Wetlands

Scotland's wetlands are home to a wide range of plants and animals. They also provide important environmental functions such as storing carbon and sustaining the supply of clean water.

Summary

Key messages

- Wetlands are found all over the country - from the coastline to mountain tops.
- Most wetlands within protected sites are in favourable condition, with the exception of lowland raised bogs where 59% of sites are in unfavourable condition.
- We have little information about wetlands outside protected areas.
- Peat is associated with many wetlands, and stores huge quantities of carbon. It is estimated that around 1,600 million tonnes of carbon are stored in peat soils in Scotland.
- Wetlands can help reduce flooding, and provide valuable grazing.
- Areas of damaged wetland are being restored, and new ones are being created.

State and trend

State: Poor - high agreement, medium evidence

Trend: Stable/declining - high agreement, low evidence

There is an explanation of the diagram and further information on how we carried out the assessments on the summary pages.

- Although the state is shown as poor, it's on the boundary between moderate and poor.
- Wetlands are very diverse, with a range of habitats and a range of conditions.
- Assessments are of the current "average condition"; some wetlands are in a worse condition, and others are in a better one. Equally, the condition of some wetlands is declining, while others are improving.
- Making any overall assessment is necessarily a simplification.
- We have taken account of the scale of any damage to the environment in these assessments; impacts can be locally damaging, but may have little effect on a national scale.
- We have stated how confident we are in the assessments based on the level of agreement between the specialists involved, and the quality and quantity of the supporting evidence.

Overview

Scotland's climate has been cool and wet for much of the last 10,000 years – since the end of the last ice age. Over centuries the wet weather has been ideal for the development of a wide range of wetland types. Today wetlands cover large areas of Scotland where poorly draining soils, high rainfall and low temperatures create permanently or frequently waterlogged areas, which support a wide diversity of species adapted to these conditions. Wetlands range from coastal salt marshes and wet dune slacks, to fens, marshes and wet woodlands in river valleys and loch edges, to the springs and flushes, wet heath and blanket bogs on mountain slopes and plateaux (Figure 1).

Wetland types

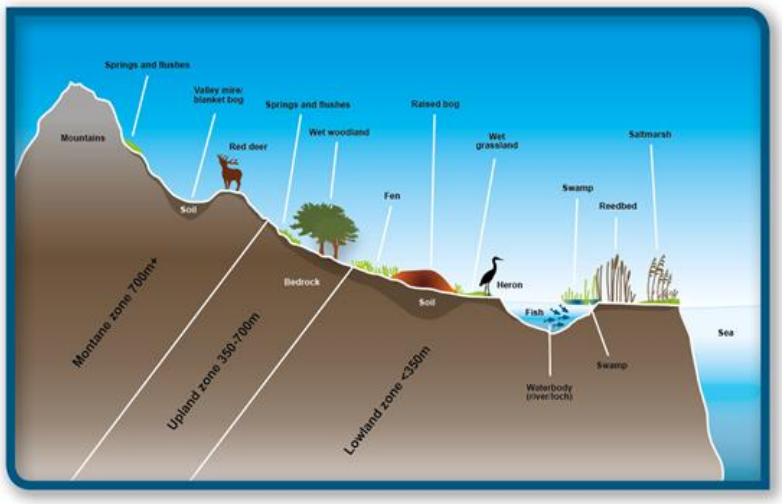

Figure 1: Typical setting of wetlands in the Scottish landscape

Source: A Functional Wetland Typology for Scotland

Peatlands are wetland areas in which peat has accumulated and can support vegetation that is able to form new peat. Bogs (a type of peatland) are one of the most extensive semi-natural habitats in Scotland, covering 23% of our land area (just over 2 million hectares). Although relatively common in Scotland, blanket bog is a globally rare habitat. Scotland has a significant proportion (60%) of the total blanket bog in the UK, and this hold 4% of Europe's peat carbon store.

There are several ways to describe the range of wetland types; to make it easier to identify wetlands, a wetland typology has been developed. Wetlands can be broadly categorised using the Scottish Wetland typology. The variation in vegetation types and the supporting water supply, as well as the chemistry of the water and soil, are all assessed to classify a wetland.

The type of wetland that develops depends on where it sits in the landscape (e.g. at the bottom of a hill or in a steep valley), the underlying geology and the way in which the land is managed. Often, several wetland types can exist in the same location (known as a habitat 'mosaic').

Starting at the seashore, salt marshes provide a nursery habitat for fish, food for birds and natural protection from coastal erosion and tidal flooding. Between some sand dunes, 'wet dune slacks' form in the hollows; these are flooded in different seasons and create a unique, rare habitat that supports plants such as sedge, moss, cross-leaved heath and creeping willow.

Further inland, bordering rivers and lochs and across the floodplain, swamps, fens, wet grassland and wet woodland provide feeding and breeding habitats for birds and animals. These wetlands also support a wide range of plants, such as the greater tussock sedge, a variety of mosses and early marsh-orchid. They also provide rich grazing for livestock and can store water during floods.

Blanket bog is found where the climate is cool and wet. It can develop on gentle slopes near the top of hills and across large areas of the far north (such as the Flow Country, Caithness) and the islands (particularly Lewis and Shetland). These extensive areas of rain-fed bog support plants like cotton grass and many species of *Sphagnum* moss and heather. Blanket bogs are often interspersed with groundwater-fed fens and flushes. They store and accumulate large quantities of carbon in peat. Land-management practices in these upland catchments, in particular artificial drainage, can reduce the bogs' ability to slow down floods and provide clean drinking water.

Wetlands are sensitive habitats, and provide living space for a wide range of animals and plants that are not found elsewhere, such as the highly adapted, carnivorous Sundews. The more remote areas of wetland support rare breeding birds like the common scoter, as well as more common wading bird species such as golden plover and dunlin.

The location of wetlands in Scotland

Although so much of Scotland's land area is covered by wetlands of different types, we are only just beginning to understand the way in which they function and where they lie in our landscape.

Wetlands can be mapped on the Scottish Wetland Inventory (Figure 2).

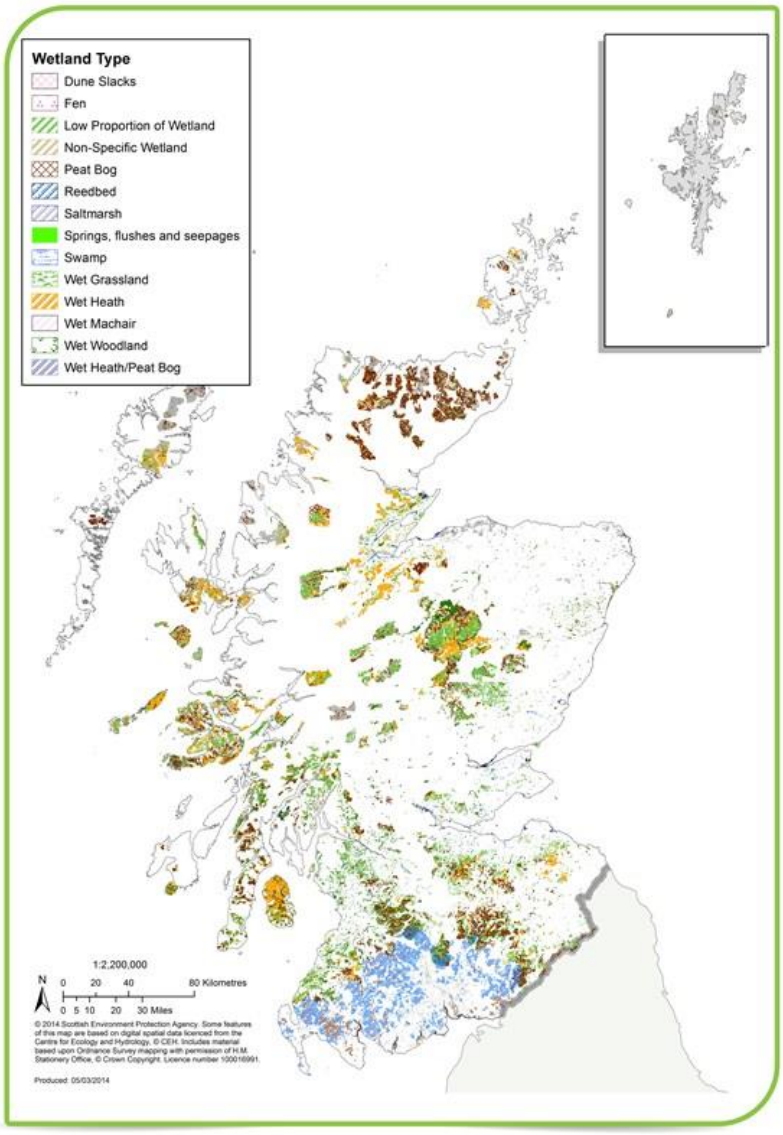

Figure 2: Locations and extent of wetlands (areas not yet surveyed have been left blank; they may contain wetlands).

Please note: the area of Dumfries and Galloway was surveyed using a different methodology to the rest of the country.

Wetland use

In the past, wetlands close to human habitation were used by local people to provide food and refuge for livestock and themselves (e.g. crannogs), for building materials

(e.g. reed, rush and turves for roofs) and for food and warmth (peat and firewood). The value humans have attached to wetlands is closely linked to the biological communities that have developed on particular wetlands and people's ability to exploit those communities or replace them with something perceived as having greater value. For example, after World War II technology became widely available that allowed people to drain large areas of blanket bog to cultivate land for agriculture and forestry. These changes in land use were supported by successive governments in an era when producing food and timber was seen as more important than wildlife conservation. However, since the 1980s the biodiversity value of Scotland's wetlands and their ecological function (see Table 1) have been given greater recognition and protection. Current projects to restore the best examples of these wetlands, because of their species diversity and carbon storage, demonstrate the extent to which the value placed on a habitat can change in just a few decades.

Table 1: Functions of wetlands and associated benefits.

Function	Benefit
Carbon storage and accumulation	Wetlands that create peat (such as fen, raised bog, blanket bog and some types of wet woodland) can store large quantities of carbon for thousands of years. Some management practices (e.g. drainage) can trigger the release of carbon (methane, carbon dioxide, particulate and dissolved carbon).
Water purification	Wetlands often form between land and open water, and can prevent pollutants (suspended solids, nitrogen and phosphorus) getting into rivers and lochs. Some artificially created wetlands (e.g. in Sustainable Drainage Systems (SuDS)) are constructed primarily to remove pollutants from run-off in towns and cities and retain flood water.
Flood management	Wetlands slow the flow of rain water into rivers and lochs, which can slow down flooding. This is known as 'attenuation' of floodwaters. Wetlands can store floodwater in the floodplain, reducing the peak of the floodwater that passes through our towns and cities. On the shorelines of lochs and on the coast, wetlands act as a natural defence against coastal erosion.
Water supply / groundwater infiltration	Wetlands collect and store water, which replenishes groundwater and therefore the water supply. Most Scottish drinking water has passed through a wetland before it reaches a reservoir. How these wetlands are managed affects the quality of the drinking water and the costs of purification treatments that may be needed. Artificially created wetlands play an important role in local water management where chemical or mechanical means would otherwise be needed to treat the water; for example, in sewage management.

Wetlands provide a range of important functions.

For example, fens:

- provide rich grazing land;
- store floodwater by slowing down and filtering water moving through the fen;
- store carbon by forming peat soils.

Coastal salt marsh habitats provide:

- a nursery habitat for fish and shellfish;
- flood protection, through the absorption of wave energy which could otherwise damage sea defences;
- wild foods, such as sea samphire.

State

Scottish wetlands have developed since the end of the last ice age and have continued to change as a result of natural processes and human activity. Sea-level changes since the end of the last ice age have resulted in a complex pattern of overlying marine and peat deposits, such as those found in the Carse of Stirling (e.g. at Barnyards). Future changes in weather patterns, especially severe storms, may alter the location and extent of other wetland types like bogs, and rising temperatures are predicted to slow down the rate of peat accumulation and carbon storage. Historic changes are also, in part, the result of human pressures. For example, felling trees from the hills changed the vegetation structure of the blanket bog, grazing on common land has influenced the fens around villages, and peat-fuel extraction has changed some raised bogs into fens.

Protected sites and species

From an environmental perspective, data are available for the state of wetlands that are protected for nature conservation or are a UK Biodiversity Priority Habitat or contain a protected species. Table 2 gives an overview of the state of wetlands protected for nature conservation (as determined by Scottish Natural Heritage's Site Condition Monitoring programme). Changes in the status and condition of a wetland's features allow us to assess what may be having a negative effect on the quality of the wetland and what may be leading to improvements.

Table 2: Current state of wetlands protected for nature conservation (as determined by Scottish Natural Heritage's Site Condition Monitoring programme).

Designated habitat type	Number of designated features assessed (March 2010)	Number of designated features in favourable condition (and percentage of total wetland features) (March 2010)
Lowland fen marsh and swamp	224	155 (69%)
Lowland raised bogs	111	64 (58%)
Upland bogs	188	117 (62%)
Upland fen marsh and swamp	67	40 (60%)

Pressures affecting wetlands

Pressures upon a habitat can be direct, indirect or sometimes both. An activity in one land area may negatively affect wetlands in other areas. The main pressures on wetlands include:

- land-use change and land-management practices;
- development;
- long-term changes in weather patterns;
- pollution;
- water management.

Many of the changes to wetlands are due to historic activities or land management priorities, for example, widespread draining of wetlands occurred in the 1970s, in response to financial incentives to increase the amount of land used to produce food.

Land-use change and land-management practices

What society wants from a wetland, and how it is appreciated, changes over time – sometimes very quickly. The type of land-management regime alters the range of species that are supported by the wetland. For example, installing drainage ditches has a major impact on the water table and could disrupt groundwater flows, which can change the vegetation. As part of the management regime for livestock and game species like grouse, land managers sometimes carry out controlled burning of the plants on a moor or wetland (known as 'muirburn'). If the burning is too frequent or too severe, this can damage wetland habitats and species.

Development

Developments (for example, transport infrastructure, housing estates, wind turbines and hydropower schemes) can involve covering wetland with surfaces that water cannot penetrate, or installing drainage systems that deprive wetlands of their water source. This can result in a loss of species diversity.

Flood management

There has been a shift towards using wetlands as a natural tool to help manage flooding rather than using hard landscaping and engineered solutions. This approach to flood management could alter the character of some wetlands. For example, long-term changes in the duration, frequency and magnitude of flood peaks could affect the diversity of wetland species. New wetland areas have been created to manage flooding and wetland vegetation has been planted, which helps to improve the function and connection between natural wetlands that have become fragmented. However, using wetlands as flood-management areas often results in extended periods of soil saturation, which can eventually change a fen to a wetter type of wetland, such as a swamp. Although the altered wetland will provide valuable habitat, it is likely to support a different range of species. This may result in rare species found in the original wetland type being lost or displaced.

Changing weather patterns

The projected impacts of climate change in Scotland include warmer, drier summers and milder, wetter autumns and winters. We can also expect to see an increase in summer heatwaves, extreme temperatures and drought, as well as more frequent and intense extreme rainfall and less frequent frost and snowfall.

These changes are likely to affect different wetland habitats in different ways depending on the sensitivity of the wetlands to seasonal drying. In some locations, the following might occur.

- Increased average surface temperatures are likely to encourage vegetation growth in fen peatlands and, with it, the accumulation of carbon in peat. However, the rates of peat accumulation in *Sphagnum* bogs is likely to reduce.
- Heavier rainfall could lead to erosion and the loss of carbon-rich soils with sediment deposits downstream. This deteriorates the wetland's function as a carbon store and could reduce species diversity in the downstream water environment. Once dried out, peat does not become wet again easily and it is prone to erosion.
- An increase in dissolved and particulate carbon, which could be partly attributed to climate change, has been observed in some Scottish rivers.
- Habitats such as blanket bog rely on receiving rainwater all year round. Changing rainfall patterns are likely to increase the frequency of seasonal drying, which will affect the function and diversity of the habitat.

Pollution

Pollution can alter the chemical balance (e.g. acidity) and concentration of nutrients (in particular nitrogen and phosphorus) in wetlands. Certain events and activities pose a particular threat to wetlands.

- Land drainage that leads nutrient-rich surface water directly into wetlands.
- Feeding and watering livestock.
- Flooding, and the resulting deposits of sediments in the wetland.

- Air pollution from some industrial processes and transport.
- Groundwater pollution from landfill sites and illegal dumping.

Adding nutrients to wetlands changes the species present and reduces the habitat's ability to perform important functions. For example, nitrate pollution in fens will result in tall vegetation growth and invasion of reeds and nettles. This can lead to permanent changes in the wildlife that lives in the wetland; for example, typical reed-dwelling birds are absent when nettles take over.

Water management

Wetlands are very sensitive to the volume of water that flows in and out of them, so any water-management practice that changes the water flow can damage wetlands. For example, the removal of groundwater, or intensive 'gripping' (cutting drainage channels in a wetland to increase run-off) can lead to lower water tables and less frequent waterlogging, which will change the character of a wetland and the range of species it can support. Changing the depth and frequency of flooding could result in a change from swamp or reed bed to a fen. If peat dries out as a result of water-table management, carbon can be released into the atmosphere as greenhouse gases or to surface waters as particulate or dissolved carbon.

What is being done

Policy

The recent focus on an ecosystem services-based evaluation of land use as highlighted by the National Ecosystem Assessment has meant that wetlands are now more widely recognised for the functions they provide.

Wetlands in the wider countryside (non-designated sites) are being protected through legislative and regulatory mechanisms established under the European Water Framework Directive, Nature Conservation (Scotland) Act 2004 and Habitats Directives for Natura sites.

Land management

Development

SEPA and Scottish Natural Heritage (SNH) are statutory consultees in the planning system. In both SEPA and SNH, a risk-screening approach is taken when assessing developments and activities close to wetlands, and an assessment of the impact is made as part of the licensing or planning application. In some cases, measures are put in place to protect the wetland habitat and its supporting hydrology.

Conservation

Conservation funding is becoming more widely available for restoring and improving wetlands in the wider countryside. The Scottish Government has recently allocated funding for the restoration of peatlands through projects such as the Green Stimulus Peatland Restoration Project and incentives through the Scotland Rural Development Programme. Similar schemes also encourage the creation or expansion of wetland areas to improve the ecosystem in an area or to improve the environmental status of a water body; for example, the creation of reed bed or wetland infiltration or treatment systems to reduce the concentrations of agricultural nutrients entering rivers.

In addition to wider national protection of wetlands, management strategies are also employed to improve the conservation status of statutory protected sites; for example, Sites of Special Scientific Interest (SSSIs) local nature reserves (LNRs) and reserves managed by other organisations such as the Royal Society for the Protection of Birds, Scottish Wildlife Trust and Buglife. If wetland sites are found to be in an unfavourable or declining condition, active management is often needed to improve the wetland, such as removing scrub or blocking drains to raise the wetland's water-table levels.

Sustainability

Although the restoration of damaged wetlands improves wetland function and can restore some aspects of ecosystem functions, many wetlands will require ongoing management to maintain their restored condition. Wetlands that have been severely damaged in the past rarely recover to a completely natural state. Scotland's resource of pristine wetlands should continue to be protected to ensure of these valuable environmental functions are not lost in the future.