SCOTTISH NATURAL HERITAGE

Soils

SCOTLAND'S LIVING LANDSCAPES

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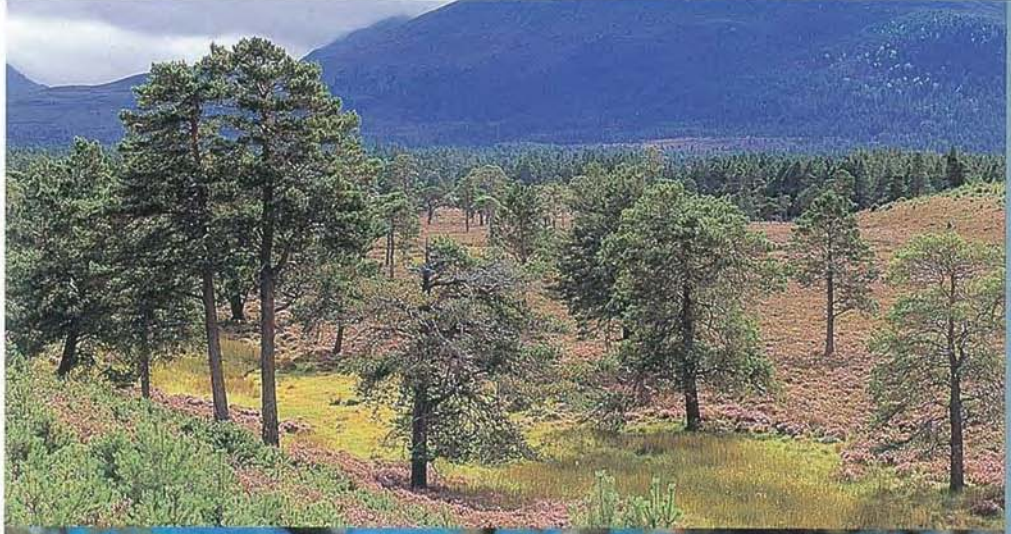
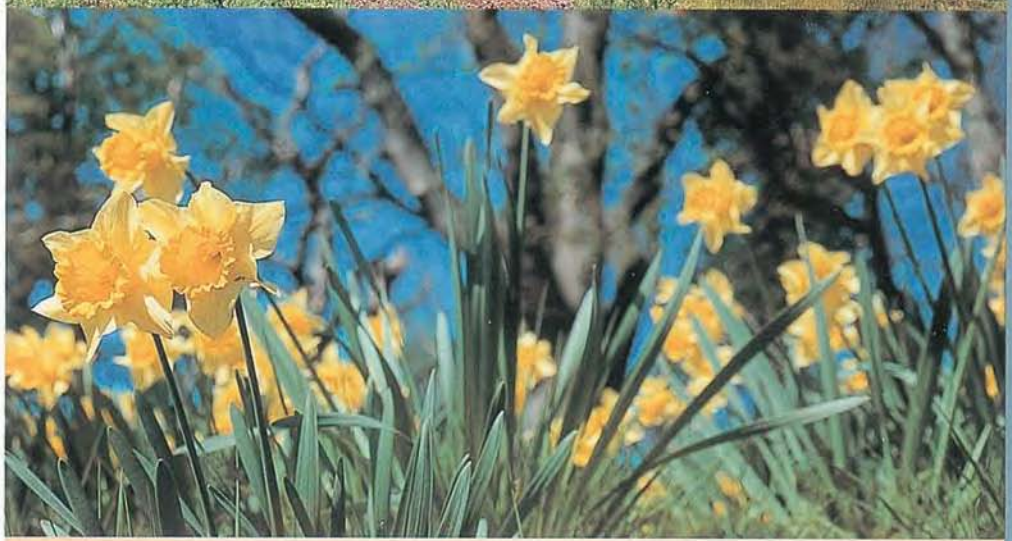
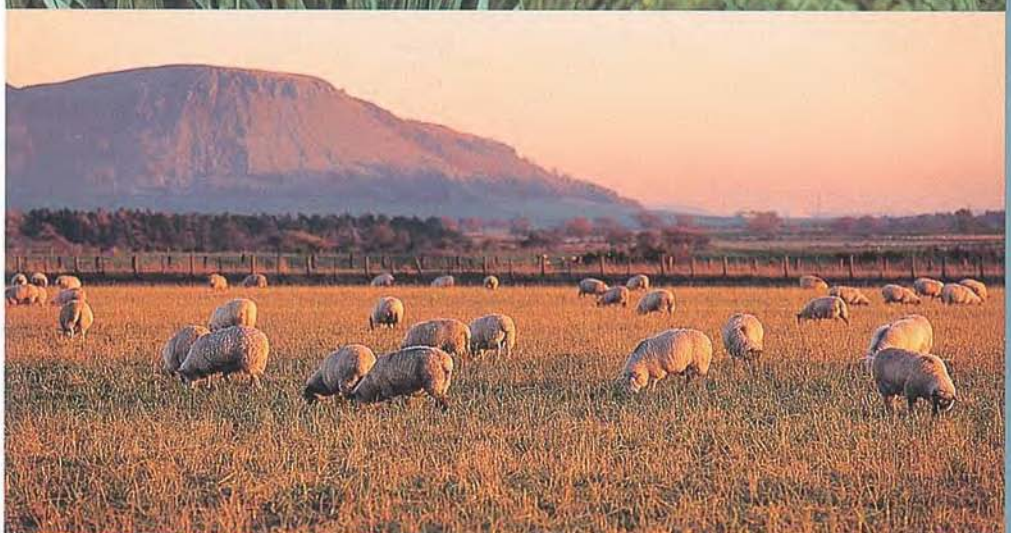






A hidden resource

What do the following images have in common? A rolling heather moorland. A hillside covered in pine forest. A field full of grazing sheep or cattle. A riot of colour in a summer garden. A game of football on a muddy pitch in winter.

The answer is that none of these familiar scenes could exist without soil. People simply cannot survive without it. Soil is 'what plants grow in', but it is much more besides. It plays an important role in producing most of our food, timber and fibres for our clothing. It also provides a base for our homes, our industry and many of our leisure activities. In spite of this dependence, we often treat the soil as if it were an inexhaustible resource which we do not need to care for!

Soil can look after itself – can't it?

A difficulty with soils being underneath us is that we cannot really see when things are going wrong, as we can when plants and animals disappear or die. There is a tendency to assume that everything is 'all right'. But, in other parts of the world, misuse of the soil has brought about a whole list of major environmental disasters. In both the past and at present, this neglect has led to catastrophic consequences. The effects of drought on over-farmed land in Africa during the 1980s and the American Dust Bowl of the 1930s are familiar examples, but there is good evidence that the collapse of several ancient civilisations was influenced at least in part by mismanagement of the soil.

Whilst the situation in Scotland is not like this, there are still several issues of concern. Soil erosion, pollution, acidification, loss of fertility and of organic matter all occur in different parts of the country. These problems result either directly or indirectly from using inappropriate management techniques on particular soils.

It should be evident that when we talk about nature conservation and environmental protection the well-being of soils must also be a major consideration.

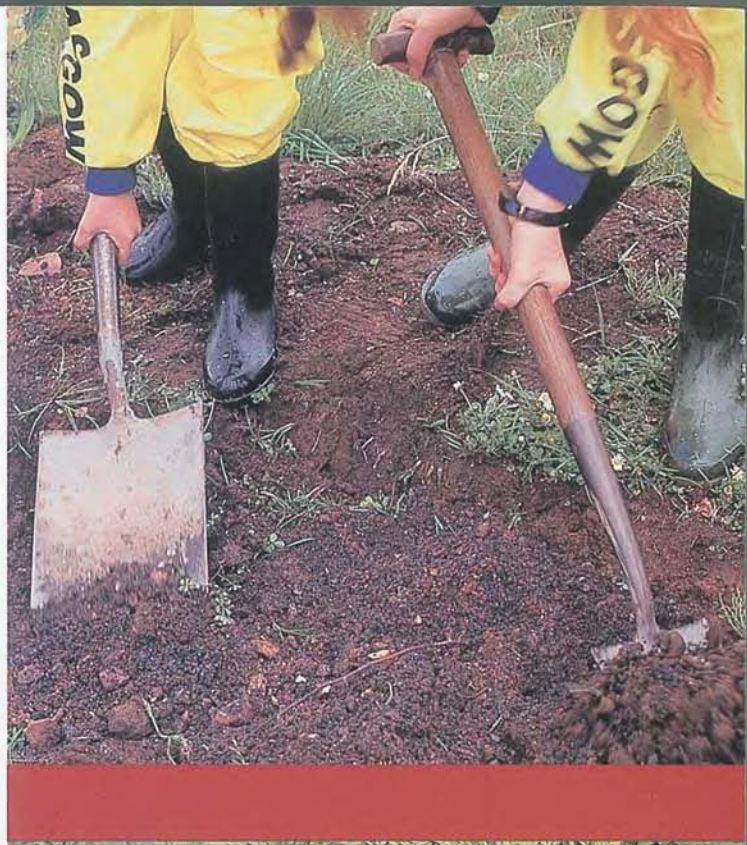
Soil is essential for many of mankind's activities. Yet it is a part of our environment which is frequently taken for granted. We only start to take notice when it becomes damaged in some way, for example by pollution or erosion.

Even then, the damage to the soil itself is not always the main issue. Instead, it is the follow-on effects on other parts of the environment that receive much of the attention. The rate of soil development is extremely slow, at least in the timescales of humans. It has taken hundreds, thousands and, in some environments, millions of years to produce the range of soils that exist today. The soil is not an unlimited resource to be lost or damaged by poor management – just a few years of inappropriate use can, in some instances, seriously harm a soil which has developed over centuries.

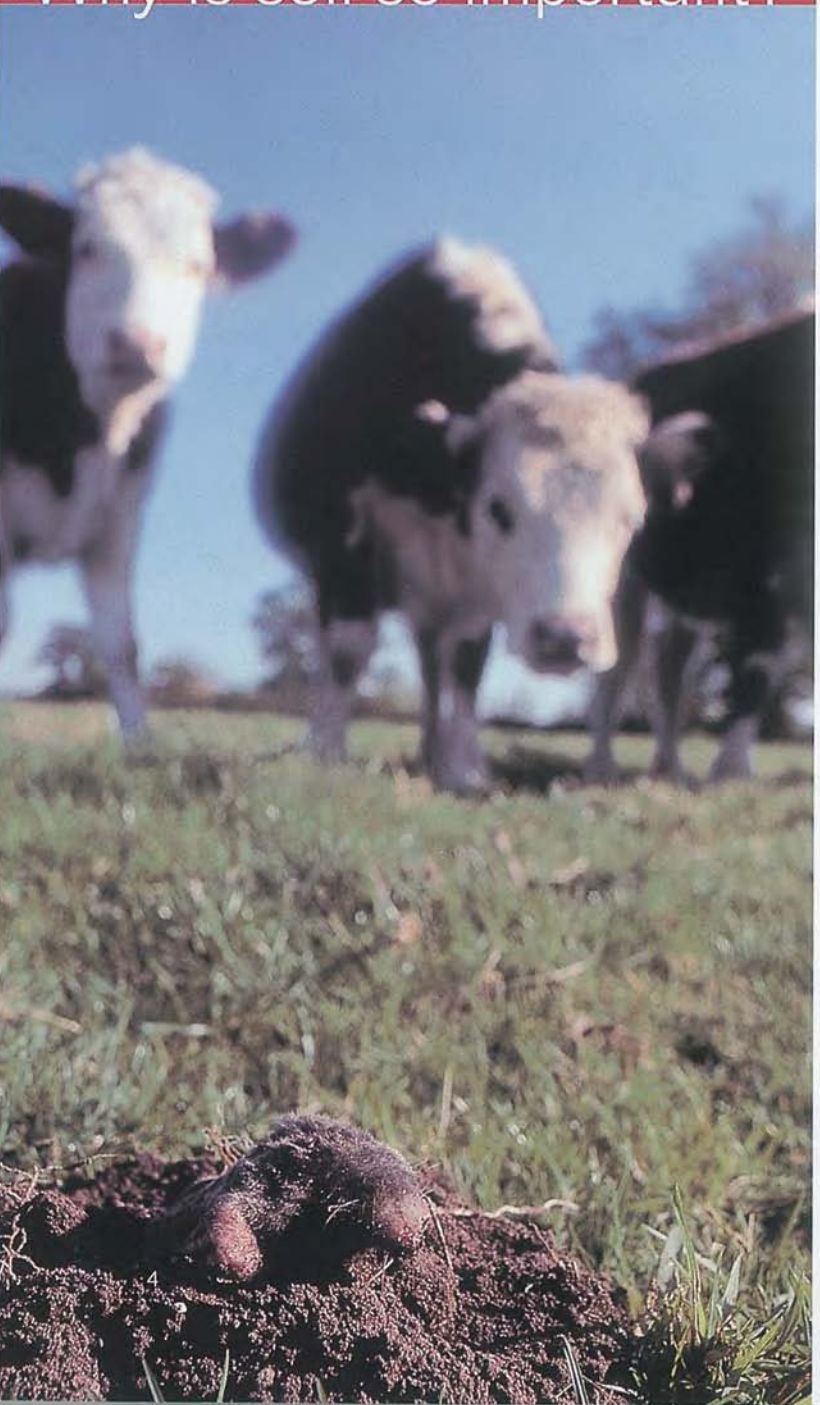
But what is soil?

'Soil' is a word which has several different meanings. To the engineer, soil is usually thought of as the finely ground, loose rock material at the Earth's surface (often termed 'overburden' and frequently regarded as an inconvenience because it may have to be stripped, stored carefully and replaced as part of an engineering project). The geologist calls this layer the 'regolith' (essentially meaning the same as the engineer's overburden) and frequently begins investigations below it. The farmer and gardener think of the soil as the top few centimetres – the depth of plough or cultivation for the former and a spade or garden fork depth for the latter (the 'topsoil'). They tend to ignore what's underneath. Yet this deeper material (or 'subsoil') is very important for plant growth, storing and supplying nutrients and water. Also, a number of chemical substances (whether naturally produced within the soil or added by human activity) pass from the topsoil through to the subsoil. These may eventually reach underground water stores and rivers, burns or lochs.

Good quality soil must be capable of carrying out all the uses for which it is needed, without long-term deterioration. Scientists often talk about sustainable use of soils – current uses of the soil should not affect its range of other uses, either now or in the future. If we do not maintain the soil in a reasonable condition, certain aspects of modern life could start to become unsustainable. It may be considered as 'dirt' by some, but to those who are concerned with its ability to support the world's population, it is perhaps the most valuable non-renewable resource on Earth.



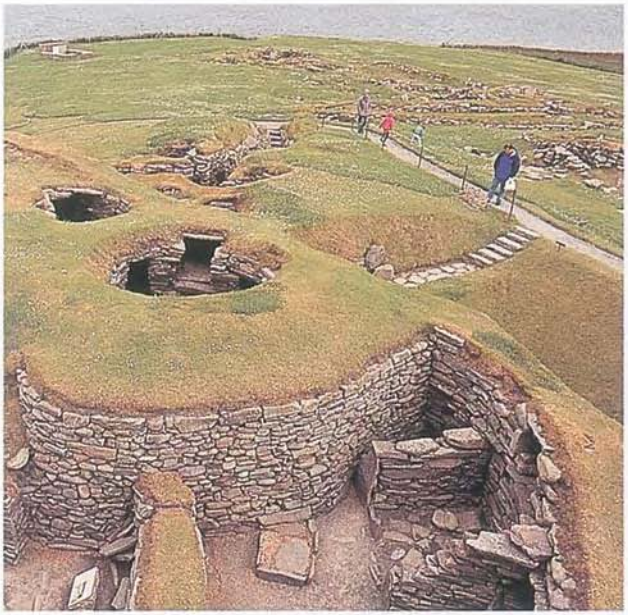
Why is soil so important?



Soil is a vital part of the natural environment. It is just as important as plants, animals, rocks, landforms, lochs and rivers. It influences the distribution of plant species and provides a habitat for a wide range of organisms. It controls the flow of water and chemical substances between the atmosphere and the earth, and acts as both a source and store for gases (like oxygen and carbon dioxide) in the atmosphere. Soils not only reflect natural processes but also record human activities both at present and in the past. They are therefore part of our cultural heritage. The modification of soils for agriculture and the burial of archaeological remains are good examples of this.

Soil, together with the plant and animal life it supports, the rock on which it develops, its position in the landscape and the climate it experiences, form an amazingly intricate natural system – more powerful and complex than any machine that man has created. Soil may look still and lifeless, but this impression couldn't be further from the truth. It is constantly changing and developing through time. Soil is always responding to changes in environmental factors, along with the influences of man and land use. Some changes in the soil will be of short duration and reversible, others will be a permanent feature of soil development.

Soil through history

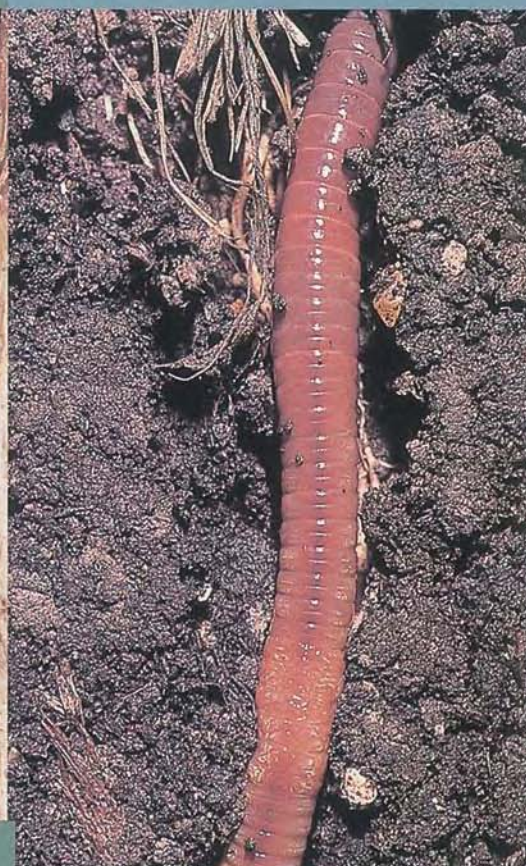


Human development since prehistoric times has been closely linked with an increasing ability to manage soil and other parts of the natural environment. During early attempts at soil management, areas of land were cleared of natural vegetation and cultivated for short periods. Once fertility started to decline, the site was abandoned and left to revert slowly to natural vegetation. Activity shifted to a newly cleared site.

Increases in population and the development of towns and villages encouraged people to remain at a single place for longer periods. This meant that some way of restoring soil fertility had to be found. One approach was to clear more land than was required and leave a part of it uncultivated or fallow. Another common practice was the addition of organic waste, from households or animals, directly to the soil. These remained the normal methods of land management until about 100 years ago. Since this time they have been less widely used, as inorganic fertilisers have developed. At first these fertilisers consisted chiefly of ground up rock (in some cases treated by simple chemical processes). In the second half of the twentieth century there has been an enormous development of inorganic fertilisers, offering a wide range of nutrient inputs.

A home for millions

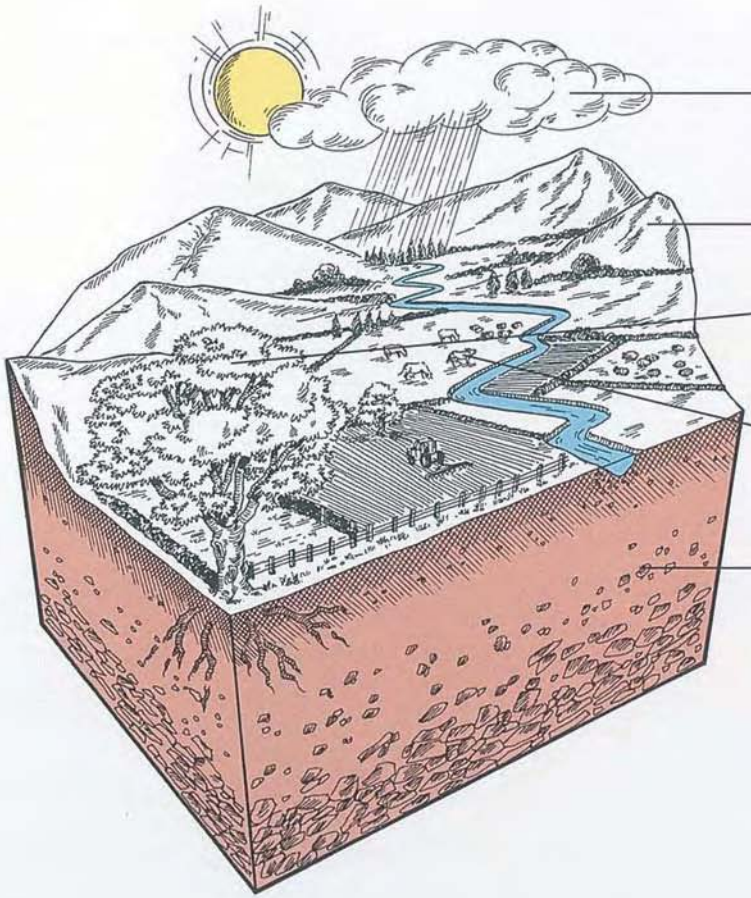
Soils are also home to an amazingly large number of different organisms. In fact, scientists believe that there are probably more individual species living below ground than above the surface. We have as yet only identified a fraction of them, though. Soils contain so much life that they are to Scotland what the rainforests are to the tropics. Worms, beetles, caterpillars, ants and larger animals like moles are all obvious soil creatures. However, just one teaspoon of soil will also contain up to several million protozoa (probably the simplest form of animal life), bacteria, algae and nematodes (microscopic worm-like animals). Many of these species are vital to the proper functioning of soils. Unfortunately we know nowhere near enough about them to describe the roles of more than just a few.



Where does soil come from?

Although we tend to refer to 'the soil', there are in fact many different types of soils found in Scotland, just like the numerous plants and animals that surround us. Unlike plants and animals, however, soils do not exist as distinct types but form a continuous pattern over the land surface. Frequently, one soil type gradually merges into another. The soil found at any given location reflects how the five **soil forming factors** interact there. The importance of each factor varies between different areas and it is this variation that produces different soil types.

In most areas, the influence of human activities such as agriculture, forestry and building have modified the natural processes.



CLIMATE At low temperatures, the rate of soil formation is slower. This is because the organisms that break down and incorporate dead organic matter are less active. Precipitation (rain, snow, mist) influences both chemical and physical breakdown of parent material. Rain water is very important in washing organic matter and other substances down through the soil.

RELIEF The shape of the land controls factors such as soil depth and drainage. On slopes, soils tend to be thinner as material moves downslope. Deeper soils are found on valley floors and in hollows. Altitude acts together with temperature to influence rate of soil development.

VEGETATION Different plants are made up of many different chemical compounds. When the plants die and decay, these are released into the soil. The physical action of plant roots and earthworms pushing through the soil is also important.

ORGANISMS Micro-organisms are essential to a healthy soil. They break down and incorporate dead plants and animals, eventually forming a black, crumbly substance called humus. Larger creatures, like moles and earthworms, help to improve soil structure.

PARENT MATERIAL Usually, the chemical composition of the soil is very similar to the parent material it develops on. Few soils in Scotland have formed directly from underlying rocks. At the end of the last Ice Age (around 10,000 years ago), the retreating glaciers deposited a layer of material over the original land surface. It is this material – known as glacial till – that forms the basis for most Scottish soils.

TIME Scottish soils are quite 'young', being at most around 10,000 years old. In other parts of the world, like the tropics where soil formation has not been interrupted by glaciation, the soils are often far older – millions of years in some cases – and deeper.

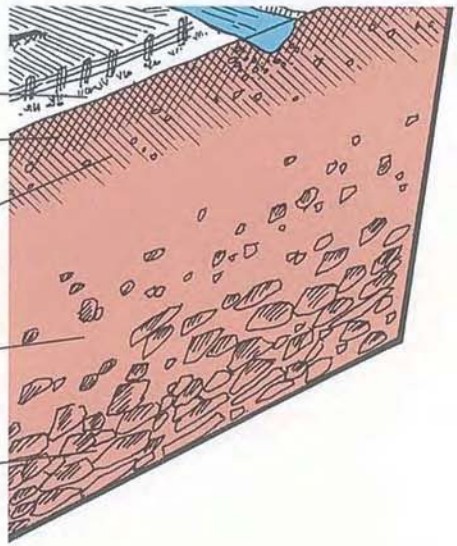
SURFACE VEGETATION Living vegetation affects the composition of the soil underneath by releasing into, and removing from it, various substances.

TOPSOIL Topsoil is darker in colour than the layers beneath it. This is mainly due to the organic matter that it contains. Most plant roots and plant and animal life are found here. Organic matter helps to bind the soil particles into structures called peds.

SUBSOIL Subsoil consists mainly of mineral matter and substances that have been transported from the topsoil.

WEATHERED PARENT MATERIAL Some soils have an intermediate layer, where the parent material has been considerably weathered, but not sufficiently for it to be termed subsoil.

PARENT MATERIAL Consists of almost unaltered rock, or more commonly in Scotland, glacial till material.



Only a very limited amount of information can be gained from looking at the soil surface. To find out more, it is necessary to dig a pit and expose a vertical cross-section of the soil. This is known as the **soil profile** – each soil type is distinguished by its profile, almost like a fingerprint. A soil profile is divided into a number of distinct layers, which are called **horizons.** Although we can use these horizons to identify many complicated subdivisions within the soil, a much simpler approach is to split the profile into topsoil, subsoil and parent material.

Soil Structure

Well structured soils have a good balance of clay, silt and sand particles, organic matter and pore spaces to ensure good drainage and aeration. Poorly structured soils either have too much sand, which does not hold together well, or too much clay. The clay binds together tightly, becoming hard and cloddy when dry, and sticky when wet.

Despite the wide variety of soil types which exist in Scotland, soil scientists have developed a classification system to make description and interpretation much easier. Using this system, we can identify four basic soil types in Scotland – these are termed peats, gleys, podzols, and brown forest soils. The characteristics of these soils are described (right).

Alpine and subalpine soils

Alpine and subalpine soils are found on hill and mountain summits.

They are shallow and poorly developed. They are often little more than a thin surface organic layer over barely altered parent material.

They can be frozen for several months of the year.

Peat

There are two main types of peat.

Basin peat develops in damp, low-lying areas such as marshes and bogs. Slowly decaying vegetation gradually builds up a series of layers in the open water, eventually forming solid ground.

Blanket peat, which is by far the most common form in Scotland, as its name implies 'blankets' the landscape.

Blanket peat forms in areas of high rainfall, often with low temperatures.

Dead plant material builds up faster than it can be broken down by soil organisms. Their activity is reduced under such harsh conditions.

Pure peats contain relatively little inorganic material.

Peatlands are very important habitats for nature conservation.

Brown forest soil

These are fertile, often deep soils that are favoured for agriculture.

The natural vegetation cover is deciduous woodland.

This produces a litter rich in nutrients and organic matter. It is rapidly broken down and incorporated by soil organisms.

These soils are not very distinctive visually. The main feature is a gradual lightening in colour as the organic content decreases with depth.

Most brown forest soils are now used for agricultural purposes. They require artificial additions of organic matter and nutrients to maintain fertility.

Brown forest soils are mainly restricted to the area around Aberdeen, Fife and the Lothians and parts of south west Scotland.

Gley

Gley soils are characterised by waterlogging, either permanent or temporary.

Waterlogging may result from the soil being poorly drained, perhaps through a high clay content or an impermeable layer. It may also be because the soil is at the bottom of a slope or in a hollow and water collects faster than it can drain away. Gardeners who have to deal with heavy clay soils will be familiar with this situation.

When a soil is waterlogged for long periods of time it may become anaerobic – oxygen is either absent or present at very low levels. If this happens, iron compounds in the soil are changed chemically from their normal red and brown forms, to forms which are grey and green in colour.

Scientists can use the pattern of these different colours in a gley soil to interpret the various processes which are taking place.

Podzols

Podzols are probably the most visibly distinctive of the main soil types in Scotland. They form in acid, coarse textured, well drained materials.

At the surface, a layer of dead vegetation builds up which is only slowly broken down. This is because soil organism activity is reduced under acid conditions.

The surface vegetation is usually coniferous woodland or heather moorland. Both of these produce leaves fairly resistant to breakdown.

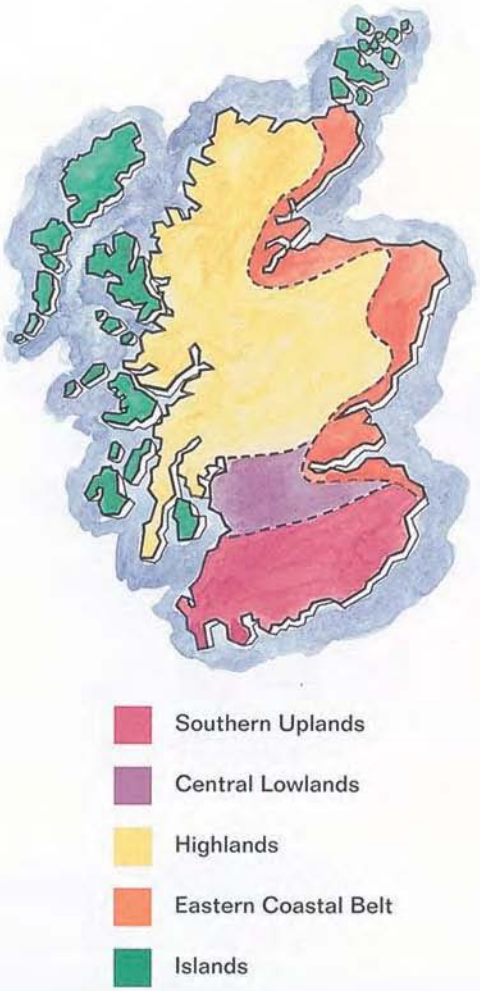
Below, organic matter and nutrients, along with iron and aluminium compounds, have been leached out. It is mainly these substances that give soils their brown colouring, so here the soil takes on a bleached appearance.

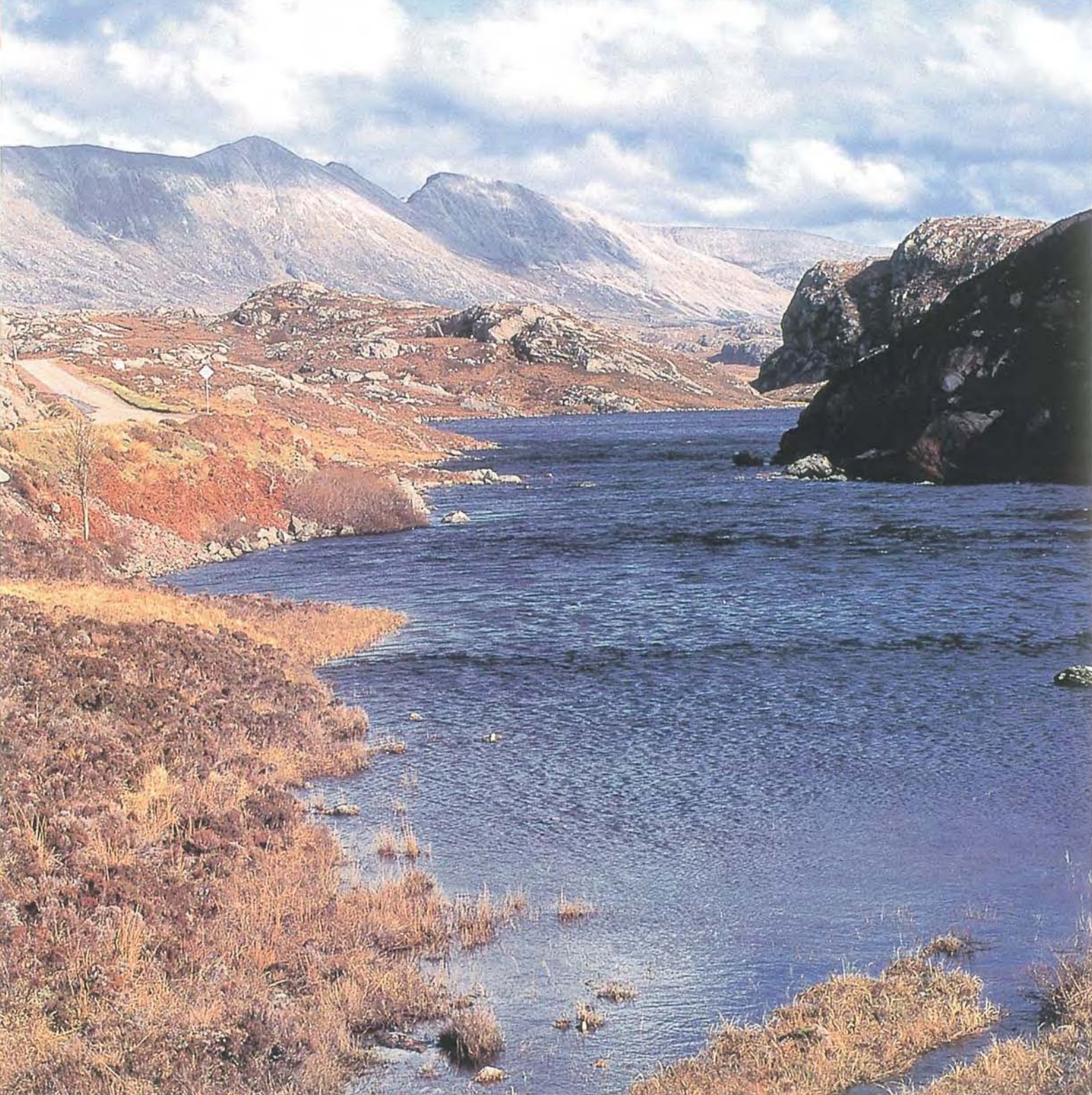
Organic matter is often redeposited in a thin black layer. Finally, the iron and aluminium compounds are redeposited in an ochreous (orange-brown) layer.

Soils and the Scottish landscape

Most of us are familiar with the sheer variety and diversity of the Scottish landscape, from the spectacular mountain scenery of the north, to the lush, rolling agricultural lands in the south and east. We associate different habitats – for example, moorland, pine forest, deciduous woodland, arable fields – with particular areas of the country. We also know many of the groups of plants, animals and physical features, like rivers and mountains, which are characteristic of these areas. Yet how often do we pause to consider the role that soils play in all of this? For most people, the answer is: rarely or not at all. Why should this be so? Soils for the most part are out of sight under our feet. Even when they are visible, as in a bare field or a road cutting, they often lack the immediate visual appeal characteristic of some other aspects of our natural heritage. But without soils, much of the rich natural diversity that Scotland possesses simply would not exist.

Anyone who enjoys gardening will have some awareness of soil variability. Some soils can be worked better than others, some drain well and some do not, some plants thrive in conditions where others would die. Soil patterns in the landscape are simply the same thing on a much larger scale. We can consider some of the characteristic soil-landscape patterns in Scotland by dividing the country into five geographical regions. These are the Southern Uplands, the Central Lowlands, the Highlands, the Eastern Coastal Belt and the Islands (Western Isles, Orkney and Shetland).





The soil landscapes of Scotland

Several different soil patterns are found in the Southern Uplands. These result both from natural processes and human influence. The patterns are reflected in a variety of habitat types and land uses. One of the main controlling factors is altitude. In the east of the region, the soils often gradually change with increasing height, for example on the Pentland, Lowther and Lammermuir Hills. They generally become shallower, peatier, stonier and less fertile. This is because, as rainfall increases and temperature decreases with height, many of the chemical and biological processes involved in soil formation become slower.

Further west, soil patterns are often more complicated. For instance, in lowland Galloway, the ways in which material was deposited by retreating glaciers greatly influence the soils. The Galloway Hills are more similar to parts of the Highlands and Islands than the easterly hills. They are more rugged with large areas of bare rock, thin covers of glacial deposits and shallow soils. The soil characteristics change rapidly and frequently over short distances.

Land Use

Land use in the Southern Uplands is governed by certain limiting factors, such as slope, temperature and wetness. The altitude at which good quality pasture is possible declines from east to west as rainfall increases. Artificial drainage is often used in the wetter areas to produce grassland suitable for grazing. This alters the characteristics of the soils, for example by reducing waterlogging. Soils in the western Southern Uplands may be stonier and shallower than their eastern counterparts. This places further restrictions on grazing through reduced grass growth (less soil for roots), and therefore the number of animals that the land can support. Agriculture is by far the biggest land use in the Southern Uplands, although forestry has undergone a great deal of expansion in recent decades.

Few of the familiar scenes described here are 'natural'. Apart from the higher hill tops, virtually all the land in the Southern Uplands has been modified by mankind for his own purposes. Historically, most of the area was covered by mature woodland, as indeed was much of Scotland. This was rapidly cleared by early human settlers to provide fuel, building materials and land for agriculture. The soil and vegetation patterns in many areas have changed drastically as a result, particularly at lower altitudes. The landscape that we see around us is, in effect, a man-made one.

At higher altitudes, the subalpine soils can be damaged by heavy concentrations of walkers. This sometimes leads to localised soil erosion.

On upper slopes and hill summits below about 600 metres, the podzols become increasingly peaty.

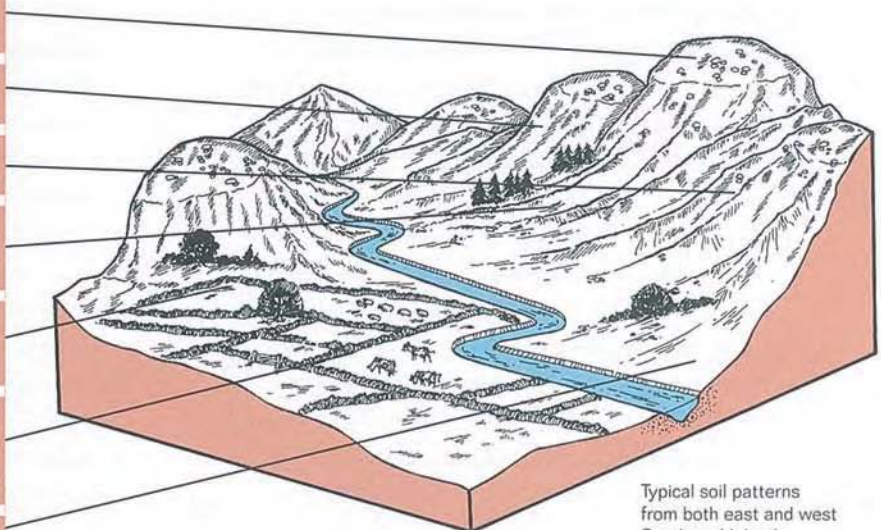
Podzols develop on midslopes, partly because nutrients are leached downslope.

Brown forest soils are the most valued for tree planting. This is because podzols are lower in fertility and also provide a less stable and often restricted rooting base.

Pastoral agriculture dominates, but in some areas – mainly valley floors towards the east of the region – a limited amount of arable cropping is often possible.

On the lower hill slopes, improved pasture is often found. This is an important source of nutrition for stock. It allows land which cannot be cropped to be retained for agriculture.

Brown forest soils often occur below about 250 metres.



Typical soil patterns from both east and west Southern Uplands

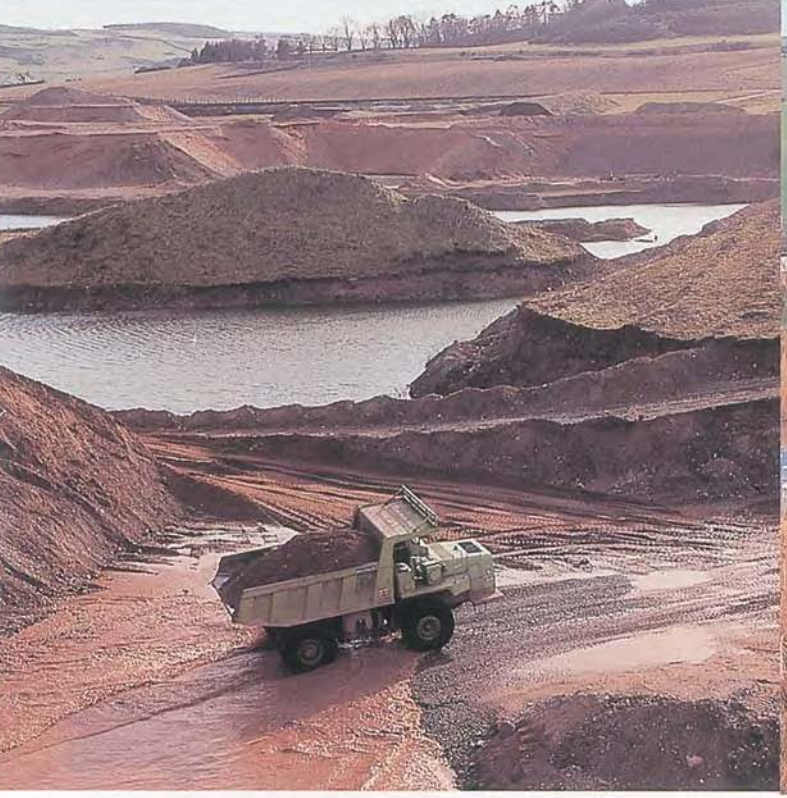
The Central Lowlands extend across Scotland between the mountains of the Highlands and the hills of the Southern Uplands. The soil distribution is mainly controlled by the type of material deposited by retreating glaciers following the last Ice Age. This material often contains many small particles, and can produce poorly drained soils, especially in the west where rainfall is higher. Moving towards the drier east, the soils gradually change. Gleys first, then brown forest soils with gleying and finally freely drained brown forest soils on coarser sandy material. This latter soil occurs particularly in river valleys. On higher ground, such as the moors and uplands of Cumnock and around Muirkirk, peats and peaty gleys can be found.

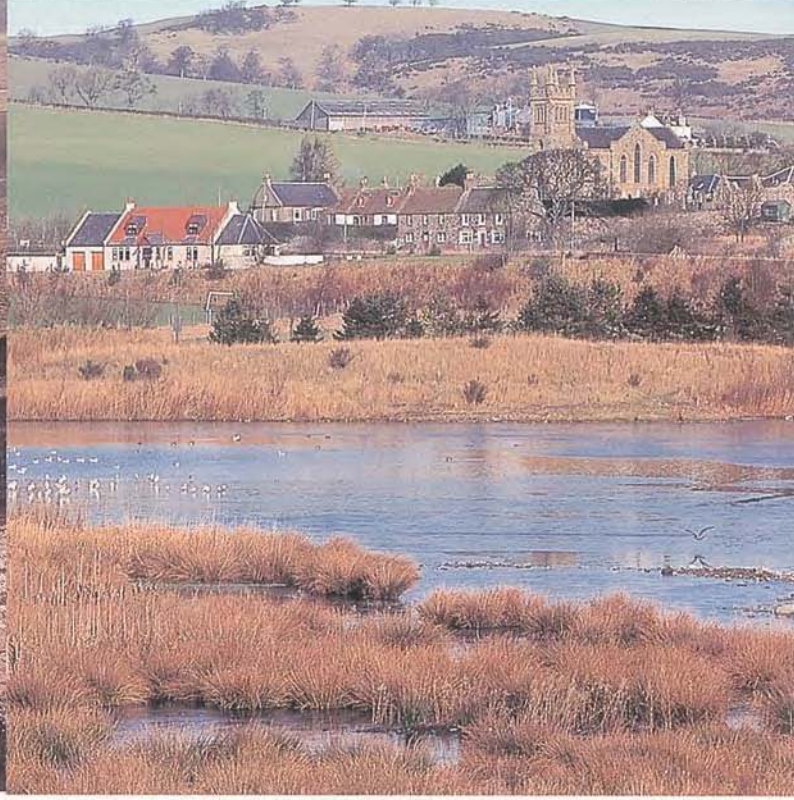
Land Use

Human influence on the vegetation of the Central Lowlands has been profound. A good example is the widespread planting of plantation woodland, both coniferous (for commercial forestry) and deciduous (in estates). Grasses, herbs and rushes have invaded former mining and industrial areas between Edinburgh and Glasgow as these industries disappeared.

Apart from agriculture and forestry, the main land use in the Central Belt is urban and industrial. The conurbations of Edinburgh and Glasgow accommodate a large proportion of the Scottish population. The legacy of land use for mining and other industry is evident to anyone travelling between the two cities and has completely transformed the nature of the landscape. But aside from the visual element, what effect has this had on the soils in the area? In terms of mining and other extraction industries, the soil is often regarded as a hindrance to be removed in order to get at the valuable resource under the surface. Towns, buildings and roads are often located on the best quality soils in a given area. This is because the soils are usually associated with other environmental factors like good drainage, a flat surface for building, and shelter. The soils are effectively rendered unusable and even if they are re-exposed at some time in the future, their characteristics will have been drastically altered. In the past, there were far fewer controls than now on the environmental impacts of development and on disposal of waste materials – the consequences of this are obvious in many parts of the region.

In recent years legislation has been greatly improved to protect land. And there is a growing interest in the reclamation and restoration of derelict areas. Areas can be reclaimed by importing topsoil and spreading it over the land surface. However, this can be a very expensive operation. Often a more practical solution is to use the existing material and establish vegetation that can adapt to the conditions. Over time, the soil quality can improve. Derelict land is often deficient in nitrogen, an essential plant nutrient. Legumes – plants which can take up nitrogen directly from the atmosphere – are very useful in these situations. The nitrogen is released into the soil when the plant dies and decays. Some other plants are tolerant to high concentrations of certain metals, and others still of very acid conditions. The rate of improvement may be increased by adding organic waste by-products, including animal slurry, sewage sludge and other recycled organic wastes. Many of the large number of coal and oil shale bings in, for example, the area around Hamilton and Motherwell, have been successfully reclaimed in this way. The restored land is put to a variety of uses.





Soil-plant relationships are also seen in woodlands. The brown forest soils support elm, oak, ash and birch communities, whereas the poorly drained gleys are often associated with alder.

Where the gley soils remain undrained, they are associated with a range of wet grassland habitats. The species found in these habitats are directly related to soil type and climate. The more acid soils generally support a more restricted range of plants.

Soil contamination as a consequence of industrial development is a problem in some areas.

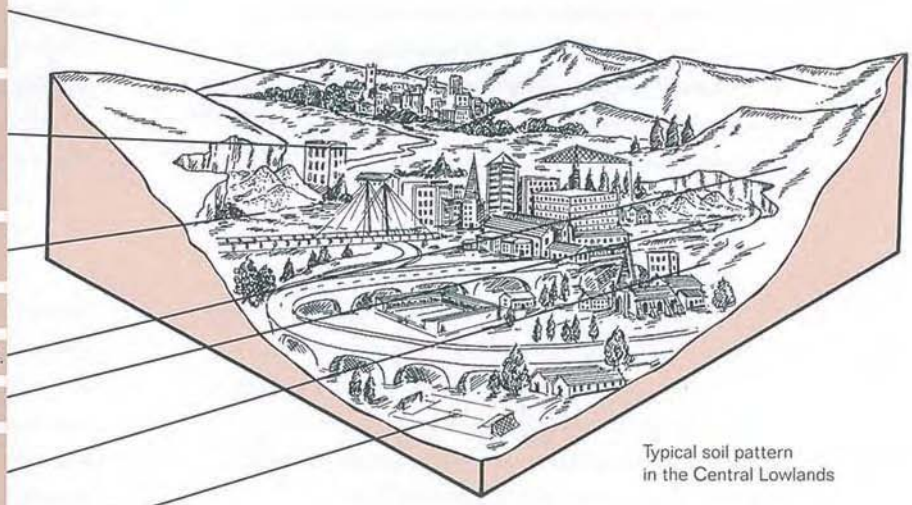
Physical damage by machinery can affect the wetter soils.

Drought is occasionally a problem on the drier soils in the east.

For mineral extraction, soil has to be completely removed.

Old established settlements and roads are often located on good quality soils. This renders them unusable for other purposes.

Level, well drained and stone-free soils are required for sports pitches.



Typical soil pattern in the Central Lowlands

The Highlands of Scotland form the largest of our geographical regions and probably the most diverse in terms of landscape and soil patterns. The soil pattern in the Highlands is influenced to a large extent by climate, especially temperature and rainfall. Changes in soil type with altitude are quite marked. Many Highland soils are stony and coarse textured: they are also characterised by being wet and acid, with high organic contents. These are properties inherited from the parent materials of the region. A typical soil pattern is podzols and brown forest soils on gentle slopes, with gleys and peats in depressions.

A hard brittle layer – known as an **indurated** horizon – is often found in Highland soils. It usually occurs close to the soil surface (within about 40cm). It is thought to form as a result of freezing and thawing cycles which redistribute the soil material. Indurated horizons can be found in many different soil types. They are important because they can block drainage and also stop plant roots reaching far into the soil. Most Highland soils are very shallow, often due to shallow parent materials. Peat is very common throughout the Highlands, in fact, it occurs more widely in Scotland than anywhere else in Europe, except Ireland.

Land Use

The Highland soil conditions impose severe restrictions on land use. Steep slopes and wet, peaty surfaces make the use of agricultural machinery difficult. When rainfall is lower – usually in late spring – non-peaty soils can dry out quickly, creating further management problems. In the past, labour-intensive management allowed small patches of good land to be worked fairly easily. Modern developments in intensive agriculture – the trend towards larger fields and machinery, for example – are largely unsuitable here. In general, the land once used for cropping is now under grass. The main land use in the Highlands is rough grazing. Lower ground, in Strathspey for instance, is used for winter grazing and cropping.

Most woodlands in the Highlands are small and patchy – larger areas (both coniferous and deciduous) are usually plantations. Oak and birch woodland are common at lower altitudes, on brown forest soils and podzols. The mix of species varies between the east and the west of the region. Recreation is an important land use in the Highlands and is both indirectly and directly related to soil type. Deerstalking and grouse shooting, for example, are associated with particular moorland habitats which are closely linked to the underlying soils.

In some parts of the Highlands, soil erosion is becoming increasingly significant. Given the vulnerability of the soils, it requires relatively little disturbance to cause damage, particularly on peaty surfaces. The causes of erosion can be complex and varied but overgrazing by sheep or deer is often involved. Recreational pressures from, for example, skiing developments or large numbers of walkers concentrated into small areas, also cause soil erosion.

Forestry is affected in a similar way to agriculture by soil limitations. Restricted root volume (due to shallow soils), lack of moisture and the suppression of many species by heather at planting time are the main problems. The best areas are in the lower sheltered glens where soils are deepest. In most areas, only Scots pine, lodgepole pine and sitka spruce are widespread.

The relief of the region is extremely complex. It produces rapid changes in slope and moisture conditions, reflected in the variety of soils.

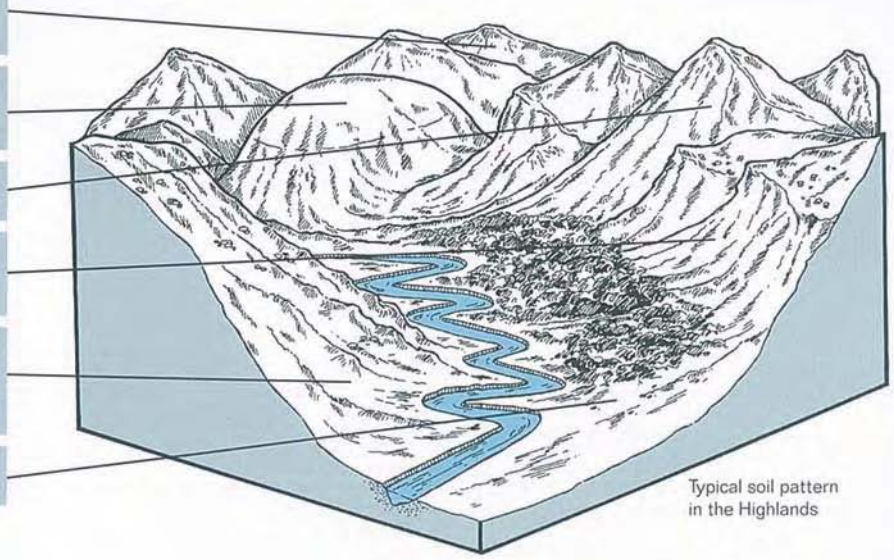
Poorly developed subalpine and alpine soils are very common. The former start between 400 and 600 metres and the latter between 700 to 850 metres.

Most of the parent materials are acid, which means that the soils are too.

The peat areas contain blanket bog habitats which generally have little land use value apart from rough grazing. They are very important habitats for nature conservation though.

Brown forest soils and podzols at lower levels in the straths and valleys support the better quality moorland and grassland, along with most of the semi-natural woodland still left in the Highlands.

On some of the foothills of the main farming areas, rough and improved grassland has been created out of moorland.



Typical soil pattern in the Highlands

The eastern coastal belt forms the main agricultural zone in Scotland. It fringes the mountains of the Grampian Highlands, and extends northwards to the Moray Firth and Caithness and south to Fife, with parts of the Lothians and the Merse of Berwickshire. The most northerly part of the region, the Caithness Plain, contains soils which are rather different to the rest – mainly gleys, with some peat. The dominant soils of the Moray Firth area are podzols developed on coarse, acid parent materials. Further south, the soil pattern becomes rather more complex, dominated by podzols and brown forest soils.

Land Use

Cereals and root crops are grown in many parts of the region; market gardening is also common. On parts of the coast itself, there are large areas of windblown sand. Here, the soil profile development is limited, due partly to the effects of continual deposition of sand. For example, soils on the windblown sands at Tentsmuir and at Culbin Sands are little more than a thin organic layer developing directly on the sand itself. Distinctive dune vegetation communities can be seen. Where the soils have been longer established, a greater variety of grasses can survive, making the land suitable for grazing or for use as golf links. The main restrictions on land use in the coastal strip are periodic drying out (due to sandy soils and low rainfall levels), and also exposure to strong winds. Where these limitations cause particular problems, the land is used for pasture rather than crops. There are recreational pressures associated with the use of the dune soils for activities like caravanning and camping. These include compaction and increased susceptibility to erosion.

Soil erosion is not widespread but can be locally significant. There may be a number of causes, for example leaving fields bare at vulnerable time of the year and removing field boundaries. A gradual decline in organic matter content (important in binding soil particles together), following centuries of cropping may also be involved. Another important issue is the use of fertilisers which, if applied in excess, can lead to nutrients like nitrogen and phosphorus being released into watercourses.

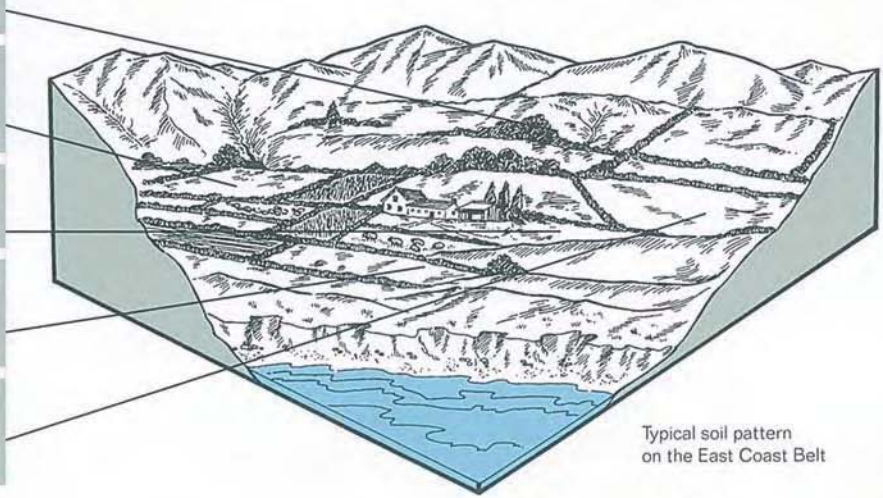
Most soils are used for agriculture, but some areas are given over to plantation forestry. There are also small pockets of native pine, and oak and birch woodland remaining.

Away from the immediate coast, conditions allow vegetables and soft fruits to be grown. Around 90% of the Scottish raspberry crop is produced in Perth, Angus and Fife. Other major crops grown in the region are barley, peas and potatoes.

On the brown forest soils, beef cattle are supported. Dairy cattle, lambs and lowland sheep are more common where drainage is not as good.

Some of these soils contain a high proportion of fine sand, making them susceptible to wind erosion. This can be a major localised problem at certain times of the year, particularly late spring and early summer when the soil surface is often bare.

Most soils are now cultivated and have lost their distinctive upper horizons. These have been replaced by 'man-made' layers formed by the addition of fertilisers and organic matter over many hundreds of years.



Typical soil pattern on the East Coast Belt

Although we are grouping the islands of Scotland together into one region, they contain a wide variety of soil types and landscapes.

Western Isles

The landscape of the Outer and Inner Hebrides is very variable. This produces frequent changes in the soils over short distances. The pattern of outcrops and hollows, slopes, and depths of parent material are involved. Vast expanses of peat dominate the landscape.

Human influence can be important in areas where peat has been removed and the ground cultivated. Lewis, the Uists and Benbecula are examples. Cultivation is also carried out on the dune (machair) soils, for instance, along the coast around the western Uists. In the Outer Hebrides, most of the remaining land is moorland. Woodland is confined to very small sheltered areas. In the Inner Hebrides, grassland is more evident on the brown forest soils and the gleys. Small pockets of moorland occur on podzols. Most of the soils of both the Outer and Inner Hebrides are susceptible to damage by recreational activities, such as hillwalking and camping.

Orkney

Much of Orkney is either cultivated or under permanent pasture. Moorland is restricted to the more hilly areas. Most of the rough grazing is on the slopes, where soil improvement is rarely economically viable. Beef cattle and sheep are the main land use. The soils are quite vulnerable to physical damage, both by animals and by machinery. Forestry is not common on Orkney due to the frequency of gales, the salty air and the necessity to use the land primarily for agriculture. Because the soils are generally fairly fertile, level and relatively stone free, they can be drained where necessary and used for cropping. As a result, arable agriculture is common. As in the Hebrides, the soils are vulnerable to recreational pressures.

Shetland

Cultivated land in Shetland is mainly restricted to the mineral soils around the coast. Here, the centuries-old practice of manuring has helped to increase the depth and the quality of the topsoil quite significantly. Crofting is widespread and the landscape reflects this. Woodland is extremely scarce in Shetland as it is in Orkney. Soils are generally shallow and stony, low in fertility and with thick organic surfaces. There is however, considerable soil variation over short distances. This makes land drainage and widespread cultivation impractical. Rough grazing makes up around 90 per cent of the total land in Shetland.

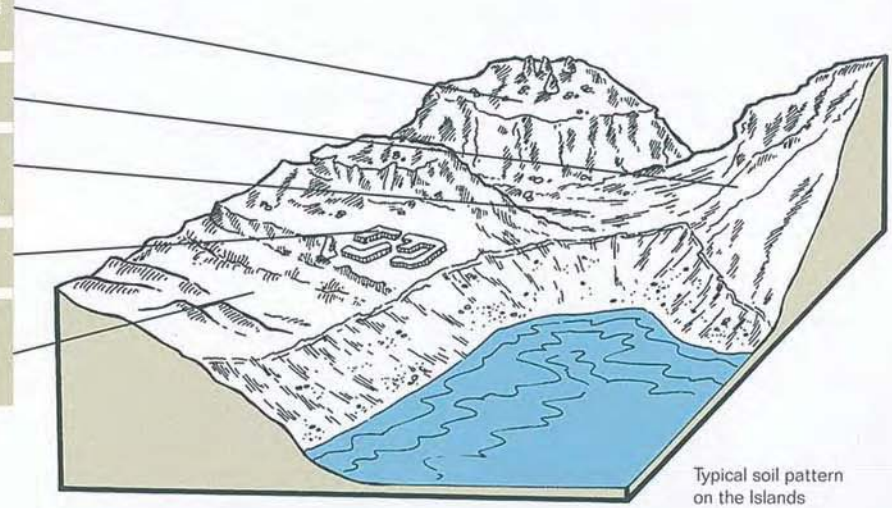
The hills and mountain tops have subalpine and alpine soils. These tend to occur at lower levels than in mainland Scotland, due to exposure to strong winds.

Peat is widespread. Peaty gleys occupy the vast majority of the remaining areas.

Some sheltered parts, where temperatures are slightly higher or rainfall is reduced associated with less acid parent materials, have limited areas of brown forest soils.

Neolithic remains indicate that there has been a long history of settlement.

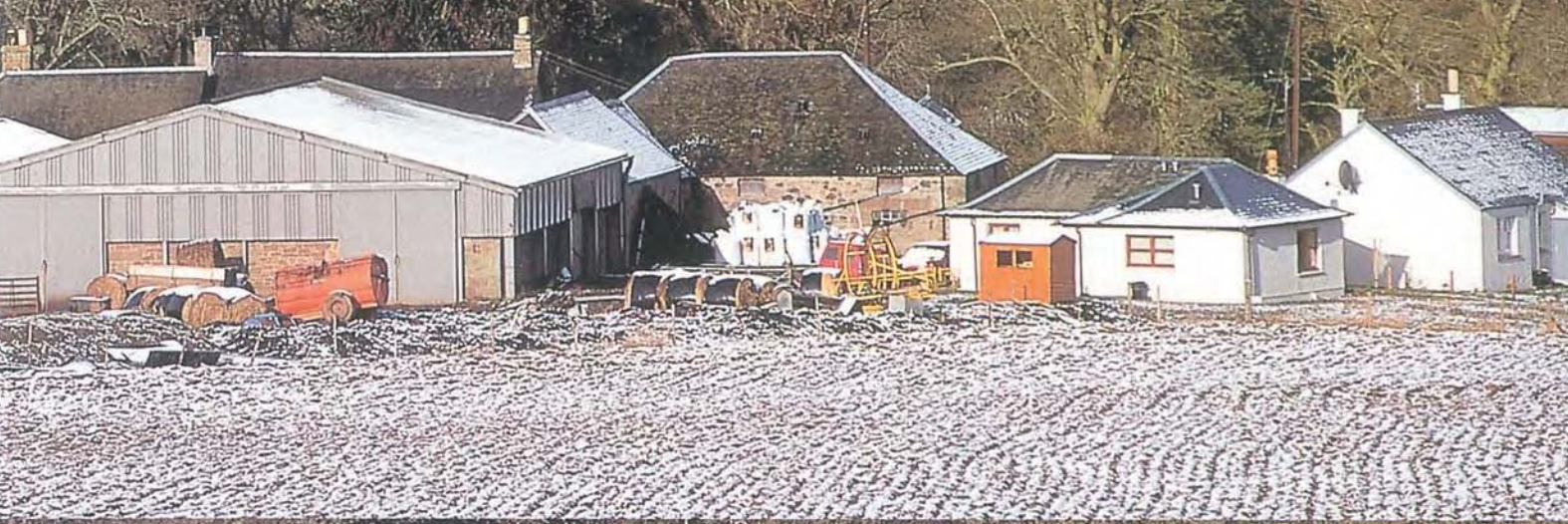
Cultivation is carried out on the dune (machair) soils in some areas. These soils have been improved by additions of organic matter over hundreds of years. Oats and potatoes are commonly grown crops.

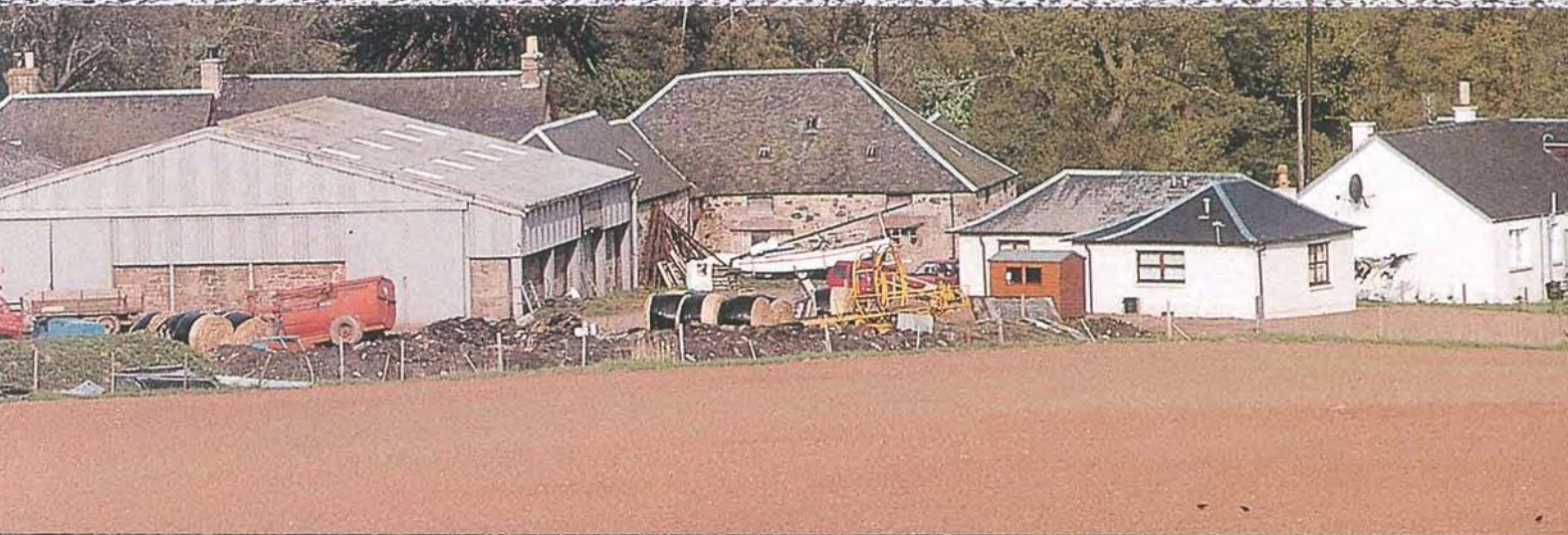


Typical soil pattern on the Islands

Not just 'dirt'

Nowadays, most people are more aware of environmental issues. Acid rain, air pollution, global warming, conserving endangered plants and animals, to name but a few, have all received a great deal of attention in recent years. Yet why do we rarely consider that the soil beneath our feet may be affected by an equally diverse range of problems? To many people, soil is just 'dirt', something that is used for growing plants in the back garden, or that farmers use for producing crops. But there is far more to soil than this. Without soil, life as we know it simply would not be able to exist. Without a range of soils we would not be able to enjoy so many different habitats, plants and animals, nor would we be able to put the soil to the number of uses that we do to benefit society. In other countries – the United States and the Netherlands are particularly good examples – the view that soils are worthy of conservation in their own right is rather more advanced. Both of these countries have specific legislation to protect soils and the Dutch express this by saying that we should regard ourselves as "guests in our environment, not masters of it". Soils are far more important to human and environmental well-being than we often give them credit for. Just because they are out of sight, they should not be out of mind.





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Our task is to secure the conservation and enhancement of Scotland's unique and precious natural heritage – the wildlife, the habitats and the landscapes which have evolved in Scotland through the long partnership between people and nature.

We advise on policies and promote projects that aim to improve the natural heritage and support its sustainable use.

Our aim is to help people enjoy Scotland's natural heritage responsibly, understand it more fully and use it wisely so that it can be sustained for future generations.

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