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Wetlands

Scotland's wetlands, including peatlands, are home to a special range of plants and animals and contribute uniquely to storing carbon as well as to sustaining clean water.

Summary

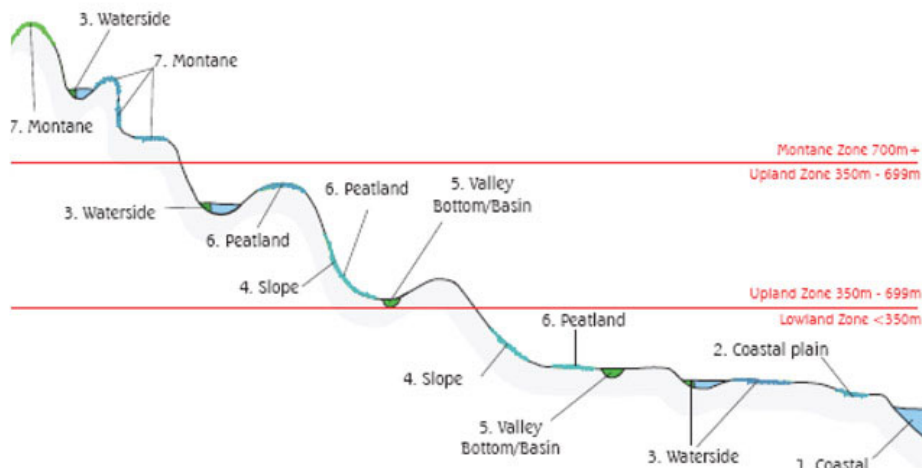
Scotland's wetlands are special habitats in their own right and provide living space for a wide variety of plants and animals.

Found from the sea shore to mountain tops, most wetlands within protected sites are in favourable condition, with the exception of lowland raised bogs. In addition to being an amazing recreational resource, peatlands (a type of wetland) store and accumulate significant quantities of carbon, with around 1600 million tonnes stored in peat soils. Further down the catchment, wetlands can help reduce flooding, and provide valuable grazing.

Introduction

Wetlands occur over large areas of Scotland where the presence of water, high rainfall and low temperatures create either permanently or frequently waterlogged conditions, which support a rich biodiversity adapted to these conditions. Wetlands range from coastal saltmarshes 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 sides and across areas of the Highlands (Figure 1).

Figure 1: Likely setting of wetlands in the landscape



Source: [A Functional Wetland Typology for Scotland](#)

Peatlands are a type of wetland where peat has been deposited and can support vegetation that is able to form new peat. Bog (a type of peatland) is one of the most extensive semi-natural habitats in Scotland, covering just over 2 million ha, 25% of our land area. Blanket bog is a rare habitat globally and Scotland holds a significant proportion of Europe's stock.

There are several ways to describe the range of wetland types; to make it easier to identify wetlands, we have developed what is known as a **wetland typology**, which links the vegetation, landscape and soil.

In Scotland, the type of wetland that develops is determined by where it sits in the landscape (e.g. the bottom of a hill or in a steep valley), the underlying geology and land management. Often, several wetland types can exist in the same location, with the type dependent on the vegetation management and land use.

Starting at the seashore, saltmarsh provides a nursery habitat for fish, a food resource for birds and natural protection from



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coastal erosion. Among some dunes, 'wet slacks' form in the hollows; these are seasonally flooded and create a unique and rare habitat that supports a variety of plant species such as sedges, mosses, 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 mammals. These wetlands also support a wide range of plant species, such as the common sedge, greater tussock sedge, mosses and early marsh orchid. They also provide grazing for livestock and the potential for flood water storage.

In low-lying areas, raised bogs are often found with a distinct dome of deep peat and a range of colourful sphagnum mosses. When properly managed, raised bogs can store and accumulate large quantities of carbon.

Blanket bog is found on gentle slopes near the top of hills and across large areas of the far north (such as the Flow Country, Caithness) and the Isles (particularly Lewis and Shetland). These extensive areas of rain-fed bog support plants such as heather, cotton grass and sphagnum mosses and are often interspersed with groundwater-fed fens and flushes. Like the raised bog, blanket bog stores and accumulates large quantities of carbon and provides a habitat that supports recreational activities such as deer and grouse shooting and hill-walking. The land and drainage management of these upper catchment areas impact on their potential to slow down floods and provide clean drinking water.

Historically, wetlands were very important on a local scale as people used them to feed and shelter animals and themselves (e.g. Crannogs), to provide building materials (e.g. reed, rush and turves for roofs, and timber for construction) and for food and warmth (peat and fire wood). The human use of wetlands is closely linked to the biodiversity that has developed on a particular wetland; for example a grazed fen does not develop shrub or tree cover and therefore is unlikely to host tree-dwelling birds and insects.

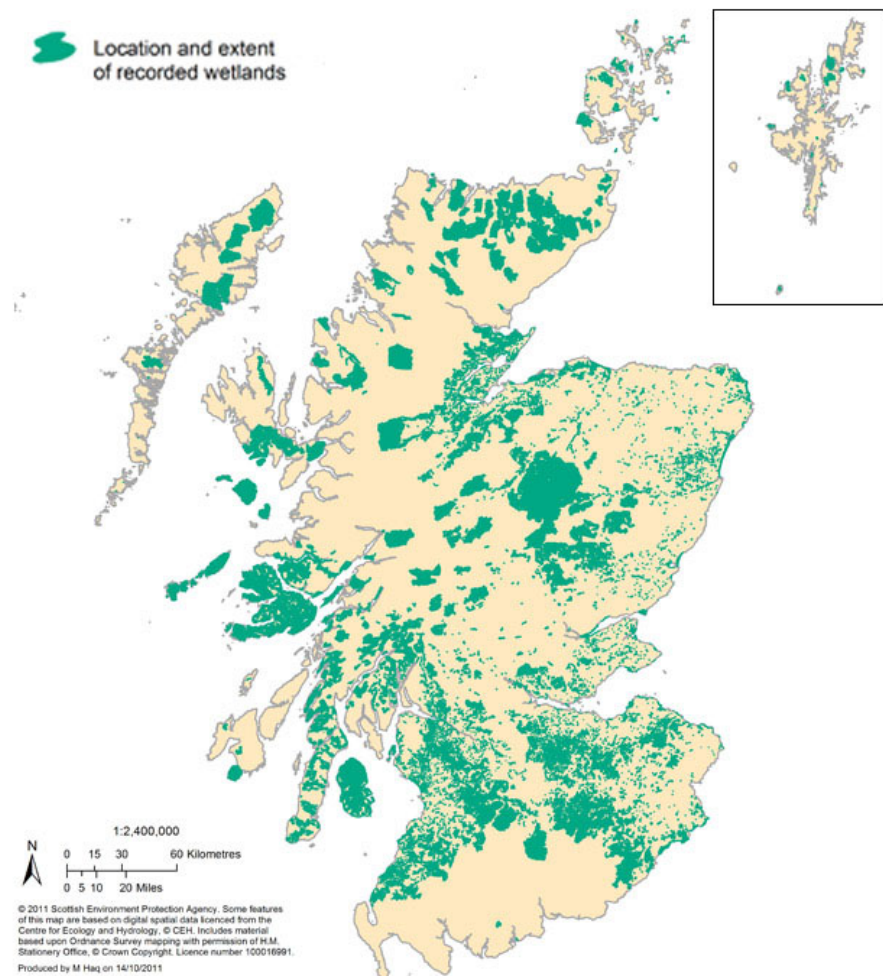
Wetlands are sensitive habitats, and provide living space for a wide range of special animals and plants such as the insect-eating sundews and bladderworts. Dragonflies are frequently seen darting around wetlands in search of prey, and breeding birds include waders (dunlin, redshank) greenshank and waterfowl (divers and the very rare common scoter).

Where are wetlands?

Given that Scotland has so many wetlands of different types, it is surprising that we are only just beginning to understand and map their full extent. This is because in the recent past we have not valued wetlands in the same way as, for example, woodlands.

We are now developing a clearer picture of the location of wetlands (including peatlands) across the whole of the Scottish landscape with the delivery of the Scottish Wetland Inventory (Figure 2).

Figure 2: Locations and extent of recorded wetlands



Note that absence of a wetland on the inventory may be because the inventory does not yet have complete coverage of Scotland.

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Description of wetlands

What is the state of wetlands?

Scottish wetlands have developed since the end of the last ice age and have continued to change in character. Part of the change was due to climatic changes affecting sea levels, as shown by the complex overlays of peat and marine deposits in the Forth Carse. Historic changes are, in part, the result of human pressures. For example, the felling of trees from the hills changed the vegetation structure of the blanket bog, the grazing of common land has influenced the fens around villages and peat fuel extraction has changed some raised bogs into fens.

This strongly interwoven relationship between their use by society and biodiversity makes it difficult to determine the 'state' of Scottish wetlands. For instance, a wetland that is well managed for grazing may not support the range of biodiversity that would be expected of extensively managed wetland.

From a biodiversity perspective, we can look at the state of those wetlands that are protected for nature conservation or are a UK Biodiversity Priority Habitat or Species. Table 1 gives an overview of the state of wetlands protected for nature conservation (as determined by Scottish Natural Heritage's [Site Condition Monitoring](#) programme).

Table 1: An overview of the 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)	Percentage of designated features in favourable condition (March 2010)
Lowland fen marsh and swamp	224	69
Lowland raised bogs	111	58
Upland bogs	188	62
Upland fen marsh and swamp	67	61



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Pressures affecting wetlands

The main human activities that put pressures on wetlands are:

1. intensive land management and change in use of wetlands;
2. land-take for development (such as buildings, roads, windfarms);
3. climate change;
4. nutrient pollution from water and the atmosphere;
5. drainage or removal of groundwater flow as a result of developments.

Land management and change in use

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 biodiversity supported on a wetland, for instance, ditching (local water management) has a major impact on the water table and could stop groundwater flow which can change the vegetation. Changes in the function of a wetland drive land management, for example the draining of large areas of wetland to increase food production during World War 2, or sustainable low-impact management of wetlands to provide material for baskets. As part of the management regime for game species like grouse, and livestock, landowners and managers sometimes carry out controlled burning of the plants on a moor or wetland. If the burning is too frequent or too severe, this can damage wetland habitat and species.

Land-take

Developments (transport infrastructure, housing estates, wind turbines/hydropower) cover the wetland surface with impermeable surfaces or result in permanent flooding or deprive groundwater-fed wetlands from their water source. This results in irreversible impacts and permanent loss of biodiversity.

There is a general appreciation of how wetlands can manage flooding, rather than hard landscaping. This change to more natural forms of flood management will impact on the biodiversity of wetlands: changes in the duration, frequency and magnitude of flood peaks will impact on wetland species and habitat; for example changes in vegetation due to entrapment of enriched sediment particles deposited after a flooding event affect the grazing potential of the wetland. The use of wetlands as natural food management areas often means longer water saturation and inundation of the soils. This will result in a change from fen to a wetter type of wetlands such as swamp. Although swamps provide valuable habitat, the new swamp will have a different range of species, which may replace rare species found in the original wetland.

Climate change

The likely effects of climate change (predicted temperature increases and decreased snow cover and duration) are likely to increase plant growth, and thus the amount of carbon stored in wetland and the quality of feed for livestock. Although not yet seen in Scotland, the change in growth can change the vegetation structure or species within the wetland and could thus impact on its biodiversity. Increased rainfall intensity could result in erosion and the loss of the carbon-rich soil and high sedimentation downstream, and thus affect the wetland function as a carbon store and impact on the biodiversity in the downstream water environment. An increase of [dissolved and particulate carbon](#), which could be partly related to climate change, has been observed in some Scottish rivers. Increased temperatures and less summer rainfall in the east of Scotland could reduce the summer water table and thus potentially change the wetland biodiversity.

Pollution

Nutrients, such as nitrogen and phosphorus, can be introduced in excessive amounts from:

1. some land management activities (e.g. farming and forestry);
2. flood water (re-suspension of sediments);
3. aerial deposition (from some industrial processes like power stations);
4. shallow groundwater pollution.

These additional nutrients change the species make-up of the wetlands and thus impact on their ability to perform functions and on their biodiversity. For example, nitrate pollution in fens will result in tall growth and invasion of reeds and nettles. An increase in nutrients can lead to permanent changes in the wildlife that live in the wetland; for example, typical reed-dwelling birds are absent when nettles take over.

Water management

Wetlands are critically dependent on the appropriate volume of water; inappropriate water management (too much or too little) can damage wetlands. For example, abstraction of groundwater lowers water tables or deprives wetland from essential groundwater contributions, and as a result changes the biodiversity of the wetland. 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 biodiversity it can support. Changing the flooding depth and frequency could result in a change from swamp or reedbed to a fen,



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which will impact on the biodiversity. Drying out of peat as a result of water table management can result in oxidisation of the peat, and thus loss of the stored carbon to atmosphere or surface waters.

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Consequences of a change in wetlands

Wetlands and their associated species (such as deer and grouse) are [important to Scotland's economy](#) and biodiversity. They often provide more than one function or use (Table 2), with functions of particular wetlands being determined by society choices. In the recent past, this function has changed considerably for a range of wetlands.

In the 1800s, many wetlands were drained for arable purposes, and, today, still fulfill this useful function. However, this drainage meant that their typical wetland biodiversity was greatly reduced or lost.

For example, fens can provide:

1. grazing;
2. flood water storage;
3. fire wood;
4. basket materials;
5. a habitat for protected species;
6. carbon storage.

However, over time the management of fens has changed (e.g. reduced grazing) resulting in increased wet scrub and woodland with a differing biodiversity from the original open fen.

Blanket bog can provide:

1. carbon storage and accumulation, but only if the water table is kept close to the surface;
2. optimal habitat for large birds of prey;
3. short-term flood water retention, so that the onset of flood peaks is delayed providing essential time for small communities downstream to respond to the threat;
4. recreational area for hill-walking and outdoor pursuits;
5. habitat for game species (such as grouse and deer).

But where the use of the blanket bog has changed from hill farming to recreation/shooting, this can significantly change the biodiversity it supports.

Saltmarsh can provide:

1. a nursery habitat for fish and shellfish;
2. flood protection, through the absorption of wave energy;
3. food, such as samphire.

Table 2: Special functions of wetlands and associated benefits

Function	Benefit
Carbon Storage and Accumulation	Wetlands that create peat (fen, raised bog, blanket bog, some wet woodland) can store and accumulate large quantities of carbon. Some management practices can release carbon (methane, carbon dioxide, particulate and dissolved carbon).
Water Purification	Wetlands often form the boundary between land and open water and can stop pollutants (suspended solids, nitrogen and phosphorus) migrating to rivers and lochs. Constructed wetlands (e.g. in Sustainable Urban Drainage Systems (SUDS)) are built primarily to remove pollutants from urban run-off and to retain flood water.
Flood Management	Wetlands slow the input of water from rain to rivers and lochs, and thus provide time-relief for flooding (hours/day scale). Wetlands can store flood water in the floodplain, thus reducing the size of flood peaks passing 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 recharges groundwater and thus benefits water supply. Artificially created wetlands play an important role in local water management and provide areas for local amenity and biodiversity. Most Scottish drinking water has passed through wetlands before it reaches a reservoir. The management of these wetlands impacts on the quality of the drinking water and the expense of potential purification treatments.



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Response by society

Wetlands have been extensively used by the people of Scotland for a long time; however, the extent of this use has changed considerably. Changes in management from subsistence farming to that required for game species, have changed grazing pressure and heather management and thus impacted on the wetlands.

Over time, societal needs have changed considerably. For example, there is a greater need for recreational space; we are more environmentally aware and although it was viewed as totally acceptable to dig peat and graze livestock on wetlands, these activities are now seen as inappropriate in most cases.

The biodiversity wealth of the wetlands has only been recognised relatively recently and is now focussed on statutory protected sites (SSSI and Natura 2000), local nature reserves and NGO-managed reserves (RSPB, SWT, Buglife). The Nature Conservation Scotland Act, and Bird and Habitats Directive are the main legal instruments in protection of the conservation wetlands. However, biodiversity action plans (BAP) and species action plans (SAP) are often less effective instruments for protection because their low importance in local decision-making is often outweighed by economic interests.

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 services they provide to the people and economy of Scotland.

Protection of wetlands outside the statutorily protected sites and species or BAP and SAP are either based on their function to the water environment ([Water Framework Directive/WEWS 2003](#)) or their flood management capacities ([FRMA 2009](#)).

The Climate Change Act has little impact as a protection instrument for wetlands, but does raise awareness of how wetlands might be affected by possible changes in climate.



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