



FENS



Priority Action (FE1)

Examine the potential for the enhancement and restoration of fens on a catchment scale, as part of a mosaic of wetland habitats.

Target: Complete a study in at least one catchment by 2012.

Lead Partner: Scottish Environment Protection Agency/Catchment Plan Steering Groups.



*Floodplain fen at Dow Lochs, Cree Valley, June 2004
(Peter Norman)*

1. Habitat Description

1.1 Physical Characteristics

Fens are minerotrophic peatlands (peatlands with a water chemistry influenced by the mineral rocks and soils of source areas, as well as by rainfall). Ground water lies close to the surface throughout the year. Where the water is derived from base-poor rock they are known as **poor-fens** and where the water is base enriched they are called **rich-fens**, but there are also intermediate forms.

Fens are subclassified depending on the ground water source and water quality: topogenous fens are subject to generally vertical water movements in the peat or soil. They occur in poorly drained areas such as basins and floodplains where the water table is permanently high. Soligenous fens occur on sloping ground where water movements are predominantly lateral, such as springs, rills and flushes and valley mires. There are also significant differences between lowland and upland fens, but many fens consist of a complex assemblage of vegetation types, which can be rich and varied.

1.2 National and International Context

Fens have been reduced to a fragment of their former size throughout Europe, with a significant proportion of European rich-fens in the UK and Sweden. In

the UK, fens are widespread but uneven in their distribution, with concentrations in East Anglia, northern England and north Wales. In 1998 there was approximately 3370km² of fen, marsh and swamp in Scotland, the majority likely to be marsh. Dumfries & Galloway has a number of fens, which cover approximately 250ha.

2. Dumfries & Galloway Status

2.1 Recent Trends

There has been little deliberate drainage or loss of fens in recent years, but several have deteriorated in quality as a result of loss of appropriate management and/or land use changes on adjacent land.

2.2 Current Distribution

Fens are scattered across Dumfries & Galloway, often where the topography of drumlins, gorse knolls and hollows has allowed their formation. Some rich-fens are also associated marginal areas of lochs and other waterbodies.

2.3 Site Examples

The **Cree Valley** floodplain between Newton Stewart and Clachaneasy, particularly within the RSPB's Wood of Cree reserve, is one of the best examples of hydroseral bog/fen development in Scotland. There is also 50ha on the RSPB's **Ken-Dee Marshes** reserve. Other important sites include **Black Loch** near Ae (SSSI), **Perchall Loch** near Lockerbie (SSSI) and **Newlaw Moss** near Dundrennan (SSSI).

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with fens, and the following action plans may also contain relevant information: Eutrophic Lochs, Mesotrophic Lochs, Oligotrophic Lochs, Swamps, Reedbeds, Marshes, Upland Springs and Flushes.



3. Importance for Associated Species

3.1 Non-flowering Plants (very high importance)

Due to the limited extent of fens in the UK, many fen mosses and liverworts are now scarce. *Imbricate Bog-moss Sphagnum affine* is known from a number of sites in Dumfries & Galloway. It is found in very wet poor-fens, as well as other wetland habitats. Twisted Bog-moss *Sphagnum contortum* is one of the most base-demanding bog-mosses, restricted to rich-fens and flushes and rare in Dumfries & Galloway. Marsh Fern *Thelypteris palustris* is a rare species, found at Newlaw Moss and a very few other sites in Dumfries & Galloway but virtually absent from the rest of Scotland.



Lustrous Bog-moss Sphagnum subnitens. Carrick, Gatehouse of Fleet, June 2007. (Peter Norman)

3.2 Flowering Plants (very high importance)

Up to a third of the UK's native higher plant species are associated with fens across the country. The nationally scarce Elongated Sedge *Carex elongata* is found at Wood of Cree as well as on part of Ken-Dee Marshes. Water Sedge *Carex aquatilis*, which is restricted in the UK, is reasonably common in Dumfries & Galloway. Other notable plants include

Purple Small Reed *Calamagrostis purpurea*, Greater Spearwort *Ranunculus lingua*, Purple Flag Iris *Iris versicolor* and Broad-leaved Cotton-grass *Eriophorum latifolium*.

3.3 Invertebrates (very high importance)

Fen habitats support thousands of invertebrate species including more than half the UK's dragonfly species, as well as a large number of aquatic beetles. A number of important invertebrates are known from fens in Dumfries & Galloway. These include: A jumping spider *Sitticus floricola*, known from just a handful of British fens and bogs including Kenmure Holms and Stroan Loch; the Large Amber Snail *Succinea putris* inhabiting fens and other wetlands at the northern edge of its range; a ground beetle *Carabus granulatus* restricted to marshes and fens in Britain; a hoverfly *Chrysogaster cemiteriorum* found in fens, wet meadows and valley bogs, at the northern edge of its British range; and the nationally scarce ground beetle *Pterostichus anthracinus*, found on shallow-profiled water margins and ditch-sides.

The caterpillars of Small Pearl-bordered Fritillary *Boloria selene* feed on Marsh Violet, and this butterfly is possibly more common on fens and marshes than in other habitats in Dumfries & Galloway.

3.4 Birds (high importance)

Fens support a number of breeding birds, including Water Rails *Rallus aquaticus*, Snipe *Gallinago gallinago*, Curlews *Numenius arquata*, Sedge Warblers *Acrocephalus schoenobaenus*, Grasshopper Warblers *Locustella naevia* and Reed Buntings *Emberiza schoeniclus*. UK Marsh Harrier *Circus aeruginosus* populations are increasing. This species has already bred recently in Dumfries & Galloway, but is likely to make more use of nesting opportunities in the future. The very rare Spotted Crake *Porzana porzana* has also bred in the past, and may still do so but is easily overlooked. The dense undisturbed nature of the habitat makes it of great value to breeding wildfowl and some areas support roosts of wintering Starlings *Sturnus vulgaris* and wintering raptors, particularly Hen Harriers *Circus cyaneus*. The habitat is also important for migratory and wintering Snipe and Jack Snipe *Lymnocyptes minimus*.

3.5 Mammals (high importance)

Fens of the region provide essential daytime cover and laying up sites for Otters *Lutra lutra*. The quiet, undisturbed cover provided by fen vegetation is also



of importance to Water Shrews *Neomys fodiens*, Water Voles *Arvicola terrestris* and the most northerly population of Harvest Mice *Micromys minutus* in the UK.

3.6 Reptiles and Amphibians (medium importance)

Five amphibian species are found in fens in Dumfries & Galloway, namely Common Frogs *Rana temporaria*, Common Toads *Bufo bufo*, Great Crested Newts *Triturus cristatus*, Smooth Newts *Lissotriton vulgaris* and Palmate Newts *Lissotriton helveticus*.

3.7 Fungi and Lichens (medium importance)

A number of specialist fungi can be found on fens, such as Fen Puffball *Bovista paludosa*, though there has been little assessment of this habitat for fungi in Dumfries & Galloway.



Angelica, typical of the tall vegetation in rich fens. Lochaber Loch, August 2007. (Peter Norman)

4. Environmental, Economic & Social Importance of Biodiversity

- Fens play an important part in the water cycle and in certain locations provide critical water storage functions that alleviate flooding.

5. Factors affecting the Habitat

- The total area of fen habitat in Dumfries & Galloway is small and there are critically **small populations of several key species**.
- Past **drainage** of surrounding areas of land for conversion to agriculture has lowered water tables and led to drying of remnant fen habitats.
- Nutrients from **agricultural run-off** and other sources leads to eutrophication of fen waters. This is likely to lead to a loss of aquatic vegetation and increased incidence of algal blooms, and may boost aggressive plants such as reed, which then become dominant at the expense of herb rich fen. Valley fens are particularly susceptible to agricultural run-off.
- Afforestation** within catchments can lead to drying.
- Loss of grazing** on fens results in a build up of vegetation layers, drying and succession to species-poor fen and ultimately carr.
- Fens on the Ken-Dee system are regularly flooded by **hydro-generation** operations, which can affect breeding birds in spring.

6. Strategic Actions

6.1 Recent and current activity

- RSPB** manage fen habitats on their Wood of Cree, Ken-Dee Marshes and Kenmure Holms reserves for the benefit of breeding and wintering birds.

6.2 Other recommended actions

- Manage catchments** to enable fens to be maintained as part of a mosaic of wetland habitats.
- Avoid water abstraction**, including from underground aquifers.
- Minimise nutrient enrichment** from the application of fertilisers within the water catchment and consider buffer zones around fens.



RAISED BOGS



Priority Action (RB1)

Investigate funding for restoration of Racks and Ironhirst Mosses as part of a Lochar Mosses complex.

Lead Partner: Regional Proposal Assessment Committee.

Priority Action (RB2)

Raise awareness of the damage caused by extraction and use of horticultural peat, concentrating on selected high-profile events such as National Bog Week.

Target: Arrange 10 public events by 2015.

Lead Partner: Dumfries & Galloway Biodiversity Partnership.



Restoration of Kirkconnell Flow through tree removal. March 2005. (SNH)

1. Habitat Description

1.1 Physical Characteristics

Raised bogs consist of a deep accumulation (up to 12m) of water-logged peat and a surface layer of plants (called the acrotelm). The surface of the bog is raised above the level of the water table and therefore all nutrients and water come from rainfall (an ombrotrophic system). Raised bogs where acrotelm is undisturbed and rich bog-moss communities typically occur are termed 'primary', whilst 'secondary' bogs occur where the bog has been damaged but where the water table has been stabilised because the drainage pattern has become blocked. Secondary bogs can be active (laying down peat) or degraded (often capable of restoration, but not always). *Sphagnum* species abundance is of critical importance to the creation of the strongly acidic conditions characteristic of ombrotrophic bogs.

Relatively undisturbed lowland raised bog surfaces are not uniform; they are made up of an almost continuous carpet of bog-mosses with a microtopography of **hummocks and hollows** providing a range of conditions that support plants

and animals. **Bog pools** are not a natural component of bogs, their frequency and pattern depending on the history of human activities. They present a very hostile environment to most species.

In the zone around raised bogs where water draining the bog meets that from adjoining mineral soils a fen type vegetation, termed the **lagg**, sometimes forms that has more nutrients and a greater species diversity. Although colonisation by trees usually leads to the loss of the bog, in some circumstances scattered scrub and **bog woodland** can exist in a stable relationship with bog communities.

1.2 National and International Context

Raised bogs are found in most EU countries, but only Finland, Sweden, UK and Ireland hold significant concentrations. In the UK they are found in upland and lowland situations but tend to be clustered in certain areas that have conditions particularly suitable for formation, such as the Scottish central belt, north-west England, Northern Ireland and both sides of the Solway. It is estimated that there once were at least 800 raised bogs covering more than 700,000ha in the UK but since around the start of the 19th century the extent of primary raised bog has decreased by around 94% from 95,000ha to around 6,000ha, with only 500ha remaining in England. Dumfries & Galloway has approximately 3.5% of UK's raised bogs.

2. Dumfries & Galloway Status

2.1 Recent Trends

The conservation importance of raised bogs has become more widely recognised in recent years, leading to changes in national policy and a number of restoration projects, including experiments to reintroduce grazing. From 2001 to 2005, as part of the Restoration of Scottish Raised Bogs Project, tens of thousands of naturally regenerated and planted conifers were removed from two sites in Dumfries



& Galloway – Kirkconnell Flow and Longbridge Muir. Further west, smaller numbers were removed from Carsegowan Moss, and as part of a separate project, 64ha of Moss of Cree was cleared of conifers. Drainage ditches at these sites have been blocked.

However, most of Dumfries & Galloway's area of remaining raised bogs remains under conifer plantation, and there are extant planning permissions for peat extraction on several other sites.

2.2 Current Distribution

Dumfries & Galloway's largest raised bogs occur in lowland areas on the inner Solway plain and adjacent to the Cree estuary. There are a few raised bogs in the uplands, and several that show characteristics of both raised and blanket bogs as well as the transition habitats in-between.

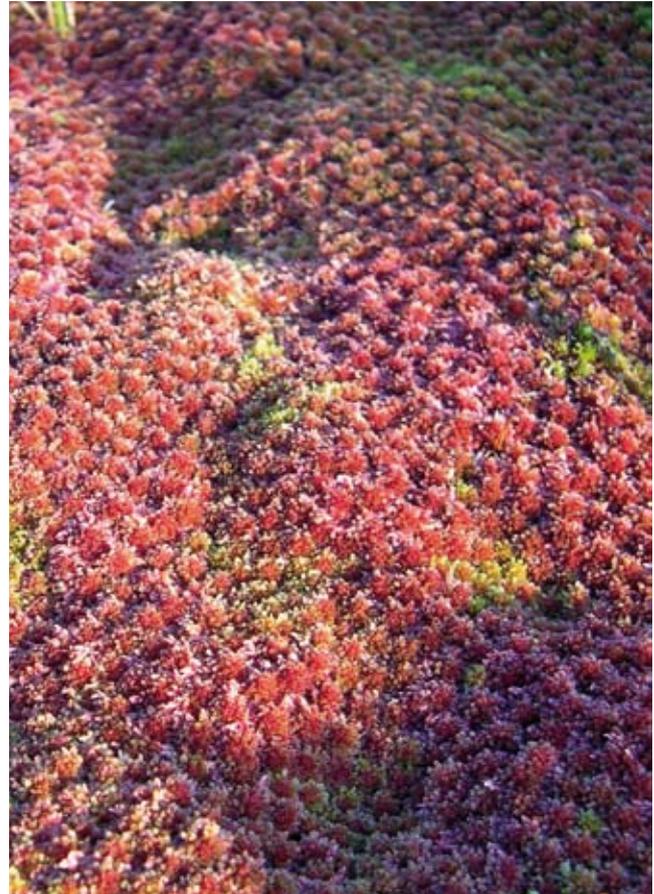
2.3 Site Examples

On the Solway plain a number of raised bogs were created under estuarine conditions. These now form the largest and most extensive raised bogs in the region, and include **Kirkconnell Flow** (SAC/SSSI/NNR), and **Longbridge Muir** (SAC/SSSI). There are many smaller sites including **Bell's Flow** (SSSI), **Raeburn Flow** (SAC/SSSI), **Ring Moss** (SSSI), **Kelhead Flow** (LWS), **Cowgarth Flow** (LWS), **Cadgill Flow** (LWS), **Burnfoothill Moss** (LWS), **Greenwrae Flow** (LWS), **Merkland Moss** (LWS), and **Carsegowan Moss** (SAC/SSSI). **Redhills Moss** (LWS) **Catherinefield Moss** (LWS) are remnants of the Lochar Moss. **Ellergower Moss** (SSSI) is one of the few remaining examples of an intact upland raised bog.

Several large sites remain under conifer plantations, although some are probably capable of restoration. These include **Craigs**, **Ironhirst** and **Racks Moss** (all part of the Lochar Moss complex), **Rascarrel Moss** (LWS) and most of **Moss of Cree** (LWS).

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with raised bogs, and the following action plans may also contain relevant information: Blanket Bogs, Fens, Native Wet Woods, Conifer Plantations.



Carpet of Red Bog-moss *Sphagnum capillifolium*. Kirkconnell Flow, February 2008. (Peter Norman)

3. Importance for Associated Species

3.1 Non-flowering Plants (very high importance)

Bog-moss *Sphagnum* abundance is of critical importance to the creation of the strongly acidic conditions characteristic of ombrotrophic bogs. In fact it could be argued that *Sphagnum* does not just occur on raised bogs, it actually *is* raised bogs. Thirty of the 36 UK species have been recorded in Dumfries & Galloway, often from raised bogs, including Feathery Bog-moss *Sphagnum cuspidatum* and Cow-horn Bog-moss *S. denticulatum* in pools, Red Bog-moss *S. capillifolium* and Papillose Bog-moss *S. papillosum* on hummocks, and Blunt-leaved Bog-moss *S. palustre* forming carpets between the hummocks. The scarce Golden Bog-moss *Sphagnum pulchrum* occurs on pool edges, and the very rare Baltic Bog-moss *Sphagnum balticum*, was identified on Racks Moss in 1960 but is now probably extinct following afforestation. A wide diversity of other mosses and liverworts are also found on raised bogs, in addition to bog-mosses.



Raised bogs are not as important for ferns as mosses, but the scarce Royal Fern *Osmunda regalis* is still extant on Lochar Moss.

3.2 Invertebrates (very high importance)

Localised invertebrates such as Black Darter dragonflies *Sympetrum danae* and Large Heath butterflies *Coenonympha tullia* are found on some lowland raised bog sites in the region. Marsh Fritillary butterflies *Euphydryas aurina* were last recorded in Dumfries & Galloway on the Lochar Moss complex in the 1970s, but are now extinct following afforestation.

Many scarce invertebrates in Dumfries & Galloway are closely linked to *Sphagnum*, including the money spiders *Maro lepidus*, *Bathyphantes setiger*, *Centromerus levitarsis* and *Erigone welchi*, the water beetle *Laccobius atratus* and Sphagnum Bugs *Hebrus ruficeps*. All of these have a very restricted Scottish, if not UK, distribution. The pond skater *Gerris gibbifer* is known in Scotland only from Dumfries & Galloway. It was last recorded on **bog pools** Lochar Moss in 1946, prior to afforestation, but still remains on Kirkconnell Flow and in non-bog habitat on the Black Water of Dee. A nationally rare jumping spider *Sitticus floricola* was recorded at Kirkconnell Flow in 2006.



Large Heath butterfly. (Laurie Campbell)

Bog woodland supports a number of specialist species, including Bog Bush Crickets *Metrioptera brachyptera* in open woodland with Cross-leaved Heath and Purple Moor Grass, and Bilberry Pug moths *Pasiphila debiliata* in birch woodland with abundant Blaeberry at their only Scottish location at Kirkconnell Flow. Although not restricted to bog woodland, the very rare Six-spotted Pot Beetle *Cryptocephalus sexpunctatus* is also known from the latter site.



Round-leaved Sundew. (Peter Norman)

3.3 Flowering Plants (high importance)

Typical species include Round-leaved Sundew *Drosera rotundifolia*, Hare's-tail Cottongrass *Eriophorum vaginatum* and Deer Grass *Trichophorum cespitosum*. Cranberry *Vaccinium oxycoccos* and Bog Rosemary *Andromeda polifolia*, though scarce in much of Britain, are abundant on many raised bogs in Dumfries & Galloway. Less common species include Great Sundew *Drosera anglica* and Oblong-leaved Sundew *Drosera intermedia*. Species associated with **bog pools** include White Beak-sedge *Rhynchospora alba* and Bog Sedge *Carex limosa* both frequently found on bare wet peat on pool margins, sometimes in shallow standing water.

It is not known if any stable **bog woodland** exists in Dumfries & Galloway, but a similar habitat, consisting of scattered trees on the central areas or more usually on the lagg, is found on most local bogs. Birch *Betula* spp. and Bog Myrtle *Myrcia gale* are typical species.

3.4 Reptiles and Amphibians (high importance)

Adders *Vipera berus* occur on most raised bogs, often the only suitable habitat for them within extensive areas of improved farmland. Common Lizards *Zootoca vivipara* may also occur, but the water is generally too acidic for amphibians to breed.

3.5 Fungi and Lichens (medium importance)

A number of species of fungi are adapted to bogs, or to the plants growing in them. This is especially the case with *Sphagnum* mosses, which have a specialised fungal flora including Bog Bell *Galerina paludosa*. However, most bog fruit bodies are small, such as those of several species of the genus *Mycocalia*, closely related to the bird's-nest fungi, which grow amongst wet vegetation.



3.6 Birds (low importance)

Breeding birds do not occur in high densities on raised bogs. Skylarks *Alauda arvensis* and Meadow Pipits *Anthus pratensis* are probably the commonest breeding species, with smaller numbers of Stonechats *Saxicola torquatus*. Although the habitat appears suitable for feeding Nightjars *Caprimulgus europaeus*, there are only a few records of this species breeding on raised bogs in Dumfries & Galloway. Red Grouse *Lagopus lagopus* and Black Grouse *Tetrao tetrix* no longer occur on most lowland raised bogs.

Birds of prey such as Hen Harriers *Circus cyaneus*, Merlins *Falco columbarius* and Short-eared Owls *Asio flammeus* hunt over raised bogs outside the breeding season, and there are a number of important roosts.

4. Environmental, Economic & Social Importance of Biodiversity

- Being supplied with water and nutrients entirely from the atmosphere, raised bogs are sensitive indicators of climate change and pollution.
- The process of peat formation locks up atmospheric carbon for thousands of years. Recent research has suggested that 3.5 times the quantity of carbon is locked up in peat than in the world's tropical rainforests. Drainage of peat releases this carbon back into the atmosphere. However, active peatlands give off methane, which is a 'greenhouse gas'.
- Peatlands provide a historical record of past climates, vegetation and human history. Stored within the peat are plant and animal remains, pollen grains, human artefacts and even occasionally 'bog bodies'. Scientists and archaeologists use these remains to reconstruct Scottish landscape history and prehistory.
- Small-scale peat extraction for domestic use has been undertaken in Dumfries & Galloway, and has not significantly damaged any sites. Although the use of peat in horticulture has provided many benefits, and supports an extraction industry, use of all horticultural peat is incompatible with biodiversity conservation.

5. Factors affecting the habitat

- **Afforestation** of bogs results in loss of habitat, although this is often a very gradual process with bog conditions persisting for many years under the trees. Tree planting on neighbouring areas also dries out bogs and acts as an invasive seed source.
- Removal of **peat for fuel or horticultural use** results in loss of habitat. Planning permissions exist on a number of bogs.
- Use of bogs for **landfill sites** results in loss of habitat.
- **Livestock and game management** on bogs may damage habitat through drainage, trampling, burning, and contamination with feed and droppings.
- **Agricultural use of neighbouring areas** often reduces water levels on bogs, as a result of marginal ring-ditches and other drainage measures. Run-off from agricultural land (fertilisers and pesticides) may also damage bog ecology.
- **Water abstraction** within the catchment area may have an adverse effect on the hydrology of raised bogs. There has been little built development on bogs, but natural hydrology may be disrupted by **neighbouring developments** and associated roads.
- Drying out the raised bog allows **invasion by scrub and trees** which it turn speed up the drying out process and lead to the loss of special habitat and fauna.
- The mosaic created by domestic hand-cutting of peat provides a range of small-scale structures across a site, and is beneficial for some species. However, **cutting** is always damaging to the habitat when carried out on a part of the bog surface not previously worked or in areas where past peat extraction has been so extensive as to leave only a thin covering of peat over the mineral soil.
- **Climate change** may affect hydrology, habitat quality and species composition.



6. Strategic Actions

6.1 Recent and current activity

- **SNH** has undertaken a programme of mapping, identifying the location, condition and potential threats to peatlands in Scotland. Details are held within the Lowland Raised Bog inventory (LRBI).
- **Forestry Commission** policy includes a strong presumption against further forestry expansion on extensive areas (exceeding 25ha) of active raised bogs and degraded raised bogs capable of restoration to active status. It also encourages the conservation and restoration of peatland habitats within forests as part of the design and management of open ground.
- The **SNH** Peat Policy promotes the use of sustainable growing-media based on recycled organic materials in place of peat.
- A number of raised bogs, such as Kirkconnell Flow and Carsegowan Moss are managed as nature reserves, and promoted to the public by **SNH** and **Scottish Wildlife Trust**.

6.2 Other recommended actions

- **Survey** all raised bogs to at least Phase 1, ideally NVC, with an assessment of habitat condition where data not currently available.
- **Review existing planning consents** for the extraction of peat on all raised bogs and examine whether consents on non-severely degraded sites can be withdrawn. Ensure Forest Design Plans **identify areas of raised bog that have previously been planted**, and where viable that they restore these areas through removal of trees.
- Use the raised bog restoration schemes at Longbridge Muir and Kirkconnell Flow to **evaluate measures for conserving and managing lowland raised bogs** and to demonstrate best practice.
- **Phase out the use of horticultural peat** by all statutory agencies. Promote public use of horticultural alternatives.

BLANKET BOGS

Priority Action (BB1)

Restore degraded blanket bogs through the blocking of moorland 'grips' and drains, especially on designated sites, or those adjacent to designated sites.

Target: Identify suitable blanket bog locations by 2012.

Lead Partner: Southern Uplands Partnership/Regional Proposal Assessment Committee.



Bog pool with Bogbean. Silver Flowe, July 1999. (Peter Norman)

1. Habitat Description

1.1 Physical Characteristics

Blanket bog is characteristic of areas of the UK with an oceanic climate, which is cool with high and regular rainfall. In such areas blanket bogs can cover whole landscapes. A mantle of peat accumulates slowly over many years through the slow decomposition of mosses. This can reach depths exceeding 5m, although 0.5-3m is more typical. It occurs in wet hollows or on slopes of up to 30°, but typically forms over large expanses of undulating ground, hence the name blanket bog.

Blanket bogs are composed mostly of water held in *Sphagnum* mosses and are ombrotrophic, that is the water and mineral supply comes entirely from atmospheric sources (rainwater, mist and cloud-cover). Active blanket bogs are those in which the peat is still capable of accumulating through growth and impeded decay of *Sphagnum*. The water chemistry is nutrient-poor and the habitat is

dominated by acidic plant communities. A blanket bog landscape may also contain minerotrophic systems (those that are affected by ground-water and the nutrients in it), such as springs, flushes, stream margins and valley mires. These will support different vegetation types that may also provide important sub-habitats.

The frequency of **bog pools** on the surface varies with local topography and geographical location, but they can be common on some blanket bogs.

1.2 National and International Context

In Europe, blanket bogs are found primarily in the UK and Ireland. The UK has an estimated 2,210,000ha of blanket bog with 1,759,000ha in Scotland, a significant proportion of the total global area, making it one of the most important international locations for this habitat. Blanket bogs are distributed mostly in the north and west of Britain from Devon to Shetland. The current area of blanket bog in Dumfries & Galloway is less than 50,000ha.



2. Dumfries & Galloway Status

2.1 Recent Trends

There has been little recent loss of blanket bog to new afforestation or drainage, but many existing drainage systems continue to operate.

2.2 Current Distribution

Blanket bog in Dumfries & Galloway occurs from 70 metres above sea level on the Wigtownshire mosses, to altitudes of nearly 700 metres on the tops of Merrick/Kells and the Moffat Hills.

2.3 Site Examples

Blanket bogs occur on many of the hill ranges in Dumfries & Galloway, including **Merrick-Kells** (SSSI), **Moffat Hills** (SSSI), and **Lowther Hills** (SPA/SSSI). Within the Merrick Kells range **Silver Flowe** (SSSI/ NNR/Ramsar) consists of almost 200ha of mostly blanket bog, although parts of the site grade into a raised bog type habitat. Areas of blanket bog are also found on **Cairnsmore of Fleet** (NNR/SSSI).

At lower altitude, there are a number of important blanket bogs in Wigtownshire, including **Mochrum Lochs** (SAC/SSSI), **Kirkcowan Flow** (SAC/SSSI), **Kilhern Moss** (SAC/SSSI), **Blood Moss** (SSSI), **Derskelpin Moss** (SSSI) and **Flow of Dergoals** (SAC/SSSI).

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with blanket bogs, and the following action plans may also contain relevant information: Raised Bogs, Upland Heaths, Acid Grasslands.

3. Importance for Associated Species

3.1 Non-flowering Plants (very high importance)

Bog-mosses, including Papillose Bog-moss *Sphagnum papillosum*, Soft Bog-moss *S. tenellum* and Magellanic Bog-moss *S. magellanicum*,



Cloudberry. Mid Craig, Moffat Hills, July 2007. (Peter Norman)

are the principal peat forming species on blanket bogs. Austin's Bog-moss *Sphagnum austinii* and Rusty Bog-moss *Sphagnum fuscum* are virtually restricted to undisturbed raised and blanket bogs. Extensive surface patterning with Feathery Bog-moss *Sphagnum cuspidatum* **hollows** occurs at Kirkcowan Flow, whilst the increasingly uncommon Golden Bog-moss *Sphagnum pulchrum* normally grows around **bog pool** edges, and is a distinctive feature at Kilhern Moss.

3.2 Invertebrates (high importance)

Blanket bog is of great importance to many invertebrates such as spiders and leaf-hopper bugs. The nationally scarce ground beetle *Agonum ericeti* is associated with *Sphagnum* moss in a few Dumfries & Galloway bogs, along with the spider *Clubionia norvegica*. Large Heath Butterflies *Coenonympha tullia* also occur on blanket bogs, though not in the density found on raised bogs. Azure Hawker dragonflies *Aeshna caerulea* breed in shallow **bog pools** with *Sphagnum*. Outside of northern Scotland, their only UK sites are in the Silver Flowe area.



Azure Hawker dragonfly, restricted in the UK to the bogs of Silver Flowe and the Scottish Highlands. (Laurie Campbell)

The fringes of blanket bogs can support important marginal vegetation. Tussocky vegetation of taller *Molinia*, *Carex* or *Juncus* and the associated litter build-up provides cooler, more sheltered microhabitats for adult craneflies and drier sites for over-wintering invertebrates such as spiders. Ericaceous dwarf shrubs also support many heather-feeding moths and other insects, as well as providing a well-developed vegetation structure for spiders.

3.3 Birds (high importance)

Many areas of blanket bog are important for Black Grouse *Tetrao tetrix* which feed on the invertebrates and cotton grasses that can be abundant in these areas. Red Grouse *Lagopus lagopus* also occur, and



wading birds such as Curlews *Numenius arquata*, Golden Plovers *Pluvialis apricaria* and Dunlins *Calidris alpina* all nest on blanket bogs, though have become increasingly scarce in recent decades.

A number of birds of prey, such as Golden Eagles *Aquila chrysaetos*, Hen Harriers *Circus cyaneus*, Merlins *Falco columbarius* and Short-eared Owls *Asio flammeus* often hunt over blanket bogs.

3.4 Flowering Plants (medium importance)

Typical blanket bog plants include Cross-leaved Heath *Erica tetralix*, Crowberry *Empetrum nigrum*, Round-leaved Sundew *Drosera rotundifolia*, Bog Asphodel *Narthecium ossifragum*, and cotton grasses *Eriophorum* spp. Cloudberry *Rubus chamaemorus* forms a dense carpet on some blanket bogs in the east of the region. Bogbean *Menyanthes trifoliata* is typical of **bog pools**.

Tall Bog Sedge *Carex magellanica* is a perennial of **bog pools** and **hummocks** in *Sphagnum* bogs, or at the edges of gently sloping bogs where there is slight lateral water movement. It is thinly scattered in Britain with some colonies lost as a result of drainage and afforestation. A number of other species are rare outside of the Highlands, but have been found in Dumfries & Galloway. These include Bog Blaeberry *Vaccinium uliginosum*, recorded in the Moffat Hills, and Few-flowered Sedge *Carex pauciflora*, a very inconspicuous species that grows on and around hummocks, usually in association with *Sphagnum*.

3.5 Mammals (medium importance)

Water Voles *Arvicola terrestris* are usually thought of as mammals of lowland rivers, but as they have declined in such habitats, it has become clear that they also occur on blanket bogs and moorlands, although their presence is often not obvious. Indeed, this is their main habitat in some parts of Europe and upland populations appear to be surviving better than those in the lowlands of the UK. Red Deer *Cervus elaphus* wallow in bog pools to rid themselves of flies and parasites.

3.6 Reptiles and Amphibians (medium importance)

Adders *Vipera berus* are frequently found on blanket bogs.



Bog Bellcap Galerina sp. on Sphagnum mosses. Mid Craig, Moffat Hills. July 2007. (Peter Norman)

3.7 Fungi and Lichens (medium importance)

As with raised bogs, several species of fungi are adapted to the plants growing in blanket bogs, especially with *Sphagnum* mosses that have a specialised fungal flora including Bog Bell *Galerina paludosa*. However, most bog fruit bodies are small, such as those of several species of the genus *Mycocalia*, closely related to the bird's-nest fungi, which grow amongst wet vegetation.

3.8 Fishes (low importance)

Salmon *Salmo salar* and Sea/Brown Trout *Salmo trutta* benefit from the quality of waters produced by peatland catchments.



4. Environmental, Economic & Social Importance of Biodiversity

- Peatlands play a significant role as carbon dioxide sinks in minimising global warming (see Raised Bogs).
- Blanket bogs play a vital role in many catchments in the maintenance of water quality. Most of Scotland's drinking water comes from catchments dominated by bogs.
- Without the protective layer of peat high rainfall would erode many of the less stable upland soils off the hill and into watercourses.
- Where numbers of birds allow, grouse shooting is a sustainable economic use of upland areas. Blanket bogs support many invertebrates, especially craneflies that are an essential component of the diet of grouse chicks.



Blanket bog at Watch Knowe, next to Loch Skene, Moffat Hills. July 2007. (Peter Norman)

5. Factors affecting the habitat

- **Afforestation** over extensive tracts of blanket bog and adjacent areas, often accompanied by furrowing of the ground, affects the hydrology and species composition. This increases as the trees mature, require more water and cast more shade.
- **Drainage** of blanket bogs and their margins has been widespread in Dumfries & Galloway. Drainage ditches, both new and old, lower the water table and may initiate erosion, oxidation of the peat and modification the surface patterning, leading to the loss of *Sphagnum* hollows. Even unmaintained old drains continue to affect hydrology. Lowered water tables alter the species composition of the surface vegetation and have a detrimental impact on specialist invertebrates.
- **Heavy grazing** by sheep can have a significant impact on blanket bog vegetation, especially if there is supplementary feeding (which will increase the nutrient input) and other management measures such as drainage, burning or fencing. Grazing and trampling by feral goats affects some sites.
- **Uncontrolled burning** can lead to increased erosion and the loss of characteristic bog species, including the death of peat-forming species. These can slowly recover over time (more than 20 years), but the invertebrate population will be seriously affected
- The **application of fertilisers and lime** to increase stock grazing productivity will inevitably lead to nutrient enrichment of the water supply, modifying bog ecology to the detriment of biodiversity.
- **Acidification** from atmospheric deposition has altered the nutrient status of bogs, and hence the plant species composition. However, if lime is added to lochs, lakes and rivers as a treatment for acidification, this may also have a detrimental effect on adjacent areas of blanket bog.
- **Development**, such as wind farms and communication masts, together with associated infrastructure such as access and maintenance roads can cause significant hydrological disruption. Links to the national grid via landlines and pylons also has an impact on very fragile blanket bog during the construction phase.
- The bog surface is a fragile habitat and can be damaged by even modest levels of **recreational use**. This is usually restricted by the natural wetness of blanket bogs, sometimes making them dangerous places to walk, but localised areas can suffer severe erosion. There is also a fire risk from recreational use.



- **Erosion** exposes more of the peat to the atmosphere, increasing drying and oxidation of the peat. Hag erosion may be instigated, resulting in extensive patches of bare eroding peat both in gullies and flatter areas.

6. Strategic Actions

6.1 Recent and current activity

- **SNH** has undertaken a programme of mapping, identifying the location, condition and potential threats to peatlands in Scotland. Details are held within the Scottish Blanket Bog inventory (SBBI).
- **Forestry Commission** policy includes a strong presumption against further forestry expansion on extensive areas (exceeding 25ha) of active blanket bog averaging 1m or more in depth or any associated peatland where afforestation could alter the hydrology of such areas. It also encourages the conservation and restoration of peatland habitats within forests as part of the design and management of open ground.

6.2 Other recommended actions

- **Manage at the scale of hydrological units or catchments.** Operations some distance away from the ombrotrophic *Sphagnum* communities can have a devastating effect if they are within the same hydrological unit. In order to conserve characteristic bog communities, it is necessary to look beyond the boundaries of a particular site.
- **Monitor the impact of recreational use** of blanket bogs. **Determine in detail the area, extent and condition** of blanket bog within Dumfries & Galloway.
- Use sites such as Silver Flowe NNR to **demonstrate good practice.**
- **Raise public and landowner awareness** of blanket bog through guided walks, talks, publications, press releases, and environmental education opportunities, including National Bog Week.
- Identify and **evaluate opportunities for restoration** of blanket bog habitats as forests are re-designed at felling and re-stocking. Where hydrologically possible, restore blanket bog adjacent to SSSIs such as Kirkcowan Flow, Derskelpin Moss, Flow of Dergoals and Ring Moss.