are not necessarily taken in the same location as the main picture, but have been chosen to give the best example of a given feature. The location of these smaller pictures is given in the caption, except when a close-up, whereas the location of the larger pictures is given in Map 2.

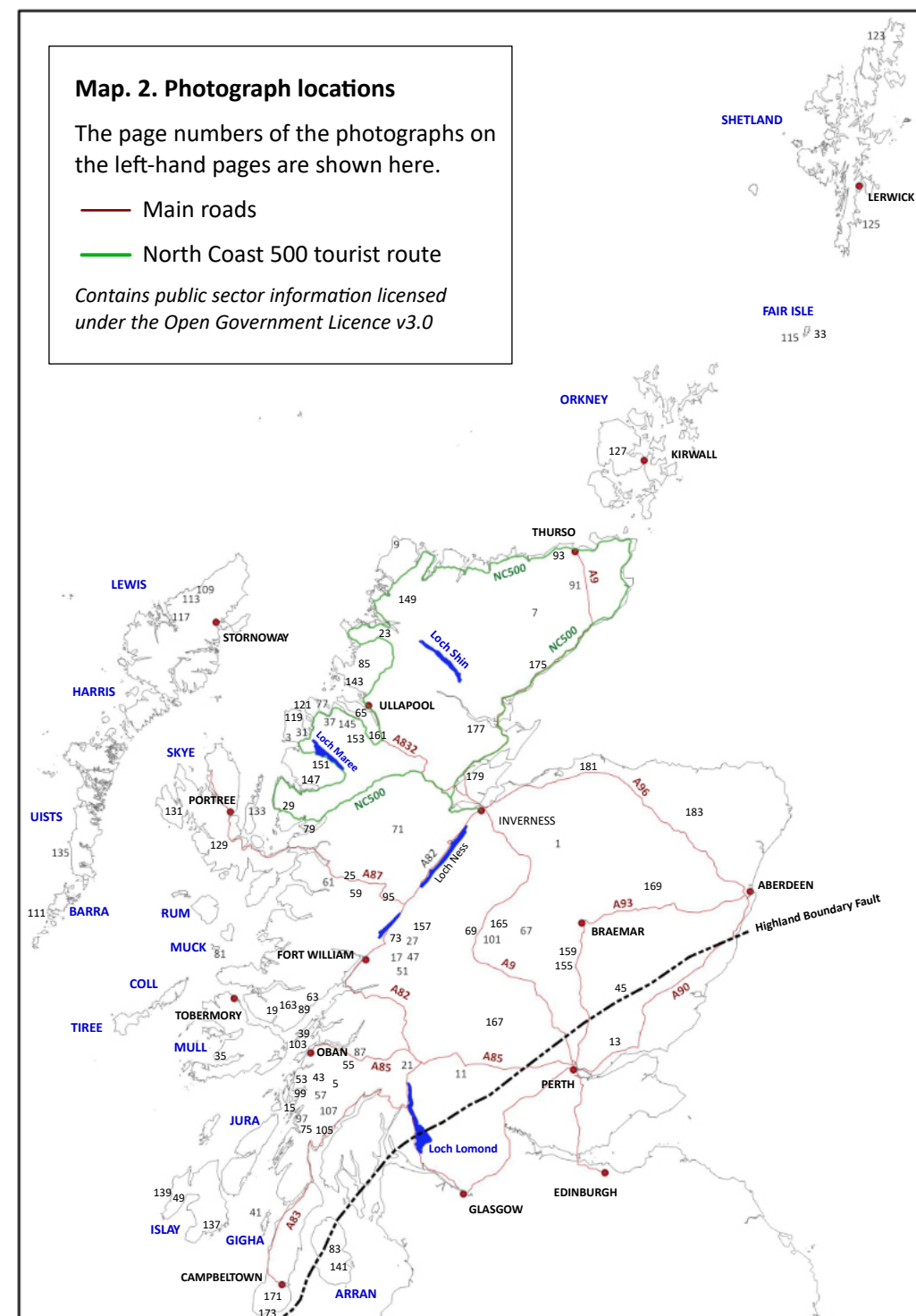
For international visitors, the Latin name is given for plants and animals when first mentioned.

The book begins by describing in detail the features which make up the landscape, starting with natural ones, then goes on to describe human-created features, such as farmland, commercial forests, infrastructure and crofting.

The second half of the book shows island and mainland views which best demonstrate the features identified in the first half. Note that views of some of these areas may already have been included in the first half of the book. A given feature can itself vary from place to place; to illustrate this variability, throughout the book a wide range of locations has been chosen to illustrate the same feature.



Map 1. Scotland can be divided into three broad zones, delimited by geological faults: The Southern Uplands, the lowlands of The Central Belt and The Highlands and Islands, that is the land north of the Highland Boundary Fault as shown on this map. Although the term 'Highlands' is used, it does include lowlands along the east coast – to the right of the dashed line.



Map 2. Only the larger photographs on the left-hand pages are included on this map.

NATURAL HABITATS: MOORLAND

Heather moorland (dry heath)



Dava Moor, Moray

Moorland vegetation dominates the landscape of the Scottish Highlands: this is natural, low-growing vegetation without trees. Although trees are absent or rare, there are still woody plants present, albeit short in stature: these are dwarf shrubs such as heather (ling, *Calluna vulgaris*), bell heather (*Erica cinerea*), cross-leaved heath (*Erica tetralix*), blaeberry (bilberry, *Vaccinium myrtillus*) bog myrtle (sweet gale, *Myrica gale*) and low-growing willows such as the eared-sallow (*Salix aurita*) and the creeping willow (*Salix repens*).

At first glance, all moorland looks much the same, but close scrutiny shows significant variations in the vegetation. This picture shows heather moorland, also known as 'dry heath', where heather is the dominant plant. It is characteristic of the drier Eastern Highlands, where it can cover the whole landscape. But, in places where the soil is infertile and well-drained, heather moorland also occurs the west. It can, in fact, be present in all kinds of moorland, including wet heaths (page 2) and peat bogs (page 7), although in these places it is not normally the dominant plant.

A bird characteristic of heather moorland is the red grouse (*Lagopus scotica*). Such moorland supports other birds such as the hen harrier (*Circus cyaneus*) and various species of breeding waders.

Because of the popularity of the sport of grouse shooting, many of the eastern moorlands are intensively managed for this activity.



A. Heather (Ling)

In sheltered areas where it is not burnt, heather can be tall and leggy and hard to walk through. In contrast, on exposed mountain slopes it be low-growing and prostrate. It is in flower in August, when it gives the hills a purple hue.



B. Bell heather

Bell heather, with its larger bell-shaped flowers, comes into bloom in July. It is not as common as heather, and is found on the driest slopes and cliffs



C. Red grouse

The red grouse is only found amongst heather. Until recently it was seen as sub-species of the European willow grouse (*Lagopus lagopus*), but is now seen as a species in its own right. The heather/red grouse ecosystem is globally rare, only found in the British Isles.



D. Muirburn, Slochd

Many areas of heather moorland are burnt on a rotational basis to benefit the grouse: 'muirburn'. This results in a patchwork of older, deep heather where grouse can shelter and hide, and shorter heather with its more nutritious shoots, ideal for feeding.

NATURAL HABITATS: MOORLAND

Wet heath



Gairloch, Wester Ross

Whereas heather moorland dominates the hills of the Eastern Highlands, particularly on granite and other nutrient-poor soils, it is less common in the west. It still occurs on dry slopes, but wet heath tends to dominate the vegetation of much of West Highlands.

Although heather grows on wet heath, it is not the dominant plant. Instead, another member of the heath family, cross-leaved heath, is the main dwarf shrub present. This comes into flower in June, earlier than heather, and has similar bell-shape flowers to bell heather (page 2), although in this case they are pale pink.

Wet heath is found on soils which do not drain freely, often because they are underlain by an ironpan. This is a layer of solid iron, an 'ironpan' impermeable to water, which has arisen because thousands of years of rainfall have washed the nutrients out of the soil and the iron has precipitated out at depth. Hence the soils are often waterlogged, with the plants growing in a thick layer of humus above the ironpan, or directly on boulder clay or bedrock.

In many places, the landscape comprises a mosaic of wet heath and peat bog (page 7), and it can be hard to differentiate between the two.



A. Deer grass

Deer grass (*Tricophorum cespitosum*) is common on wet heath (although it is not technically a grass). It turns orange in the autumn, giving wet heath its characteristic orange glow at the end of summer (as in the main picture).



B. Liverwort (*Pleurozia purpurea*)

Wet heath generally has more species growing on it than dry heath. In the northwest, the purple, worm-like liverwort, *Pleurozia purpurea*, is often found amongst the taller plants.



C. Bog asphodel and cross-leaved heath

Wet heath can be colourful in summer from the flowers growing on it, here showing yellow bog asphodel (*Narthecium ossifragum*) and cross-leaved heath. These are both globally rare plants where Scotland is the world centre.

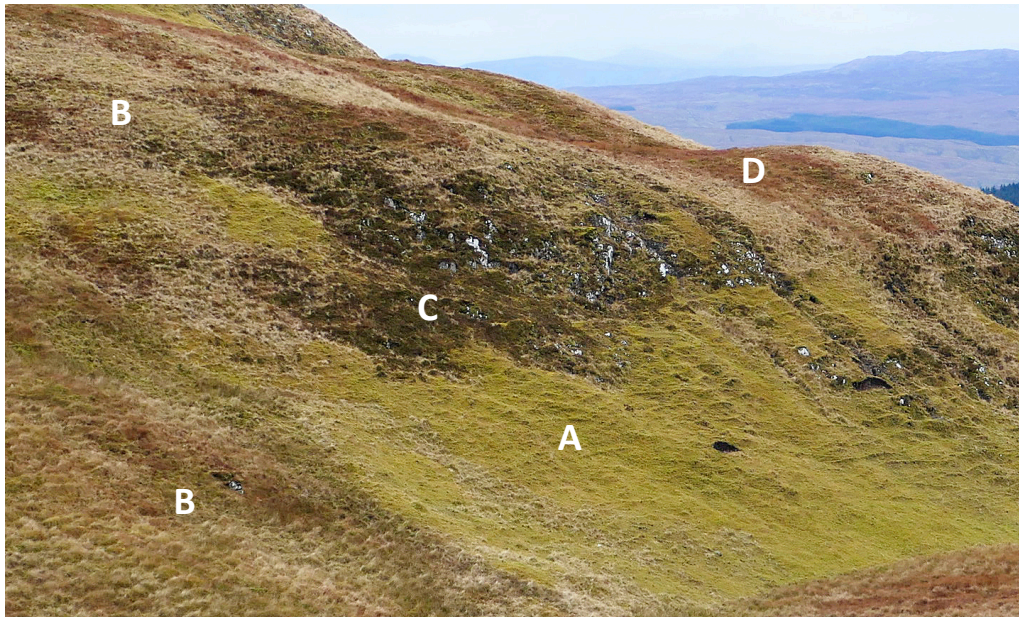


D. Vehicle tracks on wet heath, Poolewe

This shows vehicle tracks to a phone mast in Wester Ross which have damaged the wet heath vegetation. It illustrates how wet heath soils are often waterlogged and easily damaged by vehicles and trampling.

NATURAL HABITATS: MOORLAND

Grassy moorland



Ben Chapull, Argyll (winter)

Where the slopes are well-drained and the soils relatively fertile, then grass tends to dominate. Because of their high fertility, these are the areas where grazing animals such as sheep and red deer tend to congregate. As a result they tend to be heavily grazed with a short sward: hence the term 'smooth grassland' (A).

Where the soils are damper, then grassland dominated by purple moor grass (*Molinia caerulea*) can be common. This grass forms tussocks and is less favoured by sheep and deer, forming 'rough or damp grassland' (B). Such grassland can be common in the west, covering whole hillsides as on the Island of Mull. Although green in summer, in winter the grass dies back, so the hills change from green to almost white.

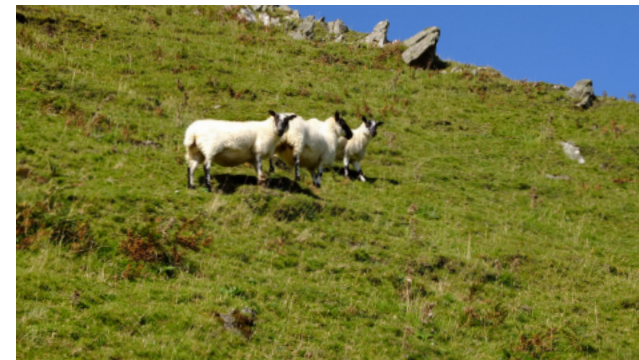
In flatter areas at low altitude where there is nutrient-rich water flowing through, then marshes are common (although not illustrated here). These are dominated by rushes and sedges and can be rich in flowers such as meadow sweet (*Filipendula ulmaria*) with its cream-coloured flowers.

This picture also shows a small area of heather (dry heath) on the cliff (C) and an area of wet heath (D).



A. Smooth grassland

This grassland is dominated by the grasses fescue (*Festuca*) and bent (*Agrostis*), and so is known as bent-fescue grassland (or *Festuca-Agrostis* grassland).



A. Smooth grassland

Because of their fertility, bent-fescue grasslands are highly favoured by grazing animals, so that the sward remains short all the year round.



B. Rough (damp) grassland

This shows tussocks of purple moor grass (*Molinia caerulea*) in winter when the leaves have died back to a whitish colour. The grass is also known as 'flying bent' by farmers because the dead leaves can fly around in a strong wind.

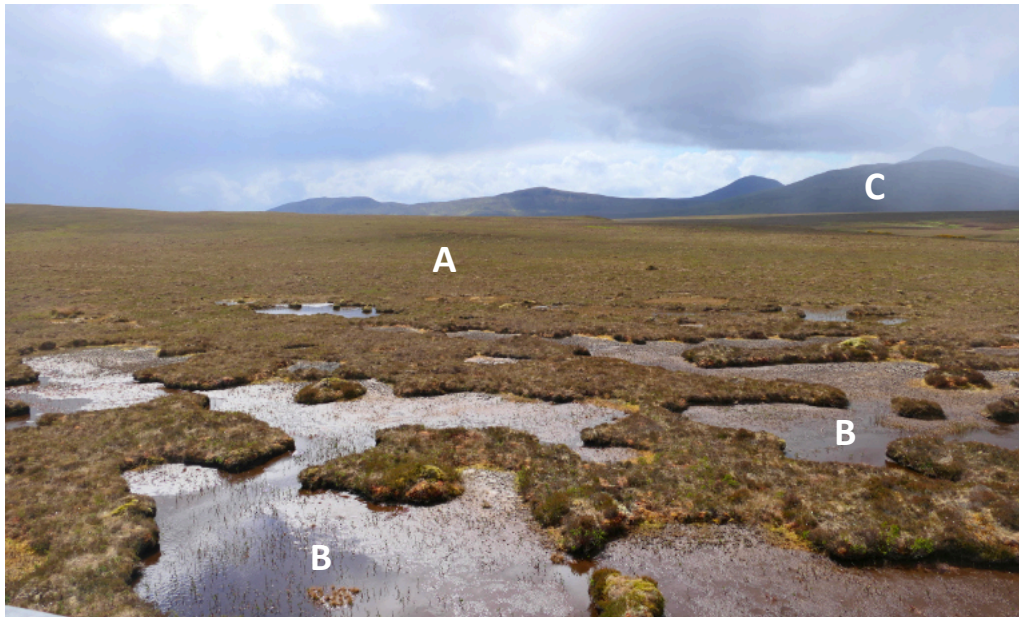


C. Rough (damp) grassland

For a short period in summer, the hills turn green from new shoots of purple moor grass (see the picture on page 163). Here, heather can be seen growing amongst the grass, with the grass beginning to turn brown at the end of summer.

NATURAL HABITATS: MOORLAND

Peat bogs



Flow Country, Caithness and Sutherland

'Peat' consists of undecomposed plant material. The cool, wet climate of Scotland means that plants decay slowly and, over time, their remains build up to form a thick layer which can cover the whole landscape. Because such peat 'blankets' the landscape (A), it is called 'blanket peat', and Scotland is a world centre for this internationally rare habitat. Peat accumulates slowly, of the order of one millimetre depth increase per year, so peat one metre thick could be at least 1,000 years old.

At deeper levels, the peat is permanently waterlogged, indicated by the fact that any hollows are permanently filled with water (B). But if the peat is cut out, and then dried, it provides a good source of fuel. Indeed because trees have always been rare in the Scottish landscape in historical times, it has been peat which has provided the main fuel for heating houses (see page 109).

Peat cannot form on steeper slopes (C) because these are better drained, and, additionally, gravity would cause any peat which did form to flow downhill.

In depressions in the landscape, 'valley peat' forms, kept waterlogged by water collecting in the hollows. On level ground, a 'raised bog' can form, which are dome-shaped. These were once common on coastal flats, but are now rare in the Highlands owing to centuries of cutting for fuel and drainage for agriculture.



A. Blanket peat, Flow Country

Much of East Sutherland and Caithness has only gentle slopes, resulting in the most extensive tract of blanket peat remaining in the UK. It is known as the Flow Country, and recognised internationally as a World Heritage Site.



A1. Valley peat, Redpoint, Wester Ross

An example of a peat-filled hollow, the depth of the peat indicated by the remains of an old peat-cutting on the left. The deepest peat in Scotland is 11 metres thick, in a hollow on Islay. Much of the valley peat around settlements has been removed over the centuries to provide fuel.



A2. Raised bog, Islay

A raised bog at a low altitude site on Islay. These were once common on raised beaches (page 37) and at the seaward end of the larger straths. Relict raised bogs can still be seen in Strathcarron, Corpach (which is now being built over), North Connel, and Machrihanish.

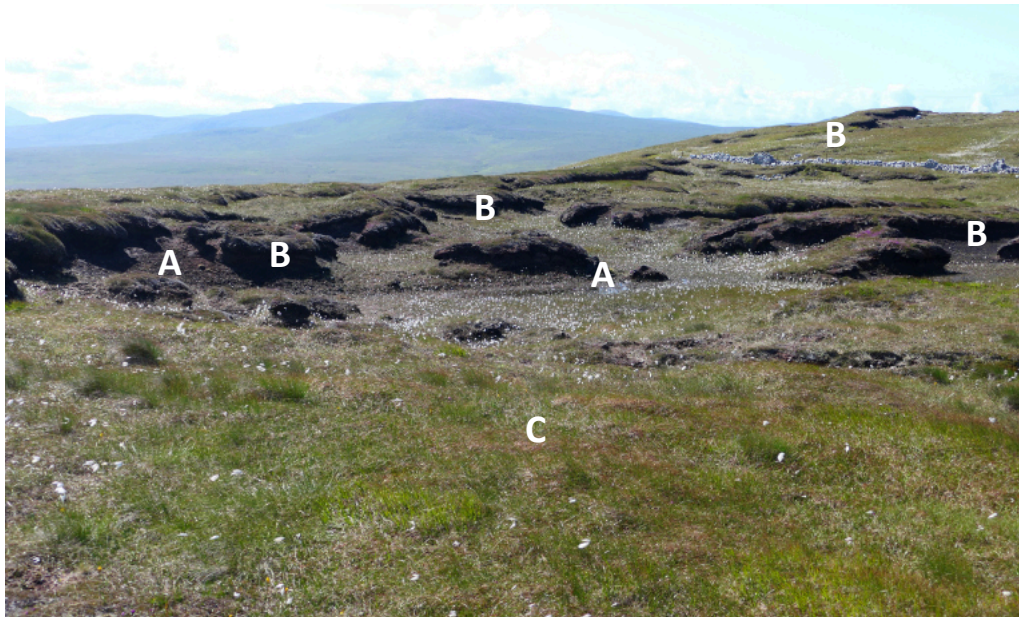


B. Bog pools, Kentra Moss (a raised bog)

In any place where a hollow in the peat is below the water table, there will be a pool. Generally blanket peat and raised bogs start off without pools but, over time, owing to the complex dynamics of peat growth, they become more common and expand to form 'dubh lochs' (black lakes).

NATURAL HABITATS: MOORLAND

Peat bog erosion



Cape Wrath, Sutherland

Peat is a soft material and subject to erosion (A, B), the chance of which increases as the peat thickens over time. The main causes of erosion are:

- 1) Water flow, with streams on the surface slowly eroding down into the peat to form gullies.
- 2) Downhill creep of the surface layers of peat, even on gentle slopes, which results in vertical edges of exposed peat.
- 3) Trampling from animals or people, breaking through the surface vegetation.
- 4) Fires in extreme conditions, which can burn down into the peat.

Erosion exposes the peat which is below the surface layer of vegetation, which is then subject to further erosion from water flow, trampling, decomposition of the peat, and frost action (where the freezing and thawing of peat moves the peat around, preventing colonisation by plants). Erosion also occurs when pools on peat naturally drain, resulting in a series of gullies and ridges, known as 'peat hags'. In many cases, eroded peat is colonised by new peat-forming vegetation (C), so the long-term process of peat growth begins again.

Peat bogs, being composed of dead plant remains, are in fact the largest stores of carbon in Britain. Actively growing peat (C) takes carbon out of the air, eroding peat (A,B) releases it.



A. Eroding peat

A gully through deep blanket peat caused by water flow. The bottom of the gully contains redistributed eroded peat, with some plant colonisation. An old peat bog may have a network of such gullies across the bog: 'peat hags'.



B. Vertical edge

A vertical edge of exposed peat. The surface vegetation, heather, has slid down over the edge, its overhang now hiding the top. A stump of Scots pine is visible at the base of the peat, exposed by erosion. This shows that the area was forest 1000s of years ago before peat began to form.



B1. Vertical edges from peat cutting, Islay

Peat was cut extensively for fuel across the Highlands and Islands, although the practice nowadays is almost died out. Old peat cuttings in the landscape can be recognised by their straight vertical edges, as here on Islay.



C. Bog cotton (peat bog vegetation)

Only the presence of certain plants results in peat formation. One of these is bog cotton (*Eriophorum*), its white seed heads being a common sight on bogs. Other plants on peat include Sphagnum moss and the plants found on wet heath (page 3).

NATURAL HABITATS

Bracken



Bracken slopes in Glen Ogle with its old railway viaduct

Bracken is a fern which is found throughout the Highlands below 500-600 metres on areas with better soil. It is, in fact, a cosmopolitan species, found on every continent in the world except Antarctica.

It is particularly notable in the Highlands because, although it has always been present, it has been expanding rapidly in recent decades. It is not popular with farmers because it invades the best grazing land (dry grassland) and is not eaten by livestock.

Ferns, which reproduce with minute spores rather than flowers, evolved before the advent of flowering plants, and so have had millions of years to evolve defences against grazing animals – in this case, being toxic to them. Bracken rarely spores in Britain, most stands reproducing through the spread of its underground stems.

In recent years, the main chemical used by farmers to control its spread, Asulam, has been banned in Scotland. This leaves the only way to control it to be by cutting, which is difficult on all but smoothest, rock-free land. If the same stand is cut repeatedly for at least three years, it eventually dies out.

New shoots of bracken are particularly frost-sensitive, but with the increasingly warm and frost-free springs, bracken spread will only continue.



A. Tall bracken

On good soils in sheltered locations, bracken can be taller than a person. It casts a dense shade, so often no plants grow underneath



B. Bracken invading grassland

Bracken can here be seen colonising good quality grazing pasture, and can advance at over two metres a year. In the past, when there were more people working the land, it was hand-cut and used for animal bedding, or bundled up and used for fuel. This controlled it to some extent.



C. Bracken invading heather

Shoots of bracken spreading through heather. Bracken, being a fern, has shoots which grow by uncurling, as visible here. Bracken is distinguished from other ferns because the leaves do not arise from a central rosette, but grow up individually from underground stems..



D. Bracken in winter, Burg, Isle of Mull

Bracken dies down in the autumn, leaving brown, dead stems which are visible throughout the winter. New green shoots first emerge in April/May.

NATURAL HABITATS

Gorse



Ballo, Perthshire

The prickly shrub, gorse (*Ulex europaeus*) forms large stands and has been expanding in extent in recent years. Although native to Scotland, it is not native to many areas the Highlands and Islands, but even in these places it is now becoming common. In Scotland is known as 'whin' or 'whins'.

For example, Osgood Mackenzie in early 1900 found gorse seeds at the bottom of peat bogs in Wester Ross, which an expert identified as likely to be those of gorse (or possibly the closely related, but non-prickly broom). He says:

"East Coast gentlemen will perhaps be astonished to hear that neither the whin or the broom are native plants here. One hundred years ago, the only broom plants in the district were a few sown round the garden of my far back predecessors in this place, and the first whins that ever grew anywhere near here were produced from seed sown by a minister on the Poolewe glebe, and some sown also by a member of the Letterewe family at Udrigal. It is certain it was not an indigenous plant here in modern times, whatever it might have been [in the distant past]."



A. Close-up of gorse

Gorse is a legume, which means it fixes nitrogen from the air – making the leaves nutritious to livestock. In the past, gorse-grinders were used by farmers to make the leaves palatable to their animals.



B. Complete takeover of heathland by gorse

This shows complete takeover of gorse on what was once the heathland of Drum Mossie Muir south of Inverness. Gorse is frost sensitive, so that it is killed by heavy frosts. With such frosts becoming less common nowadays, its spread is likely to continue.



C. Gorse-covered hill slope, Helmsdale

A hill slope colonised by gorse in Helmsdale, Sutherland.



D. Roadside gorse, Torridon

Gorse growing beside a road. Roads provide corridors for the shrub to move into new localities because the disturbed ground beside the road, created by road improvements in the 1960/1970s, provides ideal soil; and seeds are spread by the slipstream of vehicles.

NATURAL HABITATS: NATIVE WOODLAND

Birch woods



Coastal birch wood, Isle of Shuna

Although most of the landscape of the Scottish Highlands is dominated by treeless moorland, there are also many native woods, particularly on coastal slopes along the west coast (see page 23).

Birch woods are the commonest type of native wood and are found across the country. They are particularly abundant in the southwest of the area where the climate is more amenable, but extend as far north as the Island of Hoy in Orkney, where there is a small gully wood (page 25) in the hills at Berriedale.

In sites exposed to the wind, coastal woods can be low growing and scrubby, and the exposed nature of the Western and Northern Isles makes the climate unsuitable for extensive woodland.

Birch woods often have few other tree species present other than occasional rowan trees (*Sorbus aucuparia*), which have bright red berries in autumn, or various species of willow (*Salix*). Particularly in the southwest, birch woods can be replaced by hazel woods (*Corylus avellana*), trees which are low-growing and identified by their tendency to have multiple stems arising from their base.

See also 'willow scrub' on page 69.



A. Coastal birch wood, Isle of Rona

A coastal birch wood on the island of Rona, showing a typical coastal location. Birch trees are deciduous, meaning they lose their leaves in winter.



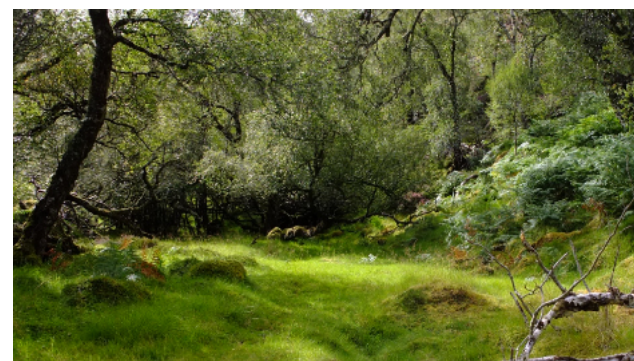
B. Birch wood in winter (downy birch)

There are two common species in Scotland: the downy birch (*Betula pubescens*) which is more common in the west, and which has rounder leaves and branches which do not hang down. This shows a downy birch festooned by lichens, common in the humid climate.



C. Silver birch (winter)

The silver birch (*Betula pendula*) is more common in the east. Its upper branches hang down (pendulous) and its leaves are more sharply triangular than the downy birch and the leaves more sharply toothed. Confusingly, both birches have silver bark – and they do hybridise.



D. Birch wood (summer)

Birch trees do not grow as tall as oak trees or Scots pine, and are more slender in appearance. Here a wood of downy birch in Wester Ross.

NATURAL HABITATS: NATIVE WOODLAND

Oak woods



Oak wood near Spean Bridge (winter)

Oak woods are commoner in the Southwest Highlands where the climate is more amenable to them, although the woods just reach as far north Caithness. Oakwoods are generally mono-specific, *i.e.* oak are the only trees present.

There are two species of oak native to the British Isles: the sessile oak (*Quercus petraea*), which is more common in upland woods, and the pedunculate oak (*Quercus robur*), more common in lowland woods. However, the trees do hybridise with each other.

Because oak was used to make charcoal to feed iron furnaces, such as the one at Bonawe in Argyll, many plantations of oak were created to provide charcoal. The iron-smelting area lasted from the mid-1700s until the end of the 1800s. These plantings can make it difficult to distinguish between a wood which originated naturally from one which was planted.

There are other types of broadleaved woodland in the Highlands, but they are less common. On richer soils at low altitudes in the Southern Highlands there can be mixed broadleaved woodland, including ash (*Fraxinus excelsior*) and wych elm (*Ulmus glabra*). In recent years, both tree have suffered a decline owing to disease outbreaks: ash die-back and Dutch elm disease.



A. Oak wood (autumn)

An oak wood at the Tarnish National Nature Reserve in Argyll.



B. Mature oak tree

A mature tree. Oaks grow larger than birches and, if not hemmed in by other trees, have widely spreading branches.



B. Mature oak tree

A close-up of a tree showing its thick, spreading branches.



C. Scrubby oak wood in exposed location

In exposed, coastal locations oak grows in a low, scrubby form, pruned by the wind, with twisty trunks and branches – here on the island of Islay.

NATURAL HABITATS: NATIVE WOODLAND

Riverside alder woods



Glen Geal, Kinlochaline

Alder trees (*Alnus glutinosa*) are common growing on riversides, particularly at lower altitudes in the south and west.

In recent years, along rivers without any trees, there has been planting of alder to create what is known as 'riparian woodland' (see page 159). This is because tree roots help stabilise riverbanks, their branches shade the water, and their dead leaves provide food for freshwater insects.

This is done to benefit the fish, particularly salmon and sea trout which have been declining in recent years (see page 149). With warmer summers becoming the norm, unshaded water can become too hot for fish; and increasing the number of freshwater insects provides them with more food.

The beaver (*Castor fiber*) became extinct in Scotland owing to hunting. It has since been reintroduced in rivers and lochs, and its presence can often be seen by its felling of riverside alder and other trees.



A. Alder close-up

Alder has large, toothed, ovate leaves with a point at the end.



B. Alder along river, River Nevis

A typical example of alder growing along riverbanks, in this case along the River Nevis.



C. Beaver felling, River Tay

Alders which have been felled by beavers along the River Tay.



D. Alder wood on damp ground, Kincaig

Alders grow not only along rivers and burns but, together with willows, also form woods on wet ground in places which are relatively nutrient-rich.

NATURAL HABITATS: NATIVE WOODLAND

Scots pine woods



Coille Coire Chuile, near Tyndrum

Scattered across the mainland as far north as Ullapool are stands of Scots pine (*Pinus sylvestris*). These are remnants of what was a larger wood which covered much of the Highlands thousands of years ago: 'The Caledonian Pine Forest' or 'The Great Forest of Caledon'.

About 10,000 years ago the Ice Age ended in Scotland, and thereafter plants recolonised the now ice-free ground. In time forests developed, but eventually these began to decline because of both a deterioration of soil quality through leaching (the washing-out of nutrients by rainfall) and a deterioration in climate. The pinewoods were replaced by open moorland, resulting in the landscapes you see today. By 1750, only five percent of Scotland had tree cover.

Stumps of ancient pine in the now treeless landscapes can be found across the Highlands. These are thousands of years old and were preserved under peat which slowly covered the landscape, replacing the woodland in many places. The stumps are nowadays revealed in places where the peat has eroded away, or has been cut for fuel: see the picture of such a stump on page 8.

However, the woods did not disappear completely as today's remnants show. Over the centuries, some pinewoods have also been harvested for timber, particularly in the Strathspey area where timber could be floated down the River Spey, and during both the First and Second World Wars when home-grown timber was needed.



A. Ancient pine wood, Strathfarrar

Mature trees of Scots pine, with no young trees present. This illustrates how these woods decline if grazing by deer prevents any young trees surviving.



B. Ancient pine wood, Mar Lodge Estate

There are ancient pinewoods on the Mar Lodge Estate, west of Braemar, owned by the National Trust for Scotland. A lot of work has been carried out in recent years to reduce the number of red deer present in order to encourage young trees to become established.



C. Ancient pine tree, Loch Maree

The oldest pine tree in Scotland is about 550 years old. Old pine trees, with their rounded tops, are known as 'Granny pines'.

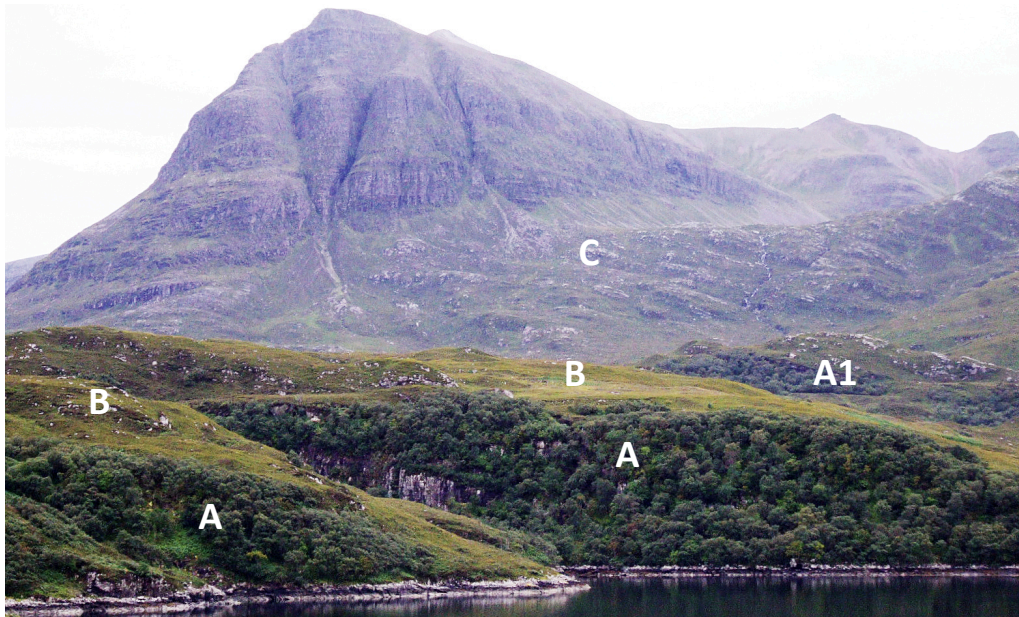


D. Pinewood regeneration, Glen Affric

The foreground here shows numerous young trees which have seeded from the two Granny pines. This has occurred because the whole wood has been fenced to keep out deer.

NATURAL HABITATS: NATIVE WOODLAND

Coastal woodland



Kylesku, Sutherland

Woodlands in the Highlands are commonest on coastal slopes along the west coast. This shows an example of a birch wood on the shores of a sea loch in Sutherland (A), also with a small wood behind on a steep inland slope (A1).

Such coastal woods are present because the steeper slopes have a better soil than the surrounding moorland (B), being well-drained and nutrient-rich. The mild climate along the coast results in some plant growth throughout the winter, which means that grazing animals, such as sheep and red deer, can feed on this winter-green herbage rather than having to eat the buds of trees.

This allows trees to regenerate whereas inland (C), which is cooler with no winter-green herbage, grazing animals will target the buds of young trees – eventually killing them, and so preventing the woodland surviving.

These coastal woods are often rich in mosses, liverworts, lichens and ferns owing to the mild, damp and humid conditions. Some of these are internationally rare. They have been called 'Atlantic rainforests', although the term 'forest' is perhaps misleading because they do not form continuous forest but isolated woods.



A. Coastal wood, Loch Nevis

A coastal birch wood on the steep slopes of Loch Nevis. Much of this wood is grazed because it is accessible to red deer. There are also some inaccessible cliffs, which contain core areas of woodland – able to survive whatever the grazing.



A. Coastal wood, Sound of Mull

A wood on the steep, basaltic slopes (page 35) along the Sound of Mull. Trees on cliffs inaccessible to deer can regenerate without being eaten. Such trees can also provide a permanent seed source for other areas, allowing trees to colonise out from the cliffs if conditions allow.



A. Coastal scrub, Isle of Gigha

This shows low-growing coastal scrub, mainly comprised of willows and sloe (blackthorn, *Prunus spinosa*). Sloe prefers richer soils and is particularly common on Argyll coasts, but rare further north. Its berries are used to make 'sloe gin'.

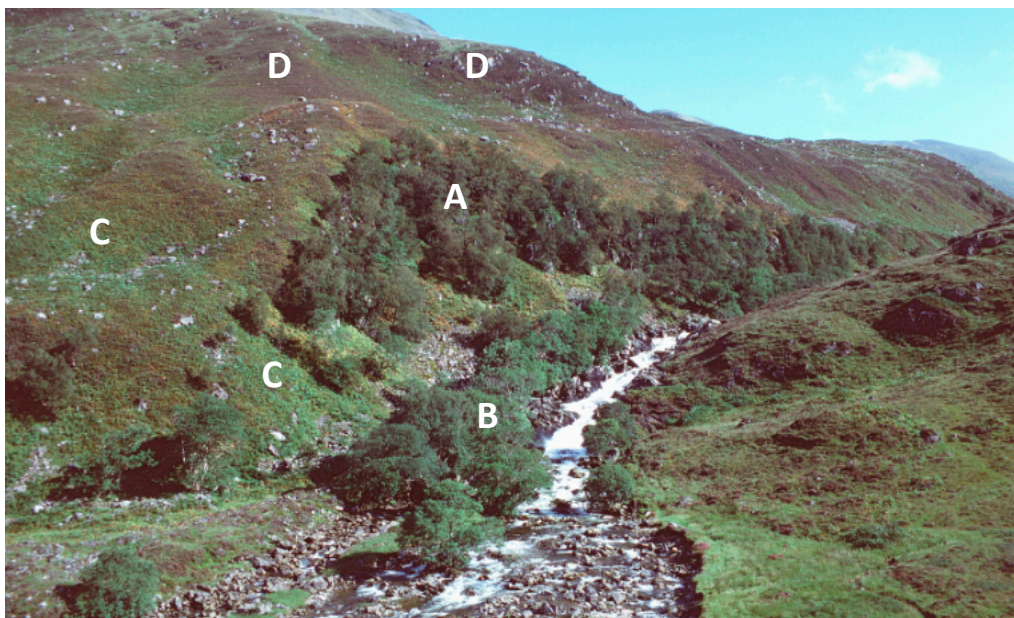


B. C. Unwooded moorland

Open moorland, *i.e.* natural vegetation without trees, is the dominant vegetation of the Highlands. Although at first glance all appearing uniform, there are in fact many different types of moorland (see pages 1-8).

NATURAL HABITATS: NATIVE WOODLAND

Hillside, cliff and gully woods



Glenshiel, Inverness-shire

In addition to coastal sites, natural woodland across the Highlands is often confined to steep slopes on hillsides and along burns and rivers. This is because such areas are free-draining and nutrient-rich, but also less accessible to sheep and deer.

On gentle slopes, long-term soil change brought about by leaching (from rain) can result in wet, nutrient-deficient soils, less suitable for trees. On these slopes, any young trees get eaten by grazing animals, particularly in winter and early spring when there is little palatable vegetation for animals to eat: tree buds are relatively nutritious.

Woodland can survive indefinitely on cliffs (A) and in gullies (B) because of the absence of grazing, so these can be seen as 'core woodland'. However, if conditions change, such as a period of lower grazing, the woods can expand outwards from these core areas – later retreating back to the core if grazing again increases.

Research has shown that, thousands of years ago, there was significantly more woodland across the Highlands, but, over the millennia this declined to about 5% of the landscape owing to changes in soil and climate. In some places, destruction of forest by humans may have been a factor, but modern research shows a largely natural decline.

Also visible are stands of bracken (C) and heather (D).



A. Cliff wood, Glencoe

Birch woodland confined to cliffs and steep slopes in Glencoe. These north-facing woods are humid and amongst the richest in Britain for rare oceanic mosses and liverworts.



A. Hillside wood, Torridon

Another birch wood on a steep hillside in Torridon, with occasional Scots pine. The dense woodland at the base indicates a recent episode of woodland regeneration, presumably dating from when there were fewer grazing animals.



A. Hillside woods, Loch a' Bhraoin

Birch woodland confined to the steepest slopes and gullies above Loch a' Chroisg in Wester Ross. There appear to be no young trees away from these slopes, indicating any trees are eaten by red deer and/or sheep.



B. Gully wood, Bridge of Orchy

An example of trees being confined to a burnside gully at a site near Bridge of Orchy. This is a very common situation in the Highlands.

NATURAL HABITATS

Moorland view



Coire Cerslie Hill, Inverness-shire (winter)

This shows a round-topped hill in winter with a summit altitude of 654 metres. The relatively flat summit ridge is covered in deep blanket peat (A). Peat cannot form on steep ground both because steeper slopes are free-draining *i.e.* drier, and because any peat which did form would move downhill under gravity.

But even on gentle slopes, there is some downhill movement of the surface layers of the peat bog which, where the slope steepens, can result in vertical edges of exposed peat (B) owing to the the surface layer breaking off.

In this picture the steeper slopes below the blanket peat are covered in smooth grassland (C), which provides the best grazing and will be where any red deer or sheep will tend to congregate. In summer, these areas will be green. It is a common situation in the Highlands that the best grazing is on the steep well-drained hill slopes, because the low ground (and sometimes the high ground, as here) is of low grazing value owing to it being covered in un-nutritious wet heath or blanket peat.

The very steep and driest ground, with some exposed rocks and cliffs, is dominated by heather (D).



A. Coire Cerslie Hill

This the summit of the same hill as on the left, in summer, when the vegetation is greener. Underneath the vegetation is a layer of peat one to two metres thick.



B. Vertical edge of peat

This is taken near the site of the photograph above and illustrates the depth of peat. Vertical edges of exposed peat are present at the downhill-end of the blanket peat. The vegetation overhanging the edge shows it is moving downhill, and/or the vertical edge is eroding back.



C. Upland grassland (summer), Bridge of Orchy

Smooth grassland, the habitat favoured by sheep and deer on hillsides. The grass on these slopes is of higher nutritional value than the other moorland types of heath and peat bog.



D. Heather moorland

In the West Highlands, heather is characteristic of the steeper, drier slopes, particularly where the underlying rock types is acidic (nutrient-poor).

NATURAL HABITATS

Moorland view



Applecross, Wester Ross (winter)

This is a moorland landscape covered in blanket peat (A), similar to the one shown on page 27. However, it differs in that at some time in the past a series of drains were cut through the peat (B), leaving their mark on the landscape. These were dug by a plough behind a tractor with the aim of draining the peat so that the drier ground produced more productive vegetation for sheep to graze; and also, on some sporting estates, to encourage heather growth for the benefit of red grouse. The practice took place mainly in the 1950s and 1960s and was grant-aided by the government in support of farming.

The ditches are known as 'moor grips' and can be seen even in remote areas. But they proved ineffective in draining the land: this is because the peat they were cut through is not permeable to water – so water does not drain out of it into the ditch. In fact, the reason blanket peat forms in the first place is because the half-decayed vegetation holds water tightly by capillary action. This means it is permanently saturated with water, which results in anaerobic conditions (*i.e.* without oxygen) which prevents further decomposition.

Hence blanket peat can grow upwards above the landscape, taking the water with it, resulting in what is called a 'perched water table', because capillary action is a stronger force than gravitational drainage.



A. Blanket peat, Coire Cerslie Hill

An example of undisturbed blanket peat, actively accumulating peat underneath, so that, over time, it rises above the landscape. Peat growth is of the order of one mm per year, *i.e.* it gets thicker by this amount every year.



B. Moor grip (ditch)

Water does not drain out the peat into the ditch, although, after rain surface-water will run into it. This can cause the ditch to deepen, resulting in erosion of the peat. This erosion releases carbon to the air, so many such ditches are now being dammed to stop this.



C. Heather (dry heath), Kingussie

The steeper slopes in the main picture are better-drained, resulted dominance of heather in some places rather than peatland vegetation.



D. Moorland (rough grassland)

The steeper slopes also contain areas of damp grassland dominated by purple moor grass. The photographs here were taken in winter, when the dead leaves make the grasslands look white. In summer, with new growth, they turn green.

NATURAL HABITATS

Moorland view



Above Loch Ewe, Wester Ross

This is a typical area of moorland at low altitudes in northwest Scotland. Trees, in this case birch trees (A) with the occasional rowan, are restricted to the steep burnside.

Dry heather moorland (B) is on the better drained slopes. The heather is in flower, giving the moor a purple colour, indicating that this picture was taken in late summer.

Stands of bracken (C) are also present on well-drained slopes, here just beginning to turn brown at the end of the growing season.

The landscape beyond is dominated by wet heath (D).



A. Gully wood, Strathconon

Trees are commonest in the Highlands along the sides of burns and rivers, where there is better soil and less grazing.



B. Moorland (wet and dry heath), Wester Ross

The main picture shows heather in flower. This shows the two other common heaths: the darker purple bell heather which prefers the driest areas (page 2), and the paler cross-leaved heath (page 3), which prefers damper areas (wet heath and peat bog).



C. Bracken

Bracken after it has died down in winter.



B. Moorland (wet heath)

Wet heath is the dominant vegetation over much of Wester Ross. The orange hue is from deer grass as it begins to die off at the end of summer.

GEOLOGY

Dry stone dykes as indicators of rock type



Fair Isle

In the eras before fencing wire was invented in the 19th century, stone walls were built as means of either enclosing or excluding farm animals from certain areas, or as land-ownership boundaries. The picture here shows a 'dry stone dyke', that is one built without mortar, as opposed to a mortared 'wet stone dyke' (D).

Many parts of the Highlands have plentiful stones, hence the prevalence of this kind of field boundary. Most building occurred at the time of 'agricultural improvement', starting in the 1700s. Before then boundaries were built of turf, which do not persist long in the landscape once they fall into disuse. However, some dykes from the Stone Age (Neolithic), characterised by the use of very large stones, are still visible.

Some dykes were traditionally built with an unstable look (many air gaps), to discourage jumping over by sheep. Farms and croftland often had a dyke separating the cultivated land from the unmanaged hill land, called the 'head dyke' (page 144).

Close observation of the building style gives an indication of the geology of the landscape, because different geologies result in landscapes and rocks of different shapes. Old, hard rocks tend to produce rougher landscapes than younger, softer rocks. The above dyke has stones of many different shapes, from a hard metamorphosed mudstone.



A. Granite, Iona

In contrast to the main picture, this dyke on Iona is built of granite boulders, which are rounded in shape. Hence, if such a dyke is present, then this means that there is granite in the vicinity. The granite here is pink, although lichens on the dyke mask the rock's colour.



B. Sandstone, Orkney

Softer sandstones, here Old Red Sandstone on Orkney, result in thin, flat rocks – resulting in a different style of building. The eastern coastal fringe of the Highlands (pages 175-184) is underlain by such softer sedimentary rocks, making the landscape smoother, with better agricultural soils.



C. Lichens on a dyke

This dyke is built of a harder rock type which has broken up into rectangular stones. It is covered in orange lichens, which indicates a coastal location where such lichens are common. A variety of different lichens and mosses can be found on dykes.



D. A mortared ('wet-stone') dyke

Perhaps counter-intuitively, a mortared dyke can be less robust than a dry stone one. This is because, as stones settle down over time, mortar can crack; in a dry stone dyke, stones become more tightly packed.

GEOLOGICAL FEATURES



Horizontal basalt, Ardmeanchach Peninsula, Isle of Mull

The geology of the Highlands and Islands is complex, with a large variety of rock types present. On the islands of Mull and Skye, millions of years ago there was a series of horizontal flows of molten lava, each one on top of the previous one. This has resulted in a landscape of alternating terraces and cliffs of basalt. Basalt sometimes contains vertical five or six-sided columns, as at the famous Fingal's Cave on the nearby island of Staffa.

A major geological feature of Northwest Scotland is the Moine Thrust running southeast from Durness on the north coast (Map 1). West of this thrust are ancient rocks, of which the Lewisian gneiss is amongst the oldest in the world. Along the line of the thrust are outcrops of limestone which is otherwise rare in Scotland; where this does occur the vegetation is noticeably greener owing to the rich soils it produces.

The other major geological feature is the Great Glen Fault (Map 1) which cuts across the Highlands from Inverness to Fort William and where the land has sunk down between two parallel faults: the highest part of the glen is only about 30 metres (100 feet) above sea level. The long, thin lochs of Ness, Oich and Lochy lie in the glen, joined by the Caledonian Canal (page 104). The lochs were deepened by glaciers so that they are now deeper than the sea at either end of the fault.

Granite is present in some areas, such as the Cairngorms, which results in rounded hills and infertile, acidic soils (see page 155).



A. Horizontal basalt, Isle of Mull

The terraces of this basalt on the northwest side of Mull are green and grassy, showing how the basalt breaks down to produce rich soils.



B. Limestone cliffs, Inchnadamph, Sutherland

These limestone cliffs contain caves caused by water dissolving the rock over the millennia. They are famous for the remains of Stone Age (Neolithic) artefacts and of animals which are no longer found in Scotland such as lynx, reindeer, arctic fox and bear.



C. Slate quarries, Glen Almond, Perthshire

There is a belt of slate running across the Southern Highlands which was extensively quarried for roofing material. The main quarries were at the Slate Islands (Seil, Luing, Easdale, Belnahua), at Ballachulish, Dunkeld and Glen Almond. None are active today.



D. Glacial moraines, Glen Torridon

The landscape of the Highlands has been shaped by ice during the Ice Age, resulting in deep glens and rugged mountains. Moraines are hummocks of rock deposited by glaciers and can be seen in many places across the Highlands.

COASTAL FEATURES



Raised beaches, Gruinard Bay, Wester Ross

Raised beaches are beaches which were once underwater when the sea level was higher. The weight of ice on the land during the Ice Age pushed the whole landmass down, in effect making the sea level higher. When the ice melted and the weight taken off, the whole land rose up again in a process called 'isostatic rebound'. The situation is complicated because all the ice on the land in icesheets and glaciers during the Ice Age caused lower sea levels because the ice was, in effect, water taken out of the sea and put on the land. When it melted, then sea levels rose.

Hence the actual sea level was a complex interplay between isostatic rebound and melting glaciers. This is shown in the above picture because there are two raised beaches visible: a lower one (A1) and a higher one (A2). Raised beaches are visible all along the coast of the west Highlands and it is their presence which largely makes the coastal regions habitable by providing level, rock-free areas for farming. There are also areas where seacliffs and caves are now present parallel to the coast but inland from the sea (B), created thousands of years ago when the sea was higher.

Additional geomorphological features shown in this book are scree slopes (page 150), corries (page 154) and alluvial fans (page 164). Note that the book only shows some of the more noticeable geomorphological features visible in the landscape.



A. Raised beaches, Poolewe

The village of Poolewe in Wester Ross lies on a raised beach. This picture illustrates how the level ground of raised beaches provides the best places for settlements and farming. The green, farmed land around the village is in contrast to the surrounding, brown moorland of heath and peat bog.



B. Raised beach arch, Port Appin

An arch produced by wave action when the sea level was higher thousands of years ago. Relict beaches, cliffs and caves are common along the west coast.



C. Sand dunes, Islay

Most of the coastline of the Highlands and Islands consists of cliffs and rocks. But sand accumulates in sheltered bays and along the west coast of the Uists (page 136), in the latter case consisting of shell-sand rather than sand from rock. Sand dunes form when the wind blows the sand inland.



D. Tombolo, Loch Eriboll

A tombolo is an 'island' linked to the mainland by a natural causeway as a result of wave action moving stones along the shore from both directions (long-shore drift). The island here consists of limestone, and a large lime kiln is visible – used in the past to make lime for use as a fertiliser.

FARMLAND: GRAZING PASTURE

Smooth pasture (unimproved/semi-improved)



The Isle of Lismore, an island of limestone with rich pastures

The mild, wet summers characteristic of the West Highlands and the Islands are ideally suited to growing grass. Before the introduction of sheep at the time of the Highland Clearances of the 1700-1800s, cattle were the mainstay of the economy of the area. Calves born in the spring were grazed on grassland throughout the summer, and in the autumn were taken to markets in central Scotland and England along 'drove roads' – the droving trade.

The farmland around settlements is the 'inbye land', beyond which is the moorland. In the past, the livestock were taken off the inbye land where they were wintered, and moved to their summer grazings on the moors. They were kept there by young people, who lived in small stone dwellings, shielings, where they would milk the animals and make cheese.

The pasture around the shielings, the remains of many of which can still be seen today, would have consisted of the grassland types discussed on page 10. In the later 'Improvement Era' of the 1700s, the moorland was separated from the inbye land by a high stone wall, the 'head dyke' (see page 144).

Within the head dyke both unimproved and improved smooth pasture can be found. Unimproved pasture is that which has minimal modification of the original natural grasslands.



A. Unimproved pasture, Isle of Seil

This shows cattle grazing grassland which has never been ploughed, fertilised or drained, *i.e.* unimproved pasture. Natural unimproved grasslands tend to be rich in species, even if grazing keeps the sward smooth and low.



B. Flower-rich semi-improved pasture on Seil.

There are degrees of agricultural improvement: putting in drains or adding lime retains the species-richness, but ploughing, reseeding, fertilising and herbicides reduces it. This shows a 'semi-improved' pasture, one with a high species-richness.



C. Rushes growing in pasture

A feature of many of the agricultural grasslands of the area is the propensity for rushes to colonise, primarily the soft rush (*Juncus effuses*) as here. They can colonise a whole pasture, as shown on page 173. Rushes should not be confused with reeds (page 150).



D. Iris (flags) growing in pasture

Damp pastures on the islands and on low ground in the Western Highlands often have patches of irises (or yellow flags, *Iris pseudacorus*). They are particularly noticeable in early summer when their bright patches of yellow stand out.

FARMLAND: GRAZING PASTURE

Improved pasture



Silage cutting, Isle of Gigha

Pasture is 'improved' agriculturally by drainage, adding fertilisers, and using herbicides to kill undesirable plants such as thistles (creeping thistle, *Cirsium repens* and spear thistle *Cirsium vulgare*) and dock leaves (*Rumex obtusifolius*); and also by ploughing the land and seeding with better quality grasses than the original native species. Improved pasture is always greener than unimproved pasture because of the increased fertility from fertilisers.

Although the Highlands produce plenty of grass in the summer, it mostly dies off in winter, so has to be cut and stored. Traditionally hay was produced, but this has to be cut late in the summer and, if it is a wet season, there is risk that it will never dry out. It will then go mouldy over the winter, lose its food value and not be palatable to livestock.

To avoid this risk, hay cutting has been replaced by big-bag silage. Here, the cut grass is wrapped in air-tight waterproof bags which prevents it going mouldy and helps retain its food value. Silage is grown on improved pasture in smooth fields where tractors can easily operate.

It is cut earlier in the year than hay, which means that any nests of breeding birds, or their chicks, are destroyed. This has caused a major decline of the once-common corncrake (*Crex crex*) across the British Isles, so that their stronghold is now the Hebrides where traditional agricultural methods such as hay cutting have survived in places (page 114).



A. Improved pasture

Improved pasture which has been ploughed is generally re-seeded with rye grass (*Lolium perenne*). This is planted because it has a high nutritional value and, in such improved fields, it may be the only plant present – in contrast to species-rich unimproved pasture (page 40).



B. Grass bale, Argyll

This shows a field cut and the grass rolled into bales, before being wrapped in plastic to create big-bag silage.



C. Silage bags, Isle of Gigha

Bags of silage are common across the Highlands and Islands, here stored for winter use. The bags can be black, green, white or pink.

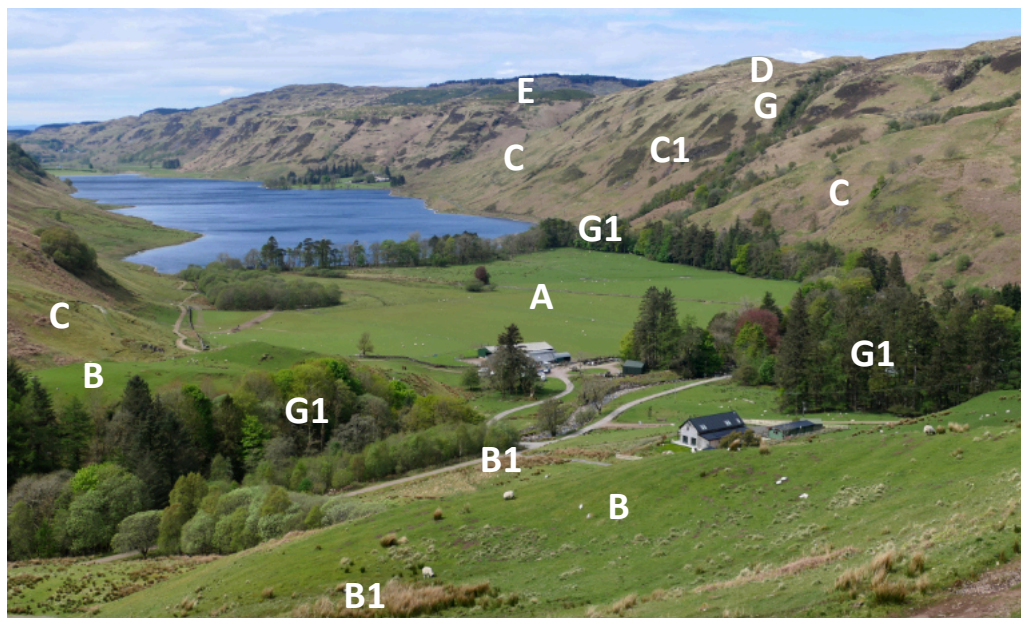


D. Adding liquid fertiliser (or a pesticide)

Using fertilisers encourages plant growth, the most common being NPK (nitrogen, phosphorus, potassium). This makes improved fields appear a brighter green than unimproved grassland. Fertilisers can also wash out from fields and pollute water courses.

FARMLAND: GRAZING PASTURE

Overview



Scammadale, Argyll (spring)

An inland landscape demonstrating the different types of pasture.

The level ground at the head of the loch (A), where it is easy to use tractors for ploughing, fertilising and cutting, consists of improved pasture where silage will be cut once the grass is long enough, to provide winter fodder for sheep or cattle.

The fertile grassland in the foreground on a well-drained hillslope is too steep for tractors, so it consists of unimproved grassland. It is highly favoured by sheep, resulting a short, smooth sward. There are also a few areas of rushes present (B1).

The rougher hill slopes consist of a mosaic of bracken and unimproved grassland (C), although in time it is possible that bracken will come to completely dominate, particularly as aerial spraying of herbicide is now banned in Scotland. The darker patches on these slopes are stands of heather growing on the steepest, driest areas (C1).

The moorland above the glen consists of rough grassland (D), where sheep will be less common because of its poor grazing quality.

There is also a gully wood visible (G) and areas of planted woodland on the lower ground (G1), containing both broadleaved trees and conifers.

On the horizon in the distance is a conifer plantation (E).



A. Improved pasture for silage, Isle of Gigha

Improved pasture being cut for silage on the Isle of Gigha. After cutting it will be made into bales before being wrapped in silage bags.



B. Unimproved pasture (smooth)

Sheep keep the pasture short by grazing close to the ground.



C. Bracken/pasture mosaic

Stands of bracken surrounding areas of smooth pasture. Unless the bracken is cut, it is likely that eventually all the pasture will be covered in bracken.

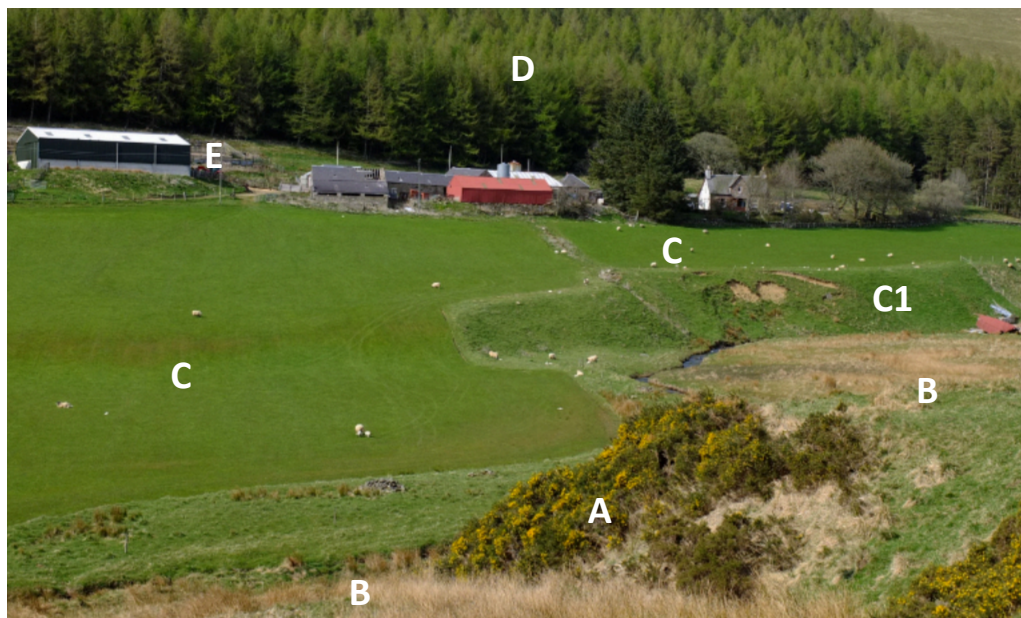


D. Moorland (rough grassland)

Rough grassland in winter, a habitat not grazed short by sheep because it consists of less palatable and less nutritious grasses. Sheep are highly selective in what they eat, going for only the best quality grassland.

FARMLAND

Upland farm

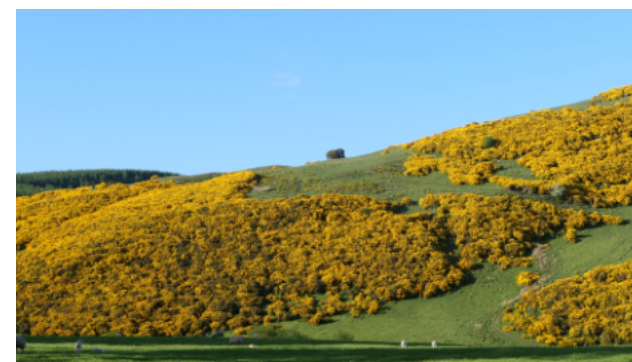


Glenhead, Angus

Many flat-bottomed glens thread their way into the Eastern Highlands, known as the Angus Glens. This is a farm on the side of Glen Damff, the glen north of Alyth which holds the Backwater Reservoir. This reservoir, opened in 1969, was created to provide drinking water for the towns and villages of Angus, and also for the large city of Dundee.

The picture shows a typical upland farm with improved pasture (C) for grazing and silage production; the steeper banks within these fields (C1) will contain unimproved grassland which is likely to be more flower-rich. There are areas of rough grassland in locations too rough or wet to be improved (B), some of which is being colonised by gorse (A). There is a large modern shed for housing cattle in winter (E).

Above the farm is a commercial forestry plantation (D). This will not be managed as part the farm because forestry and farming are not integrated in the Highlands: modern farming and modern forestry necessitate different skills. Additionally, many forests are owned by companies seeing forests as a financial investment, rather than being interested in growing trees – management of these is left to the specialist forest management companies. In contrast, farms are managed to provide an income for those living in the farm, whether owner or tenant. However, there is little money to be made in upland farming.



A. Gorse, Ballo, Perthshire

A hillside of grazing pasture being slowly colonised by gorse. Gorse is highly inflammable, and gorse fires are common across the Highlands.



B. Rough pasture

Areas of the farm which are not suitable for improvement (fertilising, re-seeding, drainage) comprise rough pasture. If close to a field, they can suffer from herbicides landing on them ('spray drift'), reducing the diversity of plants present.



C. Improved pasture and forestry, Glen Damff

A view up Glen Damff. Apart from the relict moorland in the far distance, the only vegetation visible is improved pasture with few, if any wildflowers, and commercial forests similarly deficient in wildlife. A modern upland scene of little conservation interest.

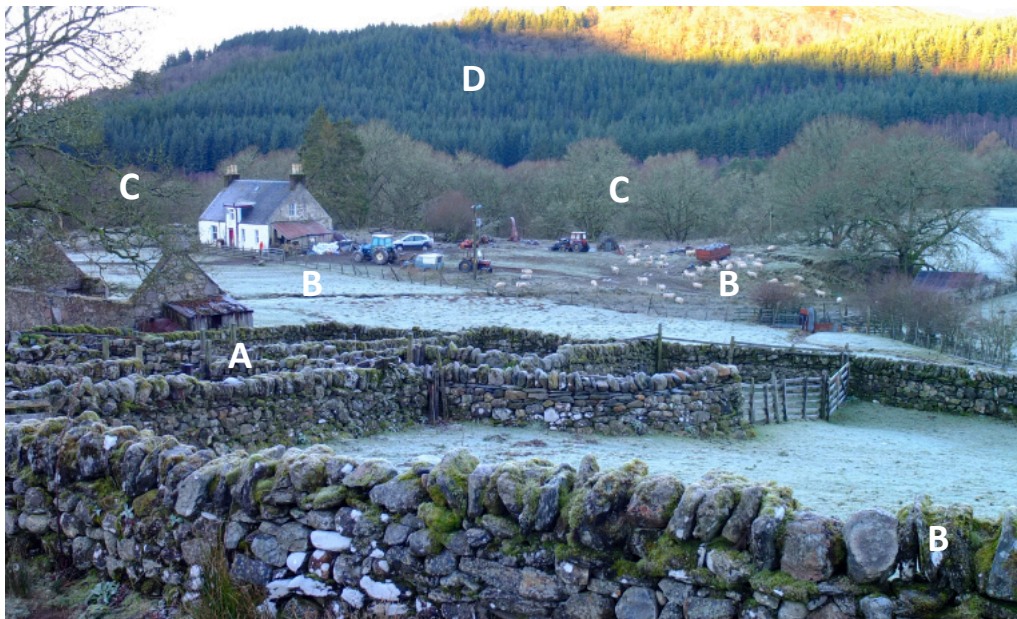


D. Conifer plantation

A dense plantation of Sitka spruce, showing how there is no vegetation under the trees and holding little wildlife interest

FARMLAND

West Highland sheep farm



Glen Spean, Inverness-shire

This is a traditional Highland sheep farm, as opposed to a croft (page 109). The number of sheep farms in the Highlands is declining for a variety of reasons. Many sheep farmers are near retirement age and have no-one to take over the farm; sheep farming is a hard, outdoor life and is a career the younger generation are not interested in. There is little money in it and the annual income is barely enough to support a living; without annual grants from government, the farms would make a loss.

The Scottish Government has a policy to cover a quarter of Scotland with trees. There are government grants for tree planting and many landowners are taking advantage of this, closing down their sheep farms at the same time. In this picture, the plantation (D) was likely once to have been part of a sheep farm about forty years ago.

Another contributing factor is that sheep farming has a bad press in many circles: sheep are accused of making the landscape barren by eating young trees and so preventing what natural woods are present from regenerating. Sheep are also accused of destroying the original native woodland following the introduction of large-scale sheep farming at the time of the Highland Clearances, made possible by the extinction of the wolf at the end of the 17th century. This is an unfair accusation because woodland had declined to a low level centuries before sheep were introduced. Finally, eating meat is seen as unethical by many.



A. Old sheep fank, Loch Awe

Stone fanks were used for holding sheep at times of sheep-shearing, dosing for parasites and end of seasons sales. This one is abandoned, with forestry plough lines above it indicating that forestry is here replacing farming. Modern fanks are made of iron fencing.



B. Pasture

Sheep, unfairly, have a bad press, with their grazing said to damage landscapes. But grazing animals maintain the fertility of the land through their dung/urine, and also maintain the species-richness of many habitats. But because they can eat young trees, they are seen as bad for the environment.



C. Oak wood, River Spean

There are extensive oak woods along the River Spean adjacent to this sheep farm.



D. Conifer plantation (Sitka spruce)

It is likely that the conifers in the main picture were planted on what was once grazing land for sheep.

FARMLAND

Arable crops



Kilchoman, Islay

Arable crops are not common in the Highlands and Islands except along the eastern coastal fringe (pages 175-184) and in some of the wider southern straths such as Strath Tay. The relatively cool and damp climate means that most of the Highlands and Islands are more suitable for growing grass for livestock than arable crops for food.

However, there were more crops grown the past when it was a largely subsistence economy, including oats, turnips and potatoes: see page 113. Bere barley (a primitive strain of barley) was also grown, particularly to make malt for the whisky stills (illicit or otherwise!).

After potatoes were introduced from South America in the sixteenth century, they eventually became the staple food for many in Ireland and the Highlands and Islands. However, in the mid-1800s, potato blight killed the potatoes, leaving to widespread starvation. Many landowners helped ameliorate this by giving employment to local people, for example in building roads: this was the case in Wester Ross where the road south from Dundonnell, the A832 over the Fain, is still known as 'Destitution Road'.

The above picture shows a field on Islay being ploughed, before planting with barley for the nearby Kilchoman distillery. The gulls are following the tractor to eat worms and insects brought to the surface by the plough. The Kilchoman distillery is unusual in growing its own barley on the island: most distilleries import it from the east coast.



A. Potato field, Roseisle, Moray

Potatoes are nowadays planted by machine in regular ploughed strips. Because the northeast coast is relatively cool and disease-free, it is ideal for growing seed potatoes which are exported around the world. Nowadays, people are eating less potatoes, so there is less money to be made.



B. Barley near Rothienorman, Aberdeenshire

The commonest crop in the fertile eastern coastal strip of the Highlands is barley for the brewing and whisky industries. These have exacting standards so, if the barley is not up to scratch, it is used as animal feed.



C. Wheat, Laigh of Moray

Wheat needs a relatively warm, dry climate, which is the case in the Inner Moray Firth.

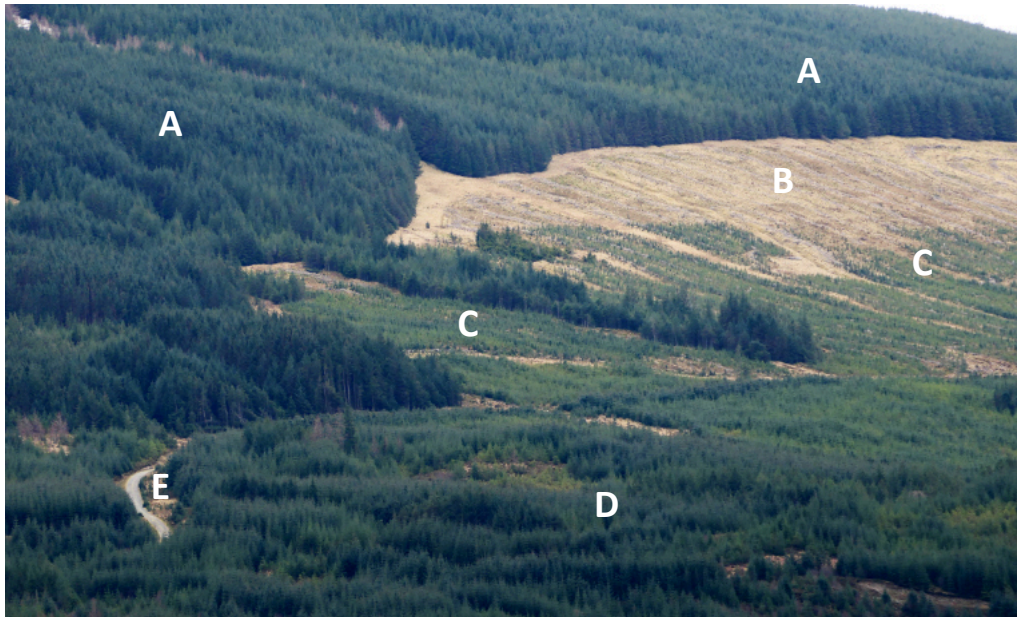


D. Oilseed rape

A distinctive crop along the east coast is oilseed rape, adding yellow patches to the landscape in summer. Its seeds are pressed to extract cooking oil.

COMMERCIAL FORESTRY

Conifer plantations



Glen Spean, Inverness-shire

As mentioned on page 21, only about five percent of the Scotland had tree cover by 1750. Today, woodland cover has increased to 20% of the land, largely through the planting of coniferous trees (A) which are grown commercially to meet the needs of the UK timber industry.

These commercial forests expanded rapidly following the creation of the UK-wide Forestry Commission in 1919. This was because the First World War brought attention to the fact that the country did not have its own strategic reserve of timber.

During a depression in sheep farming in the 1930s, whole farms were sold to the Forestry Commission, particularly in Argyll and Galloway, resulting in the landscape changing from open moorland to dense conifers. Where such forests cover a large tract of land, it is referred to as 'blanket forestry'. The Scottish Government wishes to see the forest cover of Scotland to continue its increase.

Where trees are to be planted, the land is first ploughed to improve the soil (page 55), after which small trees grown in nurseries are planted on top of the ploughed furrows. The woods are then left until felling 40–60 years later (B), after which new trees are planted (C).

Associated with forestry operations is the creation of tracks to allow planting and extraction of the timber, with one visible above (E)



A. Old plantation

The trees planted today are predominantly Sitka spruce (*Picea sitchensis*), a species native not to Scotland but to western North America. Over the years it has been genetically improved to match the climate and soil of Scotland.



B. Clearfell site

Trees are planted close together so that they grow tall and straight, without side branches; this is what the timber industry needs. In the windy climate, if trees grow too tall they are liable to blow over. Hence they are felled after 40-60 years, in large swathes known as 'clearfells'.



C. Recent planting

After felling, the site is replanted with conifers grown in distant nurseries – and the growing cycle starts again. In this picture, a new plantation of young trees has been planted on what was once farmland, as indicated by the old dyke. An old plantation is visible in the background.

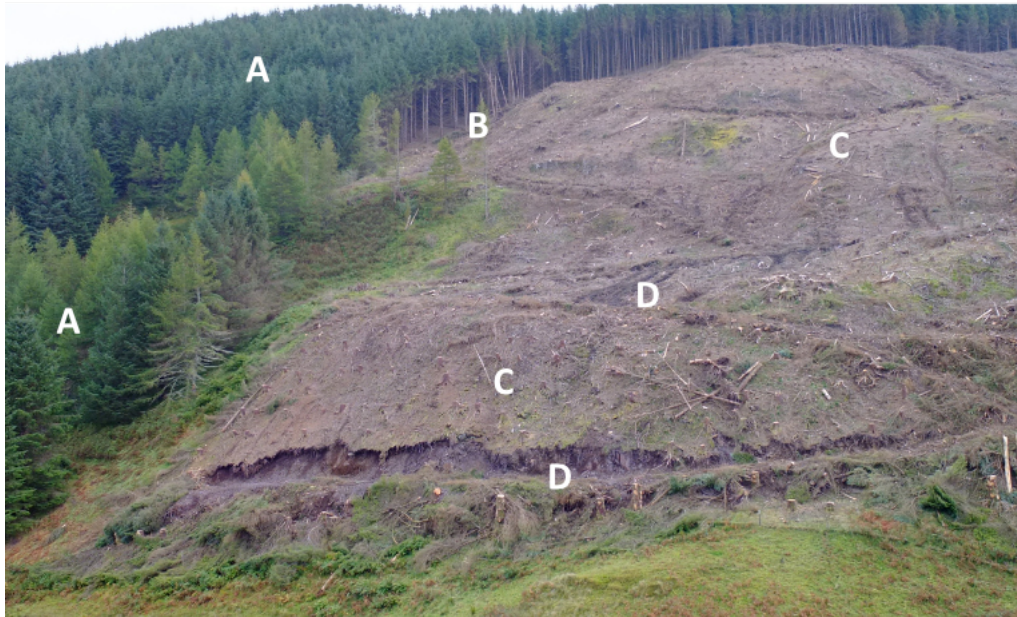


D. Young trees (brown ones are larch, *Larix*)

Here, stumps of old trees are visible in the foreground, indicating this is a second rotation forest. When trees are first planted, there is open ground between them, visible in the picture above. Over time, the canopy closes and shades out other plants.

COMMERCIAL FORESTRY

Timber extraction



Loch Seil, Argyll

This shows a commercial plantation of conifers on the left (A) and a recent clearfell site on the right (C). The trees have only recently been felled as indicated by the fact that the ground is bare of vegetation. Dense plantations shade out all the light so that plants are unable to grow under the trees, as shown on page 46. Over time, the bare ground re-vegetates.

At the very bottom of the picture the ground has not been planted with trees as shown by the presence of the original grassy vegetation. However, the planting of trees, the tree roots and the subsequent soil disturbance from timber extraction changes the soil structure, so that when a clearfell site re-vegetates, the plants which colonise are not the same as those on the original moorland.

This means that planted forests irreversibly changes the nature of the landscape, and results in the loss of the natural vegetation of the Highlands.

Additionally, the vehicle tracks built to enable the timber to be harvested (D) means that the original road-free, wild nature of the landscape is also lost: with each new forest, the extent of wild land in the Highlands beyond the reach of cars and lorries declines.



A. Conifer plantation with windthrow

Trees at the edge of a forest get buffeted by the wind and grow strong to withstand it, although they can still blow over during gales – 'windthrow'. After felling, if trees once in the middle of are now at the edge, these weaker trees are likely to be subject to windthrow.



B. Timber felling

Trees are nowadays harvested by machines which cut down the trees, remove the side branches ('snedding') and cut the trunk into lengths suitable for loading onto a timber lorry. One person can fell a large area in a single day.



C. Clearfell site

A recently felled conifer plantation, with the cut logs being piled up in advance of removal by lorry.

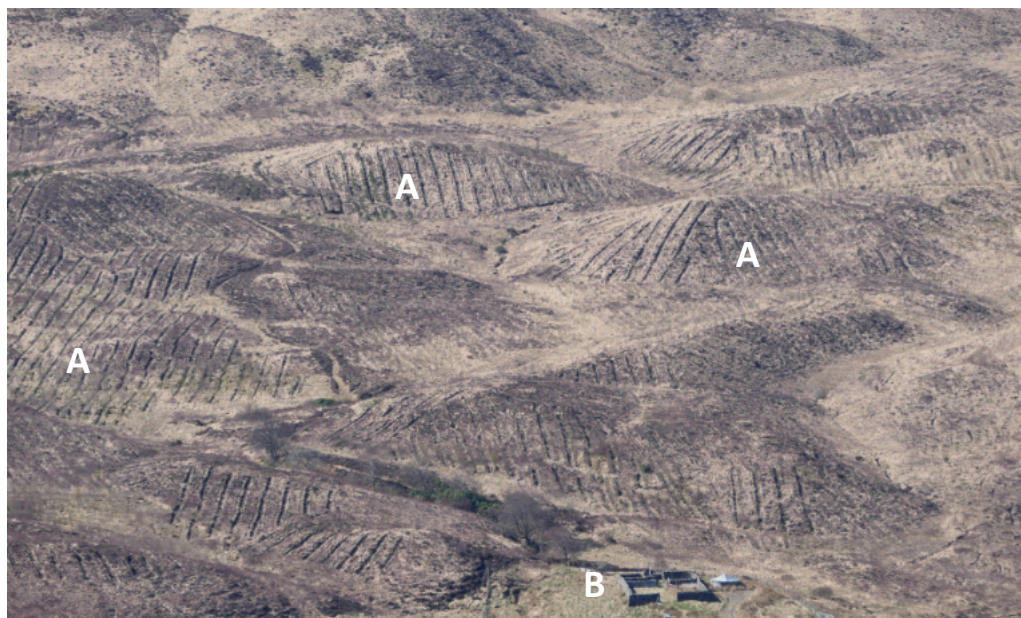


D. Forest track, Argyll

Modern forestry cannot take place without the use of large machinery and 44-tonne timber lorries. To enable access for felling and timber removal, a network of large vehicle tracks are engineered throughout the forest.

COMMERCIAL FORESTRY

Ground preparation



Loch Awe, Argyll

The soils of the Highlands and Islands have developed over the 10,000 years since the last ice age. Over time, the high rainfall across the region has washed out the nutrients beneficial to plant growth (leaching), or washed them down to deeper levels of the soil. This has made the soil too acid for earthworms, so, apart from the best soils such as occur under dry grassy moorland, there is no soil mixing by worms – with a resultant build-up of dead, acidic plant material of humus and peat at the surface.

Additionally, iron in the soil gets washed downwards where it precipitates out at depth into a solid lay impenetrable to water – the 'ironpan', or 'bog iron'. In the past it was quarried in the Roman and Viking eras as a source of iron.

The end result is that many Highland soils are not very good for growing trees without changing the soil structure. For this reason, the double mould-board plough was invented which, when towed behind a powerful caterpillar tractor, breaks through the ironpan, brings the more nutrient-rich soil horizons to the surface and allows the soil to dry out. Trees are then be planted on the dry ridges created, where they grow much faster than if planted direct in unploughed ground.

In this picture, below the area of ploughing (A) is an old sheep fank (B) illustrating that this area was once part of a sheep farm.



A. Ploughed hillside, Dalnamein, Perthshire

A hillside which has been forestry ploughed. The structure of the original vegetation can still be seen: the orange/brown areas were bracken, the white areas grass, and dark areas, heather.



A. Ploughed hillside, Dava Moor, Moray

A close-up of ploughed moorland, with planted young trees visible on the ridges of upturned soil. Such ploughing causes irreversible change to the naturalness of the landscape, and the ridge/furrow lines will remain for thousands of years.



A1. Mounding, Torridon

In recent years, 'mounding' has taken over from ploughing in many places because it is seen to do less environmental damage. This is carried out by a digger with a bucket which scoops out a small section and places it upside down nearby as a small mound: trees are planted on this.



B. Sheep fank from sheep-farming days

Sheep fanks are stone-walled enclosures used to hold sheep after they have been rounded-up from the hill land. Their presence here in an area now planted with trees illustrates this area was once a sheep farm.

COMMERCIAL FORESTRY

Seeding-out of plantation trees



Loch Avich, Argyll

Sitka spruce is a conifer which naturally grows in the Sitka area of the Pacific Northwest of America. It was chosen as a forestry tree in Scotland because it grows well on the poor soils and in the wet, cool climate of the Highlands. Over years it has been genetically improved to enhance its growth in Scotland.

However, an unforeseen side effect of this is that, as the original plantations reach maturity (A), they produce numerous seeds which are then blown beyond the confines of the plantation and thereafter germinate and grow (B).

The trees have spiky needles which are not very palatable to sheep or deer, so they survive browsing by these animals. The upshot is that, across the Highlands, these self-seeded Sitka spruce are beginning to take over the landscape.

If left unchecked, over hundreds of years the Highlands will begin to look like the conifer-dominated forests of North America. The spruce seem to grow equally well on moorland, on peat bogs and in native woods: the end result will be a loss the natural vegetation of the Highlands.

It is an issue currently without any solution in sight because the forestry industry appears to wash its hands of the problem.



A. Sitka spruce seeding outside deer fence

Plantations are normally enclosed by a tall fence to keep out deer. Here young trees, seeded from the old ones behind, have 'leaped over the fence' to begin colonising the wider landscape.



B. Self-seeded Sitka spruce, Glen Lonan

An example of young self-seeded Sitka spruce growing on moorland distant from the source plantation. The seeds of spruce can blow a long distance in the wind before germinating.



B. Self-seeded Sitka spruce, Argyll

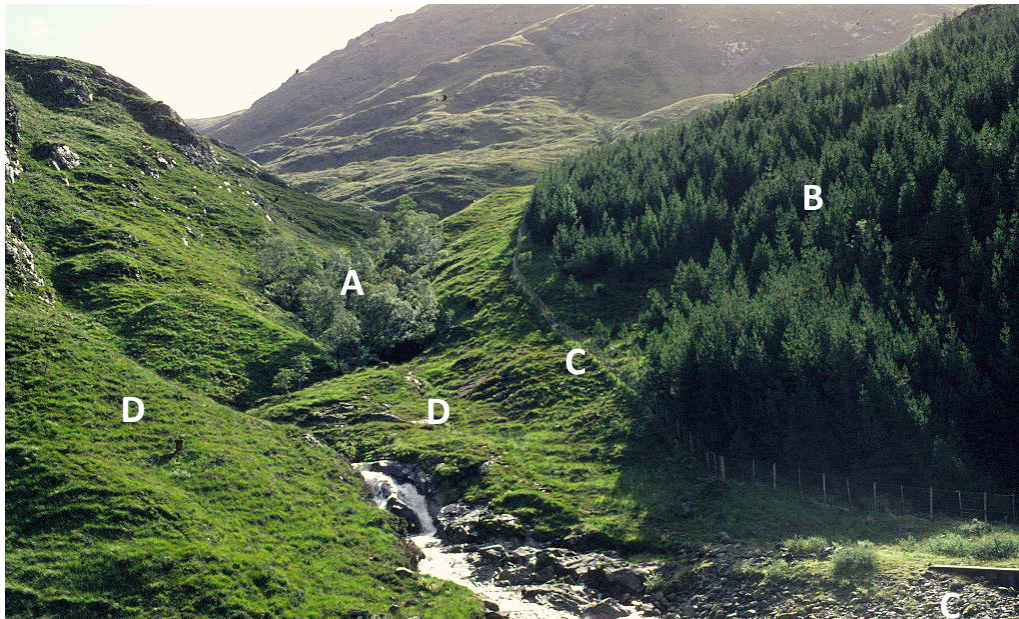
An example of self-seeded Sitka spruce colonising heather moorland. See page 142 for a picture of Sitka spruce invading a native woodland.



B. Self-seeded Sitka spruce, Isle of Seil

It is not only commercial plantations that can provide a source of self-seeded spruce. Spruce are often planted in private gardens across the Highlands because they grow fast and provide shelter. The trees here have seeded-out from a garden below. The island in the distance is Scarba.

CONIFER PLANTATION – NATIVE WOOD COMPARISON



Glen Shiel, Wester Ross

This picture shows the difference between the natural woodland of the Highlands (A) and the commercial conifer plantations (B) which have become common over much of the area over the past decades.

Natural woods are irregular, with trees of different sizes and shapes, and irregular edges: straight lines are rare. In contrast, commercial plantations have regular patterns with straight lines: trees are planted in parallel rows to match the forest plough-lines, and close together: this ensures straight growth without side branches, as required by the timber industry. Edges of plantations are often straight, surrounded by straight fences (C), although in recent years, greater effort has been put into the design of forests, so that the edges blend more into the landscape.

Additionally, plantation trees are not native to Scotland. In the early years of forestry, the native Scots pine – the only conifer native to Scotland – was used: for example, there are still several Scots pine plantations in Moray. But the tree is nowadays rarely grown commercially because it does not grow as fast as Sitka spruce – the main commercial tree today.

In the last few decades, new Scots pine plantations have been planted (page 61), not for commercial reasons, but as an attempt to recreate the original native pine forests which, thousands of years ago, once covered much of the Highlands. Fragments of these, called Caledonian Pinewoods, still occur in scattered locations across the Highlands (page 21).



A. Gully wood, Loch Hourn

Trees in the Highlands are often restricted to steep burnside gullies, here birch trees growing in such a gully near Loch Hourn.



B. Conifer plantation

A mature plantation of Sitka spruce, of an age when felling is imminent. Because large trees are more likely to blow over in the windy climate, and because growth slows as the trees age, the trees are harvested when they are 40-60 years old.



C. Deer fence

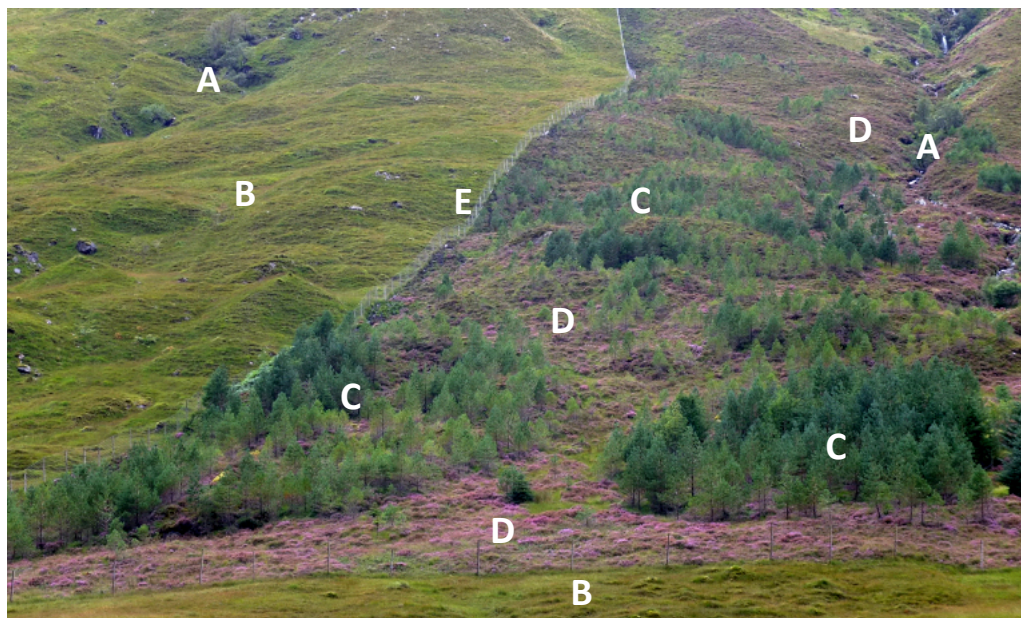
Standard fences around agricultural field are low enough that deer can easily jump over them. Tree plantations are fenced with a higher 'deer fence' to keep out red and roe deer which might otherwise browse the young trees.



D. Moorland (wet heath)

Wet heath is the type of vegetation on which the trees in the main photograph were planted. As the trees grow, they eventually shade out all the wet heath plants, leaving largely bare ground.

NEW NATIVE WOODS Plantations



Glen Shiel, Inverness-shire

Native woodland can expand in area by natural *i.e.* reliant on any self-seeded trees which might be present (see page 65), or as here, by planting. Although natural regeneration is favoured by environmentalists, the approach does not guarantee woodland, or produce enough trees quickly enough to satisfy people in these impatient times.

Therefore many woodland schemes in the name of conservation (and all commercial schemes) go down the planting avenue, as illustrated here, even though there is a small gully wood present (A), which could have been used as a seed source for natural regeneration.

Here native Scots pine have been planted (C) on wet heath (B), the young trees imported from a tree nursery as there are no native Scots pine growing in this vicinity. Unlike commercial schemes, though, the trees are not planted in straight lines and the woodland managers would have used the mounding method of planting (page 56).

There are some open spaces left unplanted (D), both to ensure habitat diversity in the forest and for aesthetic appeal. Such schemes are grant-aided by government and, for the landowner to get the grant, there have to be a minimum number of trees planted. This constraint means that the new wood is unlikely to mirror its natural counterpart.

Deer and sheep are kept out of the plantation by a deer fence (E).



A. Gully wood

The only existing natural woodland in this upper area of Glen Shiel is in gullies and on cliffs as shown on page 25, although native Scots pine is absent from this glen.



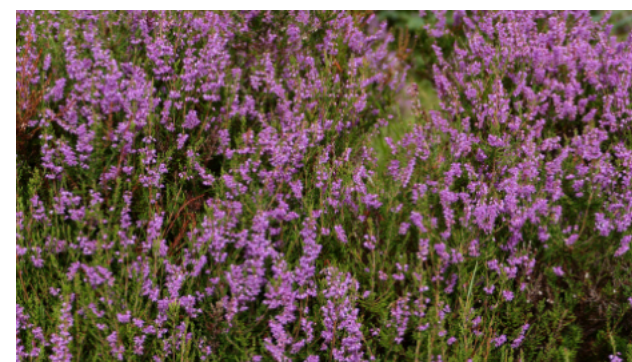
B. Moorland (wet heath)

This is the typical type of vegetation on which the trees have been planted. A woodland in the same location would absorb more solar radiation because less is reflected back to space: this reduced reflectivity (albedo), warms the local climate.



C. Planted native wood, Kingairloch

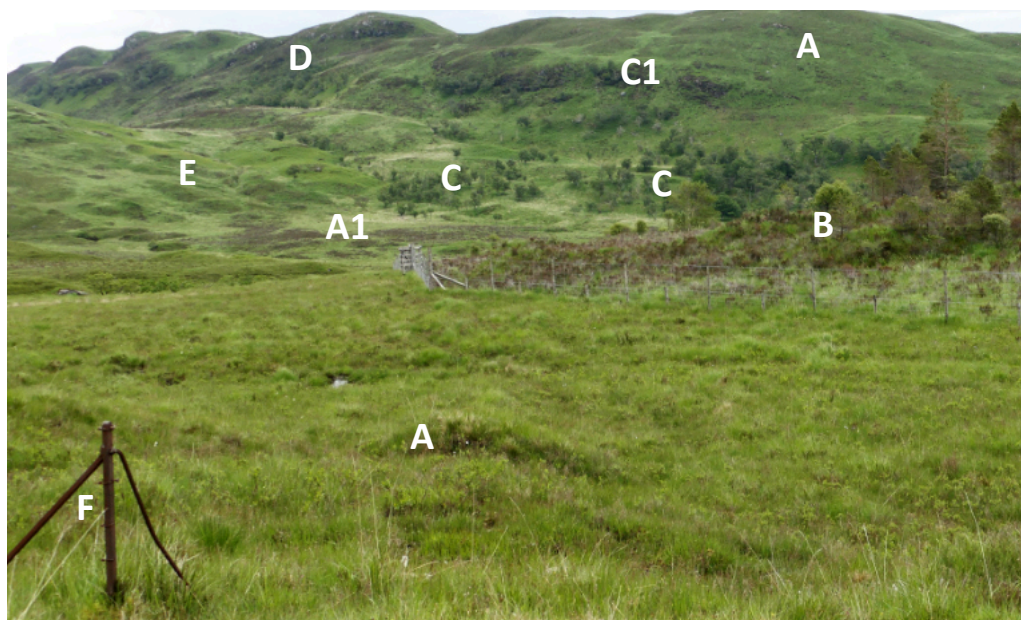
This is another planted wood of native trees, further south near Kingairloch. It is a mixture of birch (light green) and Scots pine (dark green), and is typical of the many new tree-planting schemes across the Highlands.



D. Heather

The absence of grazing within the deer fence has caused the heather to flourish. It was always present, but suppressed by grazing. Thus the main picture illustrates the impact of grazing animals on the landscape, *i.e.* keeping the vegetation short.

NEW NATIVE WOODS Plantations



Kingairloch (summer)

In summer it can be difficult to differentiate the various types of vegetation because everything is green. It is much easier in autumn and winter when each plant community is a different shade of brown. Here, the foreground consists of wet heath (A) with a raised bog (A1) visible in the middle distance, indicated by its browner colour.

There is a planted native woodland of birch and Scots pine (B) surrounded by a deer fence: the lack of grazing within the fence has allowed the vegetation to grow tall and heather to flourish (brown).

There is also a natural woodland of birch in the distance (C), with widely-spaced trees and no young trees present, indicating it is likely to die out. However, trees are also present on the cliff above (C1), representing a small core area of woodland where trees are also likely to survive however many grazing animals there are (see page 25).

The drier, steeper slopes are dominated by heather (D), and there are stands of bracken on some of the gentle slopes in the distance (E).

In the foreground is the remains of an old metal fence post (F) built to manage sheep or cattle, indicating this area was once part of a farm. Recent decades have seen much land use in the Highlands changing from farming to forestry or woodland, a change encouraged by the government grants available.



A. Bog asphodel and bog myrtle on wet heath

Bog asphodel with its yellow flowers and bog myrtle (visible on the right) are both common in wet heath. Bog asphodel is in flower during June.



B. New native wood plantation, Loch Melfort

Numerous hillsides across the Highlands are being planted with native woodland. These are not commercial forests with trees grown for timber, but are planted for conservation reasons.



C. Cliff wood with regeneration below

At the top of this picture is a cliff covered in birch trees. The wood has had a deer fence built around it, allowing dense regeneration of the trees within the fence. This is in contrast to the nearby unfenced woodland in the main picture where there is no regeneration below the cliff.

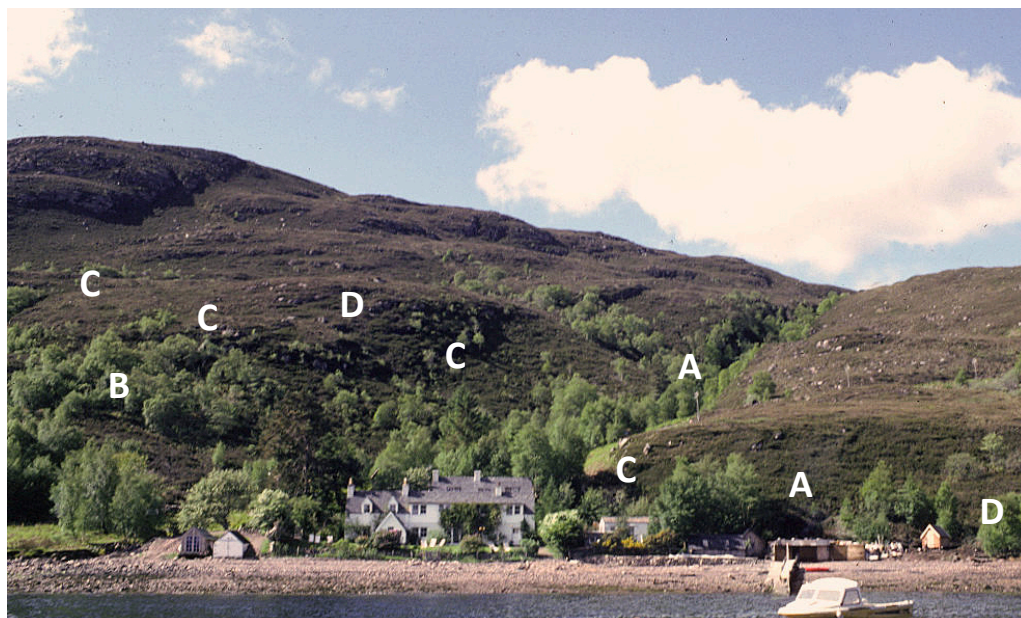


D. Dry heath (heather)

Heather moorland, characteristic of dry slopes on poor soils.

NATIVE WOODS

Birch wood regeneration



Loch Broom, Wester Ross

Natural woodland has been rare in the Highlands for the last few millennia, but has always been commonest along the coast (page 23). The amount of grazing in the landscape, whether from sheep, cattle or red deer, influences the cover of woodland because the animals eat the young trees, preventing regeneration. If the number of animals is reduced, whether through reduction or removal of livestock, or disease, harsh weather or culling of deer, then woodland can expand from its core areas of gullies (A) and cliffs (B). This is happening here with birch trees colonising heather-covered slopes (C) above Loch Broom, opposite Ullapool.

The dominance of heather (D) indicates drier soil, more suited to trees than wet heath or peat bog. This, combined with its coastal location and milder climate, means that if grazing is reduced, as presumably has happened here, then birch woodland can expand.

Expansion of woodland such as this, without any tree planting, is called 'natural regeneration'. This is the method of new woodland creation preferred by environmentalists because it results in a more natural pattern of woodland cover. However, modern research highlights the importance of grazing animals in shaping the ecosystems of natural landscapes, so whether this approach is in fact 'natural', is open to debate.



A. Gully wood, Argyll

Gully woods such as these can be seen as 'core woods' which are always present, and from which trees can expand outwards if conditions change, or retreat back if conditions revert.



B. Cliff wood, Kingairloch

Cliff woods can also be seen as core woods, always present in the landscape. In the case, the presence of dense bracken stands below the wood may inhibit any future expansion of the woodland down off the cliff.



C. Regenerating birch trees, Isle of Rona

An area where grazing has reduced significantly owing to the removal of sheep, resulting in regeneration of birch. If sheep numbers drop, then their place can be taken by red deer resulting, over time, in no overall reduction in grazing (unless the deer are culled).

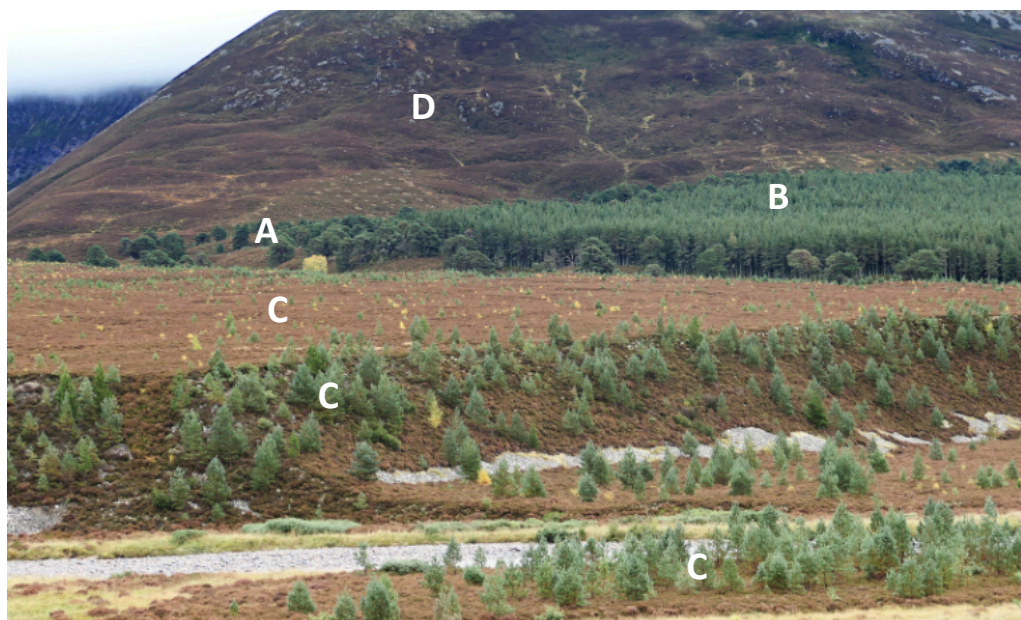


D. Dry heath, Isle of Seil

Well-drained heather moorland at lower altitude can be a suitable habitat for Scots pine, birch and oak to colonise if grazing levels are reduced. In these situations, trees regenerate best if there are some animals present whose trampling damage provides seed beds for young trees.

NATIVE WOODS

Pinewood regeneration



Glen Feshie, Cairngorms

Scattered across the Highlands are woods of Scots pine (A), remnants from a time when it was once abundant (page 21). In this picture, there is a neighbouring plantation of pine (B) as indicated by the dense stand of uniform, even-aged trees.

Even though the evidence points to the wood declining naturally from a postglacial maximum thousands of years ago, there is a strong movement in Scotland to 'restore the Caledonian Forest', mainly by reducing the numbers of red deer to levels low enough for the trees to regenerate – as here in Glen Feshie (C). This approach is now generally known as 'rewilding', but it is a moot point if this is the case when the mainly treeless moorland landscape of today is in fact the natural 'wild state', and if grazing has to be reduced to way below the assumed natural level: grazing animals are intrinsic features of natural ecosystems. The desire for more trees in the Highlands, therefore, may be based more on human preferences rather than the allowance natural processes – which, in the Highlands, have led to a long-term decline of woodland.

But whatever the case, the reduction in grazing has been successful in allowing young trees to flourish, as here in Glen Feshie. It will be noticed that the young pine are particularly abundant on the dry, steep river bank and on the alluvial soil below. Above the woodland is heather moorland (D) and it is hoped that eventually the pine will colonise these upper slopes to create a natural treeline.



A. Native Scots pine wood, Kinlochewe

A relict native pinewood, at Glas Leitire in Wester Ross. The trees are often widely spaced, with long side branches, as here – indicating trees have always been regenerating at low density. These western woods differ genetically from those in the east. There has been some felling of this wood in the past.



-B. Old pine plantation, Grantown-on-Spey

There are considerably more areas of planted Scots pine in Strathspey than original native woodland. This plantation has more widely-spaced trees than those in the main picture.



C. Pine regenerating in heather, Mar Lodge Estate

This is a location on the Mar Lodge Estate, east of Glen Feshie, where there has also been a large culling of deer to allow tree regeneration. To some extent heather inhibits trees, but if there is a large seed rain, then some seedlings establish.

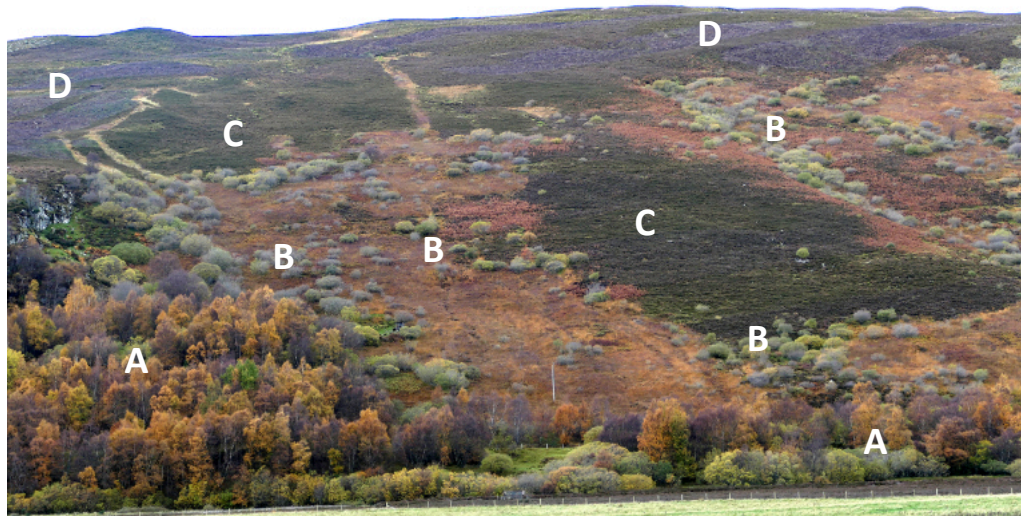


C. Regeneration amongst old Granny Pines

This is another area of Glen Feshie showing old Granny Pines with their rounded crowns. Amongst the trees there is plentiful regeneration of young trees owing to a reduction in grazing animals.

NATIVE WOODS

Scrub expansion



Glen Truim, Inverness-shire

This is a hillside north of Dalwhinnie showing what happens if grazing animals (sheep or deer) are removed from moorland.

The most obvious sign is in the increase in willow shrubs, visible as the rounded clumps (B), which are expanding on the damp grassland and heather (C). The commonest species involved is the eared sallow (*Salix aurita*). This will have been growing amongst the vegetation but kept low by grazing: once grazing is removed, any suppressed shrubs can grow tall.

This is normally the case with trees as well. In the vicinity of woodland (A), there can be a lot of young trees present, but none getting above the height of the surrounding vegetation. When grazing is taken away, there is an immediate growth of regenerating trees because they can now grow to their full height.

But after a year or two, once all the suppressed trees have got away, then tree regeneration slows. This is because the vegetation thickens-up and, without trampling breaking up the plant litter (from dead leaves), tree seeds cannot reach through to the soil to germinate.

It is an obvious fact that without grazing the vegetation gets taller. An upshot of this is that low-growing plants are shaded out and the number of different plants in the sward decreases. The risk of fires also increases.

Recently burnt heather from muirburn is at the top of the hill (D).



A. Native birch wood, Kinloch Rannoch

Birch woodland, which can expand in area if grazing is reduced; see also page 66.



B. Scrub willow (eared sallow)

Eared sallow now growing above the height of the surrounding moorland vegetation owing to lack of grazing.



C. Long, unburnt heather

Burning keeps heather short – without burning it can grow tall and leggy. It also becomes increasingly woody, so that unburnt moorland is a fire risk: with warmer and drier summers becoming more common, this increases the risk of catastrophic wildfires.



D. Muirburn, Mount Keen, Aberdeenshire

Muirburn is carried out to benefit red grouse. The landscape would still be heather moorland without burning: it just changes its structure. Regular burning for grouse started in Victorian times, but burning has long been carried out by farmers and crofters to improve the grazing.

SPORTING ESTATES



Strathfarrar, Inverness-shire (winter)

The social structure of the Highland and Islands through most of history was that of a clan-based system: a patchwork of independent clans across the land, each with its own Clan Chief. Individuals in each clan took the name of the clan, such as McLeod, Mackenzie, Munro or Campbell.

But the system broke down after the Battle of Culloden, near Inverness, in 1746. There is a complex history here, but, following the battle, the previous Clan Chiefs metamorphosed into the more traditional type of landowner as found in the rest of Britain, but known as 'the laird' in Scotland. Land came to be seen to have monetary value, with the landowners now seeing the land as a source of income rather than a place where they and their clansmen lived.

From this evolved the concept of the 'sporting estate', where a shooting lodge and associated outbuildings were constructed (A), often in remote areas – which necessitated the construction of access roads. The landowner and his rich friends stayed in the lodge for the duration of the shooting season, the principal game being red deer (B), red grouse and salmon.

'Deer forests' are hills where red deer are the main game. Note that the term 'forest' is here used in the old usage of 'uncultivated land' rather than denoting the presence of trees. Heather moorland with muirburn is on the hill land (D), where there are also patches of bracken present (E). There are rhododendrons in the garden (C).



A. Estate buildings, Glen Roy

As well as the shooting lodge itself, there are normally buildings for the associated gamekeepers and ghillies, kennels, and a deer larder where the shot deer are kept.



B. Red deer

Red deer (*Cervus* go back to previous page) indigenous to the Scottish Highlands, have been present throughout postglacial times. In previous centuries there were some 'Royal Forests', such as the Forest of Mar, where the Scottish aristocracy would go to hunt deer and other game.



C. Rhododendrons, Arisaig

Gardens around the 'big house' (the laird's house) and shooting lodges often contained rhododendrons. The site of the big house can often be identified as the locus of a spread of rhododendrons (page 73) into the wider landscape.



D. Muirburn, Eastern Cairngorms

A patchwork of older long heather, recently burnt heather (dark), and older burnt areas (light brown). On grouse moors, heather is burnt on a rotational cycle of about seven years.

SPREAD OF RHODODENDRON



Letter Finlay, Great Glen

Rhododendrons were popular shrubs in Victorian gardens, particularly those around the big house of the Scottish laird. Species of rhododendron from all over the world were often grown, and nowadays they are a feature of many Highland gardens which are open to the public, such as the National Trust for Scotland's Inverewe and Brodick (page 84).

There is one species, not native to Scotland, which is particularly hardy, *Rhododendron ponticum*, which was used as a root-stock onto which stems of more colourful species were grafted. But if not managed, it can grow up from the root and takeover.

This species has proved highly invasive in the Highlands, particularly in the wetter west: it was, after all, chosen and bred by Victorian horticulturalists because it was hardy and well-suited to the Scottish climate. It readily spreads out from the garden in which it originated.

If not managed (it is expensive and difficult to control), it will take over much of the landscape as shown in this photograph. There are several other invasive garden escapes, but not on such a scale as rhododendron.

Both rhododendron and Sitka spruce (page 57) have the potential to reshape the Highland landscape in coming centuries by slowly colonising the whole region.



A. Rhododendron ponticum in flower

The plant has a light purple flower and comes into bloom in late spring. Each plant produces thousands of fertile seeds.



B. Rhododendron spread, Tarbert

An example on the shores of Loch Fyne in Argyll showing how rhododendron has completely covered the coastal slopes. Controlling it is difficult because cutting it down does not kill it: if cut, it sends up multiple new shoots from the roots.



B1. Spread along roads, Spean Bridge

Rhododendron rapidly colonises roadsides, with roads providing a corridor for invasion of the species into a new area. Sometimes removal of a single plant in a new area would prevent costly and difficult control in future years – but this rarely happens.



B2. Spread in woodland, Lochranza

Like Sitka spruce, the plant colonises a wide range of Highland vegetation types, including moorland, peat bogs and, as here on Arran, woodland. It swamps all other vegetation and shades out the ground flora, leaving bare ground beneath.

HISTORIC ENVIRONMENT

Archaeological landscapes



Kilmartin Glen, Argyll

The Highlands and Islands have had a long history of human occupation, going back at least 10,000 years. The population was densest along the coast because in the past the sea was the main highway, and much of the inland in the west was mountainous with soils and climate not particularly suited to agriculture.

These early settlers have left their mark on the landscape in many places, particularly in places which have not been heavily modified by modern agriculture. Archaeological remains include ancient standing stones (A), some of which form stone circles; burial cans from the Stone (Neolithic) and Bronze Ages (B); 'cup and ring marks', which are stones engraved with a range of patterns, but which are hard to date; remains of Neolithic stone walls; hut circles from the Bronze Age, which are the foundations of round houses; monastic beehive which are cells, small stone huts dating from around the 6th century which are found on west coast islands; remains of Viking longhouses; brochs in the west and far north (page 125); and duns (forts) found across Scotland.

At Skara Brae in Orkney, there is a whole Stone Age village, which was covered in sand for many centuries and only revealed after a big storm blew the sand away in 1850.



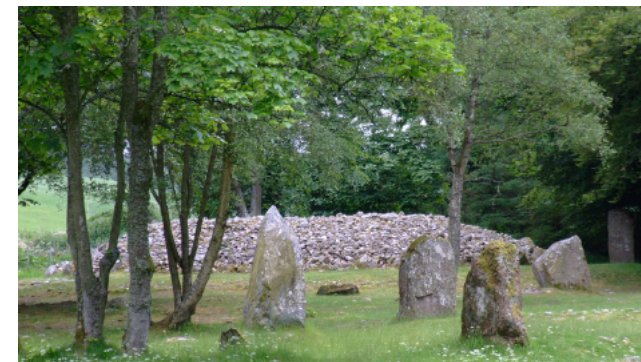
A. Stone circle, Callanish, Isle of Lewis

The Callanish (Calanais) stone circle, dating from the Neolithic era, is one of the most complete in Scotland. Another famous one is the Ring of Brodgar on Orkney (page 128).



B. Ancient burial cairn, Kilmartin Glen

One of the large burial cairns in Kilmartin Glen in Argyll, a landscape rich in archaeological remains. Some cairns have burial chambers underneath, the most impressive of which is the 5,000 year old Maeshowe in Orkney. Smaller cairns are found across the region.



B. Ancient burial cairn, Clava

The Clava Cairns south of Culloden, near Inverness, are another famous series of burial cairns.



C. Oak woodland, Taynish, Argyll

In the background of the main picture oak woodland is visible. Where these woods were managed to produce charcoal, the remains of charcoal burner's huts can sometimes be seen.

HISTORIC ENVIRONMENT

Vernacular buildings



Traditional but n' ben, Inverasdale, Wester Ross

In a landscape where woodland was scarce, the main building materials were turf and stone. This is in contrast to Norway across the North Sea where woodland is abundant and the houses are made of wood. Houses with turf walls and thatched roofs would have been commonest long ago, but, once abandoned, the turf gets absorbed back into the ground so that nowadays there is no trace of them to be seen.

The blackhouse became the design for the most people in the west, houses with wide walls and rounded corners, and roofs of thatch, often of heather. The original ones had no windows and no fireplace: just a peat fire in the middle of the floor. The remains of many of these can still be seen in the Outer Hebrides.

From the 1700s the black houses were slowly replaced by 'white houses', the traditional two-roomed 'but n' ben': the 'but' was the kitchen and the 'ben' the best room, although they proved to be draughty and needed more fuel to keep warm. They were often painted with whitewash (a lime-based paint). With a burgeoning slate industry developing in Scotland (page 36), the roofs were often of slate.

The but n' ben, and the other larger houses shown on the right, were built to a common pattern, painted white, and with the aesthetic proportions carefully worked out: the same designs were used across the country, resulting in a coherent aesthetic appeal across the whole area.



A. Ruined blackhouse, South Uist



B. Restored blackhouse, Lewis



C. House with dormer windows, Loch Ewe



D. Farmhouse and outbuildings, Isle of Bute

Blackhouses, in modern terms, were energy efficient in that there were no windows or chimneys to lose heat, and all heat generated remained in the building. Hence they were ideally suited to the cool, damp and windy climate. This one had been modernised by the addition of a chimney.

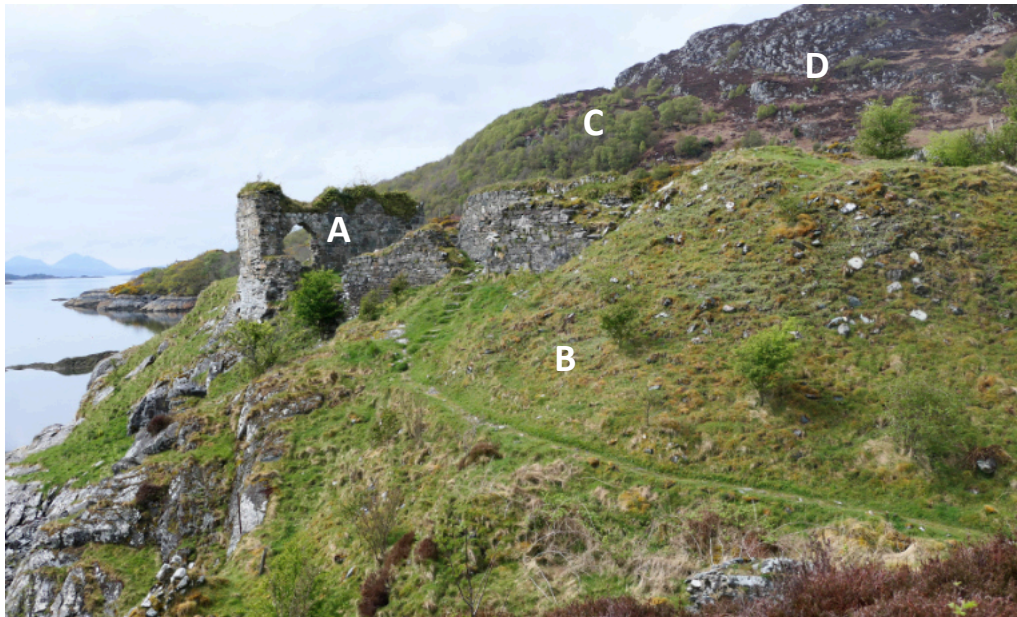
The roofs were tied down with stones to prevent the thatch blowing off in the windy climate. The soot-impregnated thatch was recycled in the fields as a fertiliser.

Richer people, such as the tacksmen (farmers), built one-and-a-half storey buildings with sloping ceilings on the top floor and dormer windows. The outside walls were harled (rendered) and painted with whitewash.

The larger farms were two-storey, with the farm buildings designed to be in the same proportion and style to the farmhouse. When these were built, starting in the 1700s, they were status symbols, showing that the Highlands were now part of the modern world.

HISTORIC ENVIRONMENT

Castles



Strome Castle, Inverness-shire

The Highlands are renowned for the castles which are found across the country. These range from ruins in different states of disrepair (A) to castles which are still inhabited (page 83). Others consist of once-ruined castles which have been restored, such as the famous Eilean Donan castle on its island in Loch Duich on the main road to Skye, and Castle Stalker in Argyll.

The history of the Highlands is often one of battles and wars, both between warring clans, and against invaders – whether from elsewhere in Britain or the Norse invasions of Vikings in the 9th century. Several were destroyed during the Jacobite uprisings in the 1700s.

It is a complex history, but the upshot is that there was a need for fortified strongholds and, because stone is readily available, these were constructed of stone.

The picture here is of Strome Castle, which guards the approaches to Loch Carron. Its history mirrors the complexity characteristic of most castles. It was built by the MacKenzies in the 1400s. In 1549, the Scottish King, James V, handed it to the McDonnells but, in the 1602 Battle of Moray it was captured by the Mackenzies and blown-up.



A. Castle ruin, Kilmartin Glen

This is Carnasserie Castle, which is in a better state of repair than Strome Castle to the left. However, it was only occupied for a short time: built in the 1560s, it was burnt down in 1690, following the 'Argyll's Rising' against the monarch.



B. Sheep-grazed smooth grassland, Isle of Seil

Strome Castle is surrounded by sheep-grazed smooth grassland, which keeps the vegetation short and makes for easy access to the ruins.



C. Native birch wood, Loch a' Draing

On the hillslope behind the castle, pictured left, is some native birch wood on a coastal hillslope.



D. Rocky heather moorland, Kingussie

Above the woodland is dry rocky moorland with heather. In this picture the green, low-growing shrub in the foreground is juniper (*Juniperus communis*), an occasional plant, commoner in the east. At one time, its berries were harvested and exported to Europe to flavour gin.

HISTORIC ENVIRONMENT

Ruined settlements



Isle of Muck: Sean Bhaile (west of Port Mòr)

Muck is a low-lying island, the smallest and furthest south of the Small Isles, a group of four islands in the Inner Hebrides. The largest is Rum, a mountainous island which is now a nature reserve. To the west of Rum is Canna, a more fertile island with a less rugged landscape composed of horizontal basaltic lava flows. In the distance in this picture is the Isle of Eigg with its distinctive ridge, well-known as it was the first place in Scotland where the local community bought the land from the landowner.

Muck is not croftland (page 109), but comprises a single farm. Like many islands, it once had a larger population as shown by the remains of old settlements (B). This settlement, Sean Bhaile, also contains a ruined chapel.

It is reported that there were 160 inhabitants on Muck in the late 1700s, but most were cleared off the land in the 1800s by the then landowner who was heavily in debt. This is an example of the infamous Highland Clearances. The island was a sheep farm for a while, before the new owner replaced them with cattle. The island is now managed for both sheep and cattle, together with sport shooting and tourist accommodation.

Away from settlements, ruins of the small stone huts accompanying shielings (summer pastures, page 39) can also be seen across the Highlands and Islands landscape.



A. Ruined dyke



B. Ruined settlement, Unst



C. Pasture, Isle of Muck (Rum in the background)



D. Bracken (winter)

Ruined dykes illustrate old field boundaries. Over time, they slowly collapse, remaining as linear features in the landscape. Many are now replaced by wire fences, which are cheaper, and easier to build and maintain than dykes.

The remains of a small settlement at Dale of Woodwick on the island of Unst in the Shetland Islands.

The grazing pasture on Muck is a mixture of improved and unimproved pasture, used for both cattle and sheep. A modern farm is visible in the distance. With some exceptions, nowadays cattle in the Western Highlands and Islands are kept for beef rather than milk and cheese.

Stands of bracken are visible in the middle distance in the main picture, and on the left side of the picture above. It is a plant that, if not controlled, can take over the pastures – reducing their grazing value.

HISTORIC ENVIRONMENT

Designed landscapes



Brodick Castle, Arran

In the 1700s there was a movement to beautify the land around the houses and castles of landowners, a fashion that took root across the British Isles. Capability Brown, as well as several others, was an English landscape architect who greatly influenced the design of such 'designed landscapes'.

The movement was also taken up in Scotland; for example, the extensive designed landscapes on the Atholl Estates at Dunkeld which included riverside walks, the planting of amenity trees such as the Douglas fir, and the building of Ossian's Hall at the The Hermitage, which overlooks the Black Linn Falls on the River Braan – all in keeping with the Victorian romantic view of nature. The planted Douglas firs at The Hermitage are now amongst the tallest trees in Britain.

The designed landscapes of Brodick Castle and The Hermitage, once private domains, are now open to public at large to enjoy through ownership by the National Trust for Scotland.

There has been a castle of some sort at Brodick from the 5th century, with the current castle dating from extensive reconstruction and expansion in 1844. As with many castles, the ownership has varied over the centuries. Surrounding the castle is parkland, a woodland garden and a walled garden – features of many designed landscapes.



A. Houses old and new, Lochbuie, Isle of Mull

The need for fortified houses disappeared as wars ended. Castles were replaced with more modern buildings in a designed landscape setting. Here, the Clan Maclean's Moy Castle on Mull (right) was replaced by the new Lochbuie House (left).



B. Castle grounds, Brodick Castle

Aesthetics were important when designing the grounds around big houses and castles, using trees and shrubs imported from all over the world. This shows the land around Brodick Castle, which includes both a woodland garden and a walled garden.



C. Walled garden, Inverewe, Wester Ross

Walled gardens, with an associated greenhouse, were a key feature of the laird's dwelling, providing fruit and vegetables throughout the year. Walls provided shelter and fruit trees were often planted against the south-facing walls. This is the one at Inverewe Garden.



D. Parkland and stables, Inveraray Castle

Around some castles, such as Inveraray Castle in Argyll, the seat of the Clan Campbell, there was extensive parkland with widely-spaced trees. There were also associated buildings built in a matching architectural style, such as the stables visible here.

UPLAND PATHS



The path up Stac Pollaidh, Sutherland

The hill pictured here is Stac Polly (Stac Pollaidh in Gaelic). At 612 m it is not high enough to be a Munro, but its spectacular mountain ridge makes it popular with hillwalkers. A 'Munro' is a hill over 3,000 ft (914 metres), so-called because they were first listed by a mountaineer named Sir Hugh Munro in 1891. There are 282 across the Highlands and Islands, and people who like to climb them are called 'Munro-baggers'.

Most hills in Scotland never had paths to the top because they were rarely climbed. In the 19th century and the first half of the 20th century, the hills were part of sporting estates. Access was the preserve of the landowner and his friends, and public access was not allowed.

As hillwalking became more popular in the second half of the 20th century, conflicts arose between the owners and those wishing to climb the hills. This was resolved in some areas by the National Trust for Scotland buying estates in popular hillwalking areas, such as Glencoe, Ben Lawers, Kintail and Torridon, which were then open to the public all year. The situation was only fully resolved by the Scottish Government passing the Land Reform (Scotland) Act in 2003, giving the public the 'right to roam' everywhere, excepting private gardens, and a few other places.

An upshot of the popularity of walking has been the proliferation of footpaths to the summits of hills, and to other tourist sites. Previously, any hill paths were built for deer stalkers in Victorian times – and they went to the corries, where the deer were, rather than to the summits.



A. Cairngorm paths

An example of how mountain paths have developed with the popularity of hillwalking. This shows paths in the Cairngorms.



B. Summit path, Ben Dòrain

Ben Dòrain is a Munro above Bridge of Orchy, and this shows the path to the summit. This was never built as a path, but has developed informally from the feet of numerous hill-walkers over time.



C. Eroding path, Bridge of Orchy

Because the paths were not constructed, but followed the easiest route to the summit, the passage of feet erodes the vegetation down to the soil or peat beneath. In the wet climate, water flowing downhill causes additional erosion.

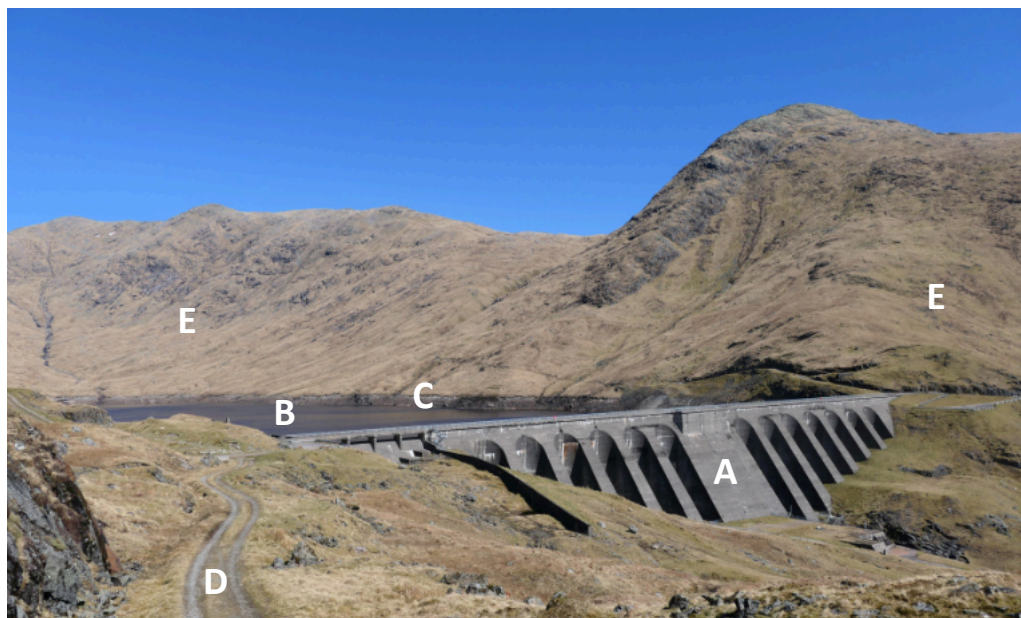


D. Restored path, Glencoe

There are now specialist mountain footpath teams dedicated to path repair. This shows a repaired section along a stretch which was once eroded as in the picture above. A restored length of path can also be seen in the main picture.

INFRASTRUCTURE: ENERGY GENERATION

Hydro-electric schemes



Cruachan Dam, Argyll

Hydro-electric schemes produce electricity by creating a reservoir to store water (B), which is then piped downhill to a power station. In most cases, Highland reservoirs were created by increasing the depth of existing lochs with a dam across the outflow (A), although occasionally a totally new loch would be created such as Loch Glascarnoch in Wester Ross.

Construction of the first large-scale scheme in Britain began in 1895 at Foyers on the shores of Loch Ness to provide power for aluminium smelting. Two similar schemes followed at Kinlochleven and Fort William. Today, only the Fort William aluminium smelting is still functioning, but the other two schemes still produce electricity to feed into the National Grid.

The Tummel-Garry scheme at Pitlochry was opened in the early 1930s to provide power for the Central Belt. Later, Tom Johnston, the Secretary of State for Scotland during the Second World War, had a vision of bringing 'Power to the Glens' to stimulate the Highland economy with cheap electricity. This vision was realised with the formation of the North of Scotland Hydro-Electric Board in 1943. Thereafter, the main era of dam building began, lasting into the 1960s. This resulted in about 50% of the river catchments in the Highlands being modified to feed water into reservoirs, producing about 10% of Scotland's electricity.



A. Reservoir dam, Cruachan

Dams were built in remote areas of moorland (E) and were a huge engineering undertaking. Roads had to be constructed to allow materials to be brought in; large work camps were created; and streams diverted through pipes and tunnels to feed water into the reservoir.



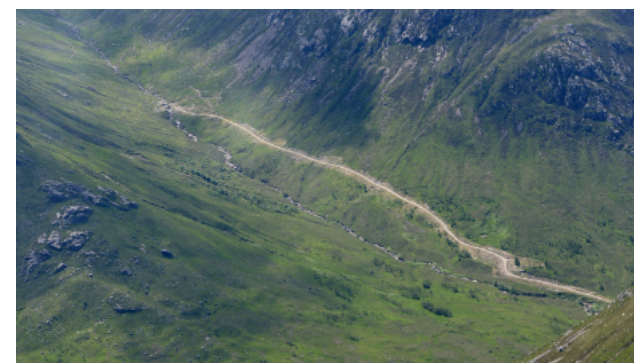
B. Reservoir behind dam, Cruachan

Tunnels or pipes are used to take the water from the dam down to the power station. Some tunnels are many miles long. This reservoir below Ben Cruachan, is a pumped-storage scheme: water is pumped up from Loch Awe when electricity demand is low, and released down when needed.



C. Reservoir drawdown zone, Loch Cluanie

Reservoirs differ from natural lochs because, as well as a dam, they have a 'drawdown' zone around the shore. The water level varies depending on rainfall and the demand for electricity; no plants can survive these variable conditions, so the shoreline is bare rock – here at Loch Cluanie.

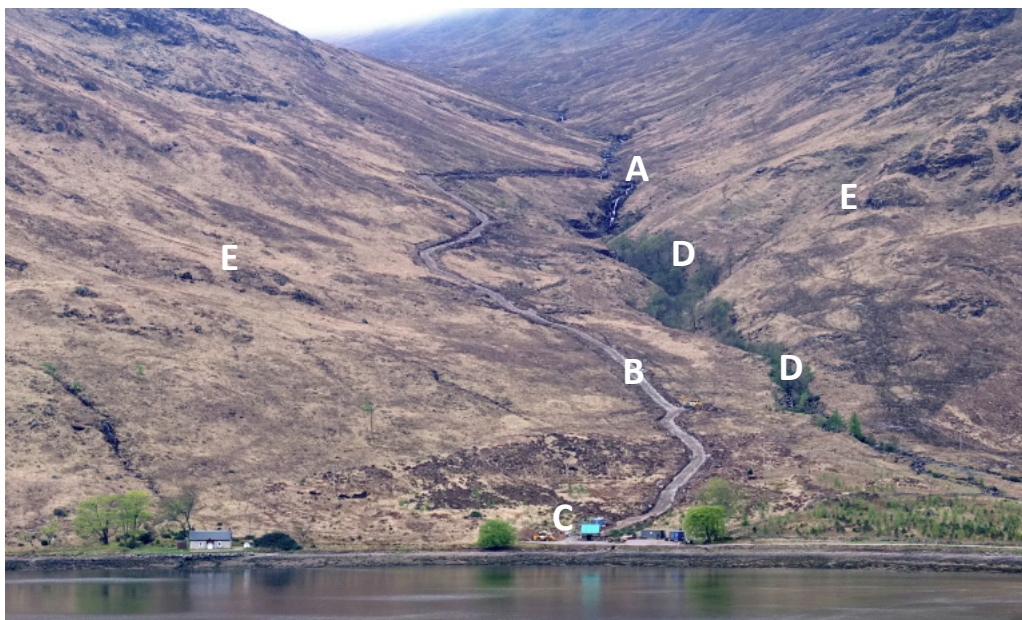


D. Associated vehicle track, Ardour

The presence of a drawdown zone makes reservoirs look artificial in comparison to natural lochs. Similarly, the constructed road or track up to a dam, and the dam itself, is a detractor to the wild character of the natural landscape. This track is to a run-of-river hydro-scheme (page 89).

INFRASTRUCTURE: ENERGY GENERATION

Run-of-river hydro schemes



Kingairloch, Inverness-shire

The era of construction of large dams and reservoirs came to an end in the 1960s when most suitable river catchments had been tamed. A few proposed schemes were abandoned owing to their landscape sensitivity, including those planned for Lochan Fada/Loch Maree, Loch Affric itself (although there is a scheme immediately downstream), and a pumped storage scheme below Ben Lomond.

The large-scale schemes have now been superseded by 'run-of-river' schemes. These differ in not having an upstream reservoir. Instead, a dam is built across a burn or river and much of the flow diverted down a buried pipe to a small power station at the bottom. The characteristics of such a scheme is illustrated above: A. B. & C.

In recent years, though, some new large-scale hydroelectric schemes are being planned or built: these are 'pumped-storage schemes', so-called because of their ability to store electricity: when electricity demand is low, water is pumped from the loch at the base to the reservoir above, and released back down when electricity demand is high. These new schemes need reservoirs built high in the remote mountains, with associated tracks, dams and pipes.

All hydro-electric schemes, old or new, introduce significant infrastructure into even remote glens.



A. Dam and intake, Braemar

A dam for a run-of-river scheme. Above the dam there will be an intake for an underground pipe taking water down to the power station. Such dams interfere with the natural flows of water-courses, although operators always to have ensure some 'compensation flow'.



B. Vehicle access track, River Grudie, Torridon

A track needs to be built for construction of the dam and buried pipe. The disturbed ground to the left of this track shows where the pipe was buried. The track needs to be retained to allow vehicle access: after heavy rain, the intake can be blocked by stones which need to be removed.



C. Powerhouse, Easter Ross

Every scheme has a small power station at the bottom, and associated electricity cables to connect the supply to the National Grid.



D. Gully wood, Isle of Mull

Often the only trees in the landscape are those in gullies along the burns as shown in the main picture. Elsewhere the vegetation comprises moorland habitats (E).

INFRASTRUCTURE: ENERGY GENERATION

Windfarms



Mybster, Caithness

'Renewable energy' is the term used for energy which uses natural flows of energy, whether plant growth (biomass), water (hydro-electric) or wind (windfarms) as here. These energy generation systems do not rely on the combustion of fossil fuels, that is fuels which depend on ancient organic matter buried underground in geological formations. It is the release of such fossil carbon into the air which is causing an increase the amount of carbon dioxide in the atmosphere – and carbon dioxide warms the surface of the earth by preventing long-wave radiation being radiated into space (the 'greenhouse effect').

With fossil fuels, a lot of energy can be obtained from a relatively small amount of fuel, hence the widespread use of coal, oil and gas. In contrast, the natural energy flows harvested by renewable energy systems are low density. A single power station burning fossil fuel can supply electricity to an order more homes than a windfarm whereas, if renewable energy is to be the main source of generation, a lot of land (or sea) needs to be covered in wind turbines.

Wind turbines need to be tall to maximise the harvest of energy, and the longer the blades the more they can harvest: as technology advances, they increase in size. The presence of windfarms, therefore, can transform the Highland landscape by the addition of a lot of visible infrastructure.



A. Wind turbines and vehicle track, Farr

For scale, three people can be seen at the bottom of the nearest wind turbine. Each windfarm necessitates the creation of a network of wide vehicle tracks, which, as with forestry and hydro-electric schemes, is reducing the wildness of the Highlands. This windfarm has been built in an area of blanket peat.



B. Associated electricity pylons, Ben Cruachan

Most electricity generated in the Highlands has to be exported to the main markets in the south, resulting in a network of high voltage transmission lines – which are highly visible within the landscape. Many of the original power lines are now being upgraded, with taller pylons.



C. Flow Country peatland, Caithness

The windfarm in the main picture on the left is in Caithness, a flat landscape of peatland to the west, and of farmland to the east (see page 94). This means that even distant windfarms and pylons are highly visible.



D. Conifer plantation and felling, Flow country

In the 1980s many conifers, especially Lodgepole pine were planted in the Flow, Country. This caused controversy because tree roots dry out the ground, causing a loss of the peat. Many of these plantations are now being removed, with felled trees here visible in the foreground.

INFRASTRUCTURE: ENERGY GENERATION

Windfarms and nuclear



Dounreay, Caithness

The windfarm in the distance (A) contrasts with the Dounreay nuclear power station [B]. The latter was an experimental fast breeder nuclear reactor built in the 1950s, but it no longer produces electricity and is now being decommissioned.

But its presence has had an unexpected consequence: a power line was built up the east coast of the Highlands so that its electricity could be exported to the south. This meant that, when windfarms started being built in the 1990s, their electricity output could be connected through this power line direct to the National Grid, without the need for new pylon lines. This explains the large number of windfarms now built, or being planned, in the far northeast of Scotland.

However, the lack of power lines to export the energy is a current constraint on the building of new windfarms in many areas of the Highlands and Islands. Hence many new power lines are being planned, some as underwater cables from the islands.

The picture demonstrates how the one nuclear reactor at Dounreay occupies a relatively small land area compared to the numerous windfarms necessary to produce the same amount of electricity (it is the same with fossil fuel power stations, whether coal, gas or oil).



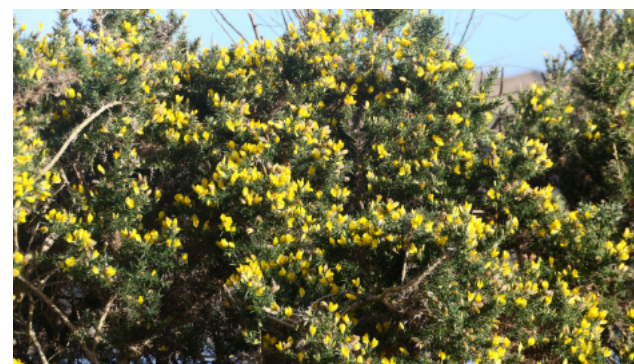
A. Windfarm, Loch Watten, Caithness

A windfarm on farmland in the flat landscape of Caithness. Conifer plantations and grazing pasture are also visible.



B. Nuclear power station, Dounreay

There is only one nuclear power station still operating in Scotland (at Torness in East Lothian). The Dounreay reactor here is being decommissioned. Nuclear power is controversial because the radioactive waste has to be stored safely for thousands of years.



C. Gorse

The extent of gorse is expanding throughout Caithness, often using the disturbed ground along roads as a path for invasion (page 14).

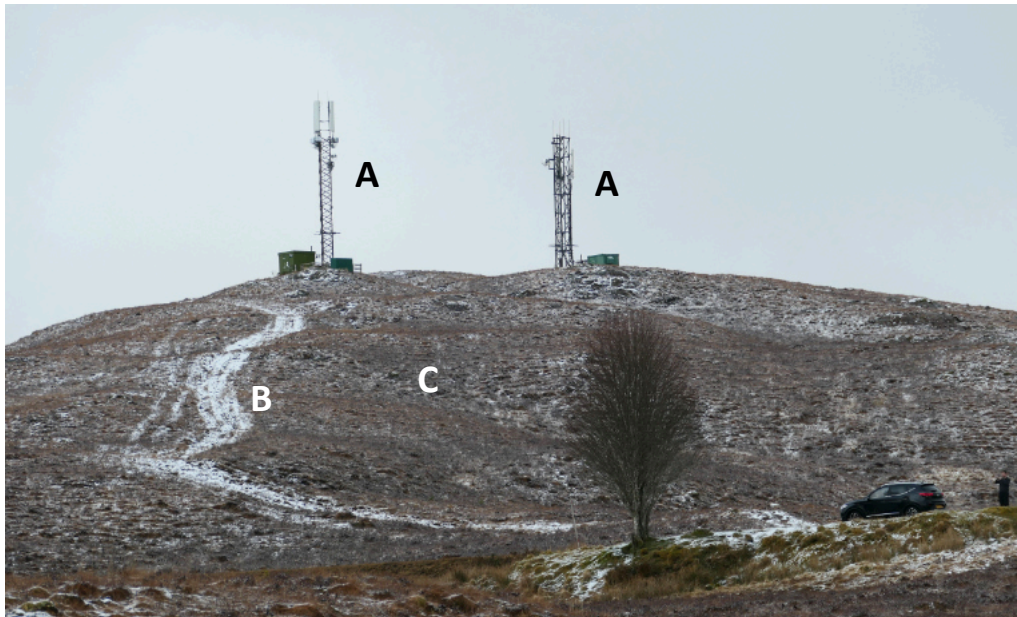


D. Peat bog, Flow Country

A close-up of peatland vegetation in the Flow Country which here includes heather and bog myrtle.

INFRASTRUCTURE

Telecommunication masts



Invergarry, Inverness-shire

With the advent of the mobile phone network in the 1980s, telecommunication masts began to be built across the Highlands. Before this there had been a few masts on coastal locations for marine navigation, some larger masts for broadcasting, and some for microwave phone links to distant islands.

But mobile phone masts spread quickly, placed in locations accessible to the road network and to settlements. In the mountainous landscape of the Highlands, more masts are needed to provide full coverage than in the relatively flat lowlands.

There may be two masts in the same location (A) because different telecommunication providers do not always share masts.

There has to be access to the masts for maintenance: some masts have constructed tracks, but others, as here, do not (B) – the vehicles just follow a given route over the vegetation (C).

The use of off-road vehicles is increasing in the Highlands, whether for access to masts, for estate management, for deer and grouse shooting, or for farming. These vehicles leave visible wheel marks in the vegetation, sometimes leading to soil or peat erosion. These marks, together with the proliferation of new constructed tracks, means the extent of wild or remote land in the Highlands continues to decline.



A. Hilltop mast, Loch Cluanie

Masts are often built on high ground in remote areas to provide signals to the road below, as here above Loch Cluanie. This is adding infrastructure to previously wild land.



A. Hilltop mast, Arisaig

A larger mast in a coastal location (Arisaig) providing microwave phone signals to distant islands.



B. Vehicle access to mast, Cliff Hill, Poolewe

Where no constructed track is built to the mast, then continual vehicle access across damp ground leaves obvious tracks in the vegetation, sometimes leading to erosion.



B. Moorland with vehicle tracks

Wheel tracks damaging wet heath and shallow peat in Glencoe, in this case from vehicles used to extract deer during deer culling. A water-filled gully has been created on the left, which will deepen and cause soil and peat erosion.

INFRASTRUCTURE

Fish farms



Loch Craignish, Argyll

Fish used to be exclusively caught in the wild, but since the 1980s, as the technology has developed, numerous fish farms have been located in sheltered locations along the west coast and amongst the islands. These are for Atlantic salmon (*Salmo salar*). The eggs are fertilised in onshore freshwater hatcheries, where they remain until big enough to be transferred to cages in the sea (as 'smolts'). This mirrors the cycle of wild salmon, which breed in freshwater rivers and burns, from which the young fish migrate down to the sea: here they feed for a year or two until they are big enough to return to the freshwater spawning grounds to breed.

Fish farms consist of cages which contain the fish, with netting both underwater and over the top to prevent predation of the farmed fish by birds or seals. The fish are fed from automated feeders sited on a nearby raft. The food consists of fish-meal and fish-oil, normally harvested from smaller species of wild-caught fish. There are also trout farms present on some freshwater lochs (page 107), growing the non-native rainbow trout (*Oncorhynchus mykiss*).

Dedicated fish farm boats bring in the feed and take away the salmon once they are ready to harvest – after one and a half to two years.

This view also shows a commercial forestry plantation with clearfell, and hence is an example of a modern economic landscape (see pages 105-108). There is also native woodland along the shore.



A. Fish cages, Seil Sound

After harvesting the salmon, the site is often left fallow, with no fish, for a year or two to allow the seabed to recover from the fish droppings and uneaten food fallen to the bottom. Fish farms use chemicals to control parasites and rely on imported fishmeal.



B. Mussel farm, Loch Eil

Farms growing mussels (*Mytilus edulis*) are seen as more environmentally benign. They use ropes hanging down from buoys on which the mussels attach. They are filter feeders, taking up plankton, so do not rely on imported fishmeal.



C. Fish farm shore base, Loch Awe

Fish farms have a shore base to service them, here associated with a trout farm on Loch Awe (page 108). The base requires an access track, buildings, hardstandings, a slipway and pontoons. Sometimes these are located as a new development in an otherwise remote area.



D. Well-boat, Loch Linnhe

'Well-boats' are a common sight on the west coast. These are used to transport the salmon, which are hoovered up from the cages in large pipes for delivery to the fish-processing factory. The industry as a whole is an important source of jobs and income to the Highland economy.

INFRASTRUCTURE

Coastal defences



Kilmelfort, Argyll

Shorelines are susceptible to erosion by the sea during storms and such erosion is becoming more common as global warming both increases the intensity of storms and is causing a rise in sea level.

Hence, roads and settlements near the sea are often protected from further erosion through the use of rock armouring: that is, large rocks piled up along the shore to break the force of the waves.

This inevitably adds an increase of artificiality to the landscape in that the rock armouring rarely, if ever, reflects the characteristics of a natural shore: the rocks are often brought in from elsewhere, not matching the colour or shape of the native rock; also, they are generally all of the same size, whereas a natural shoreline will have bigger rocks at the bottom and smaller ones above.



A. Rock armouring (non-native rock), Isle of Seil

Rock armouring on the Isle of Seil put in place to protect a new septic tank. The rocks used do not match the local rock, being of different colour and shape. Neither have they been graded small to large up the shore, so it all looks very artificial, albeit effective in preventing coastal erosion.



B. Rock armouring (native rock), Shieldaig

In this case, the rock armouring put in to protect the village is of the same type as on the natural shore, and so fits into the landscape better.



C. Gabion baskets

Gabions, wire baskets filled with rocks, are sometimes used for coastal protection. They are also commonly used to reinforce track, road, stream and river-sides. In the past such reinforcement would have used mortared walls of local stone. Gabion baskets often break apart over time.



D. Seawall of concrete blocks, Dunbeath

A breakwater has here been created to shelter the Caithness harbour of Dunbeath from waves. Although effective, the seawall in this case is particularly ugly.

TRANSPORT

Transport corridors



Dalwhinnie, Inverness-shire

Before the building of the first military roads by General Wade, which began in 1725, the mountainous areas of the Highlands were road-less, and, importantly, bridge-less, with many rivers impeding travel. Much of the land was rough and boggy, making any inland travel difficult. The sea was the main highway.

The Wade roads were not suited to civilian travel, and it was only possible for wheeled vehicles to traverse the Highlands after the completion of the road network overseen by the famous engineer Thomas Telford in the early 1800s, overseen by the local engineer, Joseph Mitchell. These were the 'Parliamentary Roads' (created by an Act of Parliament), which enabled the first regular coach services from the Scottish lowlands to Inverness to start in 1806.

Early roads tended to follow the landform and, if no longer used, have mostly merged back into the surrounding moorland landscape [E]. Modern roads (B) in contrast, are built with significant landform modification to ensure straight and level routes, and new roads are significantly wider than their predecessors.

These modern transport routes, including railways (A) follow the main straths and glens, as do the modern-day power lines (D). The increasing presence of roadside trees (C) is nowadays tending to obscure the view from many roads. The ones here were planted to prevent snow drifting over the road.



A. Highland railway, Kyle of Lochalsh (1984)

The coming of the railways opened up the Highlands to mass visitation, with the Highland mainline through the Grampian Mountains from Perth to Inverness opening in 1863. The line to Kyle of Lochalsh, pictured here, was the gateway to Skye and the Outer Hebrides, and was completed in 1897.



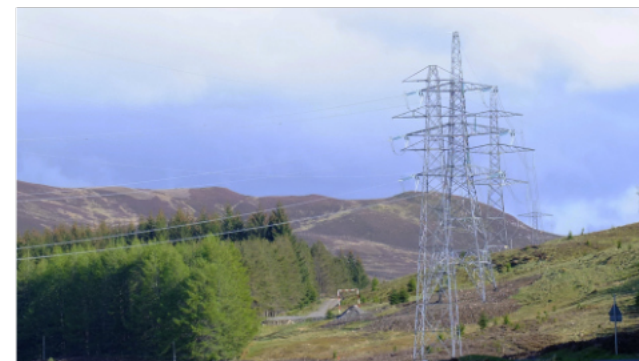
B. Road bridges old and new, A9 at Dunbeath

The early roads followed the landform, without major cuttings and embankments. Bridges were stone-arched, many still standing today. Modern roads cut through the landscape with straight lines, rather than meandering through the natural hills and hollows.



C. Roadside trees, A832, Strathbran

The sides of roads, often with disturbed soil after road improvements, are colonised by trees self-seeded from plantations and woods. Other plants also colonise roadsides, including rosebay willowherb (*Chamerion angustifolium*), with its distinctive purple flowers in August.



D. Power lines, Great Glen

With the increasing number of renewable energy schemes in the Highlands, particularly windfarms, there is a need to upgrade the high voltage pylon lines, and to build new ones, to take the electricity to the main markets in the south – because the area generates more than it needs locally.

TRANSPORT

Sea and land



Achnacroish, Isle of Lismore

The sea had always been the main method of transport across the Highlands and Islands: it was the highway linking all the islands, and also linking coastal communities along the mainland. Inland, the land was rough, boggy and mountainous, with rivers which were impossible to cross in times of spate. Additionally, the highly indented coast meant long journeys by land to communities which might be only a few miles apart.

The development of the steamship in the late 1700s improved journey times around the coast, which included the use of *The Comet*, the first commercial steamship in Europe. These engine-powered ships made the Highlands more accessible to visitors from the south. Associated with the development of the tourist trade, harbours were improved, with jetties built, and some local villages developed into tourist hubs with hotels, such as Rothesay, Oban, Tobermory and Portree.

At the same time, harbours were built on the west coast for the fishing industry, and also to promote economic development, such as at Ullapool and Stornoway; and numerous harbours were built down the east coast. Until the 1800s, boats had to beach at high tide, or off-load into tenders.

The coastal steamer trade continued into the early 1960s, after which new roads and bridges made road travel more economic. But there is still a network of ferries to service the islands of Shetland, Orkney and the west coast, and also an increasing number of small tourist ships.



A. Oban-Colonsay ferry, Firth of Lorn

The islands around the coast are serviced by ferries. Causeways have been built in the Western Isles and Orkney to replace some, and there is discussion on whether more islands could be linked by causeways, bridges (as with Skye), or tunnels.



B. Old road, single track, Glen Torridon

The traditional Highland road follows the landform and is single track with passing places, as shown here. There was a major road-improvement spree in the 1960s-1980s, so that most major routes are now two-lane, although many lesser routes remain as single track.



C. Modern road, two lane, Newtonmore

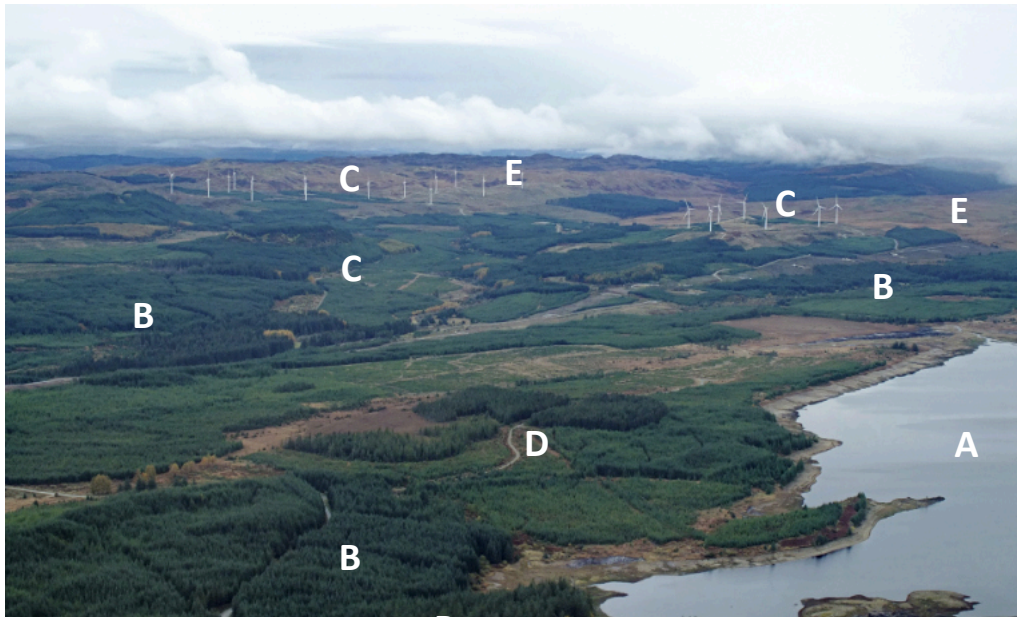
Modern roads make no concession to the landscape, but are built as straight and level as possible as shown here – the main A9 trunk-road north. Currently this road has a few sections of dual carriageway, but is in the process of being converted to dual carriageway throughout.



D. Caledonian canal, Banavie, Fort William

Two canals were built in the Highlands in the early 1800s. The Caledonian Canal (as here) which bisects the Highlands through the Great Glen, using both natural lochs and engineered sections; and the smaller Crinan Canal at the head of the Kintyre Peninsula.

MODERN ECONOMIC LANDSCAPE



Asknish, Argyll

All the economic developments listed in the pages above are causing a change to the appearance of the Highland landscape over time, an issue discussed in my book *Landscape Change in the Scottish Highlands: Imagination and Reality*. In summary, economic development is resulting in an increasing imprint of human infrastructure in what was, until about 1750, largely wild and natural in appearance.

The above picture illustrates many of these economic trends:

- A) A natural loch converted into a reservoir with a visible dam and drawdown zone.
- B) Commercial forestry plantations of Sitka spruce on a large scale. Here, both old and newly planted second-rotation forests are visible.
- C) Windfarms of wind turbines and associated vehicle tracks.
- D) A forest access track.

The original moorland vegetation (E) now only remains as small areas within a landscape of commercial forestry.



A. Reservoir with drawdown zone, Loch Cluanie

A hydro-electric reservoir has a water level which rises up and down depending on the amount of rain and the demand for electricity: this is demonstrated by the presence of the artificial-looking drawdown zone.



B. Commercial forestry

A mature spruce forest, a clearfell area (far right), new planting (middle right) and a forestry track illustrate the features of commercial forestry. This landscape differs markedly from the moorland on which it would have been planted.



C. Windfarm

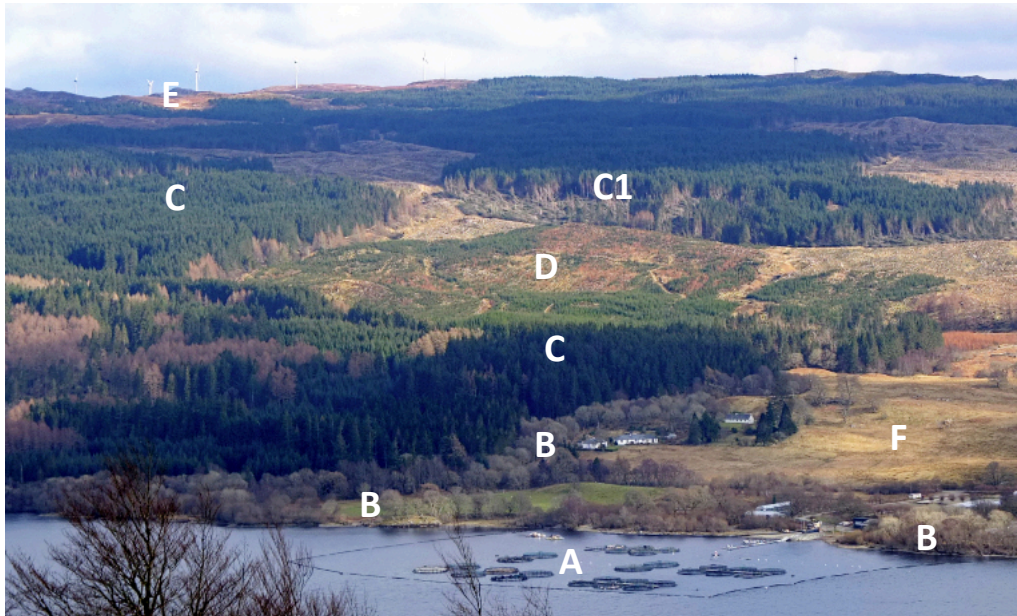
Another view in the area of the main picture, showing a windfarm built on moorland in the background; and a new windfarm being built within the plantation – demonstrated by the line of concrete bases visible here, on which the windfarm towers will be placed.



D. Forest track

Modern forestry needs to be able to deal with 44-tonne lorries for extracting the timber. Hence a network of roads such as these are built to deal with these heavy loads.

MODERN ECONOMIC LANDSCAPE



Loch Awe, Argyll

A view across Loch Awe in Argyll, again showing the features of a modern economic landscape:

- A) A fish farm, in this case a freshwater trout farm. The shore base is just visible on the loch shore on right-hand end of the fish cages.
- B) Relict native woodland along the loch shore and streamsides.
- C) Most of the landscape is now commercial forestry originally planted on moorland and farmland of which only a small area still remains (F).
- D) An area of young trees which have been planted on a clearfell site following felling of the original trees.
- E) It is hard to see in this photograph, but there is also a small windfarm on the moorland above the forestry plantation.

In the mid-1900s this whole area would have been a sheep farm, but is likely to have been planted with commercial conifers in a period when there was a depression in the sheep-farming industry. In other words, there more money in trees than sheep.

Note: Much intensively farmed land can also be seen as 'modern economic landscape': see pages 175-184.



A. Freshwater fish farm, Loch Awe

Fish cages for a freshwater trout farm on Loch Awe. The non-native rainbow trout is the fish used, as opposed to the native brown trout. Rainbow trout cannot breed in Scottish waters, so if they escape, they will not be able to colonise the local rivers.



B. Burnside alder wood, Glen Nevis

The loch shore and burnside have woods comprised of alder and birch trees. The woods have survived in these places because they are in areas where it is difficult to plant and harvest trees; and there is now a policy not to plant conifers along water courses.



C. Plantation with clearfell and windthrow

Planted conifers are liable to blow over during storms (windthrow), especially at the edge of clearfell sites, as visible at C1. It is uneconomic to harvest blown down trees, so trees are usually felled before they get big enough to blow over.



D. Replanted forest

Young trees are planted as soon as possible after felling, before the ground vegetation has time to thicken up and compete with the trees.

TRADITIONAL CROFTING LANDSCAPES



Township, Shawbost, Isle of Lewis

This photograph was taken in 1971 and shows a traditional crofting township on the northwest coast of the Isle of Lewis. A croft is a small area of land that is only worked part-time because it is not big enough for a full-time income and which also includes a croft-house. 'Crofters', *i.e.* those who live on crofts, also have a right to graze their animals on a wider area of land – known as the 'Common Grazings' because the land is shared by other crofters in the community.

Crofting, by law, is restricted to the islands of Shetland, Orkney, the Hebrides and the Western Highlands. Traditionally crofts are grouped into 'townships', with the houses centred on each croft rather than the houses being closely grouped together. This gives a spread-out feel to settlements rather than compact villages found elsewhere in Britain. The origin of crofting has a long history, as discussed on page 111.

Any small towns in the islands and Western Highlands, such as Stornoway or Ullapool, were planned towns around newly built fishing ports or, as Oban, grew up around tourist hubs. There were also planned towns built in the Central Highlands (*i.e.* not in the current crofting counties), such as Grantown-on-Spey and Dunkeld; indeed, there is a new town being built today at Tornagrain, east of Inverness.



A. Peat cutting, Isle of Coll

The main picture shows a stack of peat outside a crofter's house. The peat would have been cut from a nearby peat bank in late spring, where each crofter had a right to cut it. Traditionally, the cutting was a communal activity.



A. Peat cutting, Sutherland

Once cut, the peat was left to dry for a few months, before being taken to the township where it was stacked to provide enough fuel for a whole year. In the absence of woodland, peat was the main fuel in the Highlands across the centuries. See also page 12.



B. Croft house – but 'n ben

The traditional house in the Highlands was the 'black house'. From the 1700s this was slowly replaced by the type of two-roomed house shown here, all built to a standard pattern across the Highlands. This is known as a 'but 'n ben' (page 77).



C. Grazing pasture

Beyond the inbye land are the Common Grazings where sheep or cattle have free range. Each Common Grazings has its own committee which oversees the number of animals allowed to graze the land.

TRADITIONAL CROFTING LANDSCAPES



Vatersay, with Mingulay in the distance

A traditional form of growing crops, common to Scotland and Ireland, was using 'lazybeds' (A). These comprise a series of ridges and furrows, with the crops planted on the top of the ridges, and rainfall draining down into the furrows. The origin of the term is obscure, but it seems like misnomer because it took a lot of manual labour to work the system.

In coastal sites, seaweed was applied to the ridges to act as a fertiliser, and crops such as potatoes grown on top. The lazybed system fell into disuse in the 1800s, but old lazybeds are visible in many landscapes.

The land suitable for growing crops (the arable land) was based on the 'runrig' system, whereby each family took it in turns to work the best land on a yearly rotational basis. This meant that no family lost out by always having the worst land. In summer, the livestock were sent off the inbye land to the shielings (page 39). The use of lazybeds and the runrig system disappeared with the advent of the crofting system and the creation of formalised crofts.

This arose following outcries about the way the landlords were treating their tenants, who had no secure tenancy, *i.e.* no guaranteed right to stay on the land. They were often cleared off their land during the Highland Clearances. The Napier Commission of 1883 looked into the issue, resulting in the Crofters Holdings (Scotland) Act 1886, giving, amongst other things, security of tenure to crofters. Although most crofts are still tenanted, crofters nowadays have a right to buy their croft.



A. Lazybeds, Isle of Eigg

Lazybeds remain visible in the landscape long after they fell into disuse, here covering much of the landscape on the Isle of Eigg. There are sea cliffs beyond, meaning that a long journey would have been needed to carry the seaweed up to fertilise the ridges.



A. Lazybeds, Reiff

A field of lazybeds nearer the sea at Reiff, a township in Wester Ross. In the past, a huge amount of human effort would have been put in to creating them and using them for growing crops. Now they remain as a reminder of the past.



B. Permanent pasture, Vatersay

The main picture shows the rocky nature of much of the landscape, making agriculture difficult. Areas of arable crops were confined to the small areas where there was sufficient soil. This shows an area of pasture, but the old field boundaries visible suggest it might once have been arable land.



C. Rocky moorland, Vatersay

Rocky moorland, with shallow peaty soils, is common over much of the Highlands. It is of low grazing value, so a given area cannot support as many grazing animals as is possible in the lowlands.

TRADITIONAL CROFTING LANDSCAPES



Shawbost, Isle of Lewis

This picture was taken in 1971 and illustrates crofting agriculture as it was then. Each croft had its own strips of land (A, C) where hay and other crops were grown, with wire fences between the strips. Hay was the traditional crop grown to feed sheep and cattle over the winter, although nowadays it has largely been replaced by silage – which has the advantage in that the grass does not have to dry out fully before being put into silage bags.

Hay cutting is more dependent on the weather because, once the grass is cut, it has to dry out before it can be stored as hay. This means that, in wet summers, there is no guarantee that enough hay of good enough quality can be produced to feed the animals throughout the winter. Additionally, hay cutting has to take place in mid to late summer, whereas silage can be cut earlier. Traditional haystacks are visible here (B), a sight not seen nowadays. Instead silage bags are stored at the edge of fields (page 42).

Other crops traditionally grown included: an old variety of barley called 'bere', grown for both cattle feed and for making whisky, which is still occasionally grown today; turnips for both livestock and people; oats, the main cereal grown because it can survive cool, wet summers; and potatoes, the staple crop for most of the crofters.

Arable farming has now nearly died out, the only crop grown being grass for silage – the rest of the inbye land having become grazing pasture.



A. Hay cutting, Uists

This picture taken in 1994 in the Uists shows hay which has been cut with a hand scythe. Today virtually all cutting, for hay or silage, is from a tractor-towed forage harvester.

Photo. John Fenton



B. Stooks, Ironmacannie, Galloway

Once cut, both hay and cereals such as oats, was piled up into small heaps called 'stooks'. Once dry the hay was stacked in haystacks (B in the main picture), and the oats threshed to extract the grain. This picture was taken in the 1960s, showing a sight no longer seen.



C. Fenced strips, Calanais

Nowadays it is rare to see crops grown in the fenced strips of land associated with each croft. Much of this former arable land is pasture for sheep. However grass is still grown for silage, as shown here – the paler strip has been recently been cut. This is a modern picture from the Isle of Lewis.



D. Dry stone dyke

In the past, livestock (sheep, cattle, goats) were kept out of the arable (inbye) land by shepherding. From the 1700s, dry stone dykes were built, particularly to create a head dyke separating the inbye land from the Common Grazings on the hill land.

MODERN CROFTING LANDSCAPES



Fair Isle

Fair Isle is a remote island over 20 miles from the nearest land, situated halfway between Shetland and Orkney. It is a crofting community and the islanders are keen to keep many of the crofting traditions. Hence it is not typical of the modern crofting settlement.

Although there is much permanent pasture on the inbye land used for sheep grazing (A), there are still some fields used for growing crops and hay (B). The island is three miles long, the southern half being the inhabited area and the northern half the unenclosed Common Grazings (C).

The housing consists of a mix of traditional houses (D), some modernised and extended, and also some modern houses built in a traditional style (D1). On Fair Isle, there has been a policy of ensuring new housing is in keeping with the traditional style, assisted by the island being owned by the National Trust for Scotland – although with independent crofting tenants.

The island is good for observing migrating birds who stop off on the island on their journey north or south, especially if blown off course. Because of this, there has long been a bird observatory at the north end of the island.



A. Grazing pasture, Fair Isle

Much of the once arable land is now used for sheep pasture, with wire fences replacing stone dykes as field boundaries.



B. Arable strips, Fair Isle

A fenced-off area used for growing hay, potatoes and perhaps other crops in strips of arable land, similar to the traditional pattern. Each crofter has their own area of land, but all share the Common Grazings. A tractor can be seen cutting the hay.



C. Moorland (Common Grazings), Fair Isle

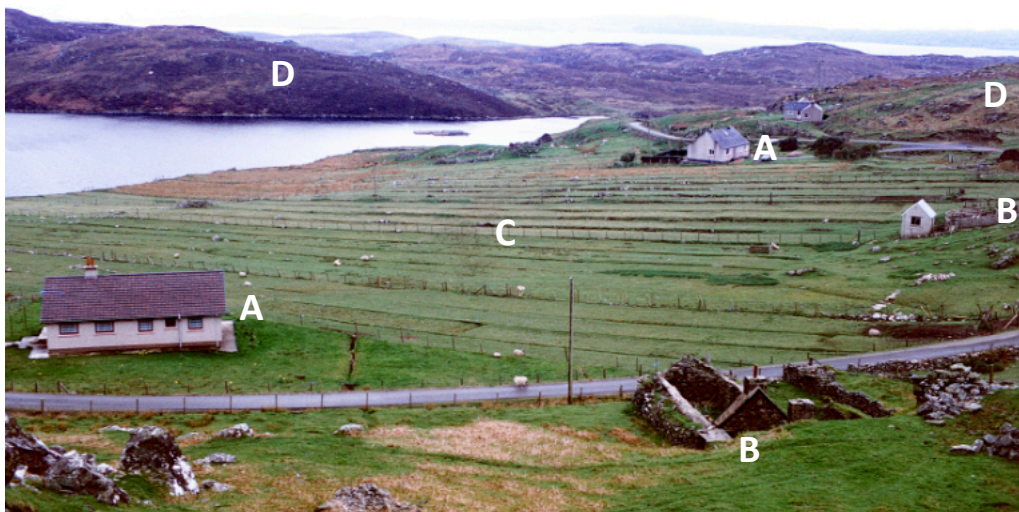
The dyke on the left is the head dyke, with the inbye land to the left and the Common Grazings to the right. Although now heather moorland, much of the area was once blanket peat, stripped over the centuries to provide fuel. There is now only one small area of peat left.



D. Traditional but 'n ben, Fair Isle

This is a photograph taken by the author on Fair Isle in the 1960s of an unmodernised but 'n ben.

MODERN CROFTING LANDSCAPES



Calanais (Callanish), Isle of Lewis

This modern crofting landscape on the Isle of Lewis in the Outer Hebrides contrasts strongly with views of a similar area in 1971 (page 113). The modern (A) bungalows are not in the but 'n ben style, although ruins of the houses which preceded them are still visible (B).

The original arable strips (C) are no longer used for cropping but, in this case, are devoted wholly to sheep grazing. Common Grazings are visible in the distance (D), consisting of rocky moorland.

The absence of trees in the landscape meant that the traditional fuel for cooking and heating was peat. Over the centuries, the cutting of peat on the Common Grazings has markedly changed the landscape. Originally the hollows would have been filled with peat, and there may also have been blanket peat covering the gently sloping ground. In the vicinity of settlements, all this peat will have been removed over the centuries; as time goes on, then people had to travel further and further from the settlement to cut peat, or even to neighbouring islands.

On some small islands, the removal of all the peat resulted in depopulation because there was no other fuel for heating and cooking, such as at Papa Stour on Shetland. Nowadays peat cutting has virtually died out owing to the availability of modern fuels, although hand-cutting and cutting by machine can still be seen in some places (page 110).



A. Modern houses, Isle of Yell

Modern houses on the island of Yell in Shetland. In the 1960s many but 'n bens were replaced by modern bungalows, as in the main picture. This resulted in a marked discontinuity in the appearance of the landscape. In recent years, more care has been taken to ensure new houses fit in with the landscape.



B. Derelict but 'n ben

it is now uneconomic to build with the traditional building material, *i.e.* stone; additionally, the older houses, without expensive modification, are not suited to modern living standards. Hence, across the Highlands and Islands, they are abandoned, to be replaced with new homes.



C. Arable strips (fenced), Calanais

Although the narrow fenced strips of land within each croft still exist, they are now largely permanent pasture for sheep, or used to grow silage. The brown vegetation is rush pasture, *i.e.* grassland colonised by rushes (page 48).



D. Rocky moorland, Isle of Eriskay

This shows rocky moorland on the island of Eriskay. In such places, population growth in the 1700/1800s created a great demand for peat – so much so that in places turf was stripped off the landscape to burn as fuel. Hence some rocky moorland might once have been covered in peat.

MODERN CROFTING LANDSCAPES



Inverasdale, Wester Ross

A croft on the Inverasdale Peninsula on the wet shore of Loch Ewe. Much of the peninsula is relatively flat and hence covered in blanket peat up to two metres thick. The foreground here (A) shows smooth blanket peat indicating that this peat is still growing. However, adjacent to the settlements, much of the peat has been cut to provide fuel, with some peat cuttings just visible below (D) on this photograph.

Nearby are the Inverasdale Peatlands, a large area of intact peat bogs which have been designated for their international importance.

The green area beyond (B) is improved pasture for sheep and cattle grazing, which may also be used to grow silage. The ground has been levelled, with any rocks which would have originally been present removed to enable the area to be ploughed, and seeded with the palatable rye grass to produce the best grazing.

The croft house (C) is a modern bungalow, with an older house visible behind.

The building (D) is a modern farm shed. Over the years, these sheds have replaced the traditional stone barns (or 'byres' in Scotland) and are used for over-wintering cattle and for storing equipment. In earlier centuries cattle were over-wintered in byres attached to the dwelling house, and the heat from their bodies helped keep the house warm.



A. Old peat cutting, Inverasdale



B. Pasture reclaimed from moorland, near Dores



C. Croft house and buildings, Poolewe

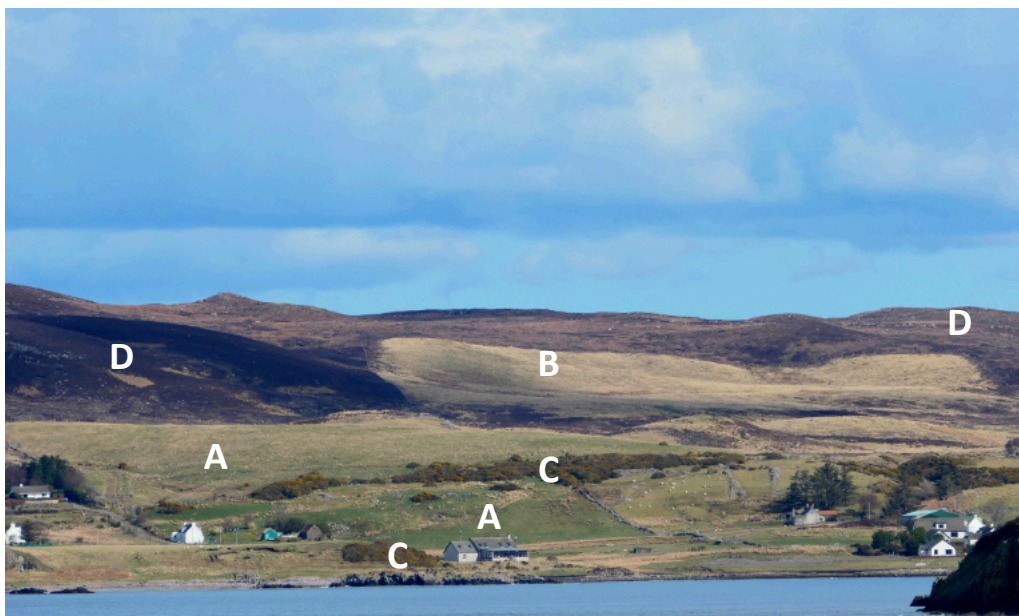
This shows the area around a typical agricultural croft house, with sheds and agricultural implements, old and new. The field at the bottom left shows signs of trampling by cattle: if cattle are wintered outside in the wet climate of the Highlands, their trampling can churn up the ground.



D. Modern farm shed, Islay

A modern farm shed on Islay with walls of corrugated metal. In the foreground is a cattle feeding ring, where silage is put inside. There is normally extensive trampling damage around such rings.

MODERN CROFTING LANDSCAPES



Mellon Charles, Wester Ross (winter)

A winter view of a crofting township on the east shore of Loch Ewe; at this time of year, only the improved grassland contains a hint of green (A).

It can be seen that, unlike crofting landscapes of the past, there is no arable agriculture here, only pasture for sheep. This simplification of the landscape and land use has arisen for several reasons: in the past, crofting was a subsistence economy, with everything grown used on the croft itself rather than sold to markets (although a portion went to the laird for rent). Growing crops takes time and commitment and it is much easier to buy food from local shops and supermarkets than grow your own. With a large amount of productive agricultural land in other parts of Scotland, it is not economic to grow crops for sale in the poor climate and on the small scale possible in the Highlands and Islands.

Ruins of old dykes are visible and sheep have a free rein to graze across the inbye land. It can be seen that a lot of the moorland (D) has been converted to pasture some time previously (B), increasing the area of better quality grazing land for sheep.

There is a stand of whins (gorse) in the middle of the picture (C), a thorny shrub which has been spreading throughout the Highlands and Islands in recent years.



A. Grazing pasture (improved)

The greenest areas indicate improved pasture, kept green through better soils and the addition of fertilisers. These are the areas of best grazing.



B. Pasture reclaimed from moorland, Naust

The light brown is permanent pasture reclaimed from the surrounding moorland vegetation. This picture was taken in winter.



C. Roadside gorse, Torridon

Gorse has been introduced into Wester Ross. Although a species native to Scotland, it is not native to Wester Ross and many other parts of the Highlands and Islands. The disturbed ground along the edges of roads, particularly after road improvements, provides a corridor for gorse invasion.



D. Moorland (wet heath), Wester Ross

A typical landscape of Wester Ross, dominated by wet heath.

ISLAND VIEWS Shetland



Unst

Unst is the most northerly of the Shetland Islands, so making it the most northerly inhabited land mass in the British Isles. The island has a complex geology, including outcrops of serpentinite (a rare phenomenon in Britain) at the Keen of Hamar Nature Reserve: see picture E on the right.

This picture shows natural rocky grassland to the left of the dyke (C) on rock which, millions of years ago, was once part of the ocean floor. The land to the right of the dyke (D) would have once looked the same, but has been improved for agriculture: it has had the rocks removed and thereafter been seeded with better quality agricultural grasses.

One consequence of creating such pastures is that, in addition to providing better grazing for sheep, they become attractive to wild geese. Some species of geese are migratory, coming south to spend the winter in Scotland, such as barnacle geese (*Branta leucopsis*) and pink-footed geese (*Anser branchyrhynchus*). But increasingly there are two species which spend the whole year in Scotland: the native greylag goose (*Anser anser*) and the non-native Canada goose (*Branta canadensis*).

The increasing numbers, particularly of greylag, are a problem for farmers and crofters because the geese consume a significant amount of grass. There are currently government schemes in place to help farmers manage the problem.



A. Power lines

In such an open landscape as this part of Unst, power lines are highly visible and detract from the quality of the landscape.



B. Ruined dyke, Isle of Seil

There is plenty of rock available for building dry-stone dykes. Many are falling into ruins and are replaced by wire fences. Fences are cheaper and easier to build and maintain. There is a picture of a ruined settlement on the east coast of Unst on page 82.



C. & D. Rocky grass moor and improved pasture

The unimproved land is on the left, consisting of the original native grasses and other plants. The improved pasture on the right would once have looked the same. It will now contain fewer plants than the unimproved pasture.

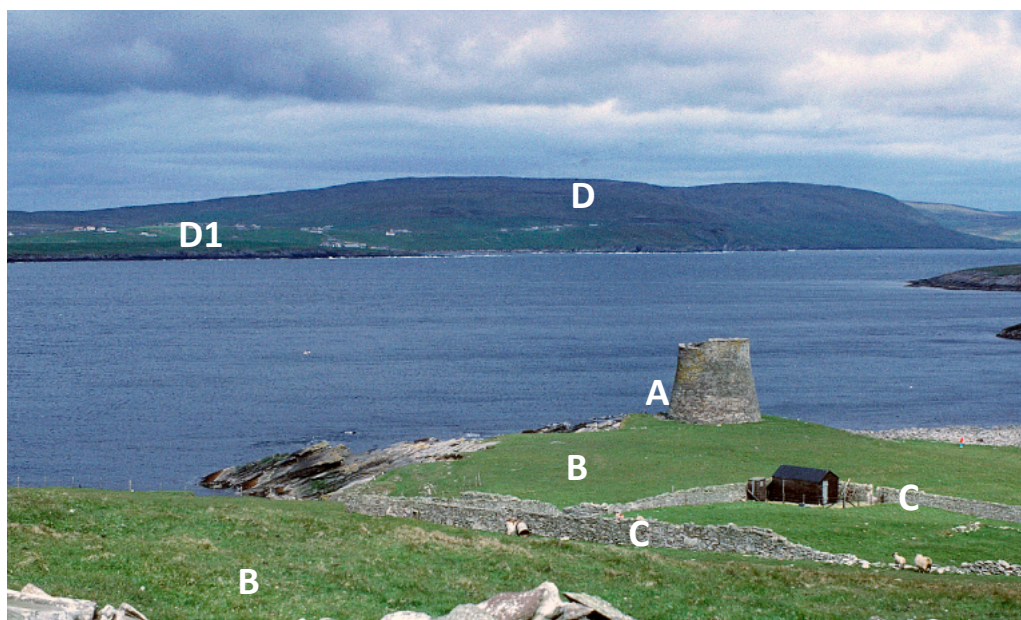


E. Serpentinite soil, Keen of Hamar, Unst

The Keen of Hamar is unvegetated because of the toxicity of the soil to plants owing to the presence of heavy metals. However, the extreme conditions have resulted in the evolution of a plant found nowhere else in the world: Edmonston's chickweed (*Cerastium nigrescens*).

ISLAND VIEWS

Shetland



Mousa

The small island of Mousa is now uninhabited but still used for grazing sheep. It is rich in archaeology and contains the most complete remains of a broch in Scotland. Brochs were built about 2,000 years ago, but their origin and use remains obscure. Most are found in the far north – Shetland, Orkney, Caithness, Sutherland – but they are found scattered across Scotland. Another famous broch is that at Carloway on the Isle of Lewis. It is estimated there are 120 in Shetland, although most now appear as circular piles of stones. Brochs have a staircase within their thick walls which circles round the building until you emerge at the top.

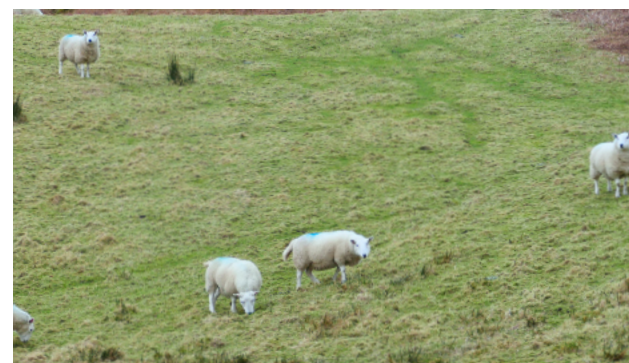
In the distance is the largest of the Shetland Islands, Mainland. On the left, the inbye land (D1) appears green with white houses above. Above this is darker vegetation (D), most of which is blanket peat. In fact, a large proportion of Shetland's landscape is peat-covered, which has provided plentiful fuel for the islanders over the centuries.

Shetland is a windy climate and currently a large windfarm is being built along the spine of Mainland – the Viking Wind Farm – although this is controversial. Fishing has been the mainstay of the economy although the islands have benefited significantly from the boom years of the oil industry, starting in the 1960s, because much of the oil came ashore at the the large Sullom Voe oil terminal.



A. The Broch of Mousa

This broch is an impressive structure, of the order of 2,000 years old. It is open to the public and it is possible to climb to the top. It is also interesting in that storm petrels nest within its walls; if visited at night, they can be heard chattering away.



B. Smooth pasture

The island provides good grazing pasture for sheep. However, although there is a long tradition of grazing sheep and cattle on offshore islands, the tradition is dying out owing to the cost and hassle of taking animals on and off islands.



C. Dyke, Mousa

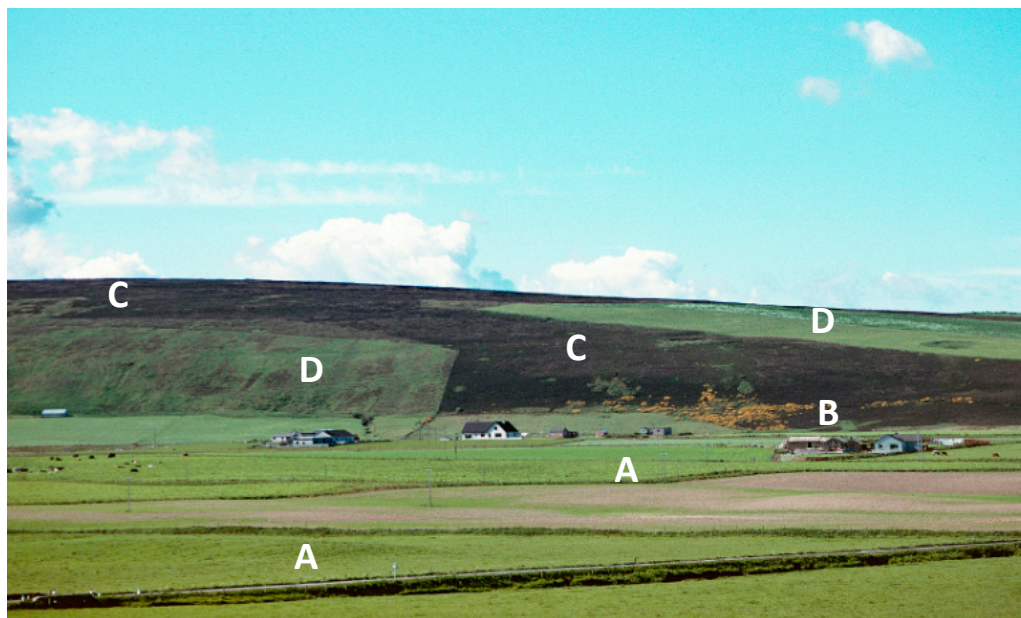
The island has a network of old dykes acting as field boundaries, but most are now falling into disrepair. This one has a covering of lichen along the stones at the top.



D. Peat-cuttings, Shetland

There is extensive blanket peat on the Shetland hills which has long been cut for fuel in the treeless archipelago. Cutting is now less common: it is much simpler to buy-in a modern fuel. On some of the smaller islands all the peat (essential fuel) was removed, resulting in depopulation.

ISLAND VIEWS Orkney



Mainland, looking east from Loch of Harray

The Orkney Islands are very different from Shetland. This is because they are underlain by the sedimentary rock Old Red Sandstone, which weathers to smooth landscapes and fertile soils. This also the case in Caithness and around the Moray Firth.

Orkney is therefore suitable for agriculture on a relatively large scale, and, as with the Kintyre Peninsula at the other end of the Highlands and Islands, is particularly suited to raising cattle, both dairy cattle and beef cattle. This is because the mild, albeit windswept, climate is good for growing grass. Orkney cheese is renowned.

This shows land north of Finstown on Mainland. Most of the pasture is improved (A), and therefore not species-rich, sometimes only containing rye grass. However, there are some marshy areas are good for wading birds.

The original vegetation would have been moorland, which is still present on the hills (C) and which covers most of the island of Hoy. But the picture here shows how much of the moorland has been converted to pasture (D), although in recent years this practice has ceased, partly because of its impact on moorland birds such as hen harriers.

The islands have been inhabited for thousands of years and have a rich archaeological history, including the 5,000 old tomb of Maes Howe, the the Ring of Brodgar and the stone age village of Skara Brae.



A. Improved pasture, Mainland

Cattle grazing is the mainstay of the Orcadian agricultural economy. In winter, they are fed silage which is harvested earlier in the year from the best fields.



B. Gorse

This prickly shrub is not native to the Orkney Islands, having been introduced by humans sometime in the past. As in the rest of the Highlands and Islands, it is expanding its range here.



C. Heather moorland (within a stone circle)

Orkney is famous for its wealth of archaeological remains. This is the Ring of Brodgar which is surrounded by agricultural pasture as in (A). But because the land around the stone circle is not used for agriculture, it has retained its original cover of heather.

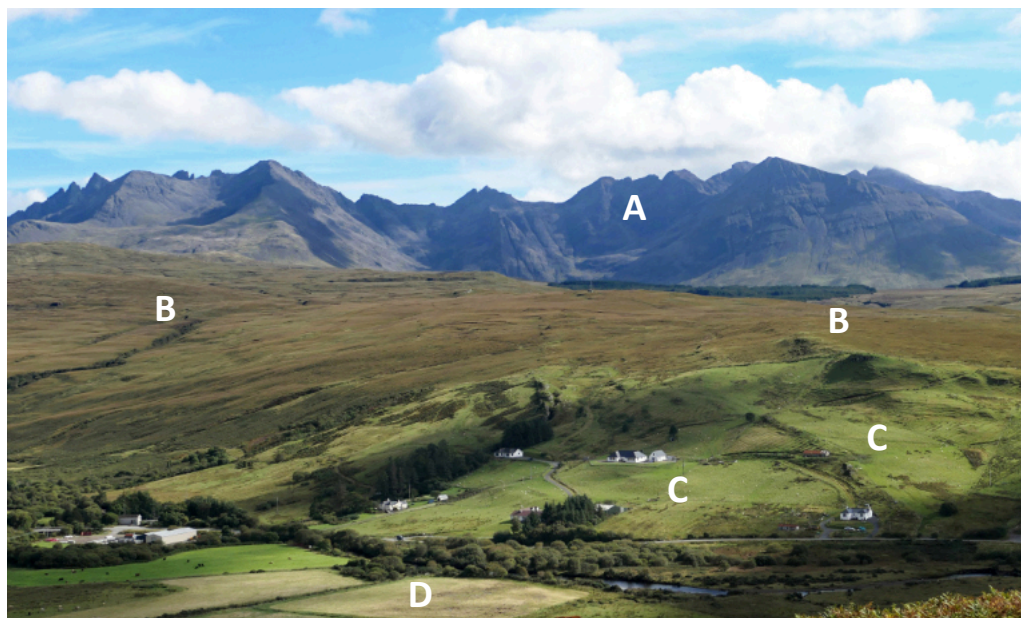


D. Pasture reclaimed from moorland, Hoy

This shows a similar situation of pasture reclaimed from moorland as in the main picture, but on the island of Hoy. This must have happened a long time ago because the fields are bordered by stone walls rather than modern fences.

ISLAND VIEWS

Skye



The Black Cuillin from the north

The Island of Skye has a complex geology and landscape. The Black Cuillin is a spectacular mountain range in the centre of the island (A), renowned for its narrow rocky ridges and steep cliffs. The mountains are composed of gabbro, a hard, dark rock derived from an ancient volcano, and popular with mountaineers because the rock is not friable. The Cuillin provide the most challenging hill climbing in the British Isles.

To the south of the Black Cuillin are the Red Cuillin, mountains composed of pink granite, a more friable rock resulting in rounded hills and more scree slopes. The landscape surrounding the hills is unwooded moorland (B) which gives a wild foreground to the stark mountains.

Since 1995, the island has been linked to the mainland by bridge which has made it easily accessible. Skye is increasingly popular with tourists, which creates problems because the roads, many single track, and the parking areas were not designed for the large increase in traffic.

There is a wide variety of popular tourist attractions which, in addition to the Cuillin, include Dunvegan Castle, seat of the Clan MacLeod, the Fairy Pools, Kilt Rock Waterfall, the coral beach (actually made from calcified red algae, not coral), and the Talisker Distillery.



A. The Cuillin mountains

This is one of the famous views in Scotland: Sgurr nan Gilleann from the Sligachan Hotel. A dramatic mountain rising out of wild moorland, unhindered by any human infrastructure.



B. Moorland (wet heath), Isle of Skye

The surrounding moorland is largely wet heath with peat in the hollows.



C. Pasture, Trotternish ridge, Isle of Skye

The Trotternish ridge runs down the northwest side of Skye, with its spectacular sites of The Quiraing and The Old Man of Storr. The scenery derives from large-scale postglacial landslides. The rich soil provides good grazing, as here near Staffin.

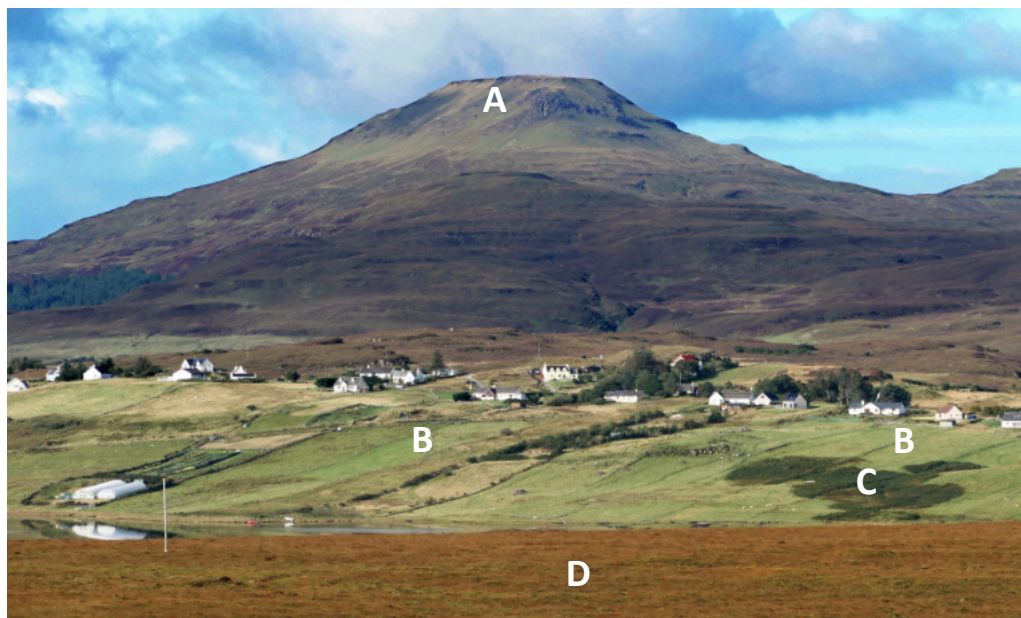


D. Improved pasture for silage, Isle of Mull

The better land is used to make big bag silage to feed to the cattle or sheep over the winter.

ISLAND VIEWS

Skye



Roag and Macleod's Table South (Healabhal Beag)

The landscape north of the Cuillin mountains is very different because the geology is different. The rock is formed from a series of massive horizontal flows of basalt from eruptions millions of years ago (page 40); these are visible at (A). This gives a more horizontal feel to the landscape compared to the southern half of Skye.

The rock, although hard, weathers down to provide richer soil than most of the Highlands and Islands which, together with flatter ground, supports a significant crofting population in northern Skye.

This view is of Healabhal Bheag, one of the two MacLeod's Tables near Dunvegan: a pair of hills of similar shape and height, both with horizontal tops. The story goes that a rich aristocratic from the south was boasting about his huge dining hall with chandeliers in the ceiling. The chief of Clan MacLeod at nearby Dunvegan Castle, said he could do better than that: he laid out a table on the top of one of the two hills, and invited his visitor up – boasting that you could not have a grander hall than this, with the endless sky above and the stars as chandeliers.

Roag is a typical crofting township, with the inbye fields (B) below the croft houses, and the Common Grazings of open moorland above. A stand of bracken is visible (C), with a peat bog (D) in the foreground.



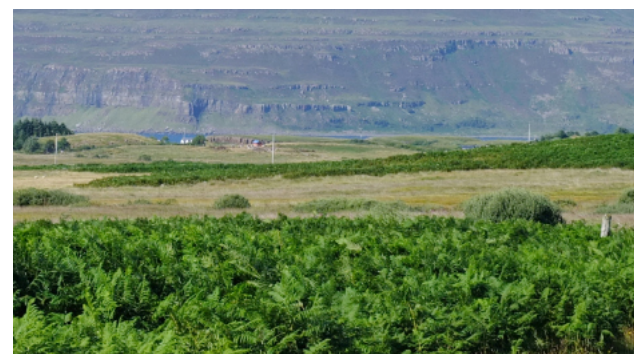
A. Horizontal basalt strata, Isle of Mull

Basalt landscapes have horizontal terraces and vertical cliffs and erode to relatively rich soils.



B. Crofting pasture, Midtown, Tongue

The strips of land below the croft houses are now mainly smooth pasture used for sheep grazing, when they once would have been used for growing crops. This is a view above Tongue Bay on the north coast of Sutherland.



C. Bracken, Isle of Mull

The dark vegetation in the pasture visible in the main picture is a stand of bracken – a plant that can spread rapidly across good grazing land.

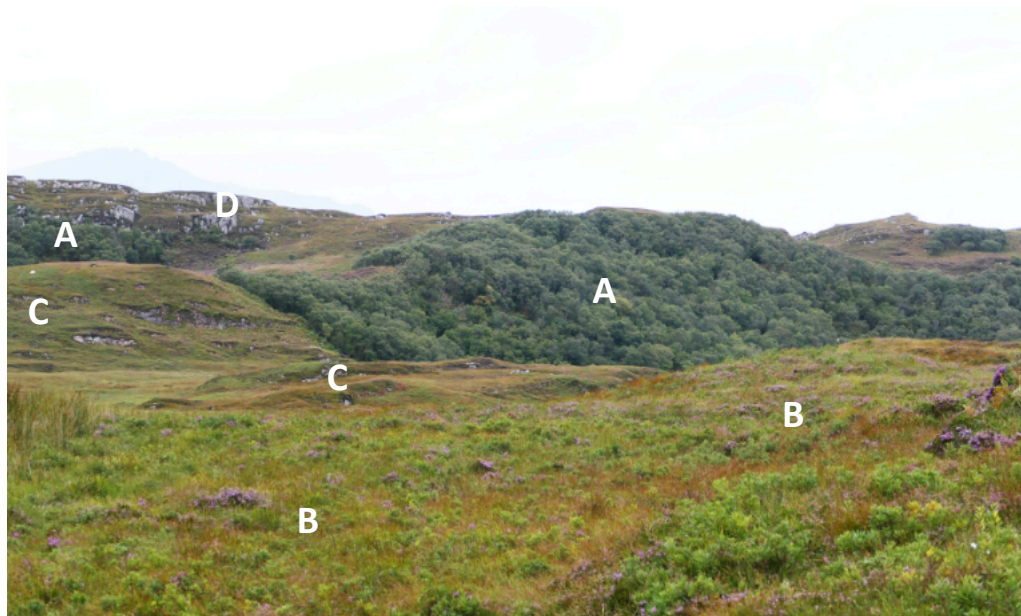


D. Peat bog, Argyll

The foreground of the main picture shows a peat bog – a location used in the past for cutting the peat as an essential fuel for cooking and heating. The picture here shows an intact peat bog which has never been cut, and which will be actively accumulating peat.

ISLAND VIEWS

Raasay



West of Brochel, north end of Raasay

Raasay is a long, thin rocky island off the east coast of Skye. It has a varied geology, including deposits of iron ore at the south end which were once mined. The remains of the mine can still be seen, including the route of a railway from the deposits down to the processing plant at the jetty. The mine only ran a few years during the First World War (1914-1918), when there was a high demand for iron. It closed down when the war ended and never re-opened, partly because the ore was low grade.

The highest hill on the island, Dùn Caan, is a small platform of horizontal basalt, made famous because James Boswell, when touring the Hebrides with Dr Johnson in 1785, danced a jig on the summit.

There is a single track road running the length of the island, mostly through moorland, the north end of which is renowned because of 'Calum's Road'. Calum MacLeod was a crofter who, when the local authority in the 1960s (Inverness County Council) refused to build a road to the remote settlement of Arnish, himself built the two-mile stretch by hand. It is now tarred and part of the local road network.

The main population resides in the southwest of the island, with the east coast consisting of steep cliffs with coastal woodland.



A. Woodland on steep slopes (winter), Seil Island

Birch woods occupy the steeper ground with its better-drained soil. Pictured here is such a wood on the Isle of Seil as it appears in winter, when birch trees can be identified by their purple tinge.



B. Peat bog

A close up of the peat bog vegetation characteristic of the West Highlands. The larger green plant visible here (and in the main picture) is bog myrtle, a dwarf shrub with aromatic leaves. Sphagnum moss and deer grass are the other main plants present.



C. Wet heath, Raasay

A picture of the east coast of Raasay, showing steep cliffs and coastal woodland. The main vegetation at the north end of the island is wet heath, with peat in the hollows.



D. Rocky Moorland, Isle of Rona

The north end of Raasay, and the isle of Rona to the north, is a landscape characteristic of a bedrock of Lewisian gneiss: rocky rounded hills, often with lochans in the hollows. This is called a 'cnoc and lochan' landscape. (Note that 'cnoc' is pronounced 'croc'.)

ISLAND VIEWS

South Uist



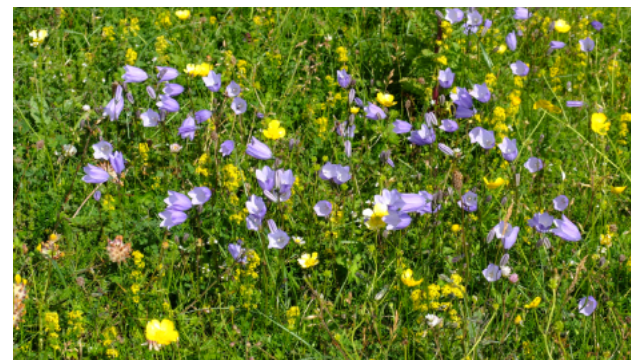
West coast

The islands of North Uist, Benbecula and South Uist in the Outer Hebrides, which are linked by causeways, are renowned for their machair.

The west coast of these islands is gently sloping and open to the full force of the Atlantic ocean. The waves have ground-up sea shells into a white, fine sand, rich in calcium carbonate (which the shells are made of). Hence there are long white beaches along much of the coast .

The sand is blown inland by the strong winds from the west. Its calcium carbonate acts as fertiliser, resulting in flower-rich grasslands called 'machair' (A). The machair is also used by many ground nesting wading birds, because there are no native predators in the Outer Hebrides such as hedgehogs (*Erinaceus europaeus*) or foxes (*Vulpes vulpes*), which would otherwise eat the eggs. Hedgehogs were introduced a few years ago, but have now been eradicated in North Uist through a successful control programme – with control now centred on Benbecula and South Uist.

The fertile and well-drained sandy soils are used to grow crops, supporting a large crofting population in this windswept landscape. Inland, between the machair and the hills (D) are the 'blacklands' of blanket peat, providing an essential source of fuel in this treeless land.



A. Flower-rich machair, Isle of Barra

Here bluebells (harebells, *Campanula rotundifolia*), meadow buttercups (*Ranunculus acris*), lady's bedstraw (*Galium verum*) and kidney vetch (*Anthyllus vulneraria*) are visible, an example of the rich flora of the machair grasslands.



B. Shell-sand beach, South Uist

Behind the white, shell-sand beaches are sand dunes covered in marram grass (*Ammophila arenaria*) a plant which traps the sand and allows the dunes to stabilise. The dunes also provide shelter to the machair behind.



C. Croft house (but 'n ben), Wester Ross

A traditional but 'n ben. These houses replaced the original blackhouses; the ruins of many of these can still be seen in North and South Uist (page 78).

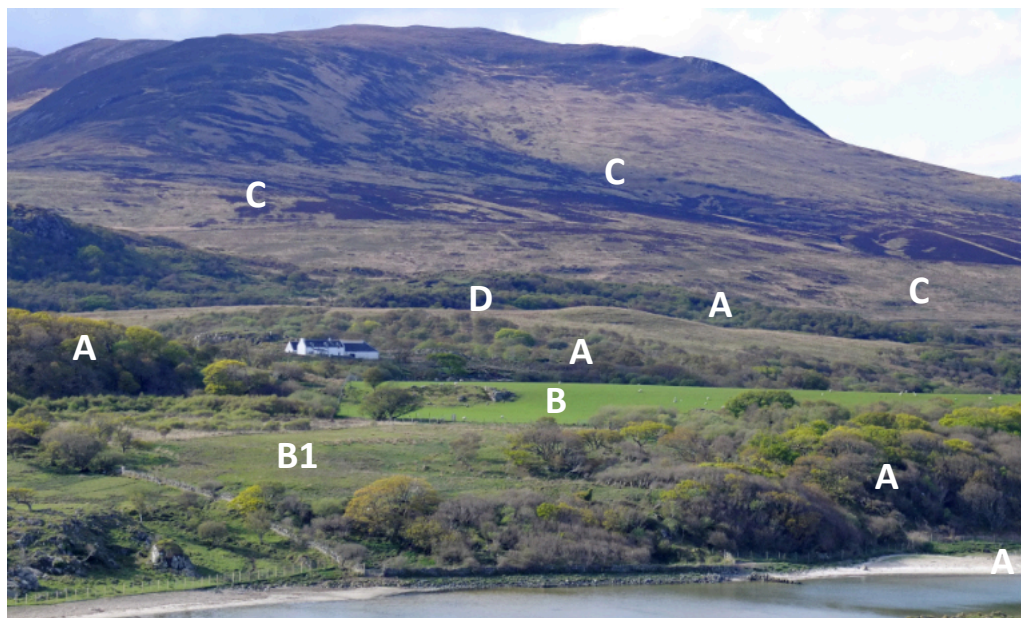


D. Backdrop of hills, South Uist

In contrast to the west coast of the Uists, there is a line of mountains along the rocky, uninhabited east coast. These are composed of Lewisian gneiss, named after the Isle of Lewis to the north. Between the mountains and the machair lie extensive peatlands.

ISLAND VIEWS

Islay



Ardtalla

Islay and Jura are two large islands off the coast of Argyll. Jura is mostly moorland and rock, with only a small human population but with a large population of red deer. In contrast, Islay is a mix of good quality farmland (B) and upland moors (C). Pictured here is a view of the southeastern area of the island. The farmland is mainly improved pasture for cattle and sheep, with silage production in the early summer.

Islay is the heart of the whisky industry in the west, with several distilleries including well-known names such as Laphroaig, Lagavulin, Bowmore and Ardbeg (D). Although some local barley is still grown (page 49), nowadays most barley is imported from Northeast Scotland, grown in the kind of fields illustrated on page 183. To make whisky, barley first is germinated in water to extract the sugars and, after a short period of fermentation by yeast, it is then distilled. Peat smoke is sometimes used to flavour the barley.

By law, Scotch whisky has to be left to mature in barrels for at least three years, and around distilleries can be seen large bonded warehouses to store the barrels. The walls of these are normally stained black; this colour arises from the whisky fungus (*Baudoinia compniacensis*) growing on the walls which survives by metabolising alcohol fumes seeping out of the barrels (the 'angel's share').



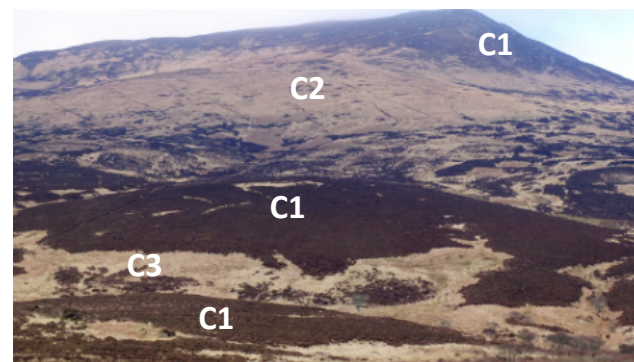
A. Native oak woodland (spring), Islay

Particularly in the southeast of the island, there are stands of natural woodland, often dominated by sessile oak. In spring, its new shoots and leaves have a slight orange tinge, as here. Although whisky is often matured in oak barrels, the oak is all imported.



B. Improved pasture, Islay

An area of improved pasture, which has been reseeded, fertilised, with buried field drains installed in the past. A stand of rushes is visible on the left. B1 in the main photograph is an area of unimproved pasture: such pasture is never bright green.



C. Moorland, Ardtalla, Islay (winter)

The vegetation of the moorland is a mosaic of heather moorland (dark brown, C1) and damp grassland dominated by purple moor grass (pale brown, C2). In the foreground are also patches of bracken (orange brown, C3).

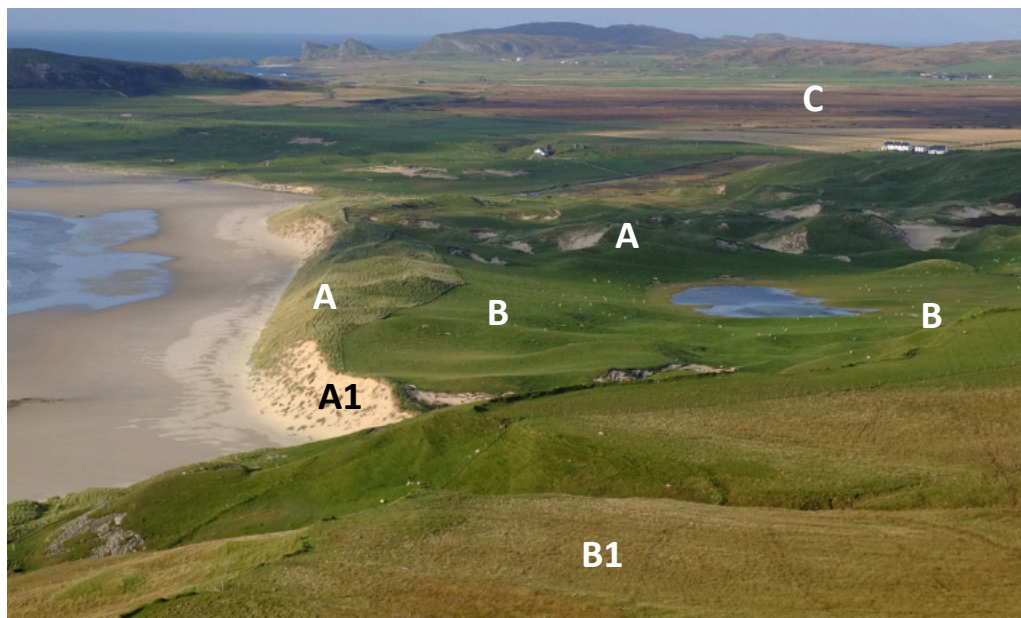


D. Whisky distillery, Islay

The Ardbeg distillery on the coast north of Port Ellen. Whisky barrels are visible in the foreground

ISLAND VIEWS

Islay



Machir Bay

Machir Bay is on the west coast of Islay. The sand of the beach is mainly derived from the local rock, not shells as in the Uists where the beaches are white shell-sand. Beyond the sand dunes (A) is smooth, grazed grassland overlying sand (B), with rough grassland above (B1). There is a large raised bog visible in the distance (C). There are several such large deposits of peat on the island, from which the peat is cut, dried, and then burned to provide smoke to flavour the whisky. In the past, peat would also have been used to heat the whisky stills.

The extent of grassland on Islay, both improved and unimproved, has resulted in Islay being a major wintering ground for geese. The island hosts 70% of the world's barnacle geese, which breed in Greenland, comprising about 40,000 birds. It also holds 40% of the Greenland white-fronted goose population (*Anser albifrons flavirostris*), comprising of the order of 10,000 birds. The RSPB has an important bird reserve at Loch Gruinart.

Choughs are a black crow-like bird with red beaks and legs. It is a rare in the British Isles and there are only two small populations in the Highlands and Islands: on Islay and the neighbouring island of Colonsay. They feed on insects, particularly those in the dung of grazing cattle, on the type of grassland visible here. They are highly social birds and the populations in Scotland are fragile, being highly dependent on how the land is managed.



A. Sand dunes with marram grass, Islay

The dunes are covered in marram grass which traps the blown sand. An area of actively eroding sand dune is visible (A1). Dunes can be mobile features, the sand moved around by the wind: eroding in some areas, and being stabilised by colonisation of marram grass on others.



B. Smooth grassland, Islay

These Highland cows are on smooth grassland at the top of the hill above Machir Bay. Such grassland is found on drier soils where the sward is kept short by grazing. The rough grassland in the main picture (B1) is not grazed short because the grass here overlies less fertile soils and is less palatable to animals.



C. Peat bog, Duich Moss, Islay

A raised bog on Islay, a habitat common at low altitudes. The dark area in the centre of the picture is where peat is being cut for the whisky industry. These bogs are also grazed by geese, although, with modern agricultural improvement, they prefer the greener fields.

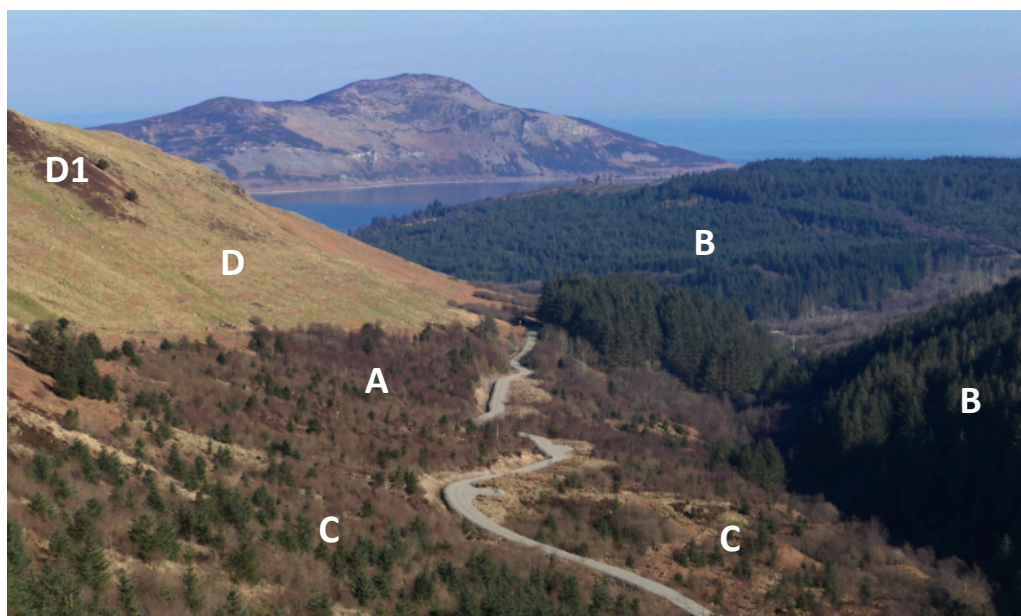


D. Improved pasture with geese, Isle of Coll

A flock of barnacle geese on farmland. The geese are not popular with farmers because of the amount of grass they eat. Being protected species, they cannot be killed; hence there are government schemes available to help farmers keep the geese of their fields.

ISLAND VIEWS

Arran



Monamore Glen (winter)

Like many of the Scottish Islands, the geology of Arran is complex. Indeed, it is the variety of different rock types in the relatively small country of Scotland which results in such a diversity of landscapes. Arran is an island in two halves: the northern half has high, rugged granite mountains, whereas the southern has a variety of rock types and less-rugged hills.

This is a view eastwards through the southern half to Holy Island in the distance. Much of the area is covered by commercial conifer plantations of Sitka spruce (B) planted on hillslopes (D). There are a few pockets of native woodland (A) on hillsides and along rivers.

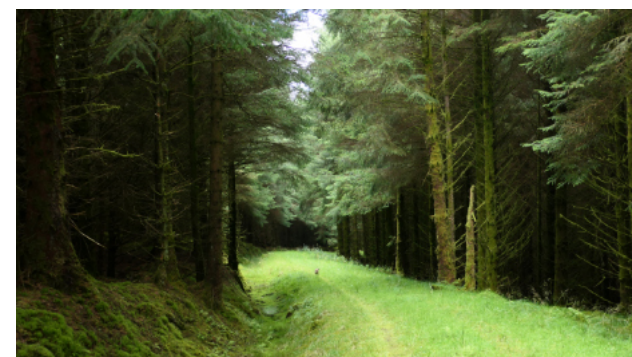
In several areas, invasion of woodland and moorland by rhododendron is a serious problem, see the bottom picture on page 74 taken at Lochranza at the north end of Arran. It has also spread out into the surrounding woods from the garden at Brodick Castle (page 83). The plant is hard to control: if cut, then new shoots readily grow up again, as do numerous seedlings. Injection of weedkiller is the best solution for, if sprayed, it runs off the waxy leavings without being absorbed. Many rhododendron control schemes fail because control needs to be continued for many years following the initial cutting – and it does not continue long enough, particularly if all the available money has been used up.

The woods at (C) demonstrate the spread of self-seeded Sitka spruce into native woods (page 57), another invasive plant.



A. Native birch wood (winter)

A natural birch wood in winter, with one small self-seeded Sitka spruce



B. Conifer plantation

Plantations cover a large percentage of the island, on land which was once sheep farms. The trees are planted close together and the woods host little wildlife, except along the edges of forest tracks or 'rides', with one pictured here.



C. Native woodland with self-seeding conifers

Self-seeded commercial conifers are becoming an increasing problem across the Highland landscape. In this location, Sitka spruce is colonising a native wood of birch and oak.

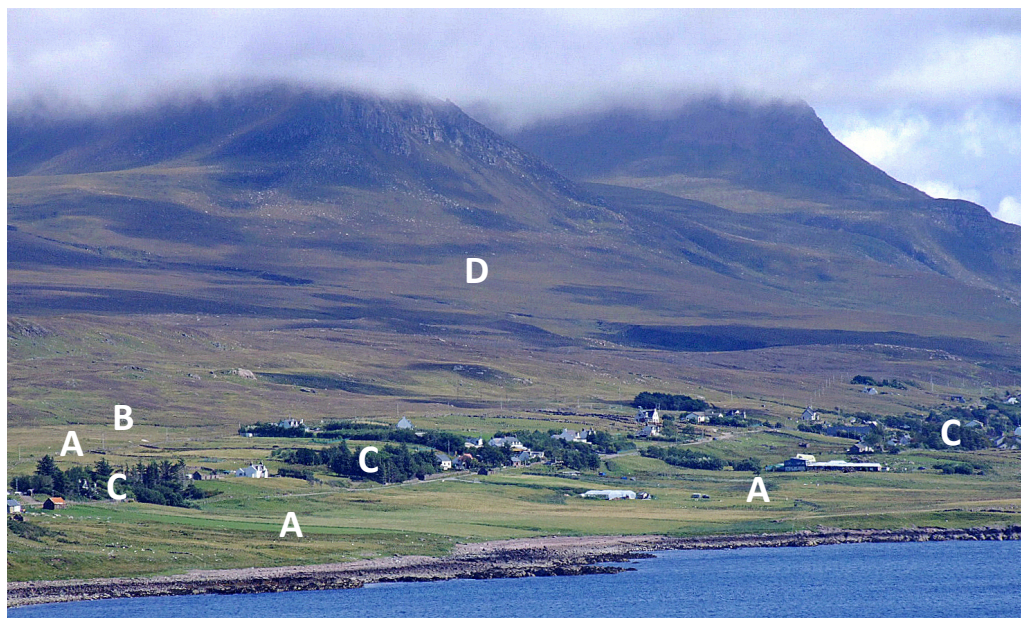


D. Bracken/grassland mosaic

The slopes in the main picture are a mixture of bracken and dry grassland. There is also a stand of heather (D1).

MAINLAND VIEWS

Sea, mountain and moorland



Achiltibuie, Wester Ross

This picture demonstrates the main characteristics of a West Highlands' landscape where most settlement is near the coast because conditions are milder and there is also easy access to the sea for fishing. In some locations, settlement is coastal because the population was settled here after removal from inland areas to provide land for sheep farming – during the period of the Highland Clearances in the eighteenth and nineteenth centuries.

It shows a crofting township, the houses widely spaced in a linear pattern along the road. An important factor in coastal locations is that there is often flat land near the sea owing to the presence of raised beaches (page 37), formed when the sea level was higher. The fields visible here (A) are on such a raised beach.

Just visible is the 'head dyke' (B), a wall which separates the inbye land where crops are grown from the open hill land beyond which comprises the Common Grazings.

Woodland has been rare over most of the Highlands for thousands of years, so that all the trees visible here (C) have been planted in gardens.

The open hill above the head dyke (D) consists of natural moorland vegetation: there will be blanket peat on the gently-sloping ground below the steeper hill-slopes; and the steeper slopes will be better drained with upland grassland and heathland rather than peat. Such an area is termed 'wild land' because there is little sign of human influence.



A. Coastal croftland, Loch Broom

The green pasture of the inbye land here stands out in contrast to the brown moorland behind. Each croft has its strip of land running down to the sea.



B. Head dyke, Gairloch

An example of a head dyke, above the church glebe in Gairloch. In summer, sheep and cattle would be kept above the dyke to protect the inbye land from grazing animals.



C. Garden trees, Inverasdale

Trees are planted extensively in Highland gardens to provide shelter from the wind. It is common to plant conifers such as Sitka and Norway spruce because they grow quickly. However, when tall, they are liable to easily blow over, and also to seed-out into the wider landscape.

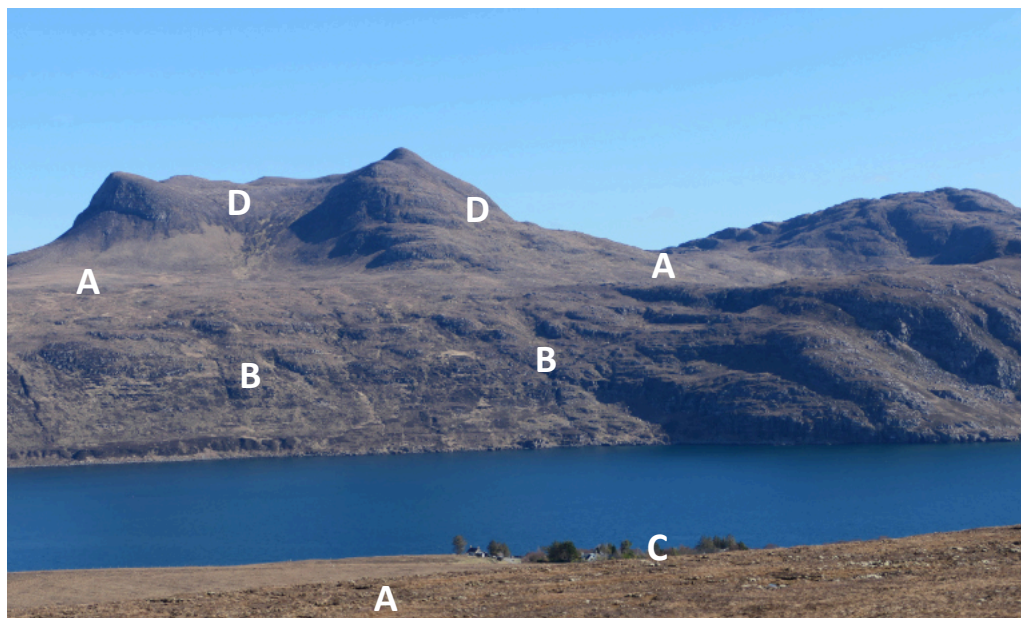


D. Wild land, Beinn Dearg (near Braemore)

Most of the Highland landscape consists of natural moorland of various types. In the foreground of this Wester Ross landscape are two heaths: bell heather (dark purple) and cross-leaved heath (pale purple). There are no roads, tracks or other infrastructure present in this area of wild land.

MAINLAND VIEWS

Sea loch, mountain and moorland



Little Loch Broom, Wester Ross

The landscape west of the Moine Thrust in the northwest of mainland Scotland (Map 1), is underlain by ancient, hard rocks. These have eroded over millions of years to produce the distinctive mountains of Sutherland and Wester Ross with narrow ridges and steep cliffs. The hill here is Beinn Ghobhlach which lies between Loch Broom and Little Loch Broom, with the latter in the foreground.

The landscape here is underlain by Torridonian sandstone, a hard rock which is about a thousand million years old. Apart from the Durness limestone adjacent to the Moine Thrust (page 36), these rocks west of the thrust weather slowly and result in infertile soils and a landscape dominated by acidic moorland of wet heath and peat bog (A), and dry heath (B). Exposed bedrock is common.

The picture is taken in early spring when the moorland vegetation is still brown. But even in summer, unlike fertile landscapes, there is always a brown tinge to the vegetation.



A. Peat bog and wet heath, Wester Ross

Level and gently-sloping ground is dominated by blanket bog and wet heath.



B. Dry heath, Isle of Seil

The steeper, drier slopes are covered in heather-dominated dry heath.



C. Garden trees

The trees visible in the main picture have been planted around gardens to provide shelter. There is no other woodland present in the main picture.

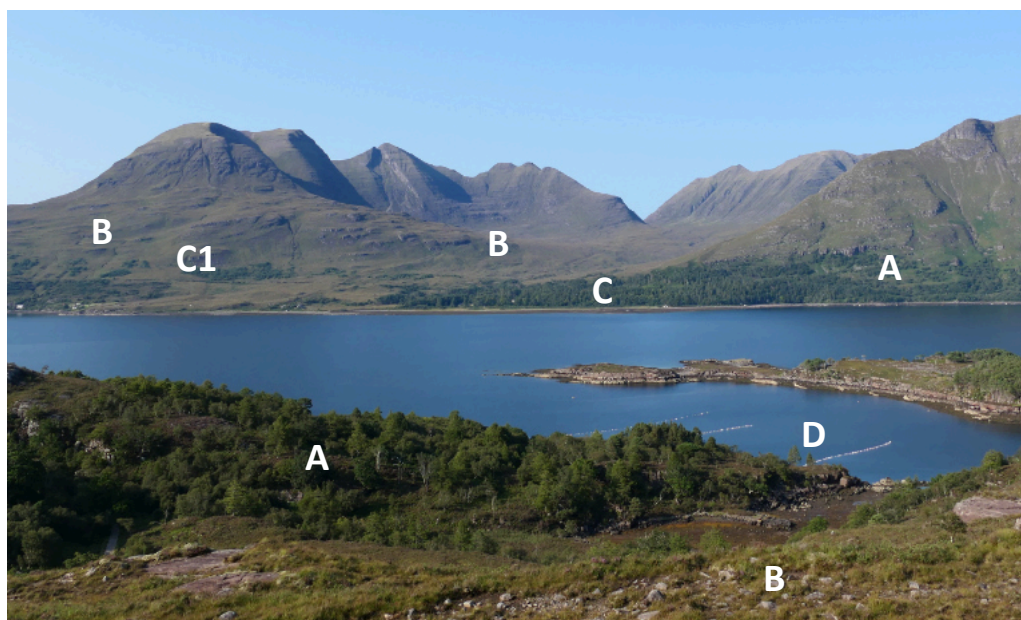


D. Mountain grassland and heath at 900 metres

At higher elevations in the Scottish hills, mountain grasslands and heaths are found, with plants able to tolerate the extreme weather found on the hilltops: strong winds much of the time, and cool, cloudy summers giving only a short growing season.

MAINLAND VIEWS

Sea loch, mountain and moorland



Loch Torridon, Wester Ross

The Torridon area of Wester Ross is renowned for its dramatic mountain landscapes. The mountain rise straight up from sea level with steep cliffs and narrow mountain ridges. Visible here across Loch Torridon is Ben Alligin (left), Beinn Dearg (middle), and the western end of Liathach (right). The mountains are built of 1,000 year old Torridonian sandstone, and have given the rock its type name. The rocks are too old to contain fossils, meaning the sandstone was laid down before multi-cellular animals became common.

During the peak of the Ice Age, which only finished about 10,000 years ago, the whole area was under a thick sheet of ice, with perhaps just the mountain tops sticking through. Movement of the ice has created the deep glens between the mountains. Below the middle peak of Beinn Alligin, a gash can be seen, caused by a massive landslide after the ice had retreated. Such landslides were common across the Highlands at the end of the Ice Age, because glacial movement scoured away the side of the mountains and when the ice melted, the sides had nothing to support them and collapsed into the glen below.

Most of the landscape here is open moorland without the trees (B), which, in this area, research shows has been the case for the last 4,000 years. However there is some native birch wood present (A), old plantations of Scots pine (C), and some new planting (C1). There is also a mussel farm (D).



A. Native birch wood, Isle of Rona

Native birch wood, similar to the one here, is present on the lower, western slopes of Liathach and along the shore; there also a few oak trees.



B. Moorland of wet heath, Ben Alligin, Torridon

Wet heath dominates the level and gently sloping ground, with mountain grasslands (page 146) at higher altitudes. The north slopes of Liathach, cool and shaded from the sun, are a good habitat for rare liverworts.



C. Old Scots pine plantation, Cairngorms

The woods around Torridon House are plantations which date from the early 19th century. The new plantation on the lower slopes of Ben Alligin (C1) was planted as part of a Scotland-wide tree-planting project: the Millennium Forest for Scotland.

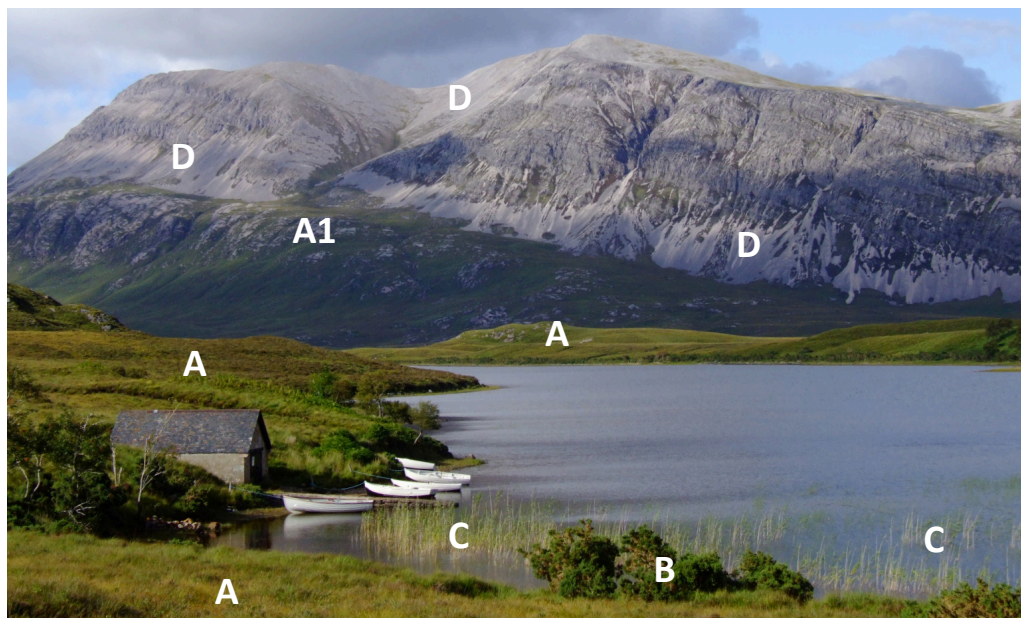


D. Mussel farm, Seil Sound

Although they have a visual impact, unlike fish farms, mussel farms do not result in any environmental damage because the growing mussels merely filter-feed the water around them, and no chemicals are used in their production.

MAINLAND VIEWS

Loch, mountain and moorland



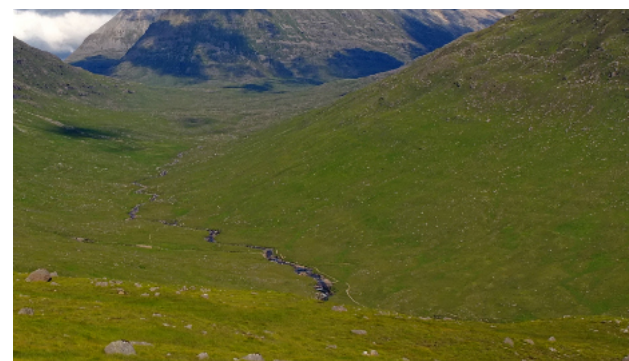
Loch Stack and Arkle, Sutherland

The boats here indicate that Loch Stack is popular with fishermen. The main fish caught will be brown trout (*Salmo trutta*), although in the past sea trout would have been an important catch. Sea trout are a variety of brown trout which, like salmon, migrate to the sea to feed. Their numbers have declined markedly in recent years.

Wild salmon are fished on rivers when the adults return from the sea to the rivers and burns where they hatched and spent early months of their life. However, as with sea trout, they were once common; but in recent years there has been a major decline in numbers returning to spawn. Some people put the blame for this on parasites (sea lice, *Lepeophtheirus salmonis*) picked-up from coastal fish farms, but over-fishing at their feeding grounds at sea may also be an issue.

This area is west of the Moine Thrust and the mountain, Arkle, is Arkle, composed of white quartzite. This is a hard and brittle rock which breaks down easily: when water enters cracks in cliffs, it expands when it freezes, causing the rock to break-up and fall onto the scree slopes below ('frost weathering') (D). The white quartzite with its scree slopes is here overlying the much older Lewisian gneiss, identified by its smoother and more rounded landform (A1), and without scree slopes.

The location is near the boundary of the Moine Thrust (Map 1), where younger rocks to the east were pushed over older ones to the west.



A. Moorland, Torridon

Typical moorland of wet heath in the Northwest Highlands.



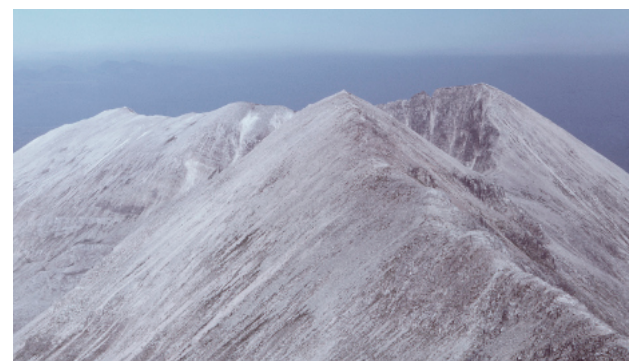
B. Gorse (winter)

Gorse is not native to Sutherland but, as in other areas, it has been spreading rapidly across the landscape in recent years. This picture is taken in winter, when gorse is in flower; there is dead bracken in the foreground.



C. Reeds

Reeds grow in the shallow edges around lochs and slow moving rivers. They are grasses – not be confused with rushes which are commonly seen colonising grass pastures. There is only one species in the world, *Phragmites australis*, so it is the same one here as, say, along the Nile in Egypt.



D. Scree slopes, Beinn Eighe, Wester Ross

Scree slopes are common below cliffs. The picture here shows a whole mountain covered in scree derived from fragmentation of quartzite – Beinn Eighe in Wester Ross. It is the same rock type, Cambrian quartzite, as on Arkle in the main picture.

MAINLAND VIEWS

Loch, mountain and moorland



Loch Maree and Slioch, Wester Ross

This is the dramatic Slioch which towers above Loch Maree. Slioch is Gaelic for 'spear'. The summit is composed of Torridonian Sandstone (E), overlying more rounded Lewisian Gneiss (E1). This area is famed for its natural beauty and was one for the five areas in Scotland identified as being worthy of National Park status by the Ramsay Committee in 1945, which met during the Second World War. Creating National Parks would have enabled public access to the hills which at that time were private domains. It was seen as a way of rewarding people for the war effort.

In the event, it took another fifty years before the first National Parks were created in Scotland: Loch Lomond and the Trossachs in 2002, and The Cairngorms in 2003. However the finest landscapes in Scotland were identified in the 1978 report by the then Countryside Commission for Scotland called *Scotland's Scenic Heritage*. 40 locations were identified, which have since been designated 'National Scenic Areas', most, but not all, of which are in the Highlands and Islands. They include the five areas identified by the Ramsay Committee. National Scenic Areas are planning designations, meaning that there are certain planning restrictions designed to protect their landscape quality. Perhaps surprisingly, most people of Scotland have not heard of them!

There was a hydro-electric scheme proposed in the 1960s connecting Lochan Fada to Loch Maree below, but this was never built owing to concerns about the effect on the landscape of such an iconic area.



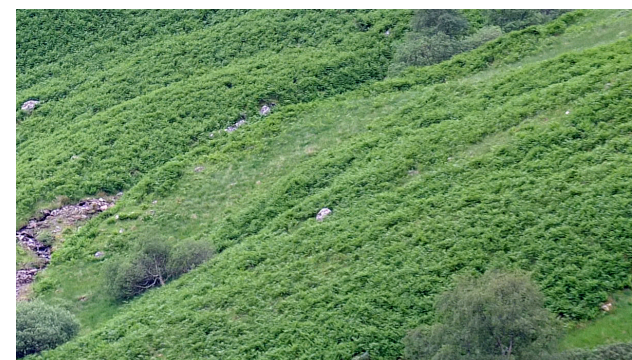
A. Scots pine, River Grudie, Loch Maree

Above Loch Maree is the Glas Leitire Pinewood, a relict from the era thousands of years ago when Scots pine wood was once common across the Highlands (page 22). The pine in the main picture are outliers from the main wood which is about three miles to the southeast.



B. Native oak wood

The east shore of Loch Maree is famous for its woods of sessile oak, once used to provide charcoal for an iron furnace at the south end of the loch. The furnace built in 1610, and was one of the first in the Highlands. However, in spite of the past harvesting of the trees, the oak woods are still there.



C. Bracken-covered slope

The lower slopes of Slioch have stands of bracken above the oakwoods.



D. Moorland (dry heath)

Above the bracken on Slioch are slopes of dry heath, composed mainly of heather (ling). Although heather is also visible on level ground in the foreground of the main picture (D1), it is growing on wet heath, as opposed to dry heath on the well-drained slopes of Slioch.

MAINLAND VIEWS

Mountain and moorland



Strath na Sealga, Wester Ross

This picture is taken in a remote area of Wester Ross far from any road in an area which has been called 'The Last Great Wilderness', encompassing the land between Loch Maree and Little Loch Broom. This is because it is wild land, containing minimal signs of human infrastructure: only some footpaths and some bothies. The bothy here is Shenavall (B). There is only one small forestry plantation in the area (at Kernsary), and no dams, pylons, or windfarms.

The Scottish Government's nature conservation agency, NatureScot, conducted a survey of such wild areas across Scotland which resulted in a map of what were called 'Wild Land Areas', published in 2014. There are 42 such areas which, apart from two in southern Scotland, are all in the Highlands and Islands. Five criteria were used to identify them:

- 1) Perceived naturalness
- 2) Rugged or challenging terrain
- 3) Remoteness from public mechanised access
- 4) Lack of built modern artefacts
- 5) Relative wildness

However, these Wild Land Areas have no legislation to back them up and, to date, have proved unpopular with government and developers because it is felt that, keeping them wild, is a constraint on development. Therefore, the extent of wild land in the Highlands and Islands continues to decline through the types of development shown in this book.



A. Bracken

Bracken is growing on the grassland around the bothy because the soils here are dry and relatively fertile.



B. Bothy, Larachantivore, Strath na Sealga

A bothy is a hut used by walkers and climbers for overnight accommodation. The conditions inside are basic, without electricity and often without running water. Most bothies were originally built as croft houses, shepherds' houses or small shooting lodges.



C. Moorland (shallow wet heath), Torridon

Trees are absent over this landscape, which is dominated at lower altitudes by shallow wet heath, and by mountain grasslands higher-up. This is natural vegetation with an unbroken ecological link back to the last Ice Age, a rare situation to find in Europe today.

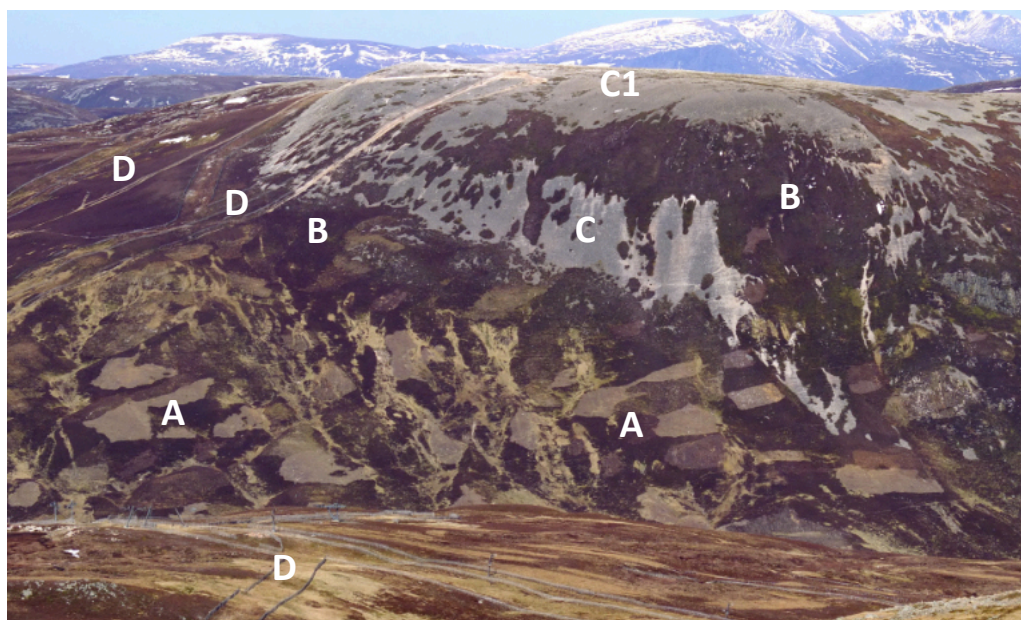


D. Mountain corrie, Beinn Dearg Mor

The higher mountains in Scotland have large bowl-shaped hollows below the summit ridge, with steep cliffs, and often a loch at the bottom. These are called corries (or cirques, cwms in Wales, coire in Gaelic), and were formed by small glaciers during ice ages.

MAINLAND VIEWS

Mountain and moorland



Upper Glen Clunie, Braemar

The Central and Eastern Highlands present a different landscape to that of the west. The mountains are less rugged and more rounded, although they can have steep-walled corries on their northern and northeastern sides. With the prevailing wind in Scotland from the west, much of the rain has already fallen by the time it has crossed the Western Highlands, so the eastern half is drier. One result of this is that wet heath is less common in the east and heather moorland more common.

The picture here shows such a moorland landscape within the Cairngorms National Park, adjacent to the Glenshee ski centre. The main Cairngorm mountain range is visible in the top right, notable for its high altitude mountain plateau, with several hills above 4,000 feet (1,200 metres), although the highest hill in Scotland is in the Western Highlands above the town of Fort William – Ben Nevis at 4,413 feet (1,344 metres).

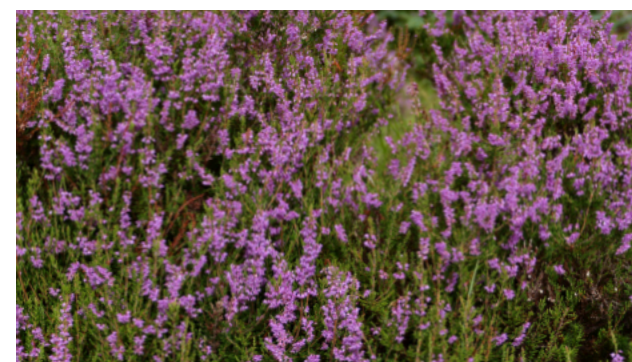
Heather moorland has been the dominant vegetation in this area for thousands of years and is the habitat for the ground-nesting red grouse. There are still pockets of native Scots pine woodland within Strathspey to the west and Deeside to the east (page 67).

The moorland here is also the habitat for mountain hares (*Lepus timidus*), which are rare in the wetter West Highlands. The hares turn white in winter as camouflage in the snow. Wading birds also use the high moors for breeding.



A. Muirburn, Slochd

A major land use in the area is grouse shooting on sporting estates. The red grouse eats heather shoots and benefits from heather with a range of different ages. This is brought about by rotational burning – 'muirburn' by land managers.



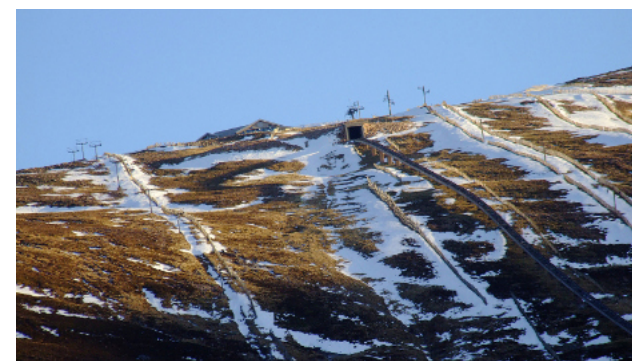
B. Unburnt heather

Older, taller heather provides shelter and concealment from predators such as hen harriers and foxes, but short, newly burnt heather provides the most nutritious shoots to eat. Hence rotational burning, on a cycle of 7-8 years is ideal. This gives grouse moors their mosaic appearance.



C. Scree slope

Both scree and fellfield is visible in the main picture. Fellfield (C1) is similar to scree, but is found on flat hilltops rather than slopes.



D. Ski slopes, Cairn Gorm

There are five ski centres in Scotland, and linear ski runs at the Glenshee centre are visible in the main picture. Runs consist of fences built to trap snow, and ski tows as illustrated in this picture. Ski centres introduce significant infrastructure into the mountains.

MAINLAND VIEWS

Mountain and moorland



Glen Roy, parallel roads visible in top half

Glen Roy is a glen further west than the Cairngorms. It is famous for its 'parallel roads', visible here as horizontal lines across the hillside in the top half of the picture. Their origins perplexed people for many years, including theories that they were built as roads by earlier populations. In fact they represent shore lines of a large lake which was present at the end of the Ice Age.

Glen Roy feeds into the larger Glen Spean to the south, which is at right angles to the glen. At one time there was a large glacier flowing down Glen Spean, which acted as a dam to any water flowing out of Glen Roy, causing a large lake to form in the glen. The water level in this slowly dropped as the glacier melted, resulting in shore lines at progressively lower levels.

Glen Roy is sparsely populated: there is a shooting lodge at the north end, and a sheep farm to the south. This picture from the centre of the glen shows that it once had a higher population because the remains of an old field is visible (A), surrounded by a ruined dyke. This has long since been abandoned, but does provide an area of better grazing than on the heather-covered hillside (D), although bracken (B) is now invading the area.

There also a gully wood on the far left of the picture (C).



A. Old field, Loch Tummel

An old field, now permanent pasture, with a ruined dyke visible. This provides the best grazing in an otherwise infertile landscape.



B. Bracken (winter)

Bracken is colonising the more fertile land of the original farmland.



C. Gully wood, Argyll

Upper Glen Roy is treeless apart trees along deep, burnside gullies, a very common situation in the Highlands. However, there are oak woods along the River Roy in the lower half of the glen, and along the River Spean below (page 26).

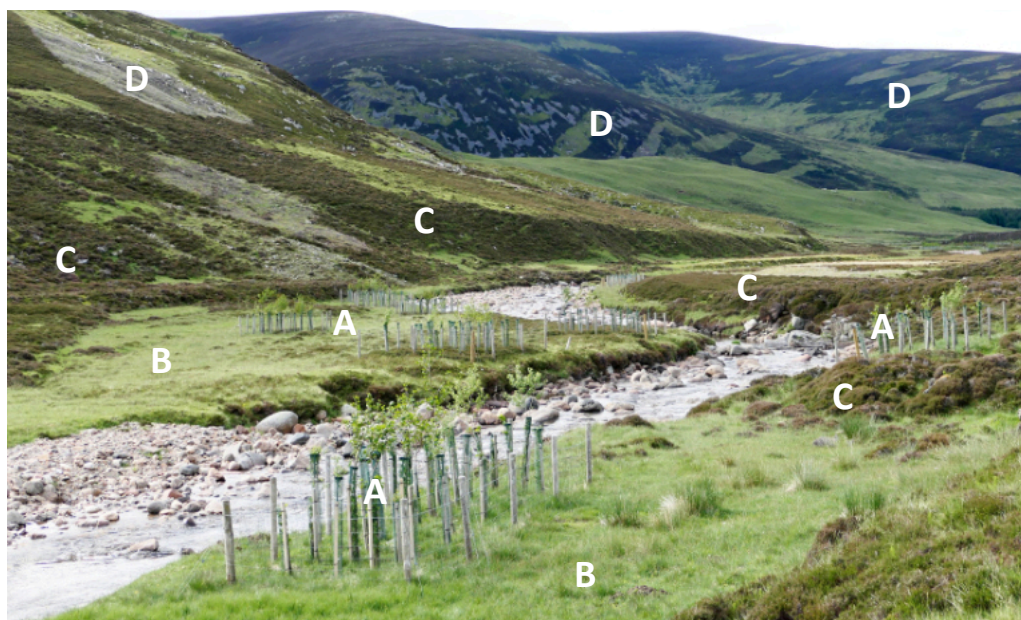


D. Heather moorland, Glen Roy

The well-drained slopes of the hillsides are largely heather covered, indicating acid, infertile soils. The glen is used for sheep grazing in its lower half and deer stalking in its upper half.

MAINLAND VIEWS

Mountain and moorland



Glen Clunie, Braemar

The picture on page 155 is taken at the upper end of Glen Clunie, which runs from Glenshee into the River Spey at Braemar. This one is taken further down the glen and illustrates an increasingly common development: the planting of riverside trees, more commonly called 'riparian planting'.

The upper reaches of most rivers in the Highland have no trees along their banks, a situation explained by many (but without evidence) that this is because 'overgrazing' by sheep and deer has prevented tree regeneration.

With the climate getting warmer, and with the increasing probability of ever-hotter summers, the water in the rivers can heat-up in the summer. The upper-reaches of Scottish rivers, together with their smaller tributary burns, are the main spawning ground of Atlantic salmon, which cannot survive the hotter water.

Hence there has been a big push to plant trees along watercourses to help keep the water cool in summer (A). Trees also drop their leaves into the water, which is food for the invertebrates the fish feed on.

Over time, all this riverside planting will transform the appearance of the land.



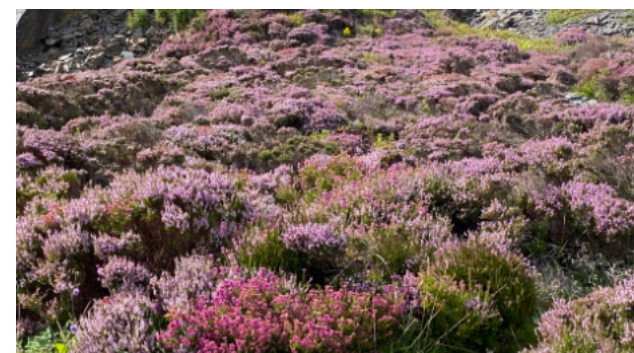
A. Riverside tree planting, Corriemulzie Burn

Another example of riverside tree planting near Braemar. Trees are either planted along fenced-riversides, or in plastic tree shelters as here. These protect young trees from grazing by deer, sheep and voles, and also provide extra warmth and shelter.



B. Alluvial grassland, Glen Clunie

River floods bring down sediment which acts as a fertiliser along the edge of the river; alluvial gravels are also free-draining. This means that some of the best grazing is on the alluvial flats, which are attractive to animals – giving trees little chance to grow.



C. Unburnt heather moorland

Where the soil is less rich, then heather dominates, both on the floor of the glen and on the hillslopes. Unburnt heather, as here, provides tall shoots where red grouse and their chicks can shelter from the wind, and also provide concealment from predators.

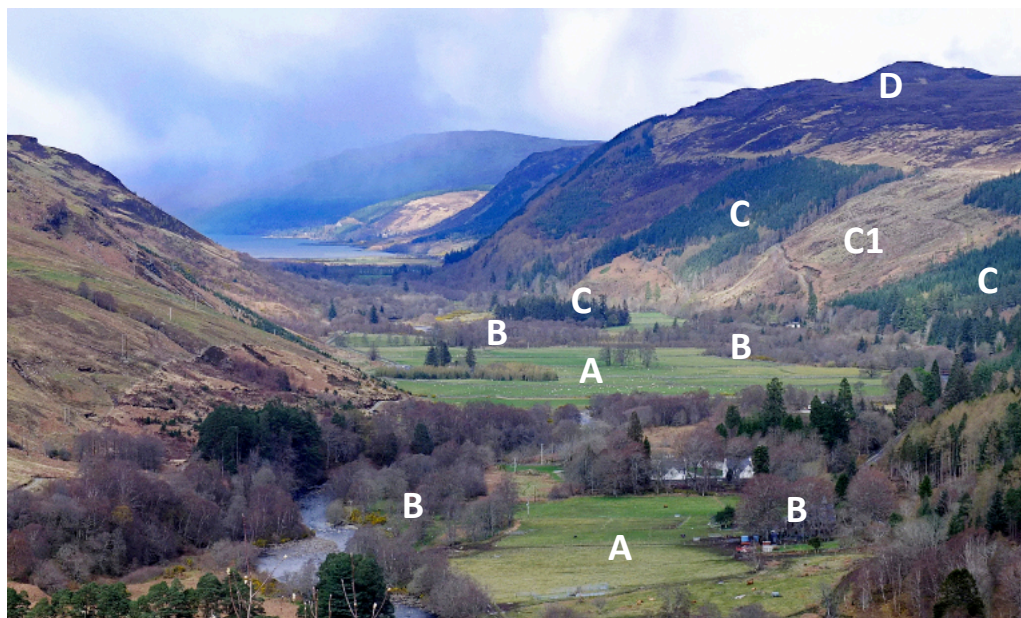


D. Muirburn, Mount Keen

A recently burnt area of heather, before it has begun to regrow from the roots or from viable seed remaining in the soil. Burning is carried out in the spring, when the underlying soil is still wet and fires do not burn deep.

MAINLAND VIEW

Wide strath (North Highlands)



Strathmore, Wester Ross (winter)

This a wide, flat bottomed strath leading down to the sea at the head of Loch Broom. It originally would have been carved out by ice flowing down into the sea from a large inland icesheet.

The flat bast of the strath, composed of sediment washing down by the river and perhaps also by raised beach deposits, is well-suited to agriculture: it is near sea level and sheltered, giving mild growing conditions, and the level ground is ideal for the creation of fields (A). Such flat ground is rare in the Highlands. The side of the River Broom has alder trees growing along its length (B) and the hillslopes have commercial conifer plantations (C), with a clearfell site visible (C1). Above the plantations is heather moorland (D).

The sheltered nature of the strath in this far north location has long been recognised and resulted, in the 1870s, in the creation of Lael Arboretum – a woodland garden with about 200 species of tree from all over the world, including the giant *Wellingtonia* from North America. This is now managed by the government's forest body, Forest and Land Scotland.

The strath ends suddenly with a steep slope leading up to the moorland to the south. Cutting through this is the famous Corrieshalloch Gorge, where water from melting glaciers at the end of the Ice Age has cut down 60 metres into the rock, leaving a narrow and spectacular gorge. It is owned by the National Trust for Scotland.



A. Pasture (improved), Glenorchy

Highland cows here grazing on improved pasture. However, this ancient breed is hardy and can also graze the poorer-quality grasses on rough pasture.



B. Riverside alder woods

Across the Highlands, alder trees are characteristic of riversides and also other wet areas at low altitudes.



C. Conifer plantation

This shows a plantation with an old clearfell site in the foreground. The purple flower is foxglove (*Digitalis purpurea*), which would not have been found on the original moorland on which the trees were planted. This shows how tree planting permanently changes the soil conditions.



D. Heather on rocky moorland

The higher slopes of the strath are dominated by heather.

MAINLAND VIEWS

Wide strath (West Highlands)



Glen Geal, Kingairloch

This picture was taken summer when all the vegetation is green and the different types are hard to tell apart from a distance.

Stones and gravel washed down by the burn have created an alluvial fan at the bottom of slope (A). These are generally free-draining and present the best grazing in a landscape of otherwise poor soils. They are therefore favoured by both wild deer and farmed livestock, and are grazed short all year round, resulting in smooth pasture with a short sward.

Because of this, they have been chosen as the site of small farms, as here, or as the location of the old shielings where livestock were once taken in the summer (page 39).

There are stands of bracken (B) on the drier ground at the bottom of the slope, with brownish-tinged areas of wet heath (C) between them. Elsewhere the slopes are mainly damp grassland, dominated by purple moor grass (D).

The purple moor grass is of lower grazing value than the dry grassland, so the sward is rough – not grazed flat as on the alluvial fan.

Heather is largely absent in this area, possibly because the bedrock erodes to richer soils than to the infertile soils preferred by heather.



A. Alluvial fan (winter), Loch a' Chroisg

This shows how a stream has created a deep gully, with the material deposited below as an alluvial fan. There is heather on the steep sides of the gully (dark), with wet heath around it, and dry grassland on the fan itself.



B. Bracken and smooth pasture

Bracken growing above smooth pasture.



C. Wet heath, Kingairloch

At lower altitudes in the west, bog myrtle is common on wet heath, visible here in the foreground. It can grow up to one metre tall in sheltered places but is normally shorter. Its leaves are strongly scented, and its roots fix nitrogen from the air which allows it to grow on poor soils..



D. Damp grassland

Rough grassland dominated by purple moor grass is characteristic of many of the hillslopes of the area.

MAINLAND VIEWS

Wide strath (East Central Highlands)



Near Insh, Strathspey (winter)

The River Spey is the largest river flowing through the Highlands. It occupies a wide strath, providing level ground and alluvial soils suitable for agriculture. In places along the strath there are ancient native pinewoods, which have been managed over the centuries to provide timber. Once cut, logs were floated down the Spey to the sea at Kingston on the Moray Firth, where there was once a ship-building industry. Before the roads were built in the Highlands from the beginning of the 19th century, this was the only means of exporting timber out of the Central Highlands.

The above characteristics, taken with the drier climate than the west, has resulted in Strathspey always having been well-populated.

The picture here, taken near Kingussie, shows the level alluvial plain with improved fields for grazing livestock (A), the best of which are used to produce silage; there is a pile of silage bags visible on the left.

In addition to the original natural woodland of Scots pine, there are also native birchwoods (B) and many planted woods of pine (C), although nowadays many are restocked with Sitka spruce. The moors above (D) are used for deer stalking and grouse shooting, with muirburn carried out.

Downstream from where this picture was taken are the Insh Marshes, one of the largest wetlands in Scotland and now important as a nature reserve.



A. Improved pasture

Improved pasture, typical of the type of grassland on the flat land adjacent to the River Spey. It is grazed in the winter, and then the grass is left to grow long from late spring to summer, after which it is cut for silage.



B. Native birch wood, Insh

Stands of birch are typical rougher ground not so suitable for agricultural improvement. Here birch is growing on hummocky glacial moraine in a location near where the main picture was taken. The ground flora here is mainly blaeberry (bilberry).



C. Scots pine plantation, Insh

A plantation of closely-spaced Scots pine in Strathspey. The tall, straight trees are very different from the widely spaced Granny pines of the native pine forests – see page 21. Because pine grows slower than Sitka spruce, the latter is normally the favoured commercial conifer.

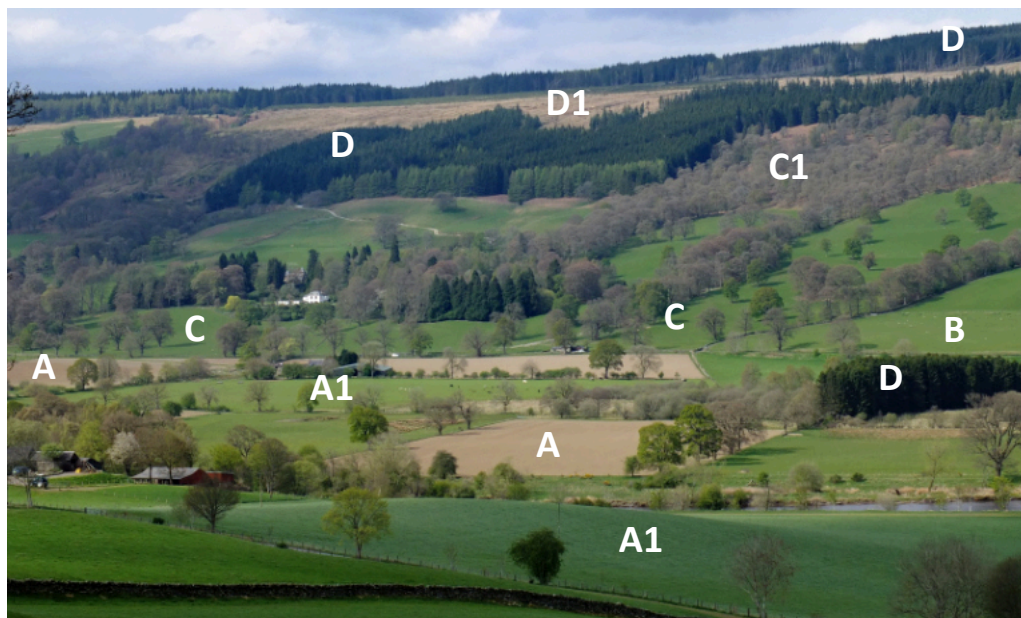


D. Moorland, Kingussie

A peat-filled hollow amongst heather moorland above Kingussie, with bog pools present. In the distance, smoke from muirburn can be seen.

MAINLAND VIEWS

Wide strath (Southern Highlands)



Strathtay, Perthshire

Perthshire has less extreme climate than many other areas of the Highlands, with wide straths and fertile flood plains. This means that the landscape is well-inhabited, with farmland extending north into the hills, and many big houses surrounded by Designed Landscapes (C). Field boundaries are often of hedges rather than stone walls.

The River Tay is Scotland's largest and longest river, with the city of Perth at its mouth; this is a picture of its middle reaches.

Cereal growing (wheat, barley, oats) is possible on the level ground (A), together with improved pasture for silage (A1), with permanent pasture elsewhere (B). Native woodland of birch and oak (C1) is more common in Perthshire than other parts of the Highlands, with commercial plantations also common (D); a clearfell site is visible (D1). The county is noted for the autumn colours that trees bring to the landscape.

The rivers often have alder trees growing along their banks, and are renowned for their salmon fishing. In recent years, beavers have been introduced into the area and their presence can be noted by their gnawing and felling of trees: see the picture on page 20. Beavers become extinct in Scotland in the 1500s because their fur was sought-after, and there are now re-introduction schemes across the Highlands – indeed, across Britain. However, they are not always popular with farmers because they can burrow into the banks which protect the farmland from floods.



A. Cereal field after harvest, Moray

It is risky growing cereals in Highland Perthshire because many of the fields are on the rich soils of flood plains – which do flood occasionally. Also, there is no guarantee the crops will ripen properly in a cool, wet summer. The Inner Moray Firth, as in this picture, has a better climate for cereal growing.



B. Permanent pasture

Permanent pasture, *i.e.* pasture which never ploughed and reseeded with agricultural grasses, occurs on the lower hill slopes.



C. Parkland. House of the Binns

The widely-spaced trees in the main picture indicate that is a designed landscape, with parkland trees around the main house for aesthetic reason. Parkland trees, unlike plantation trees, have long spreading branches.



D. Conifer plantation with clearfell

Commercially grown conifer plantations occur on the higher ground less suited to agriculture. Both mature plantations (D) and clearfell sites (D1) are visible.

MAINLAND VIEWS

Mountain – Farmland transition (Eastern Highlands)



Kintocher, Aberdeenshire

The mountains of the Eastern Highlands in Aberdeenshire do not end suddenly. There is farmland spreading west up the glens and, further east, isolated hills surrounded by farmland (D). It is, therefore, a mixture of upland and lowland.

The fields, as well as growing grass for silage, also contain barley (A), and occasionally oats. Barley is grown for the beer and whisky industries, which use malted barley, with the lower quality grain going to animal feed.

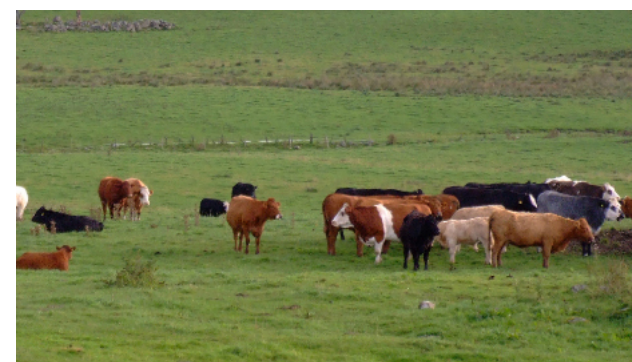
As with Islay (page 137), the Eastern Highlands are a major centre of the whisky industry, centred around Dufftown, which includes famous brands such as Glenlivet. The barley left over after fermentation is used as animal feed and any liquid waste is piped into the sea on the Moray coast. Hence a common sight on Highland roads is lorries involved in the whisky industry: transporting grain and animal feed, taking liquid waste for disposal, and the whisky itself being transported to the bottling plants in the Central Belt.

These eastern hills are increasingly being chosen for the siting of windfarms, being easily accessible and near the main power line of the National Grid running down the east coast.



A. Arable field (harvest time), Gardenstown

A recently harvested field of barley in Aberdeenshire. The remaining straw is rolled up into bales, visible here, which are sold as bedding for livestock.



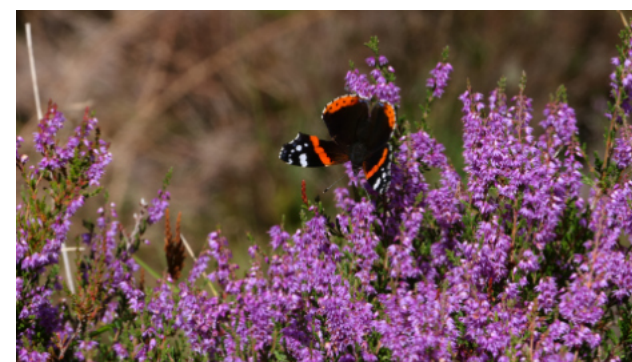
B. Improved pasture

Aberdeenshire is the centre of the beef industry in Scotland, the cattle grazing on improved pasture.



C. Conifer plantation

There are many commercial forestry plantations on the hills of the Eastern Highlands. The gently-sloping hills, the less windy climate and nearness to centres of population makes it an economic place to grow trees (although most forestry would be uneconomic without grants).



D. Heather moorland

There are many outliers of heather moorland in the east: some managed for grouse or grazing, some unused, and some being colonised by trees. Heather, here with a red admiral (*Vanessa atalanta*), is visited by bees to make flavoursome heather honey.

MAINLAND VIEWS Kintyre Peninsula



Southend

The Kintyre Peninsula is the southern extremity of the Highlands, a landscape not of rugged mountains, but of moorland, forestry plantations and farmland. The peninsula, in fact, extends much further south than Edinburgh or Glasgow to the east. The climate is mild, albeit windswept.

The farmland pictured here comprises large, smooth fields, in contrast to the small pockets of farmland further north. It is an ideal climate for growing grass.

Hence the south end of the Kintyre Peninsula is suited to dairy farming and produces good quality milk and cheese, although it suffers from being a long road journey from the main markets in the Central Belt of Scotland.

Although in the past, every farm and croft would have its own dairy cow, dairy farming is now mostly absent from the West Highlands, although there are exceptions such as on Orkney, Mull, Gigha and Bute. It is much easier to buy in milk than have your own cow, and the much larger farms in the lowlands can produce milk more economically. The dairy industry is also struggling because margins are low and the public are moving away from dairy products.



A. Improved pasture, Isle of Bute

The improved pasture in Kintyre, and on the Isle of Bute to the east, provides ideal grazing for dairy cattle, because of the mild climate and the long growing season for grass.



B. Cattle shed

Dairy and other cows are normally overwintered in large sheds. The manure (slurry) produced over the winter is later spread over the fields as fertiliser. The slurry is stored in large tanks adjacent to the shed.



C. Shelter belt

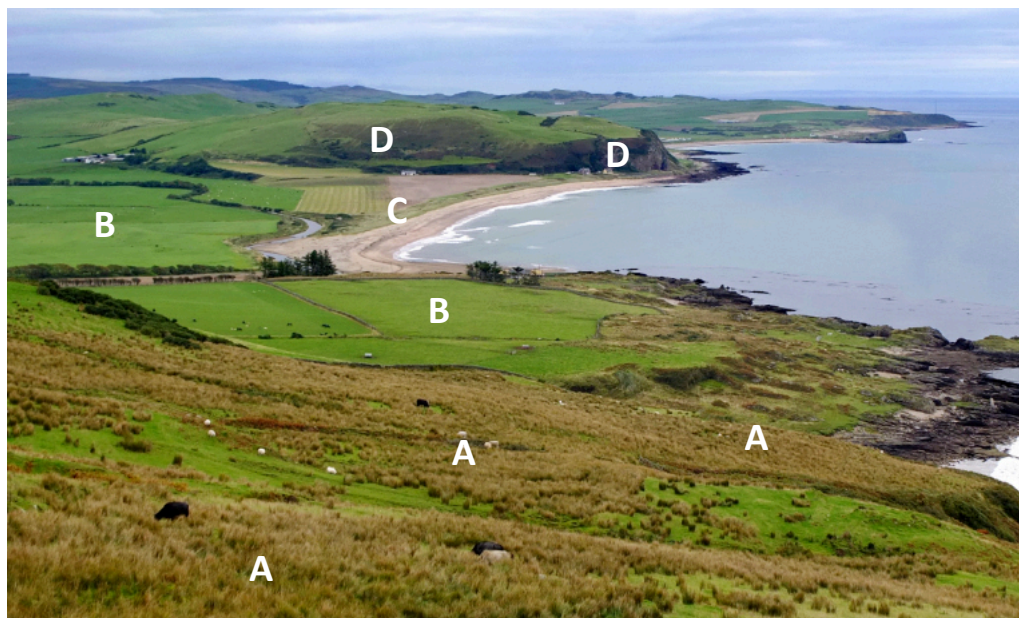
The Highlands have a windy climate. Hence strips of woodland are often planted to shelter the fields. This shows a shelter belt of conifers, and the main picture shows belts of broadleaved trees.



D. Moorland, Mull of Kintyre

The farmland in the main picture would once have been moorland. Moorland still exists at higher elevations in Kintyre and along the coast north of the Mull of Kintyre as here, a location too exposed and steep for agricultural improvement.

MAINLAND VIEWS Kintyre Peninsula



Southend

Another view of the south end of the Kintyre Peninsula. The foreground shows permanent pasture. A common feature of pasture in the Highlands is that it is subject to colonisation by rushes, so much so that at times it is called 'rush pasture' (A).

During the era of agricultural improvement starting in the second half of the 18th century, a lot of field drains were laid down. These were clay (pottery) pipes buried underground to drain off the water; the resulting drier soils were better for grass growth. Many of these drains are now becoming blocked and, without new ones, the fields are getting wetter – and this encourages the rushes. But even drained fields succumb to rushes eventually. Modern drains are flexible plastic pipes with small holes along their length to enable water to enter the pipe; the original field drains had small gaps between the pipes for this to happen

Rushes are not nutritious to animals, and so are not grazed – except occasionally at the end of winter when there is not much else to eat. Farming and crofting in the west, therefore, is often a constant battle against rushes. Even if a field is ploughed and reseeded with grasses (B), over time the rushes will return and spread throughout the grassland.

Although rarely eaten, rushes do provide some shelter from the wind for sheep.



A. Pasture with rushes

There are several species of rush, but the one which invades pastures is the soft rush. Rushes have thin shiny leaves which go brown in the winter.



B. Old silage bags caught in a fence

Silage is cut from improved pasture, and a modern sight on farm and croftland is the remains of plastic silage bags caught in fences, and blowing in the wind.



C. Sand dunes, Southend

The beach here has vegetated dunes comprised of sand which has blown inland, to be colonised by maritime grasses. The commonest such grass is marram grass (page 140), resistant to wind and salt spray, and which has deep roots to reach water deep in the free-draining sand.



D. Coastal scrub (winter), Isle of Seil

Scrub woodland in Argyll, the trees kept short by the wind. In the Southwestern Highlands, coastal woods can have a wide range of trees, including birch, oak, ash, wych elm, hazel and sloe (blackthorn). A green patch of ivy (*Hedera helix*) is also visible here.

MAINLAND VIEWS

Eastern coastal fringe

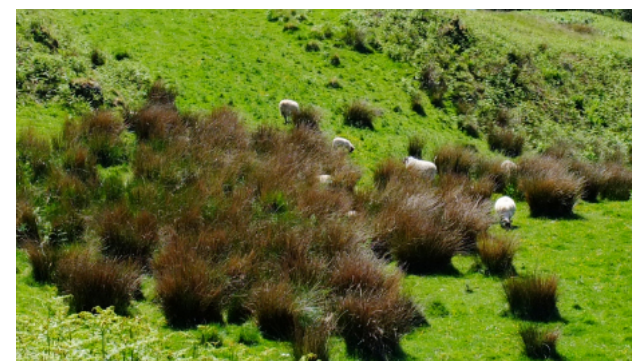


Near Helmsdale, Sutherland

The definition of 'The Highlands' used in this book, that is the land north of the Highland Boundary Fault, does not mean it is all 'high land'. The term is more of a general geographical distinction separating the northern half of Scotland from the South. The land down the east coast is low-lying compared to the rugged and infertile mountains to the west, and is underlain by younger, sedimentary rocks which weather to give fertile soils.

There is only one place where the hills actually reach the sea: at the border between Sutherland and Caithness, the Berriedale Braes. Caithness is a flat landscape bounded by vertical cliffs along the coast and hills to the west and south. To some extent, it has an island feeling to it. There are pictures of coastal Caithness on pages 91, 93 and 94.

The land bordering the Moray Firth is one of the driest parts of the British Isles, being in the rain shadow of the western hills. This, combined with the fertile soils, makes it well-suited to growing crops. As you head south into Sutherland from Caithness, the strip of arable land starts off narrow (B), as in the above picture, with the heather-covered hills close to the sea (E); but the strip slowly widens, reaching its widest in what was once Banffshire (now Aberdeenshire).



A. Pasture with rushes

Rushes have colonised a damp hollow within the improved grassland. If not controlled, they are likely to slowly invade the whole field.



B. Improved pasture for silage

The fields have been drained and fertilised to produce silage for winter feeding of livestock. This shows silage production in action, with tightly-rolled bales of grass before being put into large plastic bags.



C. Gorse, Gairloch

Gorse is spreading throughout the Highlands and can grow into large stands to the exclusion of other plants – as here on the Common Grazings of Gairloch on the west coast.

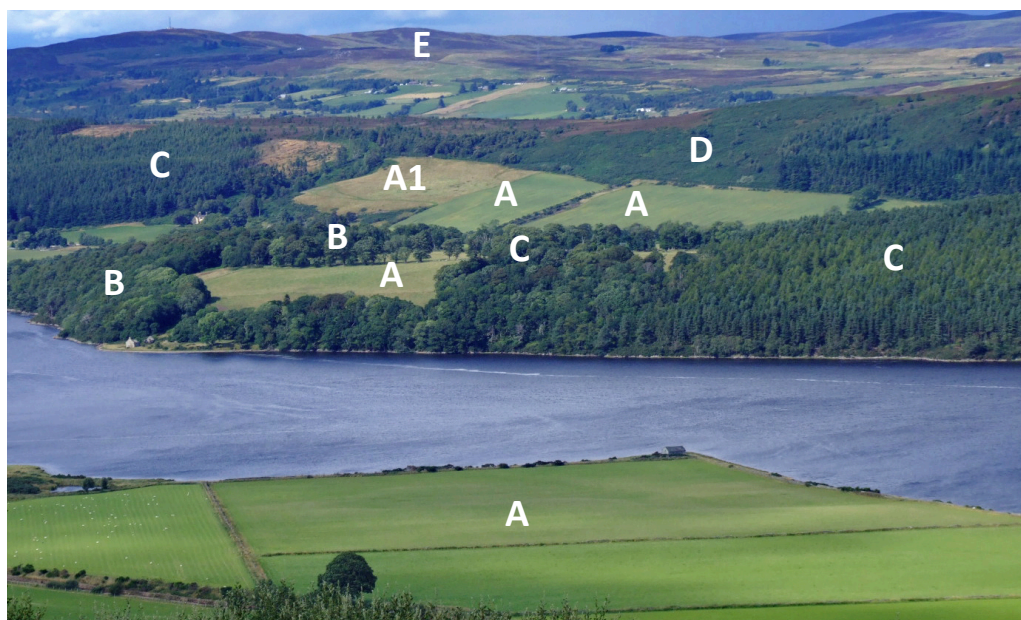


D. Bracken (winter)

There are large stands of bracken on the well-drained slopes at the bottom of the hill slope.

MAINLAND VIEWS

Eastern coastal fringe



Dornoch Firth, Sutherland

The Dornoch Firth between Dornoch and Tain extends deep into the hills, but has gently-sloping sides in comparison to the steep-sided sea lochs on the north and west coasts. It is perhaps the only such estuary in Britain with an absence of industrial development or large towns along its shores, and it has been designated a National Scenic Area (page 151).

At its eastern end are large expanses of sand which dries out at low tide, backed by extensive sand dune vegetation. Indeed, the Morrich More on the south side is one of the largest expanses of natural, undisturbed sand dune vegetation in Britain – perhaps protected by being a military firing range.

The strath has a lowland feel, with its smooth agricultural fields (A) and with broadleaved woodland plantations (B). There are also commercial plantations (C). Moorland vegetation (E) is now confined to the hills distant from the Firth because of agricultural improvement and the planting of conifers.

A large expanse of gorse is also visible (D), colonising heather moorland.



A. Improved pasture

The fields around the Firth are mainly used for growing grass for silage, but they are grazed once the silage is cut. There is a field of unimproved pasture visible in the main picture (A1), identified by its browner colour.



B. Broadleaved woodland plantation

There are stands of mature, broadleaved trees containing a variety of tree species. The trees were mostly likely planted in Victorian times to improve the landscape.



C. Conifer plantation

There are extensive commercial plantations planted on land which was once heather moorland.



D. Gorse

Gorse is expanding in extent along the east coast.

MAINLAND VIEWS

Eastern coastal fringe



Cromarty Firth, Easter Ross

The wide Moray Firth splits into two smaller Firths: the Cromarty Firth to the north and the Beauly Firth to the south. Inverness, the 'capital of the Highlands', is on the shores of the Beauly Firth, a city whose population has expanded rapidly in recent years.

The sheltered waters of the Cromarty Firth provide one of the best harbours in Britain for sheltering large fleets. It was the base of the main fleet of the Royal Navy during the First World War before Scapa Flow on Orkney was developed. Invergordon, near which this photograph was taken, has always been an important naval base, before being superseded as a base for servicing the North Sea oil sector and, recently, as the main cruise ship terminal for the Highlands. The oil industry, starting in the 1960s, has been a major provider of jobs in the Highlands. For example, an oil rig construction yard was built in the 1970s at Kishorn in Wester Ross; this closed after a few years and is now being used as a site where oil rigs are decommissioned.

An aluminium smelter was built at Invergordon to help provide jobs to the Highlands, with many people moving to the area as a result. But it only lasted ten years, closing in 1982 with 900 jobs lost – because it was unable to secure the necessary cheap electricity. Today there jobs being provided in servicing the windfarm sector at Nigg at the north end of the Firth, at a site which once built oilrigs. The Firth has now been designated a freeport.



A. Arable crop (barley), Easter Ross

The farms of Easter Ross, sheltered from the mountains to the west, have some of the best grain-growing areas in Scotland. Pictured here is a field of barley.



B. Oil rig, Cromarty Firth

Oil rigs have been a common sight in the Cromarty Firth. The deep water allows them to be brought close inshore, either between contracts, or to await decommissioning. Extraction of oil from the North Sea started in the 1960s, but is now past its peak.



C. The Black Isle

The peninsula between the Cromarty and Beauly Firths is called the Black Isle, perhaps so-called because it was once covered in black peat. Today it comprises intensive farmland around the edge and forestry plantations in the middle. There is still one relict peat bog – the Monadh Mòr.

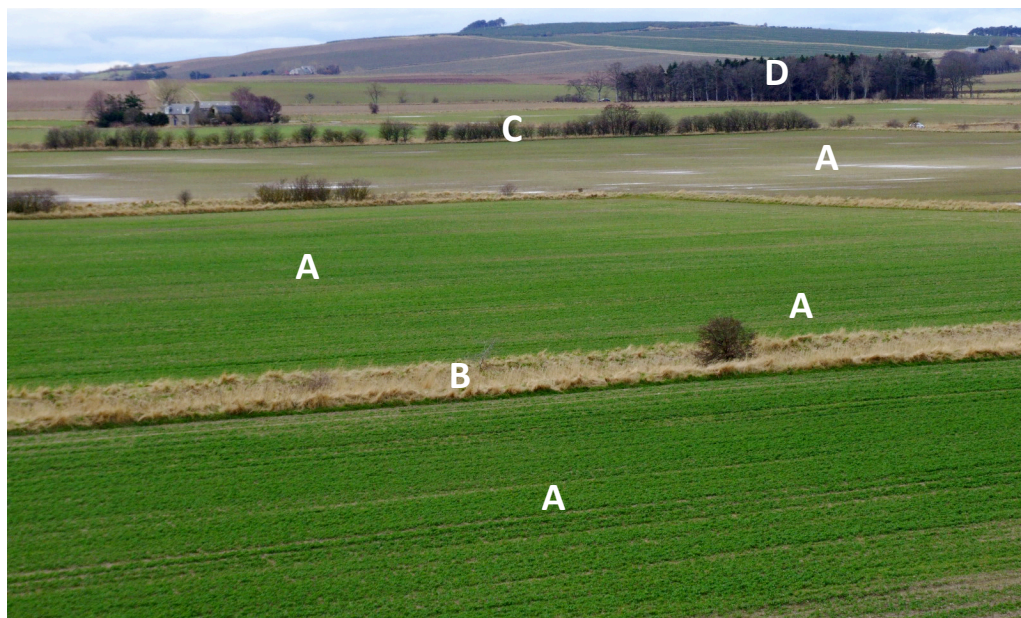


D. Conifer plantation

The landscape of the Black Isle has been transformed by the planting of commercial conifers along the spine of the peninsula.

MAINLAND VIEWS

Eastern coastal fringe



Laich of Moray (late winter/early spring)

The ancient province of Moray, between Inverness and Aberdeen, has always been a rich area owing to its benign climate. Its county town of Elgin once had a grand cathedral, dating from 1224 and the second largest in Scotland (after St Andrews). It was the seat of the bishops of Moray, but following the Scottish Reformation in the 1560s, it fell into disrepair and is now a ruin. The Reformation resulted in the abolition of bishops, and the rise of Presbyterianism as the main religion in most of Scotland.

This view is over the Laich of Moray, a low-lying area which was once a loch until it was drained in the 1800s. However, there is still a small loch remaining, Loch Spynie, which is now a nature reserve. Nearby are the ruins of Spynie Palace, the past residence of the bishops of Moray.

The fact that the area has been long-inhabited is shown by the presence of a Pictish fort at Burghead and Sueno's Stone at Forres, dating from the ninth or tenth centuries – the same era in which the brochs were built. Sueno's stone is the largest example of a carved Pictish stone in Scotland.

On the coast of Moray at Kinloss and Lossiemouth are two military bases. Fog is very rare in the region and the landscape flat, making it an ideal area for military airfields which were first built in the Second World War. Today the military provides a major source of employment to the region.



A. Arable crop (wheat), Moray

The main picture shows a recently crop, which could be wheat or barley. This shows field of wheat before harvesting. Wheat can only be grown in the drier and warmer areas of Scotland, because otherwise it does not ripen.



B. Rough grassland

Locations where cultivation is not possible comprise rough grassland. Because these areas are subject to drift of herbicides and pesticides sprayed on crops, and also to run-off of fertilisers, they tend to be species-poor, dominated by only one two species of grass or nettles.



C. Hedgerow trees

Hedges were once planted in this area as field boundaries, but in recent years they have been removed, or abandoned. When no longer cut, the woody shrubs which once comprised the hedge, can now grow to their full height as trees.



D. Farm woodland

Areas not so suitable for agriculture, are often planted with trees. These differ from the larger-scale commercial forestry plantations because they are designed to provide an income to the farm rather than distant owners. They are also planted to provide a habitat for game species.

MAINLAND VIEWS

Eastern coastal fringe



Rothiernorman, Aberdeenshire

North of the city of Aberdeen is a large tract of intensively-managed farmland. It used to be largely cattle country, but over the past decades it has changed to cereal growing, with barley for the brewing and whisky industries being the commonest crop – as illustrated here (A). However, some areas of grazing pasture remain (B).

Where there is grassland for sheep or cattle (B), it is improved grassland containing few species other than the agricultural rye grass and clover. There will be some birds such as rooks (*Corvus frugilegus*) which can find enough food in the fields, and in winter there may well be flocks of geese. But birds which used to thrive on farmland, such as corn bunting (*Emberiza calandra*), partridge (*Perdix perdix*) and corncrakes (*Crex crex*), cannot survive modern intensive management.

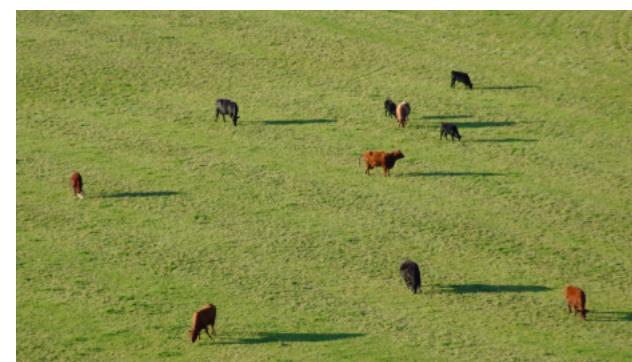
The intensive use of the land for farming means that, compared to most of the Highlands, there is little natural vegetation left, and what there is confined to the hilltops or steep ground (D). But even here, the spread of gorse can takeover the remaining natural habitats.

Two wind turbines are also visible on the side of the hill (E).



A. Barley (after harvest), Aberdeenshire

The barley is harvested in late summer, with the fields thereafter ploughed and seeded for next year. This can be done in the autumn, or the fields can be left fallow over winter with planting in spring.



B. Pasture

Grazed pasture is present on hillslopes, normally species-poor improved pasture rather than natural grasslands.



C. Shelter belt

Winds can be strong across the gently rolling countryside, so shelter belts of trees benefit both crops and livestock. However trees are not always popular with arable farmers because their leaves shade the crop, and their roots can both dry out the soil and make ploughing difficult.



D. Gorse

The hillside in the main picture is being colonised by gorse which, over time, will reduce the diversity of the vegetation.

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James Fenton, lives on the Isle of Seil with his wife Sue, and has had a long and varied career as an ecologist. He started as a researcher in the Antarctic, and thereafter taught ecology at a field centre in the English Lake District; he spent fourteen years working for the National Trust for Trust during which time he travelled the length and breadth of Scotland surveying their properties. Latterly, he worked for the Scottish Government's agency, NatureScot where he helped develop landscape policy. His final job before retirement was in the Falkland Islands as CEO of Falklands Conservation. He has also lectured on numerous small cruise ships around Scotland, the British Isles generally, the Arctic and the Antarctic.



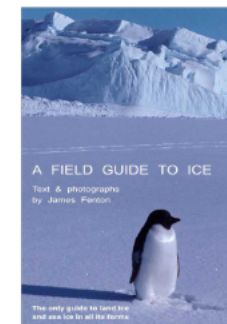
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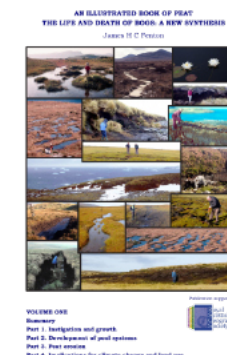


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