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 3370km^2 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, gorsey 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 *Lymnocryptes 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 helvetica.

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 – Kirconnell 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 though 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*, 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.

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

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.

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.

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

- **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.

PURPLE MOOR-GRASS & RUSH PASTURES

Priority Action (PMG1)

Determine the extent, distribution, composition and status of Purple Moor-grass and rush pastures in Dumfries & Galloway.
Target: Complete study by 2012.
Lead Partner: Dumfries & Galloway Environmental Resources Centre.

Priority Action (PMG2)

Restore Purple Moor-grass and rush pastures.
Target: Restore 8ha by 2015.
Lead Partner: Regional Proposal Assessment Committee/Farming & Wildlife Advisory Group.

1. Habitat Description

1.1 Physical Characteristics

Purple Moor-grass and rush pastures occur on poorly drained sites in lowland-mid altitude areas with high rainfall. The soils are usually acidic, supporting a distinctive species-rich vegetation community with abundant Purple Moor-grass and Sharp-flowered Rush. This habitat is often found in conjunction with wet heath, scrub and dry grassland, which contribute to a patchwork of diverse habitats that supports high biodiversity.

1.2 National and International Context

Purple Moor-grass and rush pastures occur throughout western Europe. The total estimated extent of this habitat in the UK is around 56,000ha, considerably more than survives in the rest of Europe, with the possible exception of the Republic of Ireland. It is found in south-west England, south Wales and western Scotland as far as northern Argyll. An estimated 4,500ha occurs in Scotland. The total extent in Dumfries & Galloway is not accurately known, but there is at least 65ha.

2. Dumfries & Galloway Status

2.1 Recent Trends

Recent trends are not known.

2.2 Current Distribution

Purple Moor Grass and rush pasture is found in Galloway at altitudes up to 300m, and at least 4 Sites of Special Scientific Interest in the region include this habitat.

2.3 Site Examples

The following Sites of Special Scientific Interest contain elements of purple moor grass and rush pasture, but a complete survey of the extent of this habitat has not been carried out: **Skyreburn** (SSSI), **Cleugh** (SSSI) **Bailliewhirr** (SSSI) and **Dowalton Loch** (SSSI).

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with Purple Moor-grass and rush pastures, and the following action plans may also contain relevant information: Fens, Acid Grasslands, Neutral Grasslands, Upland Springs and Flushes.

3. Importance for Associated Species

3.1 Non-flowering Plants (high importance)

A diverse moss and liverwort flora is found in many Purple Moor-grass and rush pastures. Bog-mosses such as Compact Bog-moss *Sphagnum compactum*, Cow-horn Bog-moss *S. denticulatum* and Blunt-leaved Bog-moss *S. palustre* can be common, though rarely forming the carpets found on bogs.

3.2 Flowering Plants (high importance)

The habitat is characterised by plant species such

Grass of Parnassus. Stronach Hill, Skyreburn, September 2007. (Peter Norman)

as Fairy Flax *Linum catharticum*, Field Gentian *Gentianella campestris*, Quaking Grass *Briza media,* Frog Orchid *Dactylorhiza viridis*, Greater Butterfly Orchid *Platanthera chlorantha*, Spignel *Meum athamanticum*, Whorled Caraway *Carum verticillatum* and Marsh Hawk's-beard. Many of these are locally or nationally uncommon.

3.3 Invertebrates (high importance)

Purple Moor-grass and rush pastures provide important areas for butterflies and moths such as the Small Pearl-bordered Fritillary *Boloria selene*, Scotch Argus *Erebia aethiops* and Narrow-bordered Bee Hawkmoth *Hermaris tityus*.

Scotch Argus, the characteristic butterfly of local Purple Moor Grass and rush pastures. (Richard Mearns)

3.4 Reptiles and Amphibians (medium importance)

All of the region's terrestrial reptiles and all of the common amphibians are found in Purple Moor-grass and rush pastures.

3.5 Birds (medium importance)

Breeding birds of purple moor grass and rush pasture include Lapwings *Vanellus vanellus,* Snipe *Gallinago gallinago,* Curlews *Numenius arquata* and Skylarks *Alauda arvensis.* Hen Harriers *Circus cyaneus,* Barn Owls *Tyto alba* and Short-eared Owls *Asio flammeus* are likely to feed over this habitat if they are nesting or wintering close by.

3.6 Fungi and Lichens (medium importance)

No species of fungi are restricted to Purple Moor-grass and rush pastures, but a wide range of unimproved grassland species occur, including waxcaps *Hygrocybe* spp. Field mushrooms *Agaricus* spp. may be found on more improved sites.

3.7 Mammals (low importance)

Although a wide variety of mammals may be found on Purple Moor-grass and rush pastures, including Brown Hares *Lepus europaeus* and high densities of small mammals, none are restricted to this habitat.

4. Environmental, Economic & Social Importance of Biodiversity

- Purple Moor-grass and rush pastures provide rough grazing for cattle and sheep.

5. Factors affecting the Habitat

- **Lack of information and understanding** about the distribution, quality and importance of this habitat leading to poor appreciation of its value.
- **Agricultural improvement** through drainage, cultivation and fertiliser applications.
- **Agricultural abandonment**, leading to rankness and scrub encroachment through lack of grazing.
- **Inappropriate management**, including overgrazing by sheep and burning.
- **Afforestation** on or adjacent to important sites.

6. Strategic Actions

6.1 Recent and current activity

- None known, except maintenance of this habitat on designated sites.

6.2 Other recommended actions

- Include information on the importance of this habitat and its sensitivity to land use changes in **publicity and interpretation** materials.

Purple Moor-grass and rush pasture at Stronach Hill, Skyreburn. August 2006. (Peter Norman)

CALCAREOUS GRASSLANDS

Priority Action (CG1)

Designate calcareous grasslands as Local Wildlife Sites and provide management advice.
Target: All appropriate sites designated as LWS by 2015.
Lead Partner: Dumfries & Galloway Biodiversity Partnership.

1. Habitat Description

1.1 Physical Characteristics

Calcareous grassland in former limestone quarry at Kelhead. June 2007. (Peter Norman)

Calcareous grasslands occur on shallow base-rich rocks such as chalk, limestone, serpentine and old red sandstone. They tend to be dry grasslands because of the free-draining nature of the soil and are rich in calcium but poor in available nitrogen and phosphate. A range of different calcareous grasslands occur across the UK, maintained by grazing livestock, particularly where low-intensity farming practices have survived. It is also found on roadside verges, old limestone quarries and railway cuttings.

1.2 National and International Context

There is an estimated 40,000-65,000ha of calcareous grassland throughout the UK, but it is restricted to areas of the country with suitable geology. Most lowland grasslands occur on chalk with concentrations in Wiltshire, Dorset and the South Downs. Carboniferous limestones in the north of England are another significant source of lime-rich soils, particularly in the north Pennines, Cumbria and north Lancashire. Calcareous grasslands are rare in Scotland with an estimated extent of little more than 50ha with less than 10ha in Dumfries & Galloway.

2. Dumfries & Galloway Status

2.1 Recent Trends

Scrub encroachment on disused quarries may have resulted in a decline in the quality of calcareous grasslands in recent years.

2.2 Current Distribution

Calcareous grasslands in Dumfries & Galloway are limited to small fragments on limestone, mostly in disused quarries in Dumfriesshire. However, small pockets of lime-loving plants are also found on isolated areas of base-rich glacial drift within acid grasslands.

2.3 Site Examples

Former industrial sites include flooded **lime pits around Eaglesfield**, **Barjarg Lime Kiln** and **Kelhead Quarry** (LWS). Pockets of base-rich grassland can also be found amongst other habitats at **Bailliewhirr** (SSSI), **Cleugh** (SSSI), **Skyreburn** (SSSI) and **Stranfasket**.

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with calcareous grasslands, and the following action plans may also contain relevant information: Coastal Sand Dunes, Coastal Cliffs and Slopes, Neutral Grasslands, Acid Grasslands, Upland Springs and Flushes, Quarries and Mineral Workings.

3. Importance for Associated Species

3.1 Flowering Plants (very high importance)

Common Twayblade orchids. (Peter Norman)

Calcareous grasslands are considered as the richest and most species diverse of all grassland types for flowering plants. In Dumfries & Galloway, typical species include Wild Thyme *Thymus praecox,* Quaking Grass *Briza media,* Fairy Flax *Linum catharticum* and Common Rockrose *Helianthemum nummularium*. They also contain a number of locally scarce species, such as Field Gentian *Gentianella campestris* and Hairy Rock Cress *Arabis hirsuta,* although these are not confined to calcareous grasslands. There are old records of plants of calcareous soils, such as Herb Paris *Paris quadrifolia* from upper Nithsdale and the Dundrennan area.

3.2 Invertebrates (high importance)

Calcareous grassland supports a rich diversity of invertebrates. This is particularly so where it forms a

mosaic with other habitats such as scrub, rock outcrops and sparse bracken. Species include butterflies such as Common Blue *Polyommatus icarus* and Small Heath *Coenonympha pamphilus*; grasshoppers such as Meadow *Chorthippus parallelus* and Common Green *Omocestus viridulus*; bumblebees such as the Common Carder *Bombus pascuorum* and Red-tailed *B. lapidarius* ; and ants such as Yellow Meadow Ant *Lasius flavus.* None of these insects are confined to this habitat. Although there are rare species more strongly associated with this habitat elsewhere in Britain, no detailed surveys have been completed in Dumfries & Galloway.

Common Blue butterfly. (Peter Norman)

There are several molluscs in Dumfries & Galloway that have a stronger association with calcareous grasslands. This habitat is particularly important for snails because most need calcium in considerable quantities for their shells. Species include Wrinkled Snail *Candidula intersecta,* Moss Chrysalis Snail *Pupilla muscorum* and Ribbed Grass Snail *Vallonia costata.*

3.3 Fungi and Lichens (high importance)

There are few species of fungi restricted to calcareous grasslands. Their ecology depends much more on the presence of other species, especially mosses, rather than directly on the pH of the soil, though soil pH does of course influence the presence of such plant associates. Nevertheless, several species seem to prefer calcareous grassland, including Snowy Waxcap *Hygrocybe virginea var. ochraceopallida*, Big Blue Pinkgill *Entoloma bloxamii* and Grassland Puffball *Lycoperdon lividum.*

3.4 Reptiles and Amphibians (medium importance)

The dry nature of calcareous grasslands makes them more suited to reptiles than amphibians, though the small size of most sites reduces their value. All three native terrestrial reptiles occur on calcareous grasslands that are part of a mosaic of suitable habitats.

4. Environmental, Economic & Social Importance of Biodiversity

Due to their floristic richness, calcareous grasslands tend to be attractive sites of high landscape value. One site (Kelhead) in Dumfries & Galloway is managed as a picnic area.

5. Factors affecting the Habitat

- There is **no current survey of the extent or importance** of this habitat in Dumfries & Galloway.
- **Under-grazing** and the complete cessation of management, especially at lowland sites, can result in reversion to rank grassland and eventually closed scrub and woodland.
- **Overgrazing** can result in the loss of tall herb and shrub species.
- **Agricultural intensification**, including fertiliser use, herbicide application, ploughing and re-seeding causes damage to calcareous grasslands.
- **Development**, particularly the in-filling of abandoned limestone quarries where grassland has re-established itself, can result in loss of habitat. For example, Eaglesfield lime pits were originally targeted for infill when the upgrading of the A74 was proposed; others were lost.
- Areas of calcareous grassland have been **planted with conifers**, especially those that appear as pockets within acidic grasslands.

6. Strategic Actions

6.1 Recent and current activity

- One site, at Kelhead Quarry, is currently designated as a **Local Wildlife Site**.

6.2 Other recommended actions

- Carry out a **survey** to determine extent and quality of this habitat type in Dumfries & Galloway.
- Raise awareness of the importance of this habitat with owners and encourage **appropriate management**, including possible grazing.

NEUTRAL GRASSLANDS

Priority Action (NG1)

Restore lowland neutral grasslands.
Target: Restore 5ha by 2015.
Lead Partner: Dumfries & Galloway Biodiversity Partnership/Regional Proposal Assessment Committee.

Priority Action (NG2)

Highlight the importance of lowland meadows to land managers and the public by including them in leaflets/panels and/or guided walks/talks.
Target: 10 publications/events by 2015.
Lead Partner: National Trust for Scotland.

Hay meadow at Rockcliffe. July 2007. (Peter Norman)

1. Habitat Description

1.1 Physical Characteristics:

Semi-natural neutral (sometimes called mesotrophic) grasslands grow on well-drained fertile soil that is well balanced in nutrients. They are not heavily affected by agricultural improvement, such as extensive fertiliser use and re-seeding, and are usually managed as traditional hay meadows or pastures. They are often colourful landscape features in the summer, due to a high proportion of broad-leaved herbaceous species relative to grasses.

1.2 National and International Context

Many grasslands found on farms in the UK are now species poor and improved; grassland unaffected by agricultural improvement is rare and threatened; the majority of neutral grasslands are probably somewhere inbetween these two extremes. The total UK extent of unimproved species-rich neutral grassland is estimated to be less than 15,000ha, with less than 3,000ha in Scotland. There are less than 100ha in Dumfries & Galloway.

2. Dumfries & Galloway Status

2.1 Recent Trends

The importance of this habitat is now recognised and there is little or no deliberate conversion to more intensive uses. However, the traditional and sometimes labour intensive techniques required to manage them can be difficult to maintain, particularly with more erratic patterns of weather. As a result, neglect is often the greatest threat.

2.2 Current Distribution

Unimproved neutral grasslands are now restricted to occasional, often isolated, field edges where remnants of former hay meadows can be found. Areas such as steep banks, which cannot be intensively managed for agriculture, may contain remnant unimproved grassland, but these sites are vulnerable to scrub invasion. Small areas are also found on road verges and other urban sites.

2.3 Site Examples

The best example is found at **Lag Meadow** (SSSI) in Nithsdale, but even here the small size and ground conditions make hay cutting difficult.

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with neutral grasslands, and the following action plans may also contain relevant information: Calcareous Grasslands, Acid Grasslands, Agriculturally Improved Grasslands.

3. Importance for Associated Species

3.1 Flowering Plants (very high importance)

Plants such as Yellow Rattle *Rhinanthus minor* and Meadow Cranesbill *Geranium pratense* indicate lack of agricultural improvement. Other typical plants include Black Knapweed *Centaurea nigra*, Pignut *Conopodium majus*, Crested Dog's-tail grass *Cynosurus cristatus*, Dyer's Greenweed *Genista tinctoria*, and several orchid species: Northern Marsh Orchid *Dactylorhiza purpurella*, Fragrant Orchid *Gymnadenia conopsea* and Common Twayblade *Listera ovata*. Locally scarce plants include Melancholy Thistle *Cirsium heterophyllum* and Upright Vetch *Vicia orobus* and Lesser Butterfly Orchid *Platanthera bifolia*. whilst Spignel *Meum athamanticum* may be locally common, but has a restricted UK distribution.

Crested Dog's-tail, a common grass of neutral grasslands. (Peter Norman)

3.2 Fungi and Lichens (high importance)

Species characteristic of unimproved grasslands include scarce species such as Pink Meadow Waxcap *Hygrocybe calyptriformis*. Genera with most or all of their species in grasslands include the waxcaps *Hygrocybe spp.*, pinkgills *Entoloma spp.,* earthtongues *Geoglossaceae* and *Dermoloma spp.*

Agricultural intensification has a more rapid and more drastic effect on fungi than on flora. Application of artificial fertilisers and liquid manure has been shown to eradicate many species within one year and all but a few others within five years. Once fertilised and improved for agriculture, such sites require at least 30 years to recover their grassland fungi. A few well-known species such as the Field Mushroom *Agaricus campestris* and the Giant Puffball *Calvatia gigantea* (which produces some of the largest fruitbodies of all British fungi reaching 70cm or more across) are able to withstand some fertilisation.

Common Green Grasshoppers create the sound of summer meadows. Langholm, July 2005. (Peter Norman)

3.3 Invertebrates (medium importance)

Management of grasslands as hay meadows is not ideal for many invertebrates as most larval foodplants are cut and removed all at once. However, species such as grasshoppers are able to exploit the short-term cover provided by the grasses and large numbers of pollen and nectar-feeding insects, such as bees, butterflies and hoverflies may visit during the flowering period. Earthworms occur at high densities and play a significant role in the ecology of neutral grasslands, mixing the soil, improving drainage and assisting in the decomposition of dead material.

3.4 Birds (low importance)

The demise of unimproved neutral grasslands is the principal reason for the almost total disappearance of Corncrakes *Crex crex* from the UK mainland. The last regular breeding in Dumfries & Galloway was in the 1980s. Today, Skylarks *Alauda arvensis* are the main nesting species, whilst Barn Owls *Tyto alba*, finches and other birds feed on the abundant small mammals, seeds or invertebrates associated with this habitat.

3.5 Mammals (low importance)

Field Voles *Microtus agrestis* may reach high densities during the summer. Hedgehogs *Erinaceus europaeus* and Moles *Talpa europaea* take advantage of the worm-rich soils.

4. Environmental, Economic & Social Importance of Biodiversity

- Most neutral meadows survive in a highly valued landscape of hedges and small woods, or in upland fringe landscapes with stone walls and moorland.

5. Factors affecting the Habitat

- **Commercial improvement** of pasture by drainage, ploughing, reseeding, and the application of inorganic fertilisers and herbicides has been shown to adversely affect floristic richness even at low levels of application.
- Increased **use of slurry**, which unlike traditional, occasional, light applications of farmyard manure and lime, is detrimental to floristic richness.
- The change from hay to **silage production** involves more frequent cutting, which reduces seeding opportunities for plants and disrupts the breeding of birds and other animals.
- The change from mowing to spring and summer **grazing** resulting in the loss of those meadow plants and animals which are intolerant to summer grazing and adapted to traditional cutting management.
- **Abandonment and neglect** results in gradual reversion to rank grassland dominated by False Oat-grass and eventually reversion to scrub or secondary woodland of lesser nature conservation value.
- Remaining sites are **small and highly fragmented**.

6. Strategic Actions

6.1 Recent and current activity

- Traditional hay meadow management is still practised on a few sites.

6.2 Other recommended actions

- Develop a fuller **understanding of restoration techniques** with the aim of expanding remnant patches of unimproved neutral grassland.
- **Train farmers** to recognise valuable grasslands on their farms and to link with management advisory services such as FWAG.
- Following an assessment of the likely impacts, **restore traditional management** techniques to sites where this is possible.
- Consider the feasibility of **creating new neutral grasslands** by reducing soil fertility and direct seeding of wildflowers.

Rattling ripe seed pods of Yellow Rattle once indicated harvest time. Kirkconnel, July 2007. (Greg Baillie)

ACID GRASSLANDS

Priority Action (AG1)

Restore lowland dry acid grasslands.
Target: Restore 6ha by 2015.
Lead Partner: Dumfries & Galloway Biodiversity Partnership/Regional Proposal Assessment Committee.

Priority Action (AG2)

Raise awareness of the importance of extensive areas of upland acid grassland, especially for birds, by including information on interpretation leaflets/panels and/or guided walks/talks.
Target: 10 interpretation leaflets/panels and/or guided walks/talks by 2015.
Lead Partner: RSPB.

Upland acid grasslands are typically extensive. Upper Nithsdale, June 2007. (Greg Baillie)

1. Habitat Description

1.1 Physical Characteristics:

Acid grasslands occur on soils with pH ranging from 4 to 5.5 derived from acid rocks such as sandstones, acid igneous rocks and on superficial deposits such as sands and gravels **Upland acid grassland**, which has low floristic diversity, is by far the most abundant type. It is usually managed as unenclosed rough grazing. **Lowland dry acid grassland** typically occurs below c300m on nutrient-poor, generally free-draining soils and is more likely to be enclosed than in the uplands, but is also normally managed as pasture.

Rock exposures and **springs and flushes** add considerably to the biodiversity of acid grasslands. They are the subject of separate action plans.

1.2 National and International Context

Acid grassland is probably one of the most extensive semi-natural habitats in Britain, yet little is known about its true extent or conservation management requirements, especially in the lowlands. Estimates suggest that there is in excess of 1,200,000ha of acid grassland in upland UK areas, with 743,000ha in Scotland. In the lowlands it is unlikely to exceed 30,000ha with only 5000ha in Scotland. The exact extent of acid grassland in Dumfries & Galloway is not currently known

2. Dumfries & Galloway Status

2.1 Recent Trends

Loss of acid grasslands to new afforestation has occurred at a much reduced level since the 1980s.

2.2 Current Distribution

Large expanses of uniform acid grassland are found throughout the uplands. Small patches of acid grassland are found less frequently in widely scattered lowland areas.

2.3 Site Examples

Extensive upland acid grassland examples include **Merrick-Kells Hills** (SAC/SSSI), **Moffat Hills** (SAC/SSSI) and **Cairnsmore of Fleet** (SSSI/NNR).

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with acid grasslands, and the following action plans may also contain relevant information: Upland Springs and Flushes, Upland Heaths, Inland Rock Outcrops. In many cases, the presence of other habitats in a mosaic with acid grassland is critical to the overall biodiversity of an area.

3. Importance for Associated Species

3.1 Birds (very high importance)

The typical upland acid grassland birds are Skylarks *Alauda arvensis* and Wheatears *Oenanthe oenanthe,* the latter favouring areas with **rock exposures**. Ring Ouzels *Turdus torquatus* may also occur in rocky areas.

Several species of high conservation importance occur at low densities, but require extensive areas of the habitat in order to persist. Extensive sites form an important part of the territories of birds such as Golden Eagles *Aquila chrysaetos,* Red Kites *Milvus milvus,* Hen Harriers *Circus cyaneus,* Merlins *Falco columbarius* and Barn Owls *Tyto alba.* Breeding waders may include Curlews *Numenius arquata,* Lapwings *Vanellus vanellus,* Snipe *Gallinago gallinago and* rarely Golden Plovers *Pluvialis apricaria.* Black Grouse *Tetrao tetrix* also use the habitat where it is part of a mosaic with heathland, scrub and woodland.

Hen Harriers nest in heathland but hunt over extensive upland grasslands. (Steven Round)

3.2 Invertebrates (medium importance)

Acid grasslands are poorer than calcareous sites for invertebrates, though the difference is not as marked as for flowering plants. Recent work on invertebrate fauna of Dumfries & Galloway suggests that although diversity is low, a few species are locally or nationally rare. Scotch Argus butterflies *Erebia aethiops* are reasonably common in the region on lightly grazed or ungrazed acid grasslands, but they are known from only two sites south of the border. The larvae of Small Purple-barred moths *Phytometra viridaria* feed on Heath Milkwort and possibly Lousewort, and have been recorded on a few sites in the region.

3.3 Fungi and Lichens (high importance)

Unimproved, well-drained acid grasslands can be rich in fungi, including many species of waxcap *Hygrocybe*, *Entoloma* and *Dermoloma*.

Field Voles runs - more often seen than the animals themselves. Morton Loch, February 2007. (Peter Norman)

3.4 Mammals (medium importance)

Field Voles *Microtus agrestis* can occur in enormous numbers on acid grasslands, so long as they are not heavily grazed. Populations tend to cycle wildly over 3-5 years, which has a knock-on effect on the populations of predators.

3.5 Flowering Plants (medium importance)

Lowland sites can be species rich, but most of the uplands consists of species-poor swards. Grasses such as bents *Agrostis* spp., fescues *Festuca* spp., and Mat Grass *Nardus stricta* commonly occur, and Purple Moor Grass *Molinia caerulea* is abundant in wetter areas. Typical herbs include Tormentil *Potentilla erecta*, Heath Bedstraw *Galium saxatile*,

Tormentil, perhaps the most characteristic flower of acid grasslands. (Peter Norman)

Harebell *Campanula rotundifolia*, hawkweeds *Hieracium* spp., milkworts *Polygala* spp., and Eyebright *Euphrasia* spp. Plants such as Heath Spotted Orchid *Dactylorhiza maculata*, Mountain Pansy *Viola lutea*, and Green-ribbed Sedge form interesting assemblages in Dumfries & Galloway.

3.6 Reptiles and Amphibians (low importance)

Common Lizards *Zootoca vivipara* are associated with this habitat.

3.7 Non-flowering Plants (low importance)

Mosses and liverworts occur in low density in most acid grasslands, but interesting species can still sometimes be found in otherwise species poor swards. **Rock exposures** considerably add to the interest.

4. Environmental, Economic & Social Importance of Biodiversity

- The main hillwalking routes in Dumfries & Galloway pass principally through upland acid grasslands.
- Upland acid grasslands have often resulted from a degradation of heathland. Some are capable of restoration to this habitat, including commercial grouse moors. Once afforested or otherwise converted, restoration of such moors is very much more difficult or even impossible.

5. Factors affecting the Habitat

In the lowlands the habitat is affected by:

- **Agricultural intensification**, particularly fertilisation, ploughing and drainage.
- Lack of **grazing** leading to an invasion by coarse grasses and scrub.
- Change in agricultural production to **silage** production.

In the uplands the main causes of change are:

- **Inappropriate grazing** regimes (sheep, cattle, deer), typically excessive grazing at the wrong time of year.
- **Inappropriate muirburning** can lead to habitat deterioration and destroy the nests of ground nesting birds.
- **Inappropriate forestry** planting can threaten species of high conservation concern.
- **Abandonment and neglect** leading to encroachment by bracken.
- **Liming, ploughing and re-seeding** around the lower fringes of upland areas.
- **Windfarms** can result in direct loss of habitat through turbine bases and associated infrastructure.

6. Strategic Actions

6.1 Recent and current activity

- **RSPB** has identified upland areas that are important for birds, particularly those that are sensitive windfarm developments.

6.2 Other recommended actions

- From aerial photographs and previous survey work, **identify acid grasslands** in Dumfries & Galloway that are capable of restoration, either to high quality grasslands or other high biodiversity habitats.
- Ensure **minimal reduction in habitat** area due to other land uses such as forestry.
- Through restoration, aim to **link of fragmented remnants** of acid grasslands with each other and with other habitats.
- Promote appropriate management of acid grassland habitat through **advice to landowners.**
- Ensure that the progress made in implementation and other information relevant to the habitat is disseminated in existing **newsletters and circulars**.

INLAND ROCK OUTCROPS

Priority Action (IRO1)

Expand populations of rare and scarce species on inland rock outcrops.
Lead Partner: Scottish Natural Heritage.

Parsley Fern on scree slopes amongst Heather. Mennock Pass, August 2007. (Peter Norman)

1. Habitat Description

1.1 Physical Characteristics

Inland rock outcrops form a near-natural habitat. Variation is related to aspect, altitude, soil conditions, but especially rock type. **Rock faces** support only species capable of survival in a hostile environment, but **rock ledges**, particularly those in the uplands with base-rich substrates that are inaccessible to grazing, are extremely valuable for a range of species. **Upland seepages** not only add moisture to rock faces and ledges but tend to be relatively nutrient rich in comparison to the surrounding land because they have accumulated nutrients leached down through the bedrock. Base-rich seepages are especially valuable.

Screes occur where weathered rock falls onto adjacent slopes. The rocks are usually angular but can range from small stones through to boulders and large blocks. Screes made of smaller stones tend to be more mobile, but even large blocks may be slowly moving downslope. They are generally well-drained habitats but, as they occur in areas of high rainfall, drought is rarely a problem. However, nutrients are also carried down the slope with the water.

Natural **caves** provide unique environments. Shallow caves and cave entrances possess many similar qualities and species to the exterior rock that surrounds them, but the deeper the cave goes, the greater the change becomes. Light levels drop sharply and temperature and humidity levels become much more stable, which allows a small but highly specialised fauna to exist.

1.2 National and International Context

This habitat occurs widely across Europe, but is very localised in distribution, predominantly in upland areas. Due to the fragmented nature of this habitat and its often near vertical structure, an accurate assessment of its extent, both nationally and locally, is almost impossible to achieve.

2. Dumfries & Galloway Status

2.1 Recent Trends

There has been little recent change to inland rock outcrops.

2.2 Current Distribution

Due to the nature of the geology, most natural inland rock outcrops occur in the uplands in the north of the region. Also the geology means that there are few deep natural caves that are large enough to be explored by people.

2.3 Site Examples

Granite outcrops include the **Dungeon Hills**, **Craignaw**, and **Clints of Dromore and Spout o' the Clints** (SSSI/NNR). Other notable rock outcrops include **Cairnbaber** (SSSI) **Glenwhargen Craig**, and several sites in the **Moffat Hills** (SSSI). **Crichope Linn** contains important sandstone outcrops.

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with inland rock outcrops, and the following action plans may also contain relevant information: Upland Springs and Flushes, Coastal Cliffs and Slopes, Quarries and Mineral Workings.

3. Importance for Associated Species

3.1 Flowering Plants (very high importance)

Vegetation of inland rock outcrops is characteristically

discontinuous and sparse. Typical species of upland rock **ledges** include Great Woodrush *Luzula sylvatica,* Wood Crane's-bill *Geranium sylvaticum,* Water Avens *Geum rivale* and Wild Angelica *Angelica sylvestris.* Juniper *Juniperus communis,* Aspen *Populus tremula* and Rowan *Sorbus aucuparia* may also become established on these ledges, and even in narrow cracks on vertical **rock faces**, though the latter is generally poor for flowering plants.

Botanists have long recognised the outstanding importance of upland rock **ledges** as a habitat for a diversity of nationally rare and scarce plants. They are of particular importance where water from **upland seepages** trickles over rocks. The following species are mostly confined to the Scottish Highlands, with only small populations in the Lake District, the Pennines, North Wales and at a few locations in Dumfries & Galloway: Alpine Cinquefoil *Potentilla crantzii,* Alpine Sawwort *Saussurea alpina,* an eyebright *Euphrasia frigida*, Black Alpine Sedge *Carex atrata*, Hair Sedge *Carex capillaris*, a lady's mantle *Alchemilla wichurae,* Purple Saxifrage *Saxifraga oppositifolia,* Roseroot *Sedum rosea,* Mountain Sorrel *Oxyria digyna* and Alpine Meadow-rue *Thalictrum alpinum.*

Screes colonise with flowering plants only very slowly, if at all. However, plants of more stable screes include Bell Heather *Erica cinerea* and Heath Bedstraw *Galium saxatile*. A few screes, such as in Scaur Glen, have been colonised by Hazel *Corylus avellana* and other scrub species.

3.2 Non-flowering Plants (very high importance)

Oblong Woodsia *Woodsia ilvensis* is one of Britain's rarest ferns, and was reduced almost to extinction by Victorian collectors in the Moffat Hills. It has subsequently been reintroduced, but remains highly threatened. Holly Fern *Polystichum lonchitis* also occurs on base-rich rock **ledges** and crevices in the Moffat Hills, its only site in the south of Scotland.

Inland rock ledges and outcrops are also important for mosses and liverworts. The typical habitat of Narrow-leaved Fringe-moss *Racomitrium aquaticum* is vertical siliceous **rock faces** on exposed or shaded mountain crags or in gorges, whilst Upright Brown Grimmia *Schistidium strictum* is a moss of exposed rock faces on upland crags. It is scarce south of the Highlands. Toothed Pouncewort *Drepanolejeunea hamatifolia* is a liverwort with a very limited global distribution, but has been recorded on crags near Loch Dungeon. Sandstone has good moisture holding capacity and can therefore be rich in mosses and liverworts.

Mobile **screes** are poor for ferns and bryophytes, with Parsley Fern *Cryptogramma crispa* and Woolly-fringe Moss *Racomitrium languginosum* being the most obvious species. However, more stable screes composed of larger stones, and especially block screes, support many species in moist nooks and crannies that are similar to those found in woodland.

3.3 Birds (very high importance)

Several birds of prey use **rock ledges** as nesting sites, especially Golden Eagles *Aquila chrysaetos*, Peregrines *Falco peregrinus*, Kestrels *Falco tinnunculus* and occasionally Buzzards *Buteo buteo* and Merlins *Falco columbarius*. Many of the same rock faces are used by nesting Ravens *Corvus corax*.

Peregrine. (Laurie Campbell)

Ring Ouzels *Turdus torquatus* have declined rapidly in Dumfries & Galloway, with just a few pairs now breeding in the east of the region. They particularly favour crags, gullies, **screes** and boulder fields, especially those overhung with heather and scattered trees. Wheatears *Oenanthe oenanthe* are also typical of scree slopes.

3.4 Invertebrates (medium importance)

In **upland seepages** where shallow trickles or films of water run over rock exposures, the rock surface will generally have an algal film growing on it, and this forms the base of the food chain for a small, but exceptionally specialised invertebrate assemblage. There may also be a scattering of other plants, especially mosses and liverworts that are inhabited by some of the invertebrates that constitute this assemblage.

Red Carpet moths *Xanthorhoe decoloraria* are known from only a few sites in the region, but are probably common wherever Lady's-mantle, the larval foodplant, occurs on exposed rocks in moorland. **Cave** life is largely unexplored in the region but at least 35 species of UK invertebrate are known to be restricted to such habitats.

3.5 Reptiles and Amphibians (medium importance)

Although inland **rock ledges** and outcrops may appear inaccessible to reptiles, Adders *Vipera berus* and Common Lizards *Zootoca vivipara* do manage to find their way onto these sites and south facing ledges and outcrops form ideal basking sites. Holes under rocks and **screes**, and narrow **caves** may also be used as hibernacula.

3.6 Mammals (medium importance)

Much of the biodiversity of **rock ledges** and outcrops results from the fact that they are free from mammalian grazers and predators. However, where **caves** occur, particularly deeper ones, they can be very important roosting and hibernation sites for bats.

3.7 Fungi and Lichens (medium importance)

Inland rock outcrops support many lichens but, unlike flowering plants, they are not susceptible to grazing. Therefore, the type of rock and its location/ aspect is more important than its accessibility to grazing animals, and rare species are not confined to inaccessible ledges and faces. Rocks on **scree** slopes may be subject to frequent movement, making lichen establishment more difficult.

Cudbear lichen Ochrolechia tartarea. (Peter Norman)

4. Environmental, Economic & Social Importance of Biodiversity

Inland rock outcrops add considerably to the landscape, often forming the most dramatic feature of an area.

5. Factors affecting the Habitat

- **Rock climbing** can accidentally disturb nesting birds or damage flora. Some birds, and occasionally plants, are subject to deliberate illegal disturbance and theft.
- **Stone removal** for agricultural or recreational purposes such as track/path building could damage biodiversity and geological features. However, there is no evidence that historical stone removal for drystone dyking has had a major impact.
- Some livestock and especially **feral goats** are agile enough to reach inland rock outcrops not accessible to other herbivores. They may therefore restrict the distribution of some plants in the Moffat and Galloway Hills.
- Agricultural practices such as **grazing, fertiliser and herbicide treatment**, and stock feeding can seriously damage the biodiversity of inland rock outcrops. Bracken spraying needs to be carefully planned to avoid damage to scree communities.

6. Strategic Actions

6.1 Recent and current activity

- An action programme is underway for the restoration of Oblong Woodsia populations co-ordinated by **Royal Botanic Garden Edinburgh**.
- Monitoring of Ravens, Peregrines and other crag nesting birds of prey is carried out by the **Dumfries & Galloway Raptor Study Group.** Sites prone to disturbance receive special protection.
- The **National Trust for Scotland** relays live CCTV images of nesting Peregrines to its visitor centre at Grey Mare's Tail.
- The **Mountaineering Council of Scotland** has produced an information sheet about birds and climbing, which contains guidance on responsible climbing.

6.2 Other recommended actions

- Examine **grazing levels** in key locations to assess whether modifications to rates and timing and/or use of exclosures might lead to an expansion of rock ledge communities.
- Negotiate **reasonable access restrictions** with climbing organisations on specific sites at specific times of year where recreational disturbance is known to be a problem.
- Ensure that all new **cycle and footpaths avoid disturbance to important areas** for breeding birds.

MONTANE MOSS-HEATHS

Priority Action (MMH1)

Reduce grazing pressure on montane moss-heaths where this is considered necessary.
Lead Partner: Scottish Natural Heritage/Forestry Commission Scotland/National Trust for Scotland.

1. Habitat Description

1.1 Physical Characteristics

Montane Moss-heaths are found in areas above the natural level of tree growth where conditions approach most closely to those of Arctic regions. This is around 600m above sea level throughout much of the uplands of Scotland, though can occur at lower altitudes where an oceanic climate produces exceptionally cool, cloudy summers and frequent strong winds. In these areas grass and heather give way to habitats dominated by mosses, club-mosses and lichens. Carpets of **moss-heath**, dominated by Woolly-Fringe Moss, are frequent.

Woolly-fringe Moss cannot tolerate prolonged deep snow cover. Hollows where snow accumulates and lies for long periods support an even more specialist **snow-bed** habitat of grasses, sedges, mosses and liverworts. Sparsely vegetated **stony areas and rocks** are also common on montane heaths.

1.2 National and International Context

Montane moss-heaths have a restricted European distribution, but occur extensively in Norway, Iceland, Greenland, Russia and Canada. Over 90% of the 600,000ha of montane habitat in the UK are in Scotland, mostly in the Highlands, especially the Cairngorm Mountains. The area of montane moss-heath in Dumfries & Galloway is not accurately known. Little of the land above 600m supports montane heath vegetation, probably less than 100ha.

2. Dumfries & Galloway Status

2.1 Recent Trends

The small remaining areas of montane moss-heath have continued to be adversely affected by grazing pressure, with added recent pressures from hill-walking, mountain-biking, quad/trail bikes, potential infrastructure developments and climate change.

2.2 Current Distribution

This habitat is limited to small areas on the highest hills of Dumfries & Galloway, mostly in the Moffat, Carsphairn and Galloway ranges. There are few long-lying snow-beds in the region. In areas where winter snow accumulates, although the vegetation may be modified, only rarely does it approach the species composition of the specialist communities found further north.

2.3 Site Examples

The Merrick-Kells and Moffat ranges hold some of the best developed and largest areas of montane moss-heath south of the Highlands. Good examples are found on **Corserine** (SAC/SSSI) and **White Coomb** (SAC/SSSI). Other examples occur on **Beninner, Moorbroch, Cairnsmore of Carsphairn, Cairnsmore of Fleet** (NNR and SSSI) and **Lamachan**.

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with montane moss-heaths, and the following action plans may also contain relevant information: Acid Grasslands, Upland Heaths, Montane Scrub, Upland Springs and Flushes, Inland Rock Outcrops.

Woolly Fringe-moss Racomitrium lanuginosum. White Coomb, July 2007. (Peter Norman)

3. Importance for Associated Species

3.1 Non-flowering Plants (very high importance)

Late-lying **snow-beds** and **moss-heaths** have characteristic bryophyte communities. Woolly-Fringe Moss *Racomitrium languginosum* is well adapted to montane conditions, deriving all its nutrients from rain and mist and able to withstand total drought for up to a year. Other moss heath species, though not restricted to this habitat, include Broom Fork Moss *Dicranum scoparium,* Little Shaggy-moss *Rhytidiadelphus loreus,* Glittering Wood-moss *Hylocomium splendens,* Red-stemmed Feather-moss *Pleurozium schreberi* and Fir Clubmoss *Huperzia selago*. The rare *Splachnum vasculosum,* recorded in the Galloway Hills in 1957 and 1985 is sometimes associated with such conditions. Liverworts include Alpine Rustwort *Marsupella alpina* and Notched Rustwort *M. emarginata.*

3.2 Fungi and Lichens (high importance)

A diverse range of lichens is associated with montane heath including Reindeer 'Moss' *Cladonia arbuscula* and Iceland 'Moss' *Cetraria islandica*. Fungi associated with snow-melt are known from the Alps and have recently been discovered in the Scottish Highlands and the Lake District. Some may also occur in Dumfries & Galloway.

3.3 Invertebrates (high importance)

Despite the hostile environment, a number of invertebrates specialise in moss-heath habitats, although few are totally restricted to this habitat: A money spider *Hilaira frigida* is found beneath **rocks** on the summits of mountains, a nationally scarce fly *Alliopsis atronitens* is found in **moss-heath** and **snow-bed** communities in the Moffat Hills, and a ground beetle *Carabus glabratus* is an exclusively montane species. The nationally rare Broad-bordered White Underwing moth *Anarta melanopa,* a day-flying species recorded from **moss-heath** on the Moffat and Galloway Hills, is known from just one site south of Dumfries & Galloway.

3.4 Flowering Plants (medium importance)

Though montane heaths have a low diversity of flowering plants a number of important species occur. Species present include Wavy Hair-grass *Deschampsia flexuosa* Stiff Sedge *Carex bigelowii*, Dwarf Willow *Salix herbacea,* Heath Bedstraw *Galium saxatile* and Mountain Crowberry *Empetrum nigrum* subsp. *hermaphroditum*.

3.5 Birds (medium importance)

Few birds breed in this hostile environment. Dotterels *Charadrius morinellus* have occasionally been found breeding, but are easily overlooked and most likely to be seen on their spring migration; Golden Plovers *Pluvialis apricaria* also breed in such habitats though elsewhere in the UK are more common on lower moorlands; Snow Buntings *Plectrophenax nivalis* are scarce non-breeding visitors. Perhaps only the occasional Skylark *Alauda arvensis,* Meadow Pipit *Anthus pratensis* and Wheatear *Oenanthe oenanthe* are regular breeders. Other birds, such as Golden Eagles *Aquila chrysaetos* and Merlins *Falco columbarius* visit montane heaths to hunt and swifts often feed low above montane heath.

3.6 Reptiles and Amphibians (low importance)

Remarkably, Common Frogs *Rana temporaria* on montane heaths are not uncommon. However, the habitat is generally of low importance for reptiles and amphibians.

Common Frog, (Paul McLaughlin)

3.7 Mammals (low importance)

Mountain Hares *Lepus timidus* occasionally feed on montane heaths.

4. Environmental, Economic & Social Importance of Biodiversity

Monitoring of montane heath may provide a good indicator of climate change.

5. Factors affecting the Habitat

Poor soils and extreme climate render montane heath unsuitable for forestry or intensive agriculture. However, the shallow soils, the restricted growing season, and the fragmented distribution render montane areas especially vulnerable to:

- **Overgrazing** by sheep, goats and deer which has caused the loss of much montane heath by conversion to grazing-tolerant grasses. Heavy grazing may also result in **nutrient enrichment** and **physical uprooting** of plants.
- Increasing **recreational pressure** from walkers and mountain bikes causing damage to the fragile vegetation and soils.
- **Quad bikes,** even a single journey, can cause significant damage.
- **Fires** spreading from the sub-montane zone causing destruction of soils and vegetation.
- The long-term effects of pollution such as **acidification** and global warming may result in the loss of species that will be unable to recolonise.
- **Developments** such as radio masts and wind farms have the potential to cause substantial damage.
- **Climate change** has the potential to totally wipe out this habitat in Dumfries & Galloway; a process that may already be underway.

6. Strategic Actions

6.1 Recent and current activity

- Monitoring of the impact of hill-walking and grazing on montane heath at White Coomb by the **National Trust for Scotland**.
- A PhD study entitled 'Assessing the potential for recovery of degraded montane heaths" was begun in 2006, funded by SNH and supervised by **Aberdeen University, SNH, Macaulay Land Use Research Institute** and the **Centre for Ecology & Hydrology**. It will assess the current condition of UK montane heath and whether a decrease in grazing will allow successful recovery of degraded heaths.

6.2 Other recommended actions

- Carry out **surveys** to identify areas of near natural montane communities.
- **Protect from inappropriate development**.
- **Discourage disturbance** and damage from inappropriate forms and levels of use, including vehicles and recreational pressure.
- Ensure that **Galloway Military Training Area excludes vulnerable zones and times**.
- Ensure that organised events (e.g. mountain marathon, orienteering etc.) consult with relevant organisations to **minimise damage to vulnerable zones**.
- Consider the need for studies to **investigate the effects of acid deposition** on montane communities.

Fir Clubmoss. White Coomb, Moffat Hills, May 2007. (Peter Norman)

UPLAND HEATHS

Priority Action (UH1)

Restore an extensive area of upland heath for biodiversity.
Target: Restore 3000ha by 2017.
Lead Partner: Langholm Moorland Demonstration Project/Regional Proposal Assessment Committee.

Managed heather mosaic. Mennock Pass, August 2007. (Peter Norman)

1. Habitat Description

1.1 Physical Characteristics

Upland heaths are characterised by the presence of dwarf shrubs on nutrient poor mineral soils, peaty podsols or shallow peat (less that 0.5m deep). Heath vegetation on deep peat is generally regarded as bog.

Upland heaths are found below the montane zone but above the upper edge of enclosed agricultural land. For much of Britain this is between 300m and 600m above sea level, though descending to near sea level in northern Scotland. Heathland is usually found in areas with over 100cm of precipitation a year and it is often part of a mosaic of habitats with blanket bog, grassland, scrub, woodland and rock habitats.

The variation in the vegetation communities of upland heaths is broadly linked to climate, but is also influenced by factors such as geology, altitude, aspect, slope, maritime influences and management practices (including grazing pressure and burning regime). **Dry heaths** occur on freely draining acid to neutral soils. Typical shrub species include Heather, Blaeberry, Crowberry and Bell Heather. **Wet heaths** are more commonly found in the north and west where the climate is damper. Here typical plant species are Cross-leaved Heath, Heather, Deer Grass and Purple Moor Grass, with a carpet of mosses including *Sphagnum* species.

1.2 National and International Context

Upland dwarf-shrub heaths have international conservation significance and are largely confined to the British Isles and the western seaboard of Europe. There is approximately 3.7 million hectares of upland heath habitat in the UK, 2,514,000ha of it in Scotland. This is land with at least 25% heather cover, but 1.6 million hectares of it is estimated to have less than 50% heather dominance. An estimated 100,000ha of upland heathland is found in Dumfries & Galloway. This includes the most extensive area of upland wet heath in the UK south of the Highlands.

2. Dumfries & Galloway Status

2.1 Recent Trends

Although loses to forestry have declined in recent years, areas of upland heathland have continued to be replaced with grassland, due to loss of heather cover.

2.2 Current Distribution

Heathland is found throughout the Southern Uplands, but due to geology, climate and land-use history the best quality and most extensive areas are located in the east of the region.

2.3 Site Examples

Good examples of upland heath are to be found on the **Lowther Hills** (SPA/SSSI), with extensive

areas also on the **Langholm Hills** (SPA/SSSI). Further west, the heaths tend to be wetter and more fragmented, generally with less Heather cover. **Merrick-Kells Hills** (SAC/SSSI) includes many sites, such as on Corserine, but the most extensive upland heath in west is on **Glen App and Galloway Moors** (SPA/SSSI). Smaller areas are found at many other locations, such as **Cairnsmore of Fleet** (SSSI/NNR), **Laughenghie and Airie Hills** (SSSI), **Artfield Fell**, **Criffel** and **Glenquicken Moor**.

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with upland heaths, and the following action plans may also contain relevant information: Acid Grasslands, Blanket Bogs, Inland Rock Outcrops.

3. Importance for Associated Species

3.1 Birds (very high importance)

Upland heaths are prime habitats for a suite of breeding birds including Red Grouse *Lagopus lagopus*, Black Grouse *Tetrao tetrix*, Golden Plovers *Pluvialis apricaria*, Dunlins *Calidris alpina*, Snipe *Gallinago gallinago*, Hen Harriers *Circus cyaneus*, Merlins *Falco columbarius*, Wheatears *Oenanthe oenenthe*, Ring Ouzels *Turdus torquatus* and Twites *Carduelis flavirostris*. Most of these have declined substantially over the last 100 years, and some, such as Dunlins and Ring Ouzels, are now very rare upland heathland breeding species. Wide-ranging species such as Golden Eagles *Aquila chrysaetos* hunt over upland heaths.

3.2 Non-flowering Plants (medium importance)

The moss and liverwort community of upland heaths is strongly influenced by the stage of the heather. Many species are abundant during the pioneer phase of heather growth. For example, Compact Bog-moss *Sphagnum compactum*, a moss of **wet heaths**, is a poor competitor and usually found in open vegetation with bare ground. Some mosses have been shown to aid heather regeneration, but they decline as the heather matures, only returning as the heather begins to degenerate and gaps open in the canopy. However, at this stage they have to compete with flowering plants. Light burning can be beneficial for bryophytes, allowing the pioneer phase to begin again, but intensive burning can be very damaging, wiping out some species.

Most bryophytes of upland heaths are common species, but in the north west Highlands several species of liverwort of restricted world distribution form luxuriant mats under the heather canopy. A few of these have been recorded in Dumfries & Galloway, on Cairnsmore of Fleet and other sites. They include Lesser Whipwort *Bazzania tricrenata* and Purple Spoonwort *Pleurozia purpurea*.

Northern Eggar Moths, abundant over upland heaths in some years. Grey Mare's Tail, July 1993. (Peter Norman)

3.3 Invertebrates (high importance)

Many invertebrates are dependent on the three-dimensional structure of upland shrubs and other vegetation. Insects such as craneflies *Tipulidae* form a major part of the diet of the chicks of many moorland birds, including the Red grouse. The larvae of a large number of moths feed on Heather and Blaeberry, including Emperor Moth *Saturnia pavonia* and Northern Eggar *Lasiocampa quercus.* Sword-grass *Xylena exsoleta* is also known from moorland, as well as open woodland, though its larval foodplant is not known.

A number of uncommon species have been recorded from heaths in the region, such as the nationally scarce spider *Clubiona norvegica* on wet moorlands; a nationally scarce ground beetle *Carabus nitens* on wet upland heaths with *Sphagnum;* and a rare bee *Nomada roberjeotiana* at its only Scottish sites.

3.4 Flowering Plants (high importance)

In addition to Heather *Calluna vulgaris*, upland heaths in Dumfries & Galloway are characterised by plants such as Crowberry *Empetrum nigrum*, Blaeberry *Vaccinium myrtillus*, Mat Grass *Nardus stricta*, Red Fescue *Festuca rubra* and Sheep's Fescue *Festuca ovina*. Where they are derived from former woodland, the Heather may provide a refuge for many of the associated species of the original woodland ground layer.

Less common upland heath species in Dumfries & Galloway include Cloudberry *Rubus chamaemorus* and Lesser Twayblade orchid *Listera cordata* growing amongst or beneath Heather and Blaeberry on **wet heaths**, and Bearberry *Arctostaphylos uva-ursi,* a low shrub found on **dry heaths** over gravely or rocky ground. Dwarf Cornel *Cornus suecica,* occurs in Scotland south of the Highlands in only in a few small areas of the Moffat Hills.

3.5 Fungi and Lichens (high importance)

Some areas of upland heathland are very rich in lichen communities, including a covering of *Cladonia* species.

3.6 Reptiles and Amphibians (high importance)

Adders *Vipera berus* are the typical upland heathland reptile, but Common Lizards *Zootoca vivipara* and amphibians such as Common Frogs *Rana temporaria* also occur.

3.7 Mammals (high importance)

Mountain Hares *Lepus timidus* are charcteristic members of the upland heath community, but there is evidence of local declines. Other mammals, such as Red Deer *Cervus elaphus,* also make use of this habitat.

Mountain Hare in winter. (Laurie Campbell)

4. Environmental, Economic & Social Importance of Biodiversity

- Most upland heaths are managed as extensive grazing for livestock, and/or as grouse moors that are dependent on Heather and its associated plants and invertebrates.
- Extensive upland heaths dominate the landscapes where they occur, particularly during flowering in late summer and autumn.
- Though there is a historic tradition of collecting moorland berries, this is currently limited to a few parts of the Highlands. In Finland, an estimated 67% of the population pick these resources; in Sweden it is the basis of a significant rural business; whilst in Norway the health authorities are so convinced of the benefits that they have produced maps of good berry-picking areas.

5. Factors affecting the Habitat

- **Overgrazing** of sheep and Red Deer, especially on newly burnt areas, is incompatible with maintaining upland heather cover and diversity.
- **Heather Beetles** may be increasing, along with the frequency of beetle outbreaks. It is believed that heather beetle is more likely to kill old heather or heather that has been stressed by drought, heavy grazing, trampling etc.
- **Poorly managed muirburn** causing simplification of vegetation structure, loss of lower plant assemblages and erosion of peat.
- **Conversion to more intensive forms of agriculture**, through drainage of wet heath and moorland 'gripping', ploughing, reseeding, liming and fertilisation, particularly at lower elevations.
- **Encroachment of bracken** reduces the biodiversity value of the habitat.
- Replacement of heathland with **forestry** has taken place in the past, but is now controlled by national forestry policy.
- The **development** of wind farms and associated access tracks is an increasing threat.
- **Hillwalkers and mountain bikes** can cause localised erosion.
- **Acidification** from atmospheric deposition may lead to habitat degradation.

- **Heath Star Moss** *Campylopus introflexus*, an introduced species from the southern hemisphere first discovered in Britain in 1941, has spread rapidly over heathland throughout the country and threatens native mosses and liverworts.

6. Strategic Actions

6.1 Recent and current activity

- The Linking the Ling Project, led by the **Heather Trust** has worked with landowners on demonstration sites in Nithsdale, and uses these to promote good management practice.
- The Black Grouse Recovery Project, led by **RSPB**, has heathland restoration and enhancement as an important prescription for key Black Grouse leks. Work undertaken in both Galloway and Nithsdale on upland heaths.
- **SNH**'s Moorland Management Scheme provided funding for the management of designated sites. This is now incorporated into the Scottish Rural Development Programme.
- The Langholm Moor Demonstration Project, an ambitious and innovative 10-year moorland restoration project that aims to integrate grouse, raptors, biodiversity and other land use interests was begun in 2007. It is supported by **The Buccleuch Group, SNH, The Game and Wildlife Conservation Trust, RSPB** and **Natural England.**

6.2 Other recommended actions

- **Restore, extend and enhance** upland heaths as part of upland mosaics and transitions of semi-natural and natural habitats appropriate to soils and climate. An upland heathland mosaic with grassland, scrub, flower-rich areas, boggy pools, *Sphagnum* lawns, flushes, wet peat and seepages will benefit a wide range of invertebrates and birds. Maintain as much structural diversity as possible.
- Identify opportunities for restoration in **Forest Design Plans** and restocking proposals.
- Encourage measures that **reverse habitat fragmentation**.
- Use **demonstration sites** to provide advice on best management and restoration practices for upland heaths. Promote advice on good muirburn practices.
- **Encourage studies** to investigate the effects of acid deposition.
- **Minimise disturbance** from activities such as off-road cycling or use of motor bikes or 4-wheel drive vehicles, especially at fragile higher altitude sites. A small amount of localised ground disturbance is beneficial to some species.
- **Raise public awareness** of upland heathland through guided walks, talks, publications, press releases, and environmental education opportunities.
- **Raise landowner awareness** of the importance of upland heathland.

Heather provides nectar for many bees, hover-flies and in this case a robber-fly. Wanlockhead, August 2007. (Peter Norman)

NATIVE WOODS

There are separate Habitat Action Plans for all the main types of native woodland in Dumfries & Galloway: wet woods, oak woods, Ash woods, birch woods, and scrub woods. In reality, most woods are composed of mixed broadleaved trees and stands of all woodland types can occur in close proximity and intergrade with each other. Oaks are common in many local woods, especially on sloping ground, but often with birches on the higher ground and Ash at the base of the slope. The following information applies to all woodland types, and should be read in conjunction with the individual Habitat Action Plans.

1. Habitat Description

1.1 Physical Characteristics

Native tree and shrub species are those that formed the original natural woodland cover of an area before the influence of man. Although all woods in the UK have been modified by people, native woods are those that are still composed predominantly of native species of trees and shrubs. These woods are of greatest value for biodiversity because the wildlife associated with them has evolved with them over many centuries, sometimes becoming highly adapted and highly dependent on this habitat. Although trees such as Norway Spruce and Silver Fir occurred naturally in Britain prior to the last ice age, they are not considered native as they have not evolved with native British wildlife over the last 10,000 years.

Semi-natural woods are those that have grown up from natural regeneration or vegetative regrowth; they have not been planted by man. However, semi-natural native woods are much more than simply groups of trees. The soils, bacteria, fungi, plants and animals are as much a part of woodland as the trees, and it is possible for woods to survive temporarily, as many have demonstrated during their history, without any standing trees.

From a biodiversity perspective, **ancient woods** are the most important type of native wood. These woods grow on sites that have been continuously wooded for many centuries, and are therefore most likely to support specialised woodland species. In England, woods are considered to be ancient if they can be traced back to at least 1600. In Scotland, documentary evidence dating this far back is rarely available, so all present day woods that were also shown on General Roy's Military Survey of Scotland (1747-1755) and the First series of Ordnance Survey (c1860), are considered to be ancient. However, the best way of assessing the age of a wood is through local ecological, archaeological and historical research.

Most woods consist of a ground layer of leaf litter, mosses and other plants; a field layer of wild flowers and ferns; a shrub layer or understorey of low growing woody shrubs such as Hazel and Hawthorn; and a canopy of tree boughs and leaves. In some woods one or more of the layers may not be well developed. In upland woods, for example, the ground layer is often well developed but the field layer and understorey is frequently poorly represented.

Within native woods, there are a number of sub-habitats, which although small in extent, are often valuable for biodiversity: Open areas associated with **rock outcrops** are integral parts of these woods and make a vital contribution to their ecological diversity; **woodland ponds** created in the hollows left by upturned rootplates are some of the most natural ponds in Britain; and **ground-water seepages** are often more alkaline and contain plants and invertebrates that are rare in the main part of the wood.

Decaying wood, both standing and fallen, is an important natural component of all native woods, though a history of removal means that it is not common in most modern woods.

1.2 National and International Context

Native woods currently account for only around 2% of the land cover of Scotland. The full extent and quality of semi-natural native woods in Dumfries & Galloway is not accurately known. There is thought to be about 12,000ha of broadleaved woodland (less than 2% of the region) of which 5,000ha is semi-natural. Forestry Commission Scotland owns and manages approximately 2,500ha of broadleaved woodland, but most of this is unlikely to be semi-natural, and 60% of it is identified only as 'Mixed Broadleaves'. (See Broadleaved and Mixed Plantations Action Plan).

2. Dumfries & Galloway Status

2.1 Recent Trends

Since the Forestry Commission's review of policy for broadleaves in 1985, the conservation and management of native woods has become more important. In recent years approximately 200ha of new broadleaf planting has taken place annually together with 150ha of restocking, mainly as broadleaf element within commercial woodlands.

2.2 Current Distribution

Dumfries & Galloway's native woods are concentrated in the main river valleys, especially the Cree, Fleet, Dee/Ken and Nith.

3. Importance for Associated Species

3.1 Fungi and Lichens (very high importance)

Most trees are dependent on mycorrhizal associations with fungi, so it is no surprise that fungi attain their greatest diversity in woodland. They also play an essential role in the decomposition of plant litter and in nutrient recycling. Though fungi are widely distributed in all native woods, some species that are restricted to particular types. A number of rare fungi have been recorded in the native woods of Dumfries & Galloway, including *Rimbachia bryophila* recorded on moss in Carstramon Wood in 1993. However, few mycological surveys have been undertaken and a number of other species probably await discovery.

Chanterelle Cantharellus cibarius, one of the best known woodland mushrooms. Holy Linn, September 2006. (Peter Norman)

3.2 Non-flowering Plants (very high importance)

Ferns are often abundant in native woods, notably Hard Fern *Blechnum spicant*, Male Fern *Dryopteris filix-mas* Lady Fern *Athyrium filix-femina* and Common Polypody *Polypodium vulgare*. Wilson's Filmy Fern *Hymenophyllum wilsonii* is rare, restricted to shaded woodland, often in ravines/cleughs, a similar habitat to Hay-scented Buckler fern *Dryopteris aemula*, found in Carstramon Wood. There is also a wide range of mosses and liverworts in the region's native woods.

3.3 Flowering Plants (very high importance)

The **field layer** of native woods typically flowers in spring, before the canopy comes into full leaf and restricts light levels. Ungrazed and lightly grazed native woods are particularly notable for Bluebells *Hyacinthoides non-scripta*, which occur in a profusion seldom encountered beyond the British Isles. Wood Anemone *Anemone nemorosa,* Dog's Mercury *Mercurialis perennis* and Wild Garlic *Allium ursinum* can also grow in profusion depending on local conditions. Though such species are widespread and common, they are an important component of native woods and require conservation. A few less common species also occur, including Early Dog Violet *Viola reichenbachiana* at some of its few Scottish localities.

Distinctive flush vegetation dominates **woodland seepages** with Opposite-leaved Golden Saxifrage *Chrysosplenium oppositifolium* typical in Dumfries & Galloway. The **understorey** is not noted for a high diversity of flowering plants, but a few grow on the **trees** themselves, including Atlantic Ivy *Hedera helix* subsp. *hibernica,* native in Scotland only in the south west.

3.4 Invertebrates (very high importance)

Native, especially ancient, woods have the richest invertebrate fauna of any habitat in Dumfries & Galloway. Due to the long history of woodland exploitation many species have extremely restricted distributions and some are very rare indeed.

Invertebrate species that rely on **decaying wood** are now some of the most threatened in Britain. More than 700 species of flies and a similar number of beetles are dependant to some extent on deadwood in the UK. For example, in Dumfries & Galloway the hoverfly *Criorhina floccosa* is found in wet rotting Wych Elm, Sycamore and Beech; the larvae of a nationally scarce soldier beetle *Malthodes guttifer* develops in decaying wood; fungal and epiphytic growth on both sound and decaying timber provides a habitat for invertebrates such as fungus gnats; and fallen dead wood on the ground provides shelter and overwintering sites for adult ground beetles and woodlice, as well as essential habitat for the developing larvae of saproxylic invertebrates such as many rove and longhorn beetles. Fallen dead wood

on groundwater seepages and in streams supports a varied fauna of flies, including the nationally rare *Lipsothrix errans* cranefly.

Woodland seepages are extremely important for a very large number of specialist invertebrates. Although of only moderate pH, the water in seepages is sufficiently rich in calcium to support diverse communities of molluscs, found amongst the vegetation and in saturated leaf litter.

Buzzard (Paul McLaughlin)

3.5 Birds (very high importance)

Lowland native woods support possibly a greater diversity of bird species than any other habitat, although few, if any, are restricted to this habitat. Typical species include Chiffchaffs *Phylloscopus collybita,* Sparrowhawks *Accipiter nisus,* Buzzards *Buteo buteo,* Tawny Owls *Strix aluco* and Green Woodpeckers *Picus viridis.*

3.6 Mammals (very high importance)

Most British mammals evolved in wooded habitats, so it is no surprise to find that woodland remains very important for them. Badgers *Meles meles*, Roe Deer *Capreolus capreolus*, Fallow Deer *Dama dama* and even Red Deer *Cervus elaphus* are essentially woodland animals, although they are now also found in more open habitats. Red Squirrels *Sciurus vulgaris* have moved into some conifer plantations, but are still found in native woods. In the long-term, they are likely to be displaced from this habitat by Grey Squirrels. Unless an effective control measure can be found for the greys, native woods cannot be managed to retain their Red Squirrel populations.

Fallow Deer (Paul McLaughlin)

All bats feed in and around trees. Some, such as the Brown Long-eared Bat *Plecotus auritis* are so dependent on woodland that they are rarely found in other habitats, whilst Leisler's Bat *Nyctalus leisleri*, found in woods in the Cree valley, is virtually absent from the rest of Scotland. The essential habitat requirement appears to be holes and crevices for roosting, best created by the retention of standing **decaying wood**.

3.7 Reptiles and Amphibians (medium importance)

A number of reptiles and amphibians are found within native woods, particularly in woods with extensive open spaces. Amphibians breed in **woodland ponds** that are at least partly unshaded.

4. Environmental, Economic & Social Importance of Biodiversity

- Landscapes are significantly enhanced by native woods, which soften open hillsides and plantations.
- Native woods are part of our cultural heritage and have a long association with landscapes. This is reflected in many local place names in Gaelic, Scots, Welsh as well as English, and in songs and paintings.
- Archaeological relics dating back to prehistoric times, and sometimes more recent features such as deserted shielings or ruined croft houses are often found within native woods. Those woods with a coppice history have been part of the local landscape for centuries. They and the woodbanks which define them will be amongst the oldest historical monuments in some areas.
- A number of native woods are managed as nature reserves and/or have footpaths and interpretation, providing a valuable recreation and tourism resource.
- Upland woods can often provide valuable shelter for sheep and cattle and can give good grazing. However, grazing pressure needs to be carefully managed to avoid risking the survival or ecological value of the woods.

5. Factors affecting the Habitat

- The native woods of Dumfries & Galloway are generally long and narrow, concentrated in the river valleys and in strips at the coast. This produces a **greater edge effect than the national average.**

- **Overgrazing** by sheep, deer and rabbits leading to change in the woodland structure, ground flora impoverishment and difficulties for regeneration.
- **Air pollution** affects lichen and bryophyte communities, though this is localised in Dumfries & Galloway.
- **Invasive species** such as *Rhododendron*, Cherry Laurel, Snowberry, Sycamore, Beech and other species leads to changes in the composition of the woods and the ground layer and threatens woodland regeneration.
- Management of native woods for game can be compatible with high biodiversity, but the **strawing of rides, use of release pens and introduction of exotic trees and shrubs** can all be damaging. The higher the number of pheasants in a wood, the greater is the chance of damage.
- Ditching and other **drainage** measures, including the loss or dredging of woodland ponds reduces biodiversity value.
- **Nutrient enrichment** leading to changes in soils and ground flora may occur from spray drift or runoff from adjacent agricultural land.
- In some cases, **unsympathetic forest management**, where felling rates, choice of broadleaf species planted, or methods of working do not yet reflect published guidelines.
- **Clearance of dead wood**, an essential component of woodland ecosystems, on the grounds of safety or neatness reduces biodiversity value.
- **Abandonment of practices** such as coppicing may in some areas lead to a reduction in structural diversity within the woods.

6. Strategic Actions

6.1 Recent and current activity

- **Forestry Commission Scotland** is involved with many native woodland projects, including managing grazing to assist natural regeneration, removal of *Rhododendron* and the restoration of plantations on ancient woodland sites (PAWS).
- **Scottish Natural Heritage** (SNH) carries out monitoring of designated woods and works with their owners on subsequent management.
- A large mixed upland native wood is being created by **Borders Forest Trust** at Carrifran in the Moffat Hills.
- Conservation organisations such as **RSPB** and **Scottish Wildlife Trust** own and manage a number of native woods. RSPB have begun to create 371ha of new native wood at Barclye, adjacent to Wood of Cree.
- Cree **Valley Community Woodlands Trust** has been working since 1996 to restore and link fragments of native woodland in the Cree valley.
- The **South West Community Woods** are strongly orientated to native trees and woods.

6.2 Other recommended actions

- **Expand native woods** through natural regeneration wherever possible.
- Where natural regeneration is not feasible, **maintain genetic integrity** by careful selection of planting stock.
- **Maintain existing native tree species composition**, including birches, willows and shrubs such as Hawthorn.
- **Maintain a high structural diversity** with trees of different ages and sizes, to ensure that there will be a continuity of habitat availability. A variety of aspects and degrees of exposure and shading should also be retained to provide a range of microclimates.
- Implement local integrated strategies for **management of deer and feral goats**.
- Ensure that proposals for **new non-native plantations avoid native woodland** and areas that could potentially be used to link native woods.
- **Survey the native woodland resource** in Dumfries & Galloway using standard methods. Focus on neglected, un-recorded, moribund and small woodlands (less than 2ha). Identify sites where restoration is possible.
- **Research the possibilities for reviving the economic value** of producing timber from native woodlands, with particular attention to local markets.
- **Raise awareness** of the importance of native woods, through guided walks, open days, illustrated talks and publicity.

NATIVE WET WOODS

Priority Action (NWW1)

Restore native wet woods on forested sites, giving priority to sites that connect wetland or woodland habitats of high biodiversity value.
Target: Restore 190ha by 2012.
Lead partner: Forestry Commission Scotland.

Priority Action (NWW2)

Expand native wet woods.
Target: Expand by 440ha by 2012.
Lead Partner: Forestry Commission Scotland.

Dense birches and willows at Lochaber Loch. August 2007. (Peter Norman)

1. Habitat Description

Also see general information on all types of Native Woods

1.1 Physical Characteristics

Native wet woods are found beside rivers and lochs, on floodplains and as small patches within larger wooded areas when damp ground is colonised by species such as willows, birches and Alder. They may be seasonally flooded or constantly wet, and occur on a wide range of substrates from acid to base-rich, and peaty to mineral soils.

Wet woodland often represents a transient successional stage between open wetland areas and drier woodland, but in some locations it can be relatively stable. Wet woods immediately adjacent to rivers and lochs are referred to as riparian woods, those on mires as bog woods, whilst woodland composed primarily of willows or Alder is often termed carr. **Dead wood** can be frequent in all of these, as many of the trees are short-lived species.

In seasonally flooded woods, the **flood zone** may be periodically enriched with nutrient from silt. This may extend some way up the trunks of the trees. Floods also wash in large quantities of material from other habitats, and **decaying organic litter** on the woodland floor is often abundant. Extensive networks of branching runnels or **ditches** occur in many wet woods. These are exploited by an important and exceptionally diverse fauna in the mud and detritus in and around the watercourse, although the level of shade often results in little vegetation.

1.2 National and International Context

Scotland is estimated to have around half of the wet woodland resource of the UK, totalling approximately 35,000ha. Most of this occurs in the Highlands, but Dumfries & Galloway is probably the next most important area for this habitat.

2. Dumfries & Galloway Status

2.1 Recent Trends

Habitat loss has been partially reversed in the last two decades, with extensive planting of riparian trees along rivers, particularly by fisheries bodies. However, the only significant management of carr and bog woods has been clearance of spreading trees where they threaten more valuable wetland habitats.

2.2 Current Distribution

Though native wet woods are widespread and fairly common across Dumfries & Galloway, particularly, though not exclusively in the lowlands, they are highly fragmented. Few, if any, sites extend to more than 2ha.

2.3 Site Examples

Most lowland lochs in Dumfries & Galloway have at least a narrow fringe of wet native woodland, such as at **Castle Loch** (SPA/SSSI/LNR). Other native wet woods occur in river floodplains such as at **Wood of Cree**, and on the sites of silted-up lochs, such as **Ladypark** Scottish Wildlife Trust reserve in Dumfries, **Dowalton** (SSSI) in the Machars and **Barscraigh** (LWS) in Dalbeattie Forest.

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with native wet woods, and the following action plans may also contain relevant information: River Headwaters, Lowland Rivers and Backwaters, Lowland Burns and Ditches, Eutrophic Lochs, Mesotrophic Lochs, Fens, Marshes, Raised Bogs, Native Woods, Scrub Woods.

3. Importance for Associated Species

3.1 Non-flowering Plants (very high importance)

Native wet woods have a well-developed moss and liverwort flora. Typical ground bryophytes include Feather Moss *Eurhynchium praelongum* and Forest Star Moss *Mnium hornum.* Blunt-leaved Bog-moss *Sphagnum palustre*, Girgensohn's Bog-moss *Sphagnum girgensohnii* and Fringed Bog-moss *Sphagnum fimbriatum* are shade-tolerant species found amongst birches and willows. On the trees themselves, there are many epiphytic species on willow. Alder is relatively species poor, though a few notable species have been recorded in other parts of Britain.

Blunt-leaved Bog-moss Sphagnum palustre. Killiegowan Wood, Gatehouse of Fleet, February 2007. (Peter Norman)

In the **flood zone** there are several typical species on exposed roots and tree bases enriched with silt from flooding, including Many-fruited Leskea *Leskea polycarpa*, Kneiff's Feather-moss *Leptodictyon riparium* and Blunt Feather-moss *Homalia trichomanoides*. None are particularly common in Dumfries & Galloway. The nationally scarce Spruce's Bristle-moss *Orthotrichum sprucei*, a riverside epiphyte of Alder, Ash, and willows where occasionally inundated, has been recorded beside Cargen Water, near Dumfries. Flood moss *Myrinia pulvinata*, a rare species in Scotland, is known only from Kenmure Holms.

Royal Fern *Osmunda regalis*, found in fen-carr woodland, declined heavily as a result of habitat loss and collecting in Victorian times. Though it is now recovering, it remains uncommon.

3.2 Invertebrates (very high importance)

The number of invertebrates associated with Alder, birches and willows is very large, and wet woods support many species which are rare in Britain. A snail *Leiostyla anglica* associated with this habitat type is virtually endemic, being otherwise known only from a tiny area of western France. The association of **dead wood** with water provides specialised habitats not found in dry woodland types. A large number of craneflies specialise in this habitat, including the scarce *Lipsothrix errans*, the larvae of which probably live in submerged rotting wood. Standing dead wood is also valuable for the larvae of species such as Lunar Hornet Clearwing moths *Sesia bembeciformis* that live within willow trunks.

Many invertebrates are associated with fungi, and wet woods are probably the most important single habitat for a range of fungus-feeding flies. Larvae of the hoverfly *Helophilus hybridus* are often associated with wet, **decaying organic litter**, as are soldier beetles *Malthodes dispar*. A nationally scarce spider *Maro sublestus*, has also been recorded in fens and wet woods in Kirkcudbrightshire.

Ditches and their margins support a special fauna. Strongly shaded ditches with choked with saturated organic mud provide the special habitat but biodiversity is richest where some light penetrates to allow herb or aquatic plants to grow. Even quite small wet seepages may support important invertebrates.

3.3 Fungi and Lichens (very high importance)

Willow Gloves *Hypocreopsis lichenoides* is a small but distinctive fungus that is no longer known in the wild in Britain, although herbarium collections remain. It grows on willow branches and was recorded near Dalry and Moniaive in the late 19th century. More typical fungi include Blushing Bracket *Daedaleopsis*

confragosa and Alder Bracket *Inonotus radiatus.* Lichen diversity is greatest on old trees rather than the relatively young ones that comprise the majority of wet woods. However, important species do occur. Despite its name, Scotland is the European stronghold for Norwegian Specklebelly *Pseudocyphellaria norvegica*. It grows on moss-covered trees in woods and willow carr, and has been found at a few sites in Galloway.

3.4 Fishes (high importance)

Well managed riparian woodlands provide essential habitat in the life-cycle of various fish, especially Trout *Salmo trutta.* They assist in reducing the siltation of spawning grounds, supply invertebrate and leaf-litter food, and provide shade and shelter.

3.5 Mammals (high importance)

The combination of woodland and wetland provides ideal conditions for bats, supporting large quantities of invertebrate food. Trees also provide roost sites and shelter for bats foraging over water. All bat species make use of such conditions. Otter *Lutra lutra* dens, or holts, are frequently located in flood debris or in mature bankside trees with root cavities such as oaks and Ash, although non native species such as Sycamores are also used.

3.6 Birds (medium importance)

A high density of breeding birds occurs in wet woods. Mostly these are common woodland species including Long-tailed Tits *Aegithalos caudatus*, Redpolls *Carduelis cabaret* and Willow Warblers *Phylloscopus trochilus*, the latter species now possibly declining nationally. Willow Tits *Poecile montanus* are certainly in rapid UK decline and Dumfries & Galloway is now their Scottish stronghold. They excavate new nest holes each year, so require dead wood and partially decayed trees. Woodcocks *Scolopax rusticola* require soft ground to probe for invertebrates, and are therefore often found in wet woods.

3.7 Flowering Plants (medium importance)

Native wet woods frequently contain species that are characteristic of fens and marshes. These include Marsh Marigold *Caltha palustris*, Wild Angelica *Angelica sylvestris* and Meadowsweet *Filipendula ulmaria*. A number of scarce species also occur in Dumfries & Galloway, including Elongated Sedge *Carex elongata,* a nationally scarce species found at a number of sites, particularly favouring Alder woods; and Sawwort *Serratula tinctoria* found in a range of wet habitats, including wet woods in the Dee and Urr valleys.

Bird Cherry flowers. Caldons Wood, May 2006. (Peter Norman)

3.8 Reptiles and Amphibians (medium importance)

Several of the commoner amphibians – Palmate Newts *Lissotriton helvetica*, Common Toads *Bufo bufo*, and Common Frogs *Rana temporaria* breed and overwinter in wet woodland, so long as the canopy is not so dense as to keep waterbodies in constant shade.

4. Environmental, Economic & Social Importance of Biodiversity

- Despite their relatively limited extent, native wet woods make a significant contribution to the landscape of the region. This is particularly the case in some farmland and upland areas where they may constitute the majority or even the only native trees in the landscape.
- Native wet woods are of fundamental importance to the health and productivity of freshwater ecosystems, capturing and recycling nutrients. In certain situations the input of leaves and other organic matter can provide 90% of a stream's energy budget.

Fallen timber and pools are important invertebrate habitats. Killiegowan Wood, February 2007. (Peter Norman)

- Riparian woods protect river banks and control erosion.
- Along with other natural riparian habitats, native wet woods ameliorate the effects of heavy rainfall and reduce the downstream risk of flash floods. They may also act as a buffer, intercepting excessive nutrients and reducing the risk of water pollution.

5. Factors affecting the Habitat

- **Clearance and/or coniferisation** of wet woods for agriculture or intensive forestry have occurred in the past.
- **Fragmentation.** By their nature, wet woods are small and localised. However, they would have often been linked to each other though semi-natural habitats such as wetlands.
- **Water pollution and nutrient enrichment** from agricultural run-off affects wet woods and species associated with them, especially bryophytes and invertebrates.
- **Lowering ground-water** in wet woods results in an invasion of Nettles and Brambles and loss of biodiversity.
- **Removal or major disturbance of flood debris**, tidying of fallen wood from streams, ditching of streams, and drainage or interception of seepages is extremely damaging to bryophytes and invertebrates.
- **Removal of old, diseased or larger moss-covered trees and dead wood** due to concerns over safety or hygiene.
- **Invasive species**, such as American Skunk Cabbage *Lysichiton americanus*, may have a localised impact.

6. Strategic Actions

6.1 Recent and current activity

- The **UK Forestry Standard** recognises the importance of riparian management.
- Riparian planting by **Galloway Fisheries Trust** and **district salmon fisheries boards**.

6.2 Other recommended actions

- **Collate existing information** to assess the current extent and distribution of native wet woods.
- Consider opportunities for the **creation of new native wet woods** through natural regeneration, or if necessary planting. Avoid open semi-natural habitats that are likely to already have a high biodiversity value, and important archaeological sites.

NATIVE ASH WOODS

Priority Action (NAW1)

Restore plantations on ancient Ash woodland sites.
Target: Restore 60ha by 2015.
Lead Partner: Forestry Commission Scotland.

Priority Action (NAW2)

Expand native Ash woods in areas currently of low biodiversity and archaeological importance, but that have the potential to link existing woods, especially ancient woods.
Target: Extend by 210ha by 2015 .
Lead Partner: Forestry Commission Scotland.

Coppiced Ash. Back Wood, Scaur Glen, May 2008. (Peter Norman)

1. Habitat Description

Also see general information on all types of Native Woods

1.1 Physical Characteristics

Ash woods mainly occur on neutral or alkaline soils. Canopy foliage tends not to be over-dense, thus allowing the growth of a flourishing and often diverse field layer flora. Other tree species are generally present in woodland of this type, such as Bird Cherry, Rowan and Wych Elm. Indeed, some small woods could be considered **elm woods**.

1.2 National and International Context

Ash woods are found throughout upland areas of Britain, but are particularly characteristic of limestone districts such as the Mendips, Pennines and around Morecambe Bay. Those in north-west Scotland are the most northerly examples of this type in the world. There are estimated to be 40,000–50,000ha of ancient semi-natural woods of this type.

2. Dumfries & Galloway Status

2.1 Recent Trends

Despite recent restoration and creation of native woods, Ash woods have received less attention than other woodland types.

2.2 Current Distribution

As a result of soils and climate Ash woods tends to be more common in the east of the region. There are few large woods, but a diverse range of small woods (less than 2ha) that contributes markedly to biodiversity. These are concentrated on steep slopes or poor soils in river valleys, particularly the parts of Nithsdale.

2.3 Site Examples

The best examples of upland Ash woods are concentrated in the tributary valleys of the River Nith, and include woods along the **Mennock Water** (SAC/SSSI); **Stenhouse Wood** (SAC/SSSI) in Shinnel Glen; **Chanlockfoot** (SAC/SSSI) in Scaur Glen; **Back Wood** (SAC/SSSI) on Crawick Water; and **Glenmaddie Wood** (LWS) on the Euchan Water.

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with native Ash woods, and the following action plans may also contain relevant information: River Headwaters, Waterfalls, Upland Springs and Flushes, Native Wet Woods, Native Oak Woods, Native Birch Woods, Scrub Woods, Montane Scrub.

3. Importance for Associated Species

3.1 Fungi and Lichens (very high importance)

Many native woods hold very diverse lichen communities and the alkaline bark of Ash and Wych Elm supports particularly important lichens, including rare species such as *Biatoridium monasteriense* on a single tree in Garlies Wood.

Lichen and moss covered Ash trunk. Glenmaddie Wood, June 2008. (Peter Norman)

There are relatively few fungi specifically associated with Ash. The best known is King Alfred's Cakes *Daldinia concentrica* on dead trunks and Shaggy Bracket *Inonotus hispidus* high up on mature trees. However, many other species are found in Ash woods on rotting wood or leaves.

Common Dog Violet, Scaur Glen, May 2006. (Peter Norman)

3.2 Flowering Plants (very high importance)

Well-developed Ash woods tend to have a more diverse flora than upland oak and birch woods. They are notable for displays of flowers, such as Bluebells *Hyacinthoides non-scripta,* Primroses *Primula vulgaris*, Dog's Mercury *Mercurialis perennis*, Common Dog Violets *Viola riviniana*, Wood Sorrels *Oxalis acetosella*, and Wood Avens *Geum urbanum*. A few less common species also occur, including Early Dog Violet *Viola reichenbachiana* at some of its few Scottish localities.

3.3 Invertebrates (very high importance)

Ash woods support a slightly different invertebrate fauna to oak and birch woods. They can be especially important for molluscs, which need calcium for their shells, and ancient upland Ash woods include some special species. Base rich **seepages** and springs in Ash woods support a number of rare species. Although of only moderate pH, the water in seepages is sufficiently rich in calcium to support diverse communities of molluscs, found amongst the vegetation and in saturated leaf litter. The snails *Acicula fusca* and *Spermodea lamellata* are associated with this habitat type; all are at their extreme west European distribution. *S. lamellata* is an indicator of ancient woodland. However, the invertebrate fauna of woodland seepages is very poorly known, and more survey work is urgently required in order to better inform decision-making.

The caterpillars of the rare Barred Tooth-stripe moth *Trichopteryx polycommata* feed on Ash, though have also been recorded on privet. Ash is also one of the better trees for **decaying wood** (saproxylic) insects, especially flies. These species are now some of the most threatened in Britain.

3.4 Mammals (very high importance)

There is little distinction between the mammal fauna of Ash woods and other kinds of native woods in Dumfries and Galloway; all are of very high importance for a wide range of species, especially bats.

3.5 Non-flowering Plants (high importance)

There is a wide variety of mosses, liverworts and ferns found in the region's native Ash woods. Big Shaggy-moss *Rhytidiadelphus triquetrus* grows most typically in woodland on more calcareous substrates where it forms a conspicuous part of the flora.

3.6 Birds (high importance)

The bird fauna of upland ash woods is less characteristic than other types, but all the typical woodland species are present.

3.7 Reptiles and Amphibians (medium importance)

A number of reptiles and amphibians are found within Ash woods, particularly in woods with extensive open spaces. Amphibians breed in **woodland ponds** that are at least partly unshaded.

4. Environmental, Economic & Social Importance of Biodiversity

- In common with other types of native woods, Ash woods provide landscape, cultural heritage, archaeological, recreation and tourism benefits.
- Mature upland Ash woods on fertile soils can often provide valuable shelter for sheep and cattle and can give good grazing. However, grazing pressure needs to be carefully managed to avoid risking the survival or ecological value of the woods.

5. Factors affecting the Habitat

- The native Ash woods of Dumfries & Galloway are generally **concentrated in narrow river valleys**. This produces a greater edge effect than the national average.
- Other factors affecting Ash woods are similar to those affecting other types of native wood.

6. Strategic Actions

6.1 Recent and current activity

- **Forestry Commission Scotland** has completed a survey of the current distribution of Ash woods in Dumfries and Galloway, and this has identified potential areas for expansion and creation of new Ash woods.
- **Scottish Natural Heritage** (SNH) carries out monitoring of designated woods and works with their owners on subsequent management.

6.2 Other recommended actions

- **Expand native Ash woods** through natural regeneration wherever possible. Avoid open semi-natural habitats that are likely to already have a high biodiversity value, and important archaeological sites.
- Where natural regeneration is not feasible, **maintain genetic integrity** by careful selection of planting stock.

Dog's Mercury often dominates the springtime ground flora of Ash woods. Stenhouse Wood, May 2006. (Peter Norman)

NATIVE OAK WOODS

Priority Action (NOW1)

Restore plantations on ancient oak woodland sites.
Target: Restore 250ha by 2015.
Lead Partner: Forestry Commission Scotland.

Priority Action (NOW2)

Expand upland native oak woods in areas currently of low biodiversity and archaeological importance, but that have the potential to link existing woods, especially ancient woods.
Target: Expand by 300ha by 2015**.**
Lead Partner: Forestry Commission Scotland.

1. Habitat Description

Also see general information on all types of Native Woods.

1.1 Physical Characteristics

Although there are other types of oak wood in the UK, all of those in Dumfries and Galloway, even at low altitudes are best considered as **upland oak woods**. These are found on acidic, often shallow, leached brown earth soils and are characterised by a predominance of usually Sessile Oak in the canopy, along with some birch. Varying amounts of Holly, Rowan and Hazel are often the main understorey species. The range of plants found in the ground/field layer varies according to the underlying soil type and degree of grazing, ranging from Bluebell-Bramble-fern communities through grass and Bracken dominated ones to those dominated by mosses.

Coastal oak woods are essentially a form of upland oak wood that has been modified by maritime influences. The trees are often stunted and pruned by wind and salt exposure.

1.2 National and International Context

Upland oak woods are found in western and northern Britain from southernmost Cornwall to north-west Scotland. In parts of Exmoor, Snowdonia, Lake District, and Argyll they form important elements of the finest landscapes. There are estimated to be 60,000–70,000ha of ancient semi-natural woods of this type.

2. Dumfries & Galloway Status

2.1 Current Distribution

As a result of soils and climate, oak woods are more common in the west of the region. There are few large woods, but the range of small woods (less than 2ha), concentrated on steep slopes or poor soils in river valleys, contributes markedly to biodiversity. These are most frequent in the Cree and Fleet valleys, with a few on the coast.

2.2 Site Examples

Buchan and **Glenhead Woods** (SAC/SSSI) in Glentrool probably provide the best examples of upland native oak woodland. Nearby **Caldons Wood** (SAC/SSSI) also has areas of upland birch wood. Though at lower altitude, there are many other good examples of upland oak type woods, including **Wood of Cree** (SAC/SSSI), **Holm Wood** (LWS) **Camer Woods** (LWS) and **Blackcraig Wood** in the Cree valley; **Killiegowan Wood** (SAC/SSSI), **Carstramon Wood** (SAC/SSSI) and **Cardoness Wood** (LWS) in the Fleet valley; and **Airds of Kells Wood** (SSSI), **Hannaston Wood** (SSSI), and **Oaks of Kirkconnell** in the Dee-Ken valley. **Lochwood** (SSSI), near Beattock is dominated by oaks, but has a history of wood pasture, rather than woodland.

Coastal oak woods include **Ravenshall Wood** (SSSI) at Carsluith, **Heughwood** (SSSI) at Southwick and **Gibb's Hole Wood** (LWS) at Almorness.

2.3 Associated Habitats

A number of habitats occur in close association and/or overlap with native oak woods, and the following action plans may also contain relevant information: River Headwaters, Waterfalls, Upland Springs and Flushes, Native Wet Woods, Native Ash Woods, Native Birch Woods, Scrub Woods, Montane Scrub.

3. Importance for Associated Species

3.1 Fungi and Lichens (very high importance)

Though fungi are widely distributed in all native

woods, there are some species that are restricted to oak, such as Beefsteak Fungus *Fistulina hepatica*, Oak Milk-cap *Lactarius quietus* and Hen of the Woods *Grifola frondosa.*

Beefsteak Fungus Fistulina hepatica. Holy Linn, September 2006. (Peter Norman)

Wet and mossy upland oak woodland is an exceptionally rich lichen habitat. The moss forms a base on which the rare, but conspicuous 'Lobarion' lichen community is found, including **Tree Lungwort lichen** *Lobaria pulmonaria*. Though internationally rare lichens are not as plentiful as in the Atlantic oak woods further north, a few examples of such lichens have been recorded from several Galloway oak woods.

3.2 Non-flowering Plants (very high importance)

The mosses, liverworts and ferns found in the region's native woods show a similar distribution to lichens. Upland oak woods, though generally not as diverse and rich as those in the west Highlands, are particularly important.

Little Shaggy-moss *Rhytidiadelphus loreus* is a common species of acidic upland woodland where it forms conspicuous stands. Shaded Wood-moss

Little Shaggy-moss Rhytidiadelphus loreus carpeting boulders. Hannaston Wood, February 2008. (Peter Norman)

Hylocomiastrum umbratum is found in hilly districts of western Britain where it occurs on the ground in open woodland, in turf and amongst rocks and scree. It is uncommon in Dumfries & Galloway.

Greater Whipwort *Bazzania trilobata* is a classic liverwort of oak woods in western Britain: it can be an abundant component of the ground layer in the most humid wooded valleys, but is restricted to the rockiest sections of less humid woods. As well as growing on the ground and on rocks, it can colonise logs or grow on tree trunks but it is seldom found away from woods. Trunk Pawwort *Barbilophozia attenuata* is found on decaying tree stumps and the trunks of acid-barked trees.

Rarer liverworts include Deceptive Featherwort *Adelanthus decipiens*, typical of the best Atlantic oakwoods in western Scotland. It has been recorded just once in Dumfries & Galloway, at Bargaly Glen in 1975. Outside of Britain it is known only in France and Spain. Brown Scalewort *Radula aquilegia* is a liverwort that is endemic to Europe, with its world headquarters in the west of Britain. There are several historical records from the New Galloway area, most recent of which was in Hannaston Wood in 1975. Hutchins' Hollywort *Jubula hutchinsiae* has been recorded in damp shady woodland at Chlenry Burn, and *Jamesoniella autumnalis* has been found on decaying wood.

3.4 Invertebrates (very high importance)

Acidic **oak woods** have a number of invertebrates in common with birch woods. The soldier beetles *Malthodes flavoguttatus* and *M. fuscus* are most frequently found here, whilst the Hollowed Glass Snail *Zonitoides excavatus* is the only British snail that avoids base-rich habitats. It is usually found in the leaf litter of poorly drained places in old established birch and oak woods.

Different species typically exploit different sub-habitats of native oak woods. A wide range of invertebrates occur on the leaf litter of the **ground layer**, including the common ground beetles *Abax parallelepipedus*, *Agonum ass*imile and *Calathus piceus.*

The **canopy** holds important invertebrates that are rarely seen at lower levels. The Great Prominent moth *Peridea anceps* appears restricted to larger native woods in Dumfries & Galloway, so far recorded only in Kirkcudbrightshire. Its caterpillars are associated

with the oak canopy. Purple Hairstreak *Neozephyrus quercus* butterflies, near the northern edge of their range in Dumfries & Galloway, pupate on the ground but spend most of their adult lives in the oak canopy.

3.5 Birds (very high importance)

Upland **oak woods**, especially those with a poorly developed understorey have a very characteristic bird fauna. The typical species are Pied Flycatchers *Ficedula hypoleuca,* Redstarts *Phoenicurus phoenicurus,* Tree Pipits *Anthus trivialis* and Wood Warblers *Phylloscopus sibilatrix.*

3.6 Mammals (very high importance)

There is little distinction between the mammal fauna of oak woods and other kinds of native woods in Dumfries and Galloway; all are of very high importance for a wide range of species, especially bats.

3.7 Flowering Plants (high importance)

The **field layer** of upland native oak woods is typically not as varied as other woodland types, being dominated by non-flowering plants. Ungrazed and lightly grazed native woods at lower altitudes have the greatest range of species, including Bluebells *Hyacinthoides non-scripta,* Wood Anemones *Anemone nemorosa* and Wood Sorrels *Oxalis acetosella*.

Bluebells at Carstramon Wood. May 2004. (Peter Norman)

3.8 Reptiles and Amphibians (medium importance)

A number of reptiles and amphibians are found within oak woods, particularly those with extensive open spaces. Amphibians breed in **woodland ponds** that are at least partly unshaded, though the more acidic conditions of oak woods may limit species composition in comparison to Ash woods.

4. Environmental, Economic & Social Importance of Biodiversity

- In common with other types of native woods, oak woods provide landscape, cultural heritage, archaeological, recreation and tourism benefits.

5. Factors affecting the Habitat

- The native oak woods of Dumfries & Galloway are generally **small in extent and concentrated on steep slopes** in the river valleys or on the coast. This produces a greater edge effect than the national average.
- Other factors affecting oak woods are similar to those affecting other types of native wood.

6. Strategic Actions

6.1 Recent and current activity

- **Forestry Commission Scotland** is involved with many native oak woodland projects, including managing grazing to assist natural regeneration, removal of *Rhododendron* and the restoration of plantations on ancient woodland sites (PAWS).
- **Scottish Natural Heritage** (SNH) carries out monitoring of designated woods and works with their owners on subsequent management.
- Conservation organisations such as **RSPB** and **Scottish Wildlife Trust** own and manage a number of native oak woods. RSPB have begun to create 371ha of new native wood at Barclye, adjacent to Wood of Cree.
- Cree **Valley Community Woodlands Trust** has been working since 1996 to restore and link fragments of native woodland in the Cree valley. Most of these woods are of native oak.

6.2 Other recommended actions

- **Expand native oak woods** through natural regeneration wherever possible. Avoid open semi-natural habitats that are likely to already have a high biodiversity value, and important archaeological sites.
- Where natural regeneration is not feasible, **maintain genetic integrity** by careful selection of planting stock.

NATIVE BIRCH WOODS

Priority Action (NBW1)

Restore plantations on ancient birch woodland sites.
Target: Restore 20ha by 2015.
Lead Partner: Forestry Commission Scotland.

Priority Action NBW2

Expand upland native birch woods in areas currently of low biodiversity and archaeological importance.
Target: Expand by 430ha by 2015.
Lead Partner: Forestry Commission Scotland.

1. Habitat Description

Also see general information on all types of Native Woods.

Caldons Wood, Glentrool. May 2006. (Peter Norman)

1.1 Physical Characteristics

Upland **birch woods** are typically found on acidic, infertile soils. Birches, especially Downy Birch, are dominant in the canopy, and on the poorest soils there may be few other trees. On more fertile sites, oaks, Rowan, Aspen, Ash, Alder, Goat Willow, Wild Cherry, Bird Cherry, Hazel, Hawthorn and Blackthorn can all be found. Though birch woods are extensive in the Scottish Highlands, in other upland areas they often occur as patches in a mosaic with oaks and other broadleaves. Birches also occur commonly in other habitats, such as native wet woods and scrub woods.

1.2 National and International Context

In Britain, there are estimated to be 15–25,000ha of ancient semi-natural upland birch woods, but more recent semi-natural birch woodland occupies a considerably larger area than this. They occur throughout upland Britain but are much more extensive in the north, and nearly half of all broadleaved woodland in Scotland is upland birch.

2. Dumfries & Galloway Status

2.1 Recent Trends

Until quite recently, birches were often viewed as weeds within commercial woods and plantations. However, since the Forestry Commission's review of policy for broadleaves in 1985, the conservation and management of native birch woods has gradually become more important. New areas of birch woodland have recently been planted, and in the upland valleys birch is being locally successful in regenerating and colonising new ground where grazing pressure is reduced.

2.2 Current Distribution

The full extent and quality of semi-natural native birch woods in the region is not accurately known, but they are uncommon in the region and there are few large woods.

2.3 Site Examples

Caldons Wood (SAC/SSSI) in Glentrool has areas of upland birch, as well as oak.

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with native birch woods, and the following action plans may also contain relevant information: River Headwaters, Waterfalls, Upland Springs and Flushes, Native Wet Woods, Native Oak Woods, Native Ash Woods, Native Birch Woods, Scrub Woods, Montane Scrub.

3. Importance for Associated Species

3.1 Fungi and Lichens (very high importance)

There is a distinctive and substantial mycota in upland native birch woods. Probably the best known of all British fungi, Fly Agaric *Amanita muscaria,* is usually associated with birches, and the Birch Polypore *Piptoporus betulinus* is also well-known. There are also many brittlegills *Russula,* milk-caps *Lactarius* and webcaps *Cortinarius*. Hoof Fungus *Fomes fomentarius* was formerly found almost entirely on birches, but in recent years has spread to other trees. Many native birch woods also hold very diverse lichen communities.

Hoof Fungus Fomes fomentarius on birch. Caldons Wood, March 2007. (Peter Norman)

3.2 Invertebrates (very high importance)

Upland birch woods have a number of invertebrates in common with upland oak woods. The soldier beetles *Malthodes flavoguttatus* and *M. fuscus* are most frequently found here, whilst the Hollowed Glass Snail *Zonitoides excavatus* is the only British snail that avoids base-rich habitats. It is usually found in the leaf litter of poorly drained places in old established birch and oak woods. Birches are bettered only by willows and oaks in terms of the number of larger moths they support. Although birch-specific moths occur on birch within other habitats, birch woods have a characteristic moth fauna, including Yellow-horned *Achlya flavicornis,* Scarce Prominent *Odontosia carmelita* and the day-flying Orange Underwing *Archiearis parthenias.*

Invertebrate species that rely on **decaying wood** are now some of the most threatened in Britain. More than 700 species of flies and a similar number of beetles are dependant to some extent on deadwood in the UK and birch, which rots quickly, supports many species.

Yellow-horned Moth, a birch specialist. Caldons Wood, March 2007. (Peter Norman)

3.3 Mammals (very high importance)

There is little distinction between the mammal fauna of birch woods and other kinds of native woods in Dumfries and Galloway; all are of very high importance for a wide range of species, especially bats.

3.4 Non-flowering Plants (high importance)

There is usually an abundance of mosses and liverworts in birch woods, though rarer species are more usually associated with adjacent oak woods.

3.5 Birds (high importance)

Typical species of upland birch woods include Redstarts *Phoenicurus phoenicurus,* Tree Pipits *Anthus trivialis,* Redpolls *Carduelis cabaret* and Willow Warblers *Phylloscopus trochilus*.

3.6 Flowering Plants (medium importance)

The **field layer** of upland native birch woods is typically not as varied as other woodland types, being dominated by non-flowering plants.

3.7 Reptiles and Amphibians (medium importance)

A number of reptiles and amphibians are found within birch woods, particularly those with extensive open spaces. Amphibians breed in **woodland ponds** that are at least partly unshaded, though species composition may be limited in acidic conditions.

4. Environmental, Economic & Social Importance of Biodiversity

- In common with other types of native woods, birch woods provide landscape, cultural heritage, archaeological, recreation and tourism benefits.
- Birch is used mainly for firewood at present and is often regarded as worthless for timber because of the poor form of many present-day birchwoods. The latter is at least partly due to lack of tending and to browsing, which results in twisted coppice stems. Improvements in form can be expected with good management, at least with Silver Birch on the better sites. Good quality birch timber is in fact strong and versatile and can be sawn for general use. Straight birch stems make excellent turnery wood. Other potential uses could be developed if a sufficient supply of good quality birch was available.

5. Factors affecting the Habitat

- Birch woods rarely attract the same **level of interest** from the public and land managers as other types of woodland, such as oak woods.
- **Virtually no commercial use** is currently made of birch products.
- Other factors affecting Birch woods are similar to those affecting other types of native wood.

Birch wood at Slogarie, near Laurieston. February 2008. (Peter Norman)

6. Strategic Actions

6.1 Recent and current activity

- Under **Forestry Commission** policy, native birch woods within conifer plantations are retained during felling.

6.2 Other recommended actions

- **Expand native birch woods** through natural regeneration wherever possible.
- Where natural regeneration is not feasible, **maintain genetic integrity** by careful selection of planting stock.

SCRUB WOODS

Priority Action (SW1)

Promote the value of scrub woodland for biodiversity.
Lead Partner: Scottish Natural Heritage/Dumfries & Galloway Environmental Resources Centre.

1. Habitat Description

1.1 Physical Characteristics

Scrub woods are composed of shrubs and small trees, usually less than 5m tall, often growing in dense, sometimes impenetrable stands, Much scrub occurs as a transition stage between open habitats and woodland, but in certain situations it can persist for decades, sometimes hundreds of years.

Juniper scrub, Tynron, February 2007. (Peter Norman)

Scrub grows in a range of different situations. Coastal scrub is found on shingle, dunes and coastal slopes; wet scrub on fens, raised bogs and as part of wet woods; scrub pasture on grazed grasslands and in parklands; and montane scrub above the tree line near mountain tops. Scrub also occurs in a highly-modified form as hedgerows. This action plan is concerned with scrub in the remaining situations – relatively dense semi-natural scrub woodland that is mostly ungrazed, occurring anywhere between the coast and close to the tops of the hills.

Scrub woodland can occur in isolated pockets, within woods or on the edge of woods. It can be composed of a variety of species and take a variety of forms. **Thorn scrub** is usually composed of Hawthorn and/or Blackthorn; **Gorse scrub** usually occurs on agricultural land and is often single species; Hazel usually occurs as a scattered understorey shrub within native woodland but **Hazel scrub** can form dense woods of its own; and **Juniper scrub** is a specialised and rare form of scrub woodland.

Although bramble is not a woody species and technically cannot form scrub, **Bramble thickets** can grow just as high and even more impenetrable than some scrub. Other species, such as Elder, Dog Rose and mature trees frequently occur as components of scrub woods.

1.2 National and International Context

There is little information on the distribution and abundance of scrub in Britain due to imprecise definitions and boundaries. The best estimate is that there was very approximately 900km^2 of scrub in Britain in 1990, of which 200km^2 was in Scotland. This includes coastal scrub, montane scrub and wet willow scrub, as well as the scrub types included in this action plan (but not birch or Alder scrub). All areas with a canopy cover of 50% or more were included.

2. Dumfries & Galloway Status

2.1 Recent Trends

No detailed information is available on recent trends in Dumfries & Galloway. Anecdotal evidence suggests that it may have increased in the last 10 years as a result of a reduction in stocking density, particularly in the uplands.

2.2 Current Distribution

Gorse scrub is the most widespread and abundant type of scrub woodland in Dumfries & Galloway, being especially extensive on many coastal peninsulas and some upland fringe areas. **Thorn scrub** is also widespread, perhaps being the most frequent type in the uplands. **Hazel and Juniper woods** are uncommon, the latter being restricted to the Nith valley.

2.3 Site Examples

There are many examples of Gorse and thorn scrub woods. **Banks of Dervaird** (LWS), near Glenluce, is an unusual wood in a local context, consisting almost entirely of Hazel scrub. **Tynron Juniper Wood** (SAC/SSSI), **Beuchan Juniper Wood** and **Keir Juniper Wood** are the only local examples of this type.

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with scrub woods, and the following action plans may also contain relevant information: Coastal Shingle Beaches, Coastal Sand Dunes, Coastal Cliffs and Slopes, Raised Bogs, Native Wet Woods, Native Woods, Montane Scrub, Wood Pastures and Parklands, Traditional Field Boundaries, Roads and Verges.

3. Importance for Associated Species

3.1 Invertebrates (very high importance)

Hawthorn Shieldbug, one of many invertebrates dependent on scrub. Minnigaff, May 2007. (Gavin Chambers)

Several scrub species are amongst the most important nectar-bearing plants for invertebrates in Britain. As a group, their importance is matched only by the umbellifers (many of which often grow in close association). Hawthorn, Blackthorn and Ivy are especially valuable, but **bramble thickets** in open, sunny situations are also very valuable for invertebrates.

There are also many invertebrates that feed on the leaves, flowers or other parts of scrub species. Willows, Blackthorn, Hawthorn, Hazel and Bramble each host more than 200 different UK species. Gorse and Juniper support many fewer species, but Juniper hosts several species that are specific to it alone, and are nationally rare. Moths and beetles are the most numerous of the groups represented.

Long Tailed Tits build their nests in dense scrub. (Gordon McCall)

3.2 Birds (high importance)

A number of species of birds nest commonly in scrub woods. These include Dunnocks *Prunella modularis,* Common Whitethroats *Sylvia communi,* Lesser Whitethroats *Sylvia carruca,* Willow Warblers *Phylloscopus trochilus,* Bullfinches *Pyrrhula pyrrhula,* Linnets *Carduelis cannabina* and Yellowhammers *Emberiza citrinella.* Several of these are in national decline. Other species, such as Black Grouse *Tetrao tetrix* and Long-eared Owls *Asio otus* use some types of scrub at certain times of the year as part of a wider habitat mosaic.

3.3 Non-flowering Plants (high importance)

Scrub is an important habitat for mosses and liverworts. Elder is the pre-eminent species for epiphytic mosses and liverworts, unsurpassed by any other tree in Britain, with species such as Wood Bristle-moss *Orthotrichum affine* found commonly only in association with this species. Hazel woods, especially where long established can also support notable bryophyte communities.

3.4 Flowering Plants (medium importance)

Broom, a colourful component of many scrub woods. Kate's Wood, Balmaclellan, May 2005. (Maggi Kaye)

A number of uncommon flowering plants are associated with scrub woods in Dumfries & Galloway, though the majority of these are restricted to coastal scrub. Western Gorse *Ulex gallii* is widespread in the lowlands of Kirkcudbrightshire, and sometimes forms dense patches. It is rare elsewhere in Scotland. Greater Broomrape *Orobanche rapum-genistae* is associated with Gorse and Broom. It suffered a dramatic national decline in the nineteenth and early 20th centuries and in Scotland is now largely restricted to the Nith valley.

3.5 Reptiles and Amphibians (medium importance)

Scrub woods with open areas are utilised by reptiles such as Adders *Vipera berus*, Slow Worms *Anguis fragilis* and Common Lizards *Zootoca vivipara*. Open grassy or rocky areas are used for basking, whilst the

scrub provides shelter. This shelter is also valuable, in some locations, for amphibians such as Great Crested Newts *Triturus cristatus.*

Fiery Milkcap Lactarius pyrogalus is associated only with Hazel (Peter Norman)

3.6 Fungi and Lichens (medium importance)

There are interesting fungi species associated with Hazel, Juniper and willow scrub, though less so with Blackthorn, Hawthorn or Bramble. Elder supports a good lichen flora, whilst Blackthorn scrub on the coast often has spectacular arrays of beard lichens *Usnea spp*. Hazel is even more important for lichens, with a number of rare specialist species recorded in Scotland. However few studies of Hazel lichens have been completed in Dumfries & Galloway.

3.7 Mammals (low importance)

Many mammals, including Badgers *Meles meles,* Foxes *Vulpes vulpes,* Rabbits *Oryctolagus cuniculus* and various deer, make use of scrub woods but these are common species and scrub is not a critical habitat component for any of them.

4. Environmental, Economic & Social Importance of Biodiversity

- Extensive areas of Gorse scrub form a distinctive landscape in parts of Dumfries & Galloway, especially during the main spring flowering period, and this contributes to the image of the region to tourists.

5. Factors affecting the Habitat

- Scrub is **rarely deliberately managed** as a habitat in its own right. Rather it is allowed to expand when management of open habitats is reduced or abandoned, or cleared when management of open habitats is initiated or intensified.
- **Unmanaged scrub can encroach** on more valuable biodiversity habitats and archaeological sites. Open, patchy scrub woods tend to support a greater biodiversity than dense thickets, but without low intensity management there is a tendency for open areas to be lost.
- Juniper woods have suffered from **overgrazing and burning**, diminishing its range.

6. Strategic Actions

6.1 Recent and current activity

- **Scottish Natural Heritage**, in association with the site's owner, support the management of Tynron Juniper Wood with the aim of regenerating Juniper, or restocking by planting where regeneration is not successful.

6.2 Other recommended actions

- **Survey** current local distribution, extent and value of scrub woods.
- **Assess where expansion** of scrub would be most desirable. The final decision should be made on a site by site basis but particular locations, such as the edges of native woods may be preferable. Avoid open semi-natural habitats that are likely to already have a high biodiversity value, and important archaeological sites.

Hazel scrub wood. Carlinstane Bank, Scaur Glen, May 2008. (Peter Norman)

MONTANE SCRUB

Priority Action (MS1)

Establish areas of montane scrub in Dumfries & Galloway.
Target: Establish a total of at least 40ha in 2 locations by 2015.
Lead Partner: Forestry Commission Scotland/Borders Forest Trust.

Planting montane scrub at Firth Hope, Carrifran. March 2008. (Borders Forest Trust)

1. Habitat Description

1.1 Physical Characteristics

Montane scrub consists of low-growing, crooked trees and shrubs. It occurs in a transition zone in the uplands between woodland and moss heath, in an environment where low temperatures, windy conditions and short growing season restrict the growth of tall woody species but they are not severe enough to prevent it entirely. It also occurs at higher elevations in sheltered gullies. However, only a few small remnants of montane scrub survive in Britain today, mostly on ungrazed ledges, but rarely on lightly grazed steep rocky slopes or boulder fields.

1.2 National and International Context

Montane scrub is a rare European habitat but is found on several European mountain ranges, most notably in Norway, Sweden, Finland and Czech Republic. A few small discrete stands of montane scrub occur in the Scottish Highlands, the biggest no more than 0.5ha. Elsewhere in Britain only a few scattered bushes survive in the Southern Uplands and Cumbria, though several restoration projects are underway.

2. Dumfries & Galloway Status

2.1 Recent Trends

There is virtually no evidence of the management or utilisation of montane scrub in Dumfries & Galloway in recent decades, presumably as so little of it exists. However, interest in this habitat has been increasing in Scotland, inspired by examples from Europe.

2.2 Current Distribution

A few remnants of montane scrub are found in the Moffat and Galloway Hills.

2.3 Site Examples

Tiny remnants of montane scrub occur at **White Coomb** (SAC/SSSI) and on the **Merrick** (SSSI). Montane scrub is being created at **Carrifran** (SAC/SSSI).

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with montane scrub, and the following action plans may also contain relevant information: Acid Grasslands, Upland Heaths, Montane Moss-heaths, Native Woods.

3. Importance for Associated Species

3.1 Flowering Plants (high importance)

Most remnant areas of montane scrub consist of a mixture of willows, including Dwarf Willow *Salix herbacea*, Downy Willow *Salix lapponum,* Dark-leaved Willow *Salix myrsinites and* Whortle-leaved Willow *Salix myrsinites.* However, there is no reason why other woody species such as Juniper *Juniperus communis,* as well as stunted trees such as oaks and birches, should not also form part of this habitat.

Plants such as Wood Cranesbill *Geranium sylvaticum* and Globeflower *Trollius europaeus*, usually now restricted in the uplands to ungrazed ledges, are occasionally found in montane scrub and may become more widespread with expansion of this habitat.

3.2 Invertebrates (high importance)

A number of invertebrates, including sawflies, moths and beetles, have been recorded as specialists on montane willow, though few if any of these have yet

been recorded in Dumfries & Galloway. *Pontania herbacea* has been noted as a gall on Dwarf Willow in the Moffat Hills.

3.3 Birds (medium importance)

Black Grouse *Tetrao tetrix* would benefit from areas of montane scrub. Other birds, including Ring Ouzels *Turdus torquatus* and other thrushes, Whinchats *Saxicola rubetra*, and finches would be likely to nest within the scrub.

3.4 Fungi and Lichens (medium importance)

Due to the rarity of this habitat in the UK, few studies have been completed on fungal associations. Research from elsewhere in Europe suggests that there may be a number of species restricted to this habitat.

3.5 Reptiles and Amphibians (low importance)

Adders *Vipera berus* and Common Lizards *Zootoca vivipara* would be likely to occur in montane scrub.

3.6 Non-flowering Plants (low importance)

As with fungi, little research has been completed on the importance of montane scrub in Dumfries & Galloway for mosses.

4. Environmental, Economic & Social Importance of Biodiversity

- Montane scrub could be used to soften the upper edges of conifer plantations, bringing visual improvements to upland landscapes.
- In such situations as above it would also shelter the plantation, increasing growth rates and reducing windthrow.
- Montane scrub would help prevent erosion, reduce leaching of soil nutrients, and contribute to a reduced risk of flooding in the catchment.

5. Factors affecting the Habitat

- Current environmental and grazing conditions are unlikely to result in the expansion of montane scrub.

6. Strategic Actions

6.1 Recent and current activity

- **The National Trust for Scotland** has erected a fenced exclosure at Grey Mare's Tail to prevent grazing of existing montane willows.
- **Borders Forest Trust** has designed areas of montane scrub into their Carrifran Wildwood Project.
- **Forestry Commission Scotland** and **Cree Valley Community Woodlands Trust** have initiated a montane scrub project in the Galloway Hills as part of Highland Birchwoods' Action for Mountain Woodlands Project. This involves propagating and planting out Downy Willow and Juniper above the conifers on Merrick.

6.2 Other recommended actions

- Incorporate montane scrub into **management of existing forests**.

Juniper, including dwarf forms, is a natural component of montane scrub. (Peter Norman)

VETERAN TREES

Priority Action (VT1)

Establish a veteran tree project to recruit and train volunteers, in order to identify, survey and publicise veteran trees.
Lead: Dumfries & Galloway Environmental Resources Centre/Woodland Trust.

Priority Action (VT2)

Raise awareness of the importance and management of veteran trees amongst countryside staff.
Target: Arrange 1 training course by 2009.
Lead: Dumfries & Galloway Biodiversity Partnership.

1. Habitat Description

1.1 Physical Characteristics

Technically, a tree becomes a veteran when the areas of successive annual rings in the main trunk begins to progressively decrease. However, it is rarely possible to detect such a feature and a range of less precise characteristics more usually identifies veteran trees. Veteran trees typically have greater than average quantities of **dead and decaying wood**; a large number of **hollows, holes and cavities** in the trunk and branches, often with naturally formed pools of water; areas of **damaged and lost bark** including **sap runs** where stress, wind, drought or collision damage extends from the bark to the conductive vessels; a large number of **epiphytic plants** such as ferns and lichens; and frequent **fungal fruiting bodies** of heart-rotting species. Ancient trees with such decay can survive for many years as only the bulky heartwood is affected and the living tissues are not killed. Indeed decay decreases the bulk of veteran trees, making them less susceptible to wind-throw.

Heavy-branched veteran birch. Holm Farm, Cree valley, May 2006. (Peter Norman)

Old age tends to produce many of the above characteristics and many veterans are large, old trees. However, these features can also result from a particular history of management in relatively young trees. Size and age are therefore not necessarily characteristics of all veteran trees. Trees that are old in relation to others of the same species are termed **ancient trees**. For example, birches may become ancient at 100 years old, but oaks not until 300 years old. Most ancient trees also have a large girth in relation to others of the same species. There is considerable overlap between ancient and veteran trees, but one does not automatically follow the other.

Heritage Trees need not necessarily be veteran or ancient trees, but are associated with some aspect of cultural heritage, often a specific person or historical event. Very often such trees have individual names. Veteran trees can be of any species, both native and introduced, and it is possible for **scrub** species such as Hawthorn and Hazel to become veterans.

2. Dumfries & Galloway Status

2.1 Recent Trends

The value of veteran trees has only become widely recognised in Britain since the 1990s. However, this has been matched by an increased perception of danger from trees with dead and decaying wood, and a desire for increased 'tidiness'. They therefore remain extremely vulnerable.

Massive multi-stemmed oak. High Ardwall, Gatehouse of Fleet, April 2007. (Peter Norman)

2.2 Current Distribution

Veteran trees have been recorded throughout Dumfries & Galloway, but the current distribution is imprecisely known. A number are likely to occur on long-established private estates.

2.3 Site Examples

Lochwood (SSSI) near Beattock contains one of the best collections of veteran trees in Britain. Nearby **Raehills Estate** also contains important examples. A sample survey of the **Fleet Valley National Scenic Area** in 2005 identified more than 200 potential veteran trees.

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with veteran trees, and the following action plans may also contain relevant information: Traditional Field Boundaries, Wood Pastures and Parklands.

3. Importance for Associated Species

3.1 Fungi and Lichens (very high importance)

Fungi are critical in the ecology of almost all of the wildlife associated with old trees and some are themselves rare and restricted to only the oldest of trees. It is fungi which cause the decay and hollowing on which the other wildlife depends. The decay of heartwood and hollowing are a perfectly natural part of the ageing process of the tree, probably prolonging its life, and are not necessarily a sign of ill health.

Sulphur Polypore Laetiporus sulphureus. Knockman Wood, June 2004. (Peter Norman)

Oak Polypore *Piptoporus quercinus* is restricted to veteran oaks. It was discovered at Lochwood in 2005, the first and so far only location in Scotland for this internationally rare species. The rare Beeswax Bracket *Ganoderma pfeifferi* is restricted to old Beech trees, and was recorded in Glencairn Parish 2000. Some slow-growing lichens are only found on the bark of very old trees.

3.2 Invertebrates (very high importance)

Veteran trees in Britain are the most important in Europe for invertebrates, including many rare species. Even a single tree can be very important. Few surveys have been completed in Dumfries & Galloway, but a few typical species have been identified.

Short, stubby veteran Alder with holes through the trunk. Glenmaddie Wood, Sanquhar, June 2008. (Peter Norman)

Most invertebrates associated with veteran trees require **decaying wood**, but very often this needs to be of a particular stage of decay or in a specific part of the tree. For example, the nationally scarce cranefly *Ctenophora pectinicornis* is associated with rot holes in large broad-leaved trees, especially Beech. Larvae often occur in shattered ends of trunks and have been found in rotten boughs, but only those that have fallen from at least 10m high. It is widespread in southern Britain but scarce in the west and north. The larvae of the hoverfly *Xylota sylvarum* develops in wet decaying roots of broad-leaved trees, ascending up the trunk to pupate beneath the bark, and in rot holes. It is widespread in old woods and wood pastures. The larvae of the soldier beetle *Malthodes marginatus* develops in decaying wood or beneath bark on dead timber, whilst the adults are mainly predatory on insect larvae but also feed on decaying timber. The hoverfly *Criorhina berberina* lays its eggs around the base of stumps and on the underside of leaves next to stumps. The larvae develop in the heart rot of roots, whilst adults feed at Hawthorn blossoms. It is mainly associated with ancient woods and wood pastures.

Sap runs, are often small and inconspicuous but highly important for invertebrates. They should not be viewed as a sign of ill-health.

3.3 Mammals (very high importance)

Due to the presence of numerous deep narrow crevices, veteran trees probably constitute the single most important breeding habitat for bats in Dumfries & Galloway. All species use veteran trees,

but some, such as Noctules *Nyctalus noctula* rarely roost in buildings or other non-tree sites. Though little research has been completed, veteran trees are also likely to be used by many bats as hibernation sites.

3.4 Non-flowering Plants (very high importance)

A wide range of epiphytic mosses is found on veteran trees. Park Yoke-moss *Zygodon rupestris* is closely associated with veteran trees, whilst Marble Screw-moss *Syntrichia papillosa* is most typically a species of mature trees, although rarely it also grows on walls, stones or tarmac. It is an infrequent plant throughout Britain and Ireland.

3.5 Birds (high importance)

The **hollows, holes and cavities** in the trunks and branches of veteran trees are used as nest sites by many species of birds, notably Barn Owls *Tyto alba*, Redstarts *Phoenicurus phoenicurus* and Spotted Flycatchers *Muscicapa striata*. Furthermore, the quantity of **dead and decaying wood** allows those species that excavate their own nest hole, such as woodpeckers, to utilise veteran trees.

3.6 Flowering Plants (low importance)

Apart from the fact that the veteran trees are flowering plants themselves, very few flowering plants are directly dependent on them.

3.7 Reptiles and Amphibians (low importance)

Although all native reptiles and amphibians may occasionally be found in or on veteran trees, the habitat is of low importance for this group.

4. Environmental, Economic & Social Importance of Biodiversity

- All veteran trees are of historic interest. They are as much a part of Dumfries & Galloway's heritage as its castles and churches.
- A number of veteran trees have been the subject of paintings by local artists.
- Decaying trees play a critical ecological role, releasing nutrients into woodland ecosystems.

5. Factors affecting the Habitat

- **Poor knowledge** of veteran tree distribution, history and biodiversity value in Dumfries & Galloway.
- Limited knowledge amongst tree surgeons, statutory agencies and even conservation organisations of the importance of veteran trees and their **management**.
- A **public perception** that all trees with dead and decaying wood are of little biodiversity value, aesthetically offensive and potentially dangerous. Such perceptions frequently result in pressure to remove veteran trees.

6. Strategic Actions

6.1 Recent and current activity

- **The Woodland Trust** runs an Ancient Tree Hunt that encourages volunteers to find and collect information on ancient trees for a national database. Only a few have so far been recorded from Dumfries & Galloway.

6.2 Other recommended actions

- Produce, or contribute to the national production, of an illustrated field guide to identify the various forms of veteran trees and the history and ecology that has led to their current form.

Fat-trunked veteran oak. Boreland Hills, Gatehouse of Fleet, October 2004. (Peter Norman)

CONIFER PLANTATIONS

Priority Action (CP1)

Identify conifer plantations that could be converted to broadleaves as part of a forest habitat network.
Target: Complete forest habitat network study for Dumfries & Galloway by 2012.
Lead: Forestry Commission Scotland.

Priority Action (CP2)

Expand areas of long-term retention within conifer plantations.
Target: 100ha of new long-term retention by 2015.
Lead: Forestry Commission Scotland.

1. Habitat Description

1.1 Physical Characteristics

The primary purpose of most conifer plantations is timber production, though a few in the lowlands may also have landscape and game functions. They are composed wholly or mainly of coniferous trees, often dominated by stands of single species, typically non-native larches, Sitka Spruce or Norway Spruce. At the forest scale, species composition may be more mixed, with a variety of native trees and shrubs on the **forest edge**, or more rarely scattered throughout. Most plantations are on ground that has been drained by a network of **ditches** and deep ploughed prior to tree planting, although more recent plantations may have used alternative establishment techniques.

Forest trail in Dalbeattie Forest. August 2006. (Peter Norman)

The early years of forest growth, sometimes described as the **pre-thicket stage** (when the trees are approximately 0-12 years old), is perhaps the richest for biodiversity, especially in first rotation plantations where remnants of the previous habitat are present. During the **thicket stage** (10-30 years old) the trees form a dense canopy preventing most light from reaching the forest floor, resulting in an almost total absence of ground flora and understorey. Some plantations are thinned at this stage. The **high forest stage** (30-70 years old) results in a higher, sometimes more open **canopy** (especially in deciduous larch plantations), allowing more light to reach the forest floor and some re-establishment of ground flora. This is most marked at the forest edge. Most trees are harvested at 40-70 years old, before reaching maturity. Harvesting is frequently carried out using **clearfell** methods, though continuous cover forestry is increasingly being used. The site is then restocked for a second and subsequent rotation of trees. **Long-term retention** of mature conifers beyond this age is now being practised for biodiversity and landscape purposes in some locations.

1.2 National and International Context

Approximately 1,516,000ha (7%) of Britain is covered by conifer plantations, with 993,000ha in Scotland. Along with improved grasslands, conifer plantations are the most widespread and abundant of habitats in Dumfries & Galloway, with approximately 145,000ha (23% of the region) planted with conifers, almost 10% of all UK planting. Given the extent of conifer plantations in the region, their existing and potential value for biodiversity is of high importance.

2. Dumfries & Galloway Status

2.1 Recent Trends

In the last 20 years increasing attention has been given to the biodiversity of conifer plantations. This has prompted many second rotation forests to be planned to take account of nature conservation needs through the creation of a greater diversity of tree species and ages, management of rides and glades, retention of old stands with dead and dying trees, more sensitive treatment of watercourses and encouragement of understorey vegetation. In some instances, conifer plantations have been removed to recreate former habitats, especially raised bogs.

2.2 Current Distribution

Conifer plantations are widespread, especially in the uplands. All of Dumfries & Galloway's conifers, except for a tiny number of Junipers, are of plantation origin. Only in the Scottish Highlands do semi-natural woods of native Scot's Pines occur.

2.3 Site Examples

Extensive examples of conifer plantations are found at **Eskdalemuir**, **Forest of Ae**, **Mabie Forest**, **Dalbeattie Forest** and in **Galloway Forest Park**.

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with conifer plantations, and the following action plans may also contain relevant information: River Headwaters, Exposed River Shingle, Native Woods, Broadleaved and Mixed Plantations, Forest Roads and Rides, Forest Ponds.

The region's conifer forests may offer a last refuge for Red Squirrels. Loch Ken 2007. (Gordon McCall)

3. Importance for Associated Species

3.1 Mammals (very high importance)

The natural habitat of Red Squirrels *Sciurus vulgaris* in Dumfries & Galloway is native broadleaved woodland, but they also occur in low densities in conifer plantations from the **thicket stage** onwards. However, introduced Grey Squirrels are better able to compete for food and will eventually replace them in native woods. Large conifer plantations with few large-seeded broadleaves might provide the only long-term prospect for the survival of Red Squirrels in Dumfries & Galloway, although even here changes to species composition and age structure will be required.

Insect food for bats is usually plentiful in conifer plantations, but the harvesting of the trees prior to maturity limits the availability of holes, even in the high forest stage. Special provision has to be made for them, usually with boxes. More **long-term retention** of conifers, including retention of standing dead-wood, would increase their prospects.

Pine Martens *Martes martes* were reintroduced to Dumfries & Galloway in the 1980s. Since then, the extensive conifer plantations of the region have enabled their population to expand and increase, although they are rarely seen. A variety of other mammals have successfully adapted to conifer plantations. These include Badgers *Meles meles,* Roe Deer *Capreolus capreolus* and Red Deer *Cervus elaphus.*

3.2 Fungi and Lichens (high importance)

Conifer forests, even fairly recent ones, provide good habitats for larger fungi. If the total number of species is lower than native woods, then this is almost certainly due to the fact that plantations tend to be monocultures. Species such as the Saffron Milk-cap *Lactarius deliciosus* are even able to survive in the dense **thicket stage**, though rarer fungi tend to be associated with more mature trees. For example, the nationally rare *Fayodis bisphaeriga* and *Rhodocybe gemina* have been found in association with pine and other conifers in Kirkcudbrightshire, and *Galerina stylifera* in the Forest of Ae. Some species, such as *Pholiota flammans* recorded at Kirroughtree, are more usually found in Caledonian Pine Woods, whilst *Melanotus proteus*, an uncommon fungus of pine stumps, is from a predominantly a tropical/sub-tropical genus. A number of species, such as the Larch Bolete *Suillus grevillei,* have been introduced into Britain as a result of the creation of conifer plantations.

Herald of Winter Hygrophorus hypothejus is restricted to pinewoods. Torrs Warren, November 2007. (Peter Norman)

Microfungi, including mycorrhizal species that are essential for the growth of most British plants, are less common in conifer plantations, often lost through soil disturbance during initial ploughing or subsequent use of heavy machinery.

The poor qualities of conifer bark, the lack of deadwood and old trees, excessive shade, and a lack of ecological continuity due to the clearfelling system make most conifer plantations poor in lichen diversity.

3.3 Birds (high importance)

Several birds, including Short-eared Owls *Asio flammeus* and Grasshopper Warblers *Locustella naevia* favour the **pre-thicket** stage of the conifer plantations. Second rotation forests have not so far provided the same benefits for these species as the original plantings.

Conifer plantations, especially in the **high forest** stage, are the favoured habitat for a number of species, including Song Thrushes *Turdus philomelos,* Coal Tits *Periparus ater*, Willow Warblers *Phylloscopus trochilus,* Goldcrests *Regulus regulus,* Siskins *Carduelis spinus* and Common Crossbills *Loxia curvirostra.* Only the latter species is restricted to conifers, the others also occurring in a range of other habitats. Chaffinches *Fringilla coelebs* are very common in conifer plantations and given the extent of this habitat in Dumfries & Galloway, regional numbers may well be significant in a UK context. A number of birds of prey also nest in plantations at this stage, and even more so in areas of **long-term retention**. These include Buzzards *Buteo buteo,* Sparrowhawks *Accipiter nisus,* Goshawks *A. gentilis* and Long-eared Owls *Asio otus.*

Dumfries & Galloway has many **forest edge** habitats which should offer potential for the foraging of Black Grouse *Tetrao tetrix*. Merlins *Falco columbarius* will also nest on the forest edge, so long as there is suitable adjacent open ground for hunting. Practical conservation measures within conifer forests have resulted in dramatic improvements in the number of Barn Owls *Tyto alba.*

Barn Owl, (Paul McLaughlin)

Dumfries & Galloway supports almost the entire Scottish population of Nightjars *Caprimulgus europaeus,* which nest and feed in forest clearings, including areas of **clearfell**. Forest restructuring may be able to provide suitable habitat continuity for these birds.

3.4 Invertebrates (medium importance)

Large, dense stands of conifers of uniform age are not of great interest for invertebrates. Those that do occur are either recent arrivals to Britain or common generalists that have spread from native plants. However, given their extent in Dumfries & Galloway, their overall total contribution to invertebrate biodiversity in the region is not insignificant. A few nationally scarce species, such a ground beetle *Trechus rubens,* also occur.

A number of new invertebrate species have been attracted to the **canopy** of conifer plantations, including several hoverflies. For example, *Eupeodes lundbecki*, although common in Europe, was recorded at one of its first locations in the UK at Tynron in 1984. Other recent colonists include *Eriozona erratica, E. syrphoides, Melangyna compositarum, Parasyrphus lineola*, and *P. malinellus.* The latter was new to science when discovered in 1952. Although most are predators of aphids and other canopy species, they also require the presence of flowers at ground level.

The caterpillars of Red-necked Footman moths feed on lichens growing on conifers. Glenwhan, July 2005. (Richard Mearns)

The importance of dead and decaying wood is usually associated with broad-leaved trees, but it is also of importance in **long-term retention** conifers. The longhorn beetles *Rhagium bifaciatum* favours dead and decaying pine, though it also occurs on other trees.

The Hairy Wood Ant *Formica lugubris* is regularly recorded in conifer plantations in the Highlands. There is a pre-1970 record from the Machars. Although it is now probably extinct, there is an outside possibility that a population may still exist in local forests.

3.5 Non-flowering Plants (low importance)

Although numbers of species and quantity of plants can be high, conifer plantations support a poor quality moss and liverwort flora, composed almost entirely of common species. Important species occur only where plantations contain remnants of former habitats, such as native woods or bogs, or sometimes on decaying large stumps or logs. One species of interest, Ostrich-plume Feather-moss *Ptilium crista-castrensis* is perhaps most typically a plant of northern Scottish pinewoods, where its growth can be quite luxuriant, but it has also been found, rarely, in pine plantations in Dumfriesshire.

3.6 Reptiles and Amphibians (low importance)

Conifer plantations in Dumfries & Galloway support virtually all of the region's reptile and amphibian species, but most occur at very low density within the trees. The most important areas tend to be localised open spaces, such as forest ponds or forest roads, or transient habitats such as **clearfell** areas.

3.7 Flowering Plants (low importance)

Rare plants associated with Caledonian pinewoods have been recorded in conifer plantations outside of the Highlands, including the Borders and Cumbria, but few, if any, are known from Dumfries & Galloway. As a result, the flora of conifer plantations generally consists of common and widespread flowering plants.

Following clearfelling there can be rapid recolonisation of flowering plants from adjacent or buried seed sources. However species tend to be opportunists, with little, if any recolonisation of pre-plantation flora.

3.8 Fishes (low importance)

No species of fish are strongly associated with conifer plantations. Indeed, poorly planned forests can exacerbate acidification of adjacent watercourses, severely depleting fish populations.

4. Environmental, Economic & Social Importance of Biodiversity

- Though conifer plantations are rarely economically profitable without state aid, they continue to provide economic and employment benefits to Dumfries & Galloway.
- The softwood timber produced in the plantations is generally of low quality but does supply a number of markets, typically for pulpwood.
- Given the extent of conifer plantations in Dumfries & Galloway, they make an important contribution to carbon sequestration. However this is rather limited in comparison to the totals for peatlands, semi-natural habitats and seas.
- Conifer plantations are well suited to outdoor recreation activities such as mountain-biking and paint-balling that may cause damage to less robust habitats.

5. Factors affecting the Habitat

- **Uniform age and species composition** of forests has not benefited biodiversity.
- There is the prospect of **shorter rotations** as timber processing becomes more efficient and timber markets change, which may impact on species associated with more mature trees.
- **Removal of** stumps for use in biomass power stations is likely to reduce fungal and bryophyte diversity of planted conifer plantations.
- Wind **and fire damage** can open up clearings in forests and encourage biodiversity associated with the catastrophic events that occur in natural ecosystems.

6. Strategic Actions

6.1 Recent and current activity

- The management and expansion of conifer plantations in the UK is regulated by the government through the **Forestry Commission**. Grants are paid where the management or creation of plantations is in accordance with UK forestry policy. This is set out in a series of publications: The UK Forestry Standard defines and applies government commitments to sustainability and biodiversity and this is augmented by a series of guidelines on biodiversity, landscape, water, archaeology and recreation.
- UK forestry policy addresses problems of uniform species cover, stipulating inclusion of a minimum proportion of minor conifer species together with open space and broadleaves. These elements are likely to comprise 20-30% of new and second rotation forests. The policy also provide guidance on continuous cover silvicultural systems and the identification of long term retentions to produce old trees.
- Local forest strategies, termed Forest Frameworks, have been developed by **Forestry Commission Scotland, Scottish Natural Heritage** and **Dumfries & Galloway Council** for Galloway and Lockerbie-Langholm to guide the location of new forests.

Eyed Ladybird, a conifer specialist. Kirkconnel, August 2007. (Greg Baillie)

6.2 Other recommended actions

- Direct any **new conifer plantations towards areas of low conservation value**, such as derelict industrial, low grade arable, and improved pasture, which will result in a net gain for biodiversity. Avoid semi-natural open habitats and native woods of a high conservation importance.
- Where feasible, **restore high biodiversity habitats** damaged by conifer planting.
- Identify locally, as well as nationally and internationally important habitats and species within and around conifer plantations and ensure actions for them are included in **forest plans.**
- Develop systems to **monitor the biodiversity** value of conifer plantations, for example by assessing critical habitat features and selecting key or indicator species.

BROADLEAVED & MIXED PLANTATIONS

Priority Action (BMP1)

Identify suitable locations for new broadleaved plantations as part of a forest habitat network.
Target: Complete forest habitat network study for Dumfries & Galloway by 2012.
Lead: Forestry Commission Scotland.

A mixed plantation, created entirely for recreation at Powfoot Lakes. July 2006. (Peter Norman)

1. Habitat Description

1.1 Physical Characteristics

Broadleaved and mixed plantations have been created for a number of purposes, most commonly game cover, timber, landscape and amenity, and wildlife conservation. Most have been planted on open ground or in some cases by under-planting of semi-natural woods. They are composed both of native and non-native broadleaved trees, often mixed with conifers, and occur primarily on more fertile ground in the lowlands.

Plantations of native trees should not be confused with semi-natural and/or ancient woods. As plantations mature, they take on many of the characteristics of such woods and can become more difficult to distinguish from them, but it is likely that none have yet acquired the complicated ecological inter-relationships of semi-natural ancient woods, and may not do so for many hundreds of years. Those with the best chance of doing so are those with a woodland type soil that has been least disturbed and modified during the period that the wood was absent. Plantations on highly improved agricultural soils may grow trees, but may never acquire a full woodland ecosystem.

1.2 National and International Context

The majority of Britain's broadleaved trees are of plantation origin. In Scotland, there was around 3000km^2 of broadleaved and mixed woodland in 1998, the majority of which was of plantation origin. This area will have subsequently increased.

2. Dumfries & Galloway Status

2.1 Recent Trends

The number and area of broadleaved plantations has been increasing in the last 20 years, encouraged by state grant programmes. Few have any significant timber value, but have been created for amenity, wildlife and game purposes. Short-rotation coppice is a very new form of plantation.

2.2 Current Distribution

Most woods in Dumfries & Galloway, even those composed of native species, are of planted origin. Larger plantations tend to be associated with private estates, houses or castles, but smaller woods of native oaks, birches, elms and Ash, often with non-native Beech, Sycamore and conifers, are also widespread. They often comprise a sinuous patchwork on agricultural land, and their historical origins are usually not obvious.

2.3 Site Examples

Cotland Plantation (SSSI) at Bladnoch is an old plantation, predominantly of oaks and Ash. It supports an interesting flora. Nearby, **Kilsture Forest** is the largest woodland in the Machars. **Cally Woods** at Gatehouse of Fleet was planted on top of a designed landscape in the 1930s, with oaks, Sycamore, Ash, Beech, Scot's Pine and Sitka

Beech plantation with characteristic sparse ground flora. Drumlanrig, September 2006. (Peter Norman)

and Norway Spruce the main trees. It supports good bird, bat, lepidoptera and fungi populations. Other important policy woodlands include those at **Drumlanrig, Kelhead** and parts of **Mabie Forest.**

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with broadleaved and mixed plantations, and the following action plans may also contain relevant information: Native Wet Woods, Native Ash Woods Native Oak Woods, Native Birch Woods, Scrub Woods, Veteran Trees, Conifer Plantations, Forest Roads and Rides, Forest Ponds, Wood Pastures and Parklands.

3. Importance for Associated Species

3.1 Fungi and Lichens (high importance)

A number of non-native trees are important for fungi and lichens. In particular Beech is crucial for a whole array of fungi, and Sycamore is important for lichens. The nationally rare Golden Bootleg Fungus *Phaeolepiota aurea* was recorded in a mixed open plantation in Kirkcudbrightshire and from Mabie Forest, both in 1993.

The spiny underside of the edible Hedgehog Fungus. St. Ann's, September 2006. (Peter Norman)

Chaffinch. (Paul McLaughlin)

3.2 Birds (high importance)

A wide range of birds is found in well-managed plantations, including various thrushes, tits and finches. Though very rare in Dumfries & Galloway, Hawfinches *Coccothraustes coccothraustes* may occasionally be found in plantations that contain Beech, Cherry and Hornbeam.

3.3 Mammals (high importance)

The mammal fauna of broadleaved plantations is little different to semi-natural native woods - management practices are of more importance than tree species composition. Bats in particular require the retention of mature and semi-mature trees with plenty of holes for roost sites.

3.4 Invertebrates (medium importance)

As a result of the poor colonising ability of woodland invertebrates, broad-leaved plantations lack the characteristic species of semi-natural ancient woods. Unless the plantation adjoins ancient woodland, the invertebrates will generally be common species that occur in a range of habitats. Nevertheless they can occur in high numbers. A few species of more restricted national distribution are known from mixed plantations, including the larvae of the hoverfly *Cheilosia longula* that feeds only within fungi growing under broadleaved and coniferous trees.

3.5 Reptiles and Amphibians (medium importance)

Reptiles and amphibians are more influenced by plantation structure than its age or species composition. Populations in open plantations can therefore be just as high as in native woods.

3.6 Non-flowering Plants (low importance)

Plants generally take much longer to colonise plantations than animals, especially if the plantations are isolated from existing ancient woods. As a result, most plantations lack the typical species diversity associated with ancient woods, though long-established plantations may have acquired at least some of them.

3.7 Flowering Plants (low importance)

As with non-flowering plants, the best plantations for flowering plants tend to be the oldest ones that have been least disturbed.

Common Figwort tolerates shaded habitats in plantations. Dalry, July 2007. (Maggi Kaye)

4. Environmental, Economic & Social Importance of Biodiversity

- Nature conservation is rarely the main reason for the establishment or management of broadleaved and mixed plantations. Most fulfil a variety of other roles including landscape, timber production, amenity, recreation, shelter and game cover.
- A survey by the Forestry Commission in 2003 found that 18% of the Scottish population had collected non-timber forest products in the preceding 12 months, mostly from mixed woods. 173 species were collected, mostly to eat or for medicinal or craft uses. Most products were for personal use and the collecting was considered to be of social and cultural importance, but some collecting also resulted in a modest economic income.

5. Factors affecting the Habitat

- Management work, including **felling and thinning**, can be damaging to bird and bat populations and ground flora, if carried out at sensitive times of the year.
- Creation of a dense shrub layer for pheasants in woods managed for game has sometimes been achieved by the **planting of potentially invasive shrub species** such as Rhododendron, Laurel and Snowberry.
- The **siting of pheasant release pens**, especially if intensively stocked can lead to soil enrichment and loss of ground flora.
- **Climate change** may affect tree species distribution throughout Britain. For example it has been suggested that conditions may become unsuitable for Beech in much of the south of England. Although not native to Scotland, in the future this tree may be more suited to environmental conditions in Dumfries & Galloway.

6. Strategic Actions

6.1 Recent and current activity

- New mixed plantations have been created at a number of locations including **Barfill Farm**, near Crockeford.

6.2 Other recommended actions

- Implement the same management techniques for broadleaved and mixed plantations as for native woods, wherever this does not conflict with other uses. Encouragement of **a diverse species and age structure, creation of open space, retention of wet areas and decaying wood,** can all usually be incorporated into management whilst retaining the primary purpose of the plantation.
- **Consider planting Beech woods** on ground of low biodiversity value. Do not plant Beech in existing semi-natural native woods.

Mixed broadleaved plantation. Cally Woods, Gatehouse of Fleet, July 2007. (Peter Norman)

FOREST ROADS & RIDES

Priority Action (FRR1)

Raise awareness of forest managers of the importance of forest roads and rides for biodiversity, and how best to manage them.
Target: Arrange training course by 2012.
Lead: Dumfries & Galloway Biodiversity Partnership/Butterfly Conservation/RSPB.

Forest road with grassland and scrubby edge. Potterland Hill, July 2007. (Peter Norman)

1. Habitat Description

1.1 Physical Characteristics

Roads and rides have been constructed in both coniferous and broadleaved plantations for the purposes of forest management. **Roads** are access routes with metalled surfaces designed to support use by heavy timber transport vehicles. They are created by the removal of soil and re-profiling of the ground surface, and usually have associated drainage ditches. Passing/turning places and timber stacking/loading areas may also be present. **Rides** are unsurfaced and designed for infrequent use only by specialist off-road forestry vehicles. Wayleaves cut under power lines provide a very similar habitat to forest rides. Both roads and rides may also serve as firebreaks.

Both roads and rides provide a mosaic of open ground and vegetated habitats that is often more diverse than the surrounding plantation. Broadleaved shrubs and trees frequently occur, even in predominantly coniferous forests. Grassland, bare ground and wetland (ditch) habitats can also occur.

The greatest physical asset of roads and rides for biodiversity, in comparison to the interior of the forest, is the abundance of light. However, the presence of trees also provides shelter from wind, and there are often long intervals between bouts of disturbance.

2. Dumfries & Galloway Status

2.1 Recent Trends

Maintenance of roads and rides in the recent decades has, just like forest management, become increasingly mechanised and the tractor-drawn swipe or flail is the principal tool.

2.3 Current Distribution

Forest roads and rides are widely distributed through all of the region's larger forests.

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with forest roads and rides, and the following action plans may also contain relevant information: Conifer Plantations, Broadleaved and Mixed Plantations, Forest Ponds, Quarries and Mineral Workings.

3. Importance for Associated Species

3.1 Invertebrates (high importance)

Painted Lady, one of many butterflies that use open sunny roads and rides. Dunskey, August 2003. (Maggi Kaye)

The invertebrate fauna of forest roads and rides is generally of greater interest than that in the plantation, especially where plantations are composed of even-aged single species conifers. A number of species of butterfly have been retained following afforestation through the creation and management of suitable forest roads. These include the Pearl-bordered Fritillary *Boloria euphrosyne* at Mabie, the Grayling *Hipparchia semele* at Sandyhills and the Dingy Skipper *Erynnis tages* at Dalbeattie.

Moths are less dependent than butterflies on sunlight, but the abundance of broadleaved shrubs, particularly willows and birches, on forest roads and rides provides important foodplants. Other invertebrates have been little studied, but sun-loving groups such as bugs, bees, wasps and hoverflies are likely to be more common here than in the shade of the forest. Predatory insects of other habitats, such as dragonflies from forest ponds, are often attracted to hunt in the sheltered conditions provided by roads and rides.

3.2 Fungi and Lichens (high importance)

Roads and tracks through woods and plantations provide an important microhabitat for fungi including rare tooth fungi. These species appear to have a preference for fruiting in bare mineral soils and forest tracks often offer a perfect habitat. Many other fungi also fruit along forest roads, though it is not clear exactly why this is the case. Common forest road species include Orange-peel *Aleuria aurantia* and Shaggy Ink-cap *Coprinus comatus*.

Conical waxcap Hygrocybe conica on forest road. Mabie, August 2007. (Peter Norman)

3.3 Flowering Plants (medium importance)

The flora of roads and rides can be completely different to the forests through which they pass. A greater diversity of flowering plants is found on lowland forest roads and rides than in the uplands. Bird's-foot Trefoil *Lotus corniculatus,* Common Dog Violet *Viola riviniana* and Black Knapweed *Centaurea nigra* are typical species, all of which are important for butterflies. Bird's-foot *Ornithopus perpusillus*, a tiny localised plant of open grassland, has been found thriving on the disturbance created along some forest roads in the region.

In upland areas, several species have benefited from the reduced grazing pressure in forests, compared to adjacent sheep pastures. Bog Asphodel *Narthecium ossifragum* often flowers profusely and Heather *Calluna vulgaris* and Bog Myrtle *Myrica gale* grows tall along forest rides. Heath Cudweed *Gnaphalium sylvaticum*, one of the few native vascular plant species to benefit from the extensive afforestation programmes of the 20th century, grows on open woodland and forestry rides in areas of former heathland, though now appears to be in national decline and is locally rare.

Self Heal, often abundant on forest roads. Mark Hill, Colvend, July 2007. (Peter Norman)

In forests planted on bogs, once the canopy closes the only remnants of the original bog vegetation is usually to be found along rides, including Cranberry *Vaccinium oxycoccus*. Such plants provide a reservoir of seeds that can recolonise adjacent areas following harvesting, and are therefore valuable in any bog restoration projects. However, experience at Longbridge Muir and Moss of Cree suggests that this may be a very slow process.

3.4 Reptiles and Amphibians (medium importance)

Wide roads and rides are a good habitat for Common Lizards *Zootoca vivipara*. Common Frogs *Rana temporaria* may also breed in ditches.

3.5 Birds (medium importance)

Birds of forest roads and rides are more typical of the early stages of forests, rather than the more mature high forest stage. Species include Garden Warblers *Sylvia borin*, Chiffchaffs *Phylloscopus collybita* and Tree Pipits *Anthus trivialis*. Forests roads and rides may also be important for hunting Sparrowhawks *Accipiter nisus* and owls, and for the 'roding' display flights of Woodcocks *Scolopax rusticola.*

3.6 Mammals (medium importance)

In mature forests with sufficient bat breeding sites (caves, tree holes or bat boxes) for bats, linear features such as streams, roads and rides provide essential opportunities for feeding and movement of most species, especially if they link areas of semi-natural habitat. Indeed, forest roads and rides are the best places to locate bat boxes. They are also extensively used by feeding deer, and are ideal locations for deer control where required.

3.7 Non-flowering Plants (medium importance)

Stag's-horn Clubmoss *Lycopodium clavatum* and Alpine Clubmoss *Diphasiastrum alpinum* occur sufficiently frequently on the forest roads and rides to be an important part of the flora at almost all altitudes. Neither species is common in Dumfries & Galloway. Roadside ditches support a broad range of mosses and algae.

Green Tiger Beetles Cicindela campestris benefit from open sunny rides. Balloch Wood, August 2006.(Peter Norman)

4. Environmental, Economic & Social Importance of Biodiversity

- Roads and rides are the most publicly accessible part of forests, frequently used by walkers and cyclists. High biodiversity adds to the interest and enjoyment of such forest users.
- Game management can be compatible with management for biodiversity.

5. Factors affecting the Habitat

- Blanket application of herbicides as a way of managing forest roads is detrimental to biodiversity, especially flora and invertebrates.

6. Strategic Actions

6.1 Recent and current activity

- The forest roads around Lochaber Loch in Mabie Forest have been monitored for butterflies on a weekly basis by **Forestry Commission Scotland** during the summer for more than ten years, and management adjusted accordingly.

FOREST PONDS

Priority Action (FP1)

Assess the distribution and ecological importance of forest ponds in Dumfries & Galloway, by mapping their location and carrying out sample surveys.
Target: Map 100 and survey 25 forest ponds by 2015.
Lead: Forestry Commission Scotland/Dumfries & Galloway Environmental Resources Centre.

1. Habitat Description

1.1 Physical Characteristics

Forest pond at Screel. August 2004. (Peter Norman)

As with any other pond, the biodiversity value of forest ponds depends on a range of factors, including size, depth, bank profile, water quality, degree of shading and quantity of marginal and aquatic plants. All of these are influenced by the geological and environmental conditions of the surrounding landscape, but all can also be affected by the historic and current management regime.

2. Dumfries & Galloway Status

2.1 Recent Trends

The increased mechanisation of forestry means that excavation of new forest ponds has been much easier than in the past. As a result a number of ponds have been constructed in recent years, primarily for conservation and amenity purposes. These ponds have tended to have more natural contours and features than early forest ponds.

2.2 Current Distribution

Dalshinnie Loch in Mabie Forest. July 2004. (Peter Norman)

Forest ponds are widespread within forests in Dumfries & Galloway. Although most forests are in the uplands, it is likely that the greatest density of forest ponds is located within forests at lower elevations.

2.3 Site Examples

Some ponds that are known to have high biodiversity interest include **Penninghame Pond** and **Knockman Wood Pond** near Newton Stewart, **Borgan Pond** near Glentrool, **Dalshinnie Loch** (LWS) in Mabie Forest and **Earshaig Ponds** near Beattock.

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with forest ponds, and the following action plans may also contain relevant information: Conifer Plantations, Forest Roads and Rides, Farm Ponds.

3. Importance for Associated Species

3.1 Invertebrates (high importance)

The sheltered environment of many forest ponds is ideal habitat for dragonflies, and there are numerous ponds that have recorded at least ten species. Usually common species are involved, but several forest ponds support populations of Variable Damselfly *Coenagrion pulchellum,* which has a restricted UK distribution. There have been fewer surveys of other invertebrate groups.

Common Darter, a typical dragonfly of forest ponds. Dunskey, August 2003. (Mike Kaye)

3.2 Reptiles and Amphibians (high importance)

With the exception of Natterjack Toads *Epidalea calamita*, all native amphibians (Common Toad *Bufo bufo,* Common Frog *Rana temporaria*, Great Crested Newt *Triturus cristatus*, Smooth Newt *Lissotriton vulgaris* and Palmate Newt *Lissotriton helvetica*) breed in forest ponds.

3.3 Flowering Plants (medium importance)

A range of flowering plants is found in, or on the edge of forest ponds: Water Forget-me-not *Myosotis scorpiodes*, Water Mint *Mentha aquatica*, Water Plantain *Alisma plantago-aquatica* and a number

of pondweeds *Potamogeton* spp. Forest ponds, especially in remote parts of the forest, are less frequently visited by botanists than more natural ponds.

3.4 Birds (medium importance)

Though there are no birds directly dependent on, forest ponds, they are visited by many species, including Grey Herons *Ardea cinerea*, Mallards *Anser platyrhynchos*, Moorhens *Gallinula chloropus* and a range of small birds. A number of these may breed.

Moorhens nest on most lowland forest ponds. (Gordon McCall)

3.5 Mammals (medium importance)

Larger forest ponds, especially where they connect to watercourses, are used by aquatic mammals such as Otters *Lutra lutra*, Water Voles *Arvicola terrestris* and Water Shrews *Neomys fodiens*. They are also used by terrestrial mammals for drinking.

3.6 Non-flowering Plants (medium importance)

Aquatic algae form the basis of most pond food chains, but have been little studied in Dumfries & Galloway. A number of aquatic and semi-aquatic mosses and liverworts also grow in ponds, and muddy pond edges tend to be most important for such species.

3.7 Fishes (low importance)

Though many forest ponds support fish populations, and some have been deliberately stocked, few of these are of conservation importance. The introduction of fish may seriously damage amphibian and invertebrate populations.

4. Environmental, Economic & Social Importance of Biodiversity

- Forest ponds contribute to local landscapes and provide a focal point on forest walks.
- Accessible forest ponds have high educational value.
- Correctly designed, located and constructed ponds can assist with the treatment of pollutants from forest quarries or roads.

5. Factors affecting the Habitat

- Damage during forest operations can result from **vehicle use, run-off or large amounts of brash or other debris** falling into the pond. Such damage is now usually avoided through detailed planning of forest operations.
- A **perception that forest ponds need to be regularly 'cleaned'** can result in damage.
- **Introduction of fish** into fishless ponds has occurred in ponds valuable for dragonflies. Such action is now illegal.

6. Strategic Actions

6.1 Recent and current activity

- A pond at Kirroughtree Forest Visitor Centre not only adds to visitor interest, but has been constructed by **Forestry Commission Scotland** and **Cree Valley Community Woodlands Trust** with platforms to enable educational groups to safely sample the aquatic life.
- Eskrigg, within Turnmuir Plantation at Lockerbie, is a former curling pond that is now managed as a nature reserve by the **Lockerbie Wildlife Trust**.
- Garrochar Ponds have been created on the site of a former curling pond within the Forestry Commission's Balloch Wood at Creetown. Though managed by the **Balloch Community Woods** group primarily for amenity purposes, they have quickly become of high biodiversity value.
- Contaminated groundwater (Acid Mine Discharge) issuing from the forest quarry at Craigenbay has been successfully treated by **Forestry Commission Scotland** using a series of four ponds that have a natural appearance and also make a positive contribution to wildlife.
- A number of forest ponds have been surveyed for their dragonfly populations.

6.2 Other recommended actions

- Carry out further **pond surveys to identify ponds of high biodiversity value**. Species groups likely to benefit from additional survey effort include dragonflies, water beetles, aquatic bugs, amphibians and aquatic plants.

SHORT-ROTATION COPPICE

Priority Action (SRC1)

Ensure that all grant-aided short-rotation coppice in Dumfries & Galloway is not located on or adjacent to sites important for Local Priority Habitats or Species, where there is likely to be a significant detrimental impact on biodiversity.
Lead: Forestry Commission Scotland/Regional Priority Assessment Committee.

Short-rotation coppice at Barrasgate Farm, Cummertrees, August 2007. (Peter Norman)

1. Habitat Description

1.1 Physical Characteristics

Short-rotation coppice is a highly specialised form of broadleaved plantation, designed to produce dense stands of fast-growing trees for use as wood chip fuel in biomass power stations. The species used are usually non-native, sterile willows that are planted in fields and harvested on rotations of 3 to 5 years when 7-8 metres high. The cut willows then regrow and can produce 8-10 crops over 25-30 years before the plot needs to be replanted. Poplars are also suitable, but are much less commonly used than willows.

Short-rotation coppice can be grown on most land and soil types, but it produces larger yields and is more economical to grow in the more fertile, larger fields of lowland areas. Although intensive soil preparation and herbicide use may be required during the establishment period, subsequent inputs are usually low. Mechanical harvesting takes place only in the winter months (November to March). **Headlands** are normally required for the harvesting machinery to operate, providing opportunities to manage these areas differently to the main crop. They tend to be wider and less susceptible to chemical drift than those around arable crops.

1.2 National and International Context

A number of European countries, especially in Scandinavia, have a longer history and more extensive areas of short rotation coppice than the UK.

2. Dumfries & Galloway Status

2.1 Recent Trends

Encouraged by government, interest in short-rotation coppice has been rapid since around 2005, when the first crops were established. Since then, the opening of a biomass power station at Lockerbie in 2007 has provided much of the impetus for the establishment of short-rotation coppice in the region. The area planted has been increasing and this is likely to continue in the foreseeable future, with a target of 4,000ha in Dumfries & Galloway and Cumbria by 2012.

2.2 Current Distribution

Most of the short rotation coppice planted to date is within a 50-mile radius of the power station at Lockerbie. Fields tend to be scattered on various farms within this area, though a minimum extent of 10ha per farm is preferred. A few areas have been planted beyond this radius.

2.3 Associated Habitats

A number of habitats occur in close association and/or overlap with short-rotation coppice, and the following action plans may also contain relevant information: Agriculturally Improved Grasslands, Arable Fields, Traditional Field Boundaries.

3. Importance for Associated Species

3.1 Birds (medium importance)

Once established, Short-rotation coppice plantations rapidly develop into a scrub habitat, and attract a different bird community from arable and grassland on which they are usually planted. Finches, thrushes, tits and warblers are all likely to be more abundant than in adjacent arable or grassland fields. Migrant warblers are especially common, especially Willow Warblers *Phylloscopus trochilus*.

Birds associated with open farmland, such geese, Lapwings *Vanellus vanellus*, Golden Plovers *Pluvialis apricaria*, and Skylarks *Pluvialis apricaria* can be displaced by planting, but in winter Snipe *Gallinago gallinago* and Woodcocks *Scolopax rusticola,* prefer short rotation coppice crops to arable and grass fields nearby. Recently planted or cut short rotation coppice can also temporarily support Skylarks and Lapwings.

Several species of small bird, such as Dunnocks, nest in short rotation willows. (Gavin Chambers)

3.2 Invertebrates (medium importance)

As it matures the willow **canopy** attracts a diverse insect fauna. Bugs *Hemiptera* and beetles *Coleoptera* are most abundant, However, Blue Willow Beetle *Phyllodecta vulgatissima* is the major insect pest of coppice willow and spraying for this species can harm beneficial invertebrates. The sheltered **headlands** of mature crops attract butterflies in greater numbers than surrounding arable and grassland fields, especially whites, Meadow Browns *Maniola jurtina*, Small Tortoiseshells *Aglais urticae* and Peacocks *Inachis io*. These are generalist species – few specialists have been recorded.

Peacock butterfly, one of the species that benefit from wide headlands.(Peter Norman)

3.3 Mammals (medium importance)

Little research has been carried out on small mammal populations, but plantations with a dense ground cover are likely to support large numbers of mice and voles, and their mammalian predators. Rabbits and deer are excluded from plantations where they may pose a problem during the establishment phase.

3.4 Flowering Plants (low importance)

Recently planted or harvested short rotation coppice is dominated by annual plants, such as Groundsel *Senecio vulgaris*, Fat Hen *Chenopodium album* and Creeping Thistle *Cirsium arvense*. With growth, the proportion of annuals declines and perennials increase. The number of different plant species also increases as the crop grows, especially at edge. However, few scarce or threatened species have so far been recorded.

3.5 Fungi and Lichens (low importance)

Rust caused by a number of fungi called *Melampsora* is the most important disease of short rotation coppice. No species of high conservation value are known to favour this habitat.

3.6/3.7 Non-flowering Plants & Reptiles and Amphibians

Little research has been so far carried out on the importance of short rotation coppice for the above species groups.

4. Environmental, Economic & Social Importance of Biodiversity

- Short rotation coppice has very low net carbon emissions.
- Short rotation coppice and well managed conservation headlands can provide cover and food for game birds such as pheasants.
- Correctly sited and designed, short rotation coppice can enhance the landscape.

5. Factors affecting the Habitat

The recent creation of this habitat and its limited extent to date means that few land managers and their advisors are familiar with good practice for maximising biodiversity potential.

6. Strategic Actions

6.1 Recent and current activity

- Advice and grants are available from **Forestry Commission Scotland**.

6.2 Other recommended actions

- **Do not provide grants and incentives for short rotation coppice on land of high conservation value** for species associated with open ground.
- **Carry out research** into the management of headlands to increase the natural predators of Willow Beetle and reduce the need for intensive spraying.

AGRICULTURALLY IMPROVED GRASSLANDS

Priority Action (AGG1)

Increase biodiversity around the perimeter of improved grassland fields by providing and publicising a range of sites to demonstrate best practice.
Lead Partner: Regional Proposal Assessment Committee/Scottish Agricultural College.

Improved grassland landscapes are bright green, even in winter. Goldilea, April 2006.(Peter Norman)

1. Habitat Description

1.1 Physical Characteristics

Agriculturally improved grasslands have been heavily modified through drainage, fertiliser, slurry and pesticide application and reseeding. Fertiliser use in particular stimulates the growth of competitive grasses and a small number of common broadleaved plants such as docks at the expense of other plants. This results in the dominance of a very narrow range of plant species, often consisting almost exclusively of rye grasses and clover.

Agriculturally improved grasslands are managed either for silage (animal fodder that is made by storing green plant material that is preserved by partial fermentation), hay (animal fodder that is made by storing dried plant material) or grazing, most frequently by cattle and/or sheep. Stock is excluded from silage and hay fields during the main growing season, but they are usually grazed at other times. Leys are improved grass fields that are temporary, being ploughed and reseeded or put to another use every few years.

Most agriculturally improved fields are surrounded by a stockproof barrier, usually a wire fence but this is sometimes combined with a hedgerow or a drystone dyke. Those fields in low lying areas or prone to waterlogging often have a surrounding open **ditch** that may, or may not, be linked into an artificial underground drainage network in the field.

1.2 National and International Context

In the past 60 years agriculturally improved grassland in the UK has increased by approximately 90% in area. In 2006 there were approximately 1,244,000ha of agriculturally improved grassland in Scotland, of which 322,000ha were under 5 years old and 922,000ha more than 5 years old. In Dumfries & Galloway, the respective areas were 48,000ha and 166,000ha. In 2006 there were approximately 432,000 cattle (roughly 45% dairy/55% beef) and 1,108,000 sheep in Dumfries & Galloway, representing almost a third of Scotland's total dairy herd, 15% of breeding sheep and an important element of the beef sector. There is a much smaller, but increasing number of horses (2,650 in 2006).

2. Dumfries & Galloway Status

2.1 Recent Trends

The conversion of semi-natural grassland and wetland to improved grassland has dramatically slowed in the last decade or two, but has not stopped entirely. There has also been an increase in the number of species used in seed mixtures, with 100% Rye Grass now uncommon, and more targeted use of pesticides.

2.2 Current Distribution

Agriculturally improved grassland is the most common habitat in Dumfries & Galloway. Three quarters of all land in the region is farmed and the majority of this is improved grassland, managed either as pasture or silage. Most of this is in the lowlands, particularly the Rhins, Machars and Solway plain, but there are also many examples of improved grasslands in the upland fringe.

2.3 Associated Habitats

A number of habitats occur in close association and/or overlap with agriculturally improved grasslands, and the following action plans may also contain relevant information: Neutral Grasslands, Acid Grasslands, Marshes, Lowland Burns and Ditches, Arable Fields, Traditional Field Boundaries, Wood Pastures and Parklands.

3. Importance for Associated Species

3.1 Birds (high importance)

Few birds nest on improved grassland. Lapwings *Vanellus vanellus* may occasionally do so, though this is usually limited to semi-improved pastures in the upland fringe; densely stocked lowland pastures and silage fields are rarely used.

A wider range of species, including thrushes, Pied Wagtails *Motacilla alba*, Rooks *Corvus frugilegus* and Starlings *Sturnus vulgaris*, feed on invertebrates in agriculturally improved grasslands. The local decline, to virtual extinction, of Choughs *Pyrrhocorax pyrrhocorax* is probably linked to the loss of grassland invertebrates, especially those associated with dung.

In improved pastures, Rooks feed on soil invertebrates such as leatherjackets. (Gavin Chambers)

In winter a relatively small number of fields, usually the same ones each year, are used by feeding geese and swans, including Whooper Swans *Cygnus cygnus,* Barnacle Geese *Branta leucopsis,* Greenland White-fronted Geese *Anser albifrons flavirostris,* Greylag Geese *Anser anser* and Pink-footed Geese *Anser brachyrhynchus.* For some of these species, such as Greenland Whitefronted Geese, there is evidence to suggest that the switch from feeding on semi-natural grasslands to agriculturally improved grasslands has occurred quite recently, possibly due to a reduction in semi-natural grasslands. All feeding species prefer short grass.

The edges of **ditches** are particularly valuable feeding areas for species such as Lapwings, Starlings and others.

3.2 Mammals (medium importance)

Rabbit (Paul McLaughlin)

Moles *Talpa europaea* are found wherever the soil is deep enough for them to burrow and feed primarily on earthworms. They are affected by deep ploughing. *Rabbits Oryctolagus cuniculus* and Badgers *Meles meles* also commonly feed in improved pastures. The decline of Brown Hares *Lepus europaeus* may be related to the increased use of chemicals and machinery on improved grassland, but loss of mixed farms and increased stocking rates may also have had an impact (hares are known to avoid heavily stocked fields). However conclusive evidence for any of these theories is lacking.

3.3 Invertebrates (low importance)

Species diversity of invertebrates in improved grassland is poor, but there may be high numbers of some invertebrates, including earthworms, ground beetles and cranefly larvae. Some flies, beetles and other invertebrates are associated with dung, and provide food for birds and bats. **Ditches** can be very valuable for a wide range of invertebrates, but only where there is permanent or regular flowing or standing clean water.

3.4 Reptiles and Amphibians (low importance)

No species of reptile or amphibian regularly uses agriculturally improved grasslands, unless they are in close proximity to more suitable habitats.

3.5 Fungi and Lichens (low importance)

Few fungi grow in improved grasslands, but field mushrooms *Agaricus spp*. and Brown Mottlegill *Panaeolina foenisecii,* which is stimulated by mowing, can occasionally be found. Harvested and bagged silage provides an unusual fungal habitat with the first

Scottish record of Split-gill *Schizophyllum commune* coming from near Stranraer in the 1960s. This is an uncommon deadwood species of southern England, but is now recorded breaking out through the polythene of silage bails.

Coprobia sp. fungus on dung. Crichope, June 2007. (Peter Norman)

3.6 Flowering Plants (low importance)

Agriculturally improved grasslands are dominated by a small number of highly productive grass species, sometimes grown with White Clover *Trifolium repens*. A few species, such as sorrels, may remain in semi-improved grasslands, and **ditches** may support species not found in the middle of the field.

3.7 Non-flowering Plants (low importance)

Intensively managed agriculturally improved grasslands have few, if any, non-flowering plants.

4. Environmental, Economic & Social Importance of Biodiversity

The large flocks of wintering swans and geese that feed on agriculturally improved grasslands are one of the wildlife spectacles of Dumfries & Galloway, and attract many visiting birdwatchers. They do, however, cause localised agricultural damage to fields.

5. Factors affecting the Habitat

- There has been a **move away from hay production** with lower inputs and greater species diversity to re-seeded rye grass silage with higher chemical inputs.
- **Local stock breeds are used less**, which may affect sward composition.
- A number of **avermectin-based veterinary medicines** are used to control internal worms and other parasites. Stock treated with these products excrete residues for several weeks, adversely affecting invertebrates and fungi associated with dung.
- **Careless application or spillage of chemicals, slurry and silage effluent** can affect habitats such as wetlands and watercourses by changing their nutrient status.
- **Slurry may be toxic** to soil invertebrates such as earthworms.
- **Waterlogging** reduces invertebrate populations.

6. Strategic Actions

6.1 Recent and current activity

- Goose management schemes, managed by Scottish Natural Heritage, operated in parts of the region most affected by goose grazing. These have now been incorporated into the Scottish Rural Development Programme.
- The Scottish Agricultural College has completed research that highlights the value of conservation headlands in grassland, as well as their more usual location in arable fields.
- There have been attempts to convert improved grassland to habitats closer to semi-natural types, including flower-rich grassland, heathland or woodland. So far these have been relatively small scale experiments, and there have been few in Dumfries & Galloway.

6.2 Other recommended actions

- Encourage adoption of a range of measures, including management of traditional field boundaries, to improve the biodiversity of field margins.

ARABLE FIELDS

Priority Action (AF1)

Provide advice for farmers and their advisors on improving arable fields for biodiversity, through training courses and establishment of a demonstration site.
Lead Partner: Farming & Wildlife Advisory Group.

Barley field Powfoot, July 2006. (Peter Norman)

1. Habitat Description

1.1 Physical Characteristics

Cereals, root crops, rape and maize are typical arable species. These may be grown either for human consumption or for animal fodder. **Unharvested crops**, including legumes, brassicas and linseed, have recently been introduced on some farms entirely for biodiversity and/or game purposes. For the purposes of this plan, grassland under 5 years old is not considered as arable, and is included in a separate agriculturally improved grassland action plan.

The value of arable fields for biodiversity is dependent on a number of factors. The **crop species** has a significant direct influence with some invertebrates associated with particular species. Perhaps of greater importance is the height and density of the **standing crop**. This affects the degree of shading and the wind speed, and therefore the humidity and temperature within the crop and at the soil surface. Crop height and density also influences the amount of space available for wildlife to grow or to move through the crop. These factors change at different stages of growth, and therefore the timing of cultivation, sowing and harvesting is critical. **Overwintered stubble** provides space, light and food for a range of wildlife.

Field margins have less competition from the crop, and are influenced by adjacent habitats such as hedges and woods. On arable farmland **ditches** need to have a water level well below the ground level in order to keep the surrounding land dry. They are therefore often deep and steep sided.

1.2 National and International Context

There was around 600,000ha. of arable land in Scotland in 2006. The extent in Dumfries & Galloway was small in comparison, at around 21,000ha.

2. Dumfries & Galloway Status

2.1 Recent Trends

Over the last 10-20 years, the area of arable land in Dumfries & Galloway has continued to decline. However, new methods have been developed to enhance biodiversity in arable fields with minimum loss of biodiversity. Farmers have been encouraged to adopt such techniques largely through incentives in agri-environment schemes.

2.2 Current Distribution

Most arable fields are located in the Stranraer basin, lower Nithsdale and lower Annandale. In 2006, arable crops in Dumfries & Galloway consisted of:
1632ha. wheat on 105 farms
11992ha. of barley (73% spring, 27% winter) on 572 farms
583ha. of oats (77% spring, 23% winter) on 70 farms
302ha. of oilseed rape (winter) on 15 farms
415ha. of potatoes on 57 farms
392ha. of turnips, swedes & fodder beet on 80 farms
186ha. of kale & cabbage on 45 farms
3379ha. of other crops (mostly maize) on 319 farms
1786ha. of set aside on 269 farms

2.3 Site Examples

At **Mersehead**, RSPB have introduced a range of measures that have dramatically increased bird numbers on arable land.

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with arable fields, and the following action plans may also contain relevant information: Agriculturally Improved Grasslands, Traditional Field Boundaries.

3. Importance for Associated Species

3.1 Birds (high importance)

Few birds nest in mature **standing crops**, although Quails *Coturnix coturnix* and Marsh Harriers *Circus aeruginosus* are rare exceptions. Species such as Lapwings *Vanellus vanellus* and Oystercatchers *Haematopus ostralegus* use spring-sown cereals, but not autumn/winter sown crops that are too high at nesting time. Skylarks *Alauda arvensis* also nest in standing crops, but only up to a maximum crop height of around 30cm.

Tree Sparrows have declined as a result of the loss of arable fields. (Steven Round)

Grey Partridges *Perdix perdix* require long grass for nesting and abundant invertebrate food for their chicks. They therefore tend to nest on **field margins** but feed on invertebrates within the standing crop and on winter stubbles.

Standing crops are visited for food by birds such as Tree Sparrows *Passer montanus* nesting in adjacent habitats. However, arable fields become most valuable for seed-eating species such as Linnets *Carduelis cannabina,* Corn Buntings *Miliaria calandra* and Yellowhammers *Emberiza citronella* at harvesting time and in the months following. **Overwintered stubble** is especially valuable, not only for spilt grain, but for the seeds of weed species. Roosting Golden Plovers *Pluvialis apricaria* may also use winter stubble fields, but flocks have reduced dramatically in recent years due to the loss of such fields.

Corn Spurrey, a plant introduced to Britain with early farming but now in decline. Near New Abbey, July 2007. (Peter Norman)

3.2 Flowering Plants (high importance)

Flowering plants of arable fields are mostly annuals, adapted to quickly exploit bare ground, making use of conditions that are free of competition and shade. Most of them germinate in the spring, and therefore not in autumn/winter sown cereals. They include some of the rarest plants in Britain. In Dumfries & Galloway there is a long list of such species that are now either believed extinct or are very rare in the wild. They include Prickly Poppy *Papaver argemone,* Purple Ramping-fumitory *Fumaria purpurea,* White Mustard *Sinapis alba,* Field Pepperwort *Lepidium campestre*, Cornfield Knotgrass *Polygonum rurivagum*, Field Woundwort *Stachys arvensis*, Cornflower *Centaurea cyanus* and Rye Brome *Bromus secalinus*.

3.3 Non-flowering Plants (medium importance)

A specialised moss and liverwort flora has recently been discovered in arable fields, though the species concerned are generally small and inconspicuous. Intensively managed fields may have none of these at all, but fields those managed less intensively, particularly those with **overwintered stubble**, can be rich. Although some arable bryophytes, such as Glaucous Crystalwort *Riccia glauca* have been recorded in Dumfries & Galloway, the number and extent of important sites is not known.

3.4 Mammals (medium importance)

Brown Hares *Lepus europaeus* fare better on farms with arable fields, than those without – the crop providing cover for leverets, but without the intensity of cutting of silage fields. They particularly avoid heavily stocked pastures. Dumfries & Galloway is the only part of Scotland to support Harvest Mice *Micromys minutus*, but so far they have only been found in wetlands and rough grasslands, rather than the arable fields after which they were named.

3.5 Invertebrates (medium importance)

A large number of money spiders, hoverflies and ground beetles, such as *Bembidion lampros,* occur in arable fields, many of which assist with pest control. Bumblebees are important pollinators of many crops, but also require nectar and pollen from wild plants when the crop is not flowering. Well-managed **field margins** support few rare invertebrates but very large numbers of common ones, including butterflies, grasshoppers and plant bugs.

3.6 Fungi and Lichens (low importance)

Few fungi of conservation importance occur. Crop pests such as mildews and poisonous species such as ergots are effectively controlled by modern techniques.

4. Environmental, Economic & Social Importance of Biodiversity

Traditionally managed arable fields with wide field margins, wild flowers and overwintered stubble make a significant contribution to arable landscapes that can otherwise appear monotonous. Extensive arable landscapes are rare in Dumfries & Galloway; rather individual fields contribute to a 'patchwork' landscape.

5. Factors affecting the Habitat

- The **decline of mixed farming**, with arable fields, has reduced and fragmented populations of species associated with these habitats.
- A widespread **move to autumn-sown cereals** has made many fields unsuitable for many nesting birds and wild plants.
- Loss of traditional cropping systems, and associated **loss of winter stubble**, has reduced winter food sources for many farmland birds.
- Cropping systems have become more uniform with **less rotation** giving fragmentation and reduced habitat variety.
- The **use of insecticides, fungicides and herbicides** may cause significant harm to non-target species, even at less than the recommended application rate.
- **Aerial drift of chemicals** may result in impacts outside of the cropped area, such as field margins and ponds.
- **Seed treatment** may impact on seed-eating birds if some seeds are left unburied at sowing.
- **Fertilisers** greatly encourage modern crops and a small number of weed species, but these plants then out-compete wild plants.

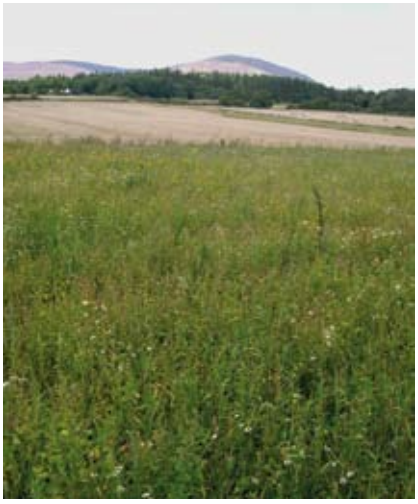
6. Strategic Actions

6.1 Recent and current activity

- Agri-environment schemes provide incentives to enhance arable fields.
- **Scottish Natural Heritage's** Targeted Inputs for a Better Rural Environment (TIBRE) project provides information to show how technology can be used in farming to benefit the environment.
- A Farmland Birds Working Group, organised by **RSPB**, meets to co-ordinate survey and management projects across the region.
- The **Game and Wildlife Conservation Trust** is undertaking a research project called Sustainable Arable Farming for an Improved Environment, which aims to enhance farmland biodiversity by developing more wildlife-friendly farming techniques.

6.2 Other recommended actions

- **Encourage the uptake of agri-environment schemes** to enhance the biodiversity of arable fields.
- **Improve awareness and training** in the practical techniques, such as headlands and beetlebanks, that can be used to enhance arable fields.



Wide arable field margins Arbigland, August 2006. (Peter Norman)

TRADITIONAL FIELD BOUNDARIES

Priority Action (TFB1)

Increase the quality of hedgerows, including hedgerow trees, in Dumfries & Galloway.
Lead Partner: Regional Proposal Assessment Committee.

Priority Action (TFB2)

Carry out research into the biodiversity of drystone dykes and their management.
Lead Partner: Scottish Agricultural College.

Drystone sheep pens, Queensberry (Richard Mearns)

1. Habitat Description

1.1 Physical Characteristics

Hedges are typically composed of Hawthorn, but many other shrubs, including Blackthorn, Elder, Holly, Beech, Hazel, Privet, Dog Rose and Gorse can also form hedges. Large hedges with a dense, bushy stock-proof structure offer an 'interior' as well as an 'edge' habitat to many species, with a slightly different microclimate. **Hedge banks** are hedges planted on earth mounds, sometimes mixed or faced with stones. **Hedgerow trees**, typically Ash, Wych Elm and oaks, provide additional structure to hedges. On some farms, they may be the single most important wildlife habitat.

Drystone walls, better known locally as **drystone dykes**, are the dominant field boundaries where rocky outcrops are common, the soil is thin and the climate is too harsh for hedgerows. But some lowland, more fertile areas also have dykes. In both environments they fulfil the similar functions for wildlife as a hedge. Individual trees can also occur within the line of drystone walls.

Drystone dykes take a variety of forms depending on local tradition and availability of materials. The standard and commonest form consists of two separate dyke faces with small stones in-between and throughstones and topstones bridging the two faces together. They are constructed from a variety of materials, often quarried sedimentary stone such as sandstone, limestone or greywacke. Single dykes, where most of the stones are very large boulders in a single wall, form only a small proportion of all dykes but can be very common in some localities, including parts of Galloway. They are almost invariably built of field clearance stone as opposed to quarried material, and the rock type is usually igneous, especially granite. There is usually an exposed, wet side to a dyke and a dryer, warmer side. The top is windswept but the bottom sheltered. Inside it can be dry and sheltered, perhaps with a trickle of water.

Red sandstone dyke at Crichope Linn, June 2007. (Peter Norman)

The bases of hedges and dykes are usually well sheltered with higher daytime temperatures and humidity than the field, and they are often relatively undisturbed by agricultural activities. Some may suffer from nutrient enrichment from adjacent roads and tracks, or fertiliser drift. **Hedge-bottoms** often have a woodland flora, whilst **dyke-bases** are usually more weedy.

1.2 National and International Context

Hedges and walls are not especially British; they occur in many forms as far away as South America, but there are few countries where they form such an integral part of the landscape as in Britain. It would be difficult to find many parts of the country where one or the other did not form part of the view. Galloway single dykes are the most locally distinctive boundary type, though similar structures are found in other parts

of Scotland, Wales, northern England and Dartmoor. There is approximately 814,000km of hedgerows in the UK, 48,700 of which are in Scotland, and approximately 87,500km of walls in Scotland. These figures compare with more than 235,000 of fences in Scotland.

Hedgelaying training course at Bombie Farm, Kirkcudbright, January 2005.(FWAG)

2. Dumfries & Galloway Status

2.1 Recent Trends

Whilst deliberate destruction of field boundaries has virtually ceased in the last 30 years, the fortunes of hedgerows and drystone dykes has varied enormously in this period. Many dykes have been rebuilt along their original lines. There are also examples of successful hedgerow restoration projects, but this has had a minimal impact on the scale of the problem. The vast majority of the region's hedgerows remain in an extremely poor condition, unmanaged other than by an annual flail with a tractor-driven machine, and continuing to slowly disappear from existence. Virtually none of them are stockproof without the need for additional fencing.

2.2 Current Distribution

Hedgerows and dykes are widespread throughout the region, though hedgerows are predominantly lowland in distribution. Hedge banks are rare.

2.3 Associated Habitats

A number of habitats occur in close association and/or overlap with traditional field boundaries, and the following action plans may also contain relevant information: Veteran Trees, Agriculturally Improved Grasslands, Arable Fields, Roads and Verges.

3. Importance for Associated Species

3.1 Invertebrates (very high importance)

Many invertebrates are associated with traditional field boundaries, though few, if any, require maintenance of the boundary in a stockproof condition. The number of invertebrates associated with **hedgerows** probably runs into many thousands. Typical moths include Early Moth *Theria primaria*, Chinese Character *Cilix glaucata* and Green-brindled Crescent *Allophyes oxyacanthae.* The caterpillars of the Orchard Ermine moth *Yponomeuta padella* live gregariously in webs on Hawthorn and Blackthorn hedges and can defoliate long stretches. The Bird Cherry Ermine *Yponomeuta evonymella* may do the same where Bird Cherry occurs in hedges, though in both cases the host plant always recovers. Many bees, wasps, sawflies, mirid bugs, shield bugs, leaf beetles are also to be found.

A myriad of invertebrates and their eggs are found in **drystone dykes** - spiders, woodlice, springtails, millipedes, bees and wasps. The rare Wall Mason Bee *Osmia parietina*, typically associated with drystone walls, has been recorded in two locations on the Solway coast (out of less than 20 in the UK), whilst the even rarer ruby-tailed wasp *Chrysura hirsuta*, usually found in pastures with dykes, has been recorded in the region just once, near Whithorn in 1973. A spider *Textrix denticulata* is often found amongst stone dykes, whilst the Muslin Footman moth *Nudaria mundana* feeds on lichens growing on dykes and other rocks.

The nationally rare Wall Whorl Snail *Vertigo pusilla* is most typically found at ivy-covered **dyke-bases**, usually shaded by trees. The weedy flora of dyke-bases can also be important for some butterflies, including Nettle-feeding Peacocks *Inachis io* and Small Tortoiseshells *Aglais urticae.*

3.2 Birds (high importance)

Well-maintained bushy **hedgerows** can provide food and nest sites for many species of small bird, including Linnets *Carduelis cannabina* and Yellowhammers *Emberiza*

Dunnock, sometimes called Hedge Sparrow (Paul McLaughlin)

citronella, whilst Grey Partridges *Perdix perdix* often nest in **hedge bottoms**. Hedgerow trees add further structure to the habitat and are used by nesting Tree sparrows *Passer montanus,* Barn Owls *Tyto alba and other species.*

Dykes are of lesser importance for birds, but some species such as Wrens *Troglodytes troglodytes*, and in the uplands Wheatears *Oenanthe oenanthe*, may nest in cavities within them.

3.3 Flowering Plants (high importance)

Hawthorn *Crataegus monogyna* is by far the most abundant **hedgerow** plant, though in Dumfriesshire there are also many Beech *Fagus sylvatica* hedges. Other shrubs that are often part of the hedge, and in some cases can be the dominant species, include Blackthorn *Prunus spinosa*, Gorse *Ulex europaeus*, Holly *Ilex aquifolium*, Elder *Sambucus nigra,* Wild Privet *Ligustrum vulgare* and Guelder Rose *Viburnum opulus*. A feature of many parts of Dumfries & Galloway in the spring are the great drifts of Cow Parsley at **hedge-bottoms**. In other areas there is more of a woodland flora with Primroses *Primula vulgaris*, Bluebells *Hyacinthoides non-scripta* and even Early Purple Orchids *Orchis mascula*.

A number of plants grow on **drystone dykes**, including cranesbills and stonecrops.

3.4 Fungi and Lichens (high importance)

Lichens generally favour the exposed side of **dykes**, leaving the damper sheltered side to the mosses. Where stock rubs against the dyke, the lichen flora may be limited to a few species able to cope with this.

Hedgerow trees are very important for lichens. They support species not found in woodlands; instead rather approaching the diversity of those of wood pastures. However, due to the abundance of hedgerows, in comparison to wood pastures, their total value may be greater. The species and age of the tree has a significant influence, but so to do local conditions and management. Elm is the prime host of the most threatened lichens, but Ash and Sycamore are also valuable. In areas with little native woodland, hedgerows may be the only significant habitat for epiphytic lichens.

3.5 Mammals (medium importance)

Bats use holes in **hedgerow trees** for breeding and roosting and will often fly along hedgerows when

Beech hedge at Claygate, near Canonbie, February 2008. (Peter Norman)

travelling between areas of semi-natural habitat. Most bats avoid from crossing open fields, and may even shun from crossing quite small gaps in hedges. Hedges can also form an important habitat component for other species, including of course Hedgehogs *Erinaceus europaeus.*

Voles, mice and shrews find shelter within **dykes**, where they are hunted by Stoats *Mustela erminea* and Weasels *Mustela nivalis*.

3.6 Non-flowering Plants (medium importance)

Shady, damp dykes can be totally covered in mosses and liverworts. Semi-derelict dykes in more exposed environments are colonised by Woolly Fringe-moss *Racomitrium languginosum.* Hedgerow trees, especially Ash, Sycamore and Wych Elm can be rich in mosses and liverworts, including the possibility of rare species.

3.7 Reptiles and Amphibians (medium importance)

Dykes are used for shelter and basking sites by Common Lizards *Zootoca vivipara* and Slow Worms *Anguis fragilis*. Newts, Common Frogs *Rana temporaria* and Common Toads *Bufo bufo* may also find shelter, perhaps even hibernation sites, within them.

4. Environmental, Economic & Social Importance of Biodiversity

- Hedges, boundary trees and dykes are highly significant features in most agricultural landscapes.
- Both hedges and dykes provide shelter for livestock and crops.

- The ground beetles, ladybirds and parasitic wasps that are associated with traditional field boundaries provide a biological control service that greatly outweighs the damage caused by the pests found in these habitats.

5. Factors affecting the Habitat

- There is a widespread perception that field hedgerows should look like garden hedges, neatly clipped and tidy. Unfortunately **mechanical flailing** can never produce the same results as garden shears.
- **Cutting hedges in the summer** destroys bird nests, and in the autumn prevents the formation of berries.
- The **loss of hedgerow trees** probably outnumbers the loss of the hedgerows themselves. Dutch Elm Disease has contributed to this loss, but management practices, including annual flailing, rarely favour their replacement.
- **Overstocking** of fields can lead to the loss of flowers and lichens associated with hedgerows, dykes and trees. Conversely, **loss of grazing** can lead to ivy encroachment, which has benefits for invertebrates, but can lead to loss of lichens.
- Well established, traditional field boundaries are often the first casualty of **road widening schemes**. Their replacements will take many decades to acquire the same biodiversity interest.

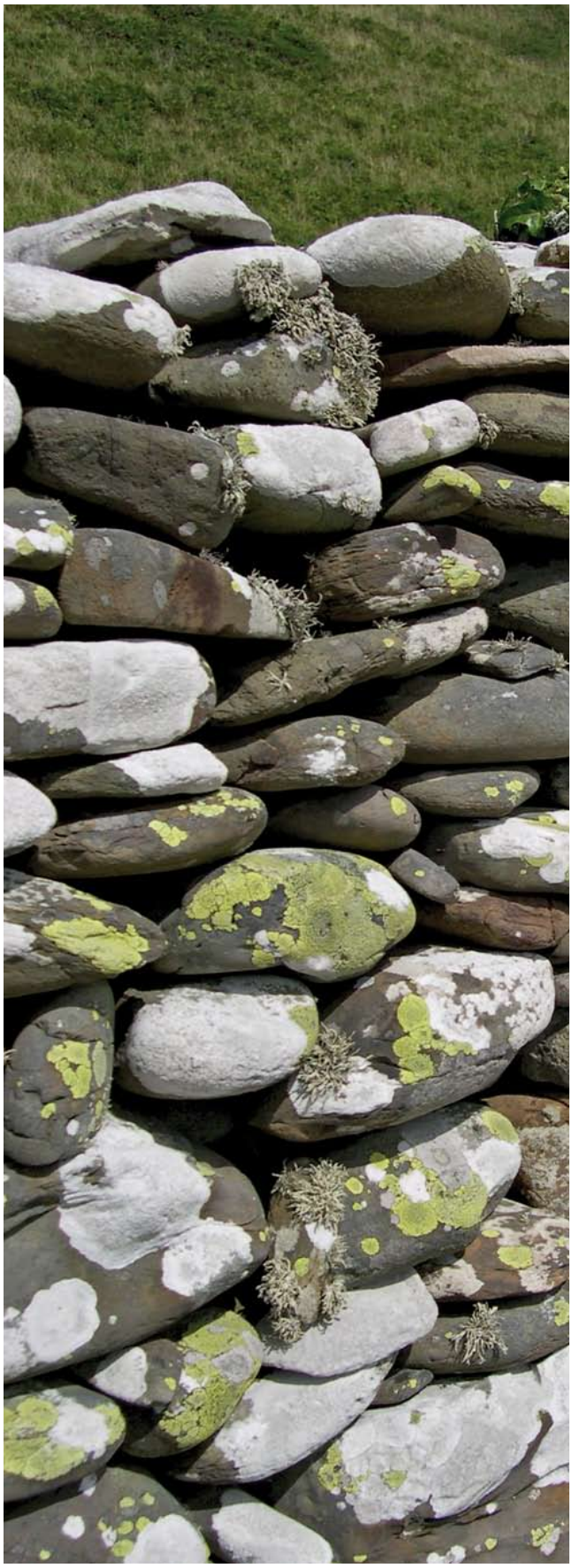
6. Strategic Actions

6.1 Recent and current activity

- Agri-environment schemes have funded the creation of new hedgerows.
- The **Farming and Wildlife Advisory Group** has promoted good practice in hedgerow management through advice, demonstrations and training events.

6.2 Other recommended actions

- Options are available for field boundaries as part of **Rural Development Contracts and Rural Priorities.**
- **Develop hedge management skills** through training and advice.



Lichen encrusted seashore stones in dyke at Claymoddie, Machars, August 2007. (Peter Norman)

WOOD PASTURES & PARKLANDS

Priority Action (WPP1)

Complete Sulwath Connections Wood Pasture project and secure funding to extend this work throughout the region.
Target: Dedicated wood pasture project to operate region-wide from 2008 to 2013.
Lead: Sulwath Connections.

Parkland at Shambellie, New Abbey, May 2004. (Peter Norman)

1. Habitat Description

1.1 Physical Characteristics

Wood pastures comprise of grazed grassland or heathland combined with trees or shrubs. Both elements of the habitat were traditionally managed for the production of both livestock and timber products, though management of trees is now rare. **Parklands** have the same vegetational structure as wood pastures but were deliberately designed, usually in the vicinity of a large house and sometimes superimposed over older wood pastures, primarily for landscape reasons.

Open-grown trees are characteristic of wood pastures and parklands. They differ from woodland trees in that they typically have rounded crowns, low heavy branching, basal swelling, fat trunks and many hollows. Some show evidence of previous pollarding, and many are now considered to be **veteran trees**.

Scrub is essential for high biodiversity in wood pastures and parklands. It not only supports numerous invertebrates and birds, but also provides protection from grazing to allow trees to regenerate.

The majority of wood pastures and parklands now have grassland that has been agriculturally improved through fertiliser and pesticide application, but **unimproved grassland** still occurs on some sites and is of high biodiversity value. Heathland under wood pasture is also of high biodiversity value, but is even rarer.

1.2 National and International Context

Wood pastures, in one form or another, exist in many European and other countries. However, the species composition and management techniques used in British wood pastures and parklands are unique, and few countries have such a long history of management. In particular, the number of veteran trees and the abundance of associated species in British wood pastures and parklands is outstanding, compared to their European counterparts.

2. Dumfries & Galloway Status

2.1 Recent Trends

The techniques of managing wood pastures were abandoned in the 19th and 20th centuries to such an extent that the very existence of this form of land management became almost totally forgotten. However, in the late 20th century there was a resurgence of interest in wood pastures, primarily for their biodiversity value, especially their veteran trees. In the last ten years there has been considerable research into new techniques to restore the remaining fragments of wood pastures, and consideration given to the creation of new ones. This has yet to have a significant impact in Dumfries & Galloway.

2.2 Current Distribution

The present distribution of wood pastures and parklands in Dumfries & Galloway has not been accurately assessed. Wood pastures occur in both the uplands and lowlands, whilst parklands are predominantly lowland. However, although both are widespread, neither is evenly distributed.

2.3 Site Examples

Lochwood (SSSI), near Beattock, is often quoted as the best wood pasture site in the region. Although the site has a history of wood pasture and contains one of

Short, stubby, veteran oaks. Boreland of Parton, July 2007. (Peter Norman)

the finest collections of veteran trees in Britain, most of it has not been managed as wood pasture for some time. There are, however, some very good examples of current wood pasture on its fringes and on nearby **Raehills Estate**. Other sites include **Boreland Hills** and **Ardwall Hill** in the Fleet Valley. Good examples of parklands are found at **Drumlanrig Castle** and at **Kirkconnell House** and **Shambellie House** near New Abbey.

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with wood pastures and parklands, and the following action plans may also contain relevant information: Native Woods, Veteran Trees.

3. Importance for Associated Species

3.1 Fungi and Lichens (very high importance)

The combination of habitats in wood pastures means that they are important for a range of fungus species. On the **open-grown trees**, light and humidity conditions are often ideal for many lichen species. For example, Tree Lungwort *Lobaria pulmonaria* is known from several current and former wood pastures across the region. Other lichens, recorded only rarely in Dumfries & Galloway, that may benefit from enhancement of wood pastures include *Bacidia incompata*, *Schismatomma graphidioides* and Orange-fruited Elm Lichen *Caloplaca luteoalba.*

The presence of **veteran trees** also makes wood pastures important for a range of saproxylic fungi. The internationally rare Oak Polypore *Piptoporus quercinus* has been recorded at Lochwood, whilst other bracket fungi such as Beefsteak Fungus *Fistulina hepatica* and Hen of the Woods *Grifola frondosa* are more common species. Where it exists, **unimproved grassland** beneath the trees may also be important for grassland fungi such as waxcaps.

3.2 Invertebrates (very high importance)

Due to the presence of many **veteran trees**, many wood pastures are very important for invertebrates. Most of these are associated with decaying wood in veteran trees, but others feed on fungi and other invertebrates that are found on the trees. For example, the larvae of a nationally scarce darkling beetle *Eledona agricola* develops in the fruiting bodies of Sulphur Polypore *Laetiporus sulphureus*, and occasionally other bracket fungi, mostly in old wood pastures. Virtually no local surveys have been completed of such species.

However, the presence of many veteran trees is not the only reason why wood pastures are very important for invertebrates; those sites with **scrub**, especially Hawthorn and Blackthorn blossom, provide essential nectar for the adult insects that emerge from the trees. **Unimproved grassland** provides a nectar-rich habitat, but scrub and associated flowers such as Hogweed *Heracleum sphondylium* and other umbellifers are equally valuable within improved pastures.

3.3 Mammals (high importance)

Though many mammals, including Brown Hares *Lepus europaeus* and Badgers *Meles meles* undoubtedly make use of wood pastures, their greatest importance is for bats. **Veteran trees**, with their numerous holes and hollows, provide many opportunities for breeding roosts and hibernacula, whilst invertebrates associated with both the trees and **unimproved grassland** provide abundant food.

3.4 Non-flowering Plants (medium Importance)

Epiphytic ferns are usually abundant on **veteran trees** in wood pastures and parklands. Common Polypody *Polypodium vulgare* is the typical species, but others also occur. Veteran trees also provide an ideal habitat for epiphytic mosses and liverworts, though isolated trees are of less value, being susceptible to drying winds. Little work has been carried out in Dumfries & Galloway, but the local bryophyte flora may be better than in some of the 'classic' wood pasture sites in southern England, where air pollution is a restricting factor. Typical species include Park Yoke-moss *Zygodon rupestris* and Squirrel-tail Moss *Leucodon sciuroides.*

3.5 Birds (high importance)

Hole-nesting species that feed in open areas are the typical birds of wood pastures. These include Barn Owls *Tyto alba,* Redstarts *Phoenicurus phoenicurus* and Spotted Flycatchers *Muscicapa striata.* Areas of scrub may attract breeding Dunnocks *Prunella modularis* and Linnets *Carduelis cannabina.*

3.6 Flowering Plants (low importance)

Apart from their veteran trees, most wood pastures in the region tend to have improved or semi-improved grassland that supports a limited range of flowering plants. Crab Apples *Malus sylvestris* are a distinctive feature of many wood pastures in Dumfries & Galloway.

3.7 Reptiles and Amphibians (low importance)

The open conditions of wood pastures is of more benefit to reptiles and amphibians than dense woods. However, the trees alone are of little value without a field layer that provides shelter, invertebrate food and, in the case of amphibians, breeding ponds. Therefore, only those wood pastures with **unimproved grassland**, heathland or wetland tend to support high reptile and amphibian populations.

4. Environmental, Economic & Social Importance of Biodiversity

- Wood pastures and parklands are of considerable landscape value. In parklands, the combination of trees and pasture was deliberately planned to be pleasing to their owners, often when viewed from the windows of their homes, but even in non-designed wood pastures, the diversity of colours, shapes and light offered by this habitat forms an attractive landscape.
- Wood and scrub offers shelter for stock in winter and shade in summer. Some grazing of trees and shrubs may occur, but this is rarely managed in any way, although recent research has suggested that livestock might benefit from the supplementary feeding of tree foliage.
- Timber production would historically have been one of the uses of wood pastures. Some sites retain patches of high forest as well as open-grown trees and these can be thinned out to provide good timber.
- Many wood pastures illustrate past land use and are therefore part of the region's cultural heritage, providing evidence of how our ancestors lived and worked. Apart from the value of the trees themselves, many contain other features of cultural heritage value including earthworks, disused mines, rock carvings, a Neolithic burial cairn, a hill fort and a 12th century motte.

Scrub pastures, often dominated by Gorse, are common across the region. Lochanhead, April 2006. (Peter Norman)

5. Factors affecting the Habitat

- **Removal of trees** and dead wood through perceptions of safety and tidiness where sites have high amenity use, forest hygiene, the supply of firewood or vandalism.
- Loss of veteran trees through **disease, physiological stress such as drought and storm damage**, and competition for resources with surrounding younger trees.
- Damage to trees and roots from **soil compaction and erosion** caused by trampling of livestock and car parking.
- Neglect, and **loss of expertise** of traditional tree management techniques (e.g. pollarding) leading to trees collapsing or being felled for safety reasons.
- **Lack of regeneration** of trees, producing a skewed age structure, leading to breaks in the continuity of dead wood habitat and loss of specialised dependent species.
- Pasture improvement through **reseeding, deep ploughing, fertiliser and other chemical treatments**, leading variously to tree root damage, loss of nectar-bearing plants, damage to the soil and epiphytes.

White Galloway cattle grazing under Ash trees. High Ardwall, Gatehouse of Fleet, August 2005. (Peter Norman)

- **Inappropriate grazing levels**: under grazing leading to loss of habitat structure through bracken and scrub invasion; and over grazing leading to bark browsing, soil compaction and loss of nectar plants.
- **Pollution** derived either remotely from industry and traffic, or locally from agro-chemical application and nitrogen enrichment from pasture overstocking, causing damage to epiphyte communities and changes to soils.
- Wood pastures have been poorly served by **agri-environment and forestry grant schemes.**

6. Strategic Actions

6.1 Recent and current activity

- A preliminary assessment of the distribution and extent of the wood pasture resource in Dumfries & Galloway was commissioned by **Scottish Natural Heritage** in 2006.
- A detailed assessment of wood pastures in the Fleet Valley National Scenic Area, including history, management, vegetation and veteran trees was carried out in 2005 by **SEPA, Solway Heritage and Dumfries & Galloway Council**. An introductory booklet to wood pastures in Dumfries & Galloway was produced at the end of this project.
- A project to manage, and possibly create, wood pastures in selected locations in Dumfries & Galloway was begun in 2007 as part of the Heritage Lottery Funded **Sulwath Connections** Landscape Scheme.
- **RSPB** has begun to create a wood pasture (or, depending on definition, restore of a degraded one) at Barclye in the Cree Valley, with the support of Sulwath Connections.

6.2 Other recommended actions

- **Promote the positive features of grazing in woodland** and the role of wood pasture in planning ecological restoration.
- **Identify sites** with current or historical evidence of wood pasture. This does not mean that all such areas should be managed as wood pasture but its existence should be appreciated and the possibility of maintaining or enhancing wood-pasture features considered.
- Examine the feasibility of running **training courses** in traditional tree management techniques (e.g. pollarding).
- Explore possibilities for the **creation of new areas of wood pasture**.
- Encourage and contribute to the national production of an **illustrated management guide** to wood pasture and parkland.

FARM WOODS & SHELTERBELTS

Priority Action (FSB1)

Create new farm woods and shelterbelts on land currently of low biodiversity and archaeological interest.
Target: 50 new farm woods on appropriate sites by 2015.
Lead Partner: Regional Proposal Assessment Committee.

Priority Action (FSB2)

Improve the biodiversity management of existing farm woods and shelterbelts through provision of site-specific advice.
Lead Partner: Forestry Commission Scotland/Farming & Wildlife Advisory Group/Scottish Agricultural College.

Conifer and broadleaved farm shelterbelts at Dalswinton. (Richard Mearns).

1. Habitat Description

1.1 Physical Characteristics

Most woods on farms are small, usually less than 2 hectares. Unlike the larger commercial plantations, which are often managed by external agents primarily for timber production, most farm woods are managed as part of the day to day activities of the farm. They are often located close to farm buildings, but may also be found along access tracks and field boundaries. As a result, many are linear in shape.

Though predominantly of planted origin, farm woods and shelterbelts can be composed of native or exotic species, and can be used for a variety of purposes depending on their structure and location. Biodiversity interest tends to increase with the age of the wood, but even relatively young plantations have some value. Often the interface between farmland and woodland offers the greatest potential for biodiversity.

1.2 National and International Context

There were approximately 250,000ha of farm woodland in Scotland in 2006, of which around 16,000ha were found in Dumfries & Galloway.

2. Dumfries & Galloway Status

2.1 Recent Trends

Few farm woods have been deliberately removed in recent decades. However, with the exception of those that have been converted to conifers, most have not been managed to any extent. Trees that have fallen as a result of disease, storms or old age have usually been cleared but not replaced. Though new farm woods have been created in recent decades, these have not been numerous.

2.2 Current Distribution

Farm woods and shelterbelts are widespread across Dumfries & Galloway, though some areas, particularly in the lowlands, have a greater density of these woods than others. Farms that are, or were once, part of a large estate often have more farm woods.

2.3 Associated Habitats

A number of habitats occur in close association and/or overlap with farm woods and shelterbelts, and the following action plans may also contain relevant information: Native Woods, Broadleaved and Mixed Plantations, Traditional Field Boundaries.

3. Importance for Associated Species

3.1 Birds (medium importance)

Farm woods are rarely large enough to support many woodland breeding birds, although a few common species are usually found. However, they can form important nesting sites for birds that feed elsewhere on the farm. Typical species include Rooks *Corvus frugilegus* and Starlings *Sturnus vulgaris* with Tree Sparrows *Passer montanus* in a few locations. Barn Owls *Tyto alba* may nest in farm woods if there are suitable holes or nest boxes. In exceptional cases,

they may also be used by Little Owls, on the northern edge of their range, or Long-eared Owls *Asio otus*, which avoid larger woods dominated by Tawny Owls *Strix aluco*.

Great Spotted Woodpeckers will nest in quite small woods if suitable deadwood is available. (Gordon McCall)

3.2 Mammals (medium importance)

Farm woods are valuable habitat features for bats. Old trees provide roost sites and the wood can be a valuable source of insect food, but even when this is not the case they provide valuable habitat linkages between areas of high insect abundance, such as wetlands, and roost sites in farm buildings. Many bat species will not cross open country.

3.3 Fungi and Lichens (medium importance)

A range of fungi can be found in farm woods, though there are none are restricted to this habitat. Such woods are of greater value to lichens, as their high ratio of edge habitat and often their open nature, provides environmental conditions closer to wood pasture than dense woodland. Also, the tree species typical of many farm woods in Dumfries & Galloway – Ash and Wych Elm, is well suited to many lichens.

3.4 Reptiles and Amphibians (medium importance)

Though farm woods in themselves may not be of high value for reptiles and amphibians, they are often an important component for a wider habitat mosaic for newts and Common Toads *Bufo bufo.*

3.5 Invertebrates (low importance)

The small size, open nature, limited range of tree species and lack of deadwood usually limits the value of farm woods for the rarer species of invertebrates. Nevertheless, such woods may contain an abundance of common species that may be rare elsewhere on the farm.

3.6 Flowering Plants (low importance)

As with invertebrates, the history and environmental conditions found in farm woods and shelterbelts, is rarely suitable for important flowering plants, but such sites may contain common species that may not be found elsewhere on the farm.

3.7 Non-flowering Plants (low importance)

The open nature of most farm woods makes them poor habitats for mosses and liverworts.

4. Environmental, Economic and Social Importance of Biodiversity

- The landscape value of farm woods and shelterbelts, both individually and collectively, is enormous. They can also screen unsightly buildings.
- Farm woods and shelterbelts act as buffers to increase farm biosecurity.
- Many small woods provide cover for pheasants and other game.
- Farm woods and shelterbelts reduce wind-borne soil erosion and help reduce both the amount and rate of run off into watercourses, thus contributing to flood alleviation.
- Footpaths and public access routes are often defined by farm woods, and they add interest for the visitor.

5. Factors affecting the Habitat

- **Dutch Elm Disease** has reduced the number of elms in farm woods and shelterbelts.
- Unmanaged **stock access** can damage ground flora and prevent regeneration.
- **Dead and fallen trees are usually cleared immediately**, often for firewood. This removes an important habitat for many species of bird, bat and invertebrate.
- Some woods are used to screen the dumping of **farm rubbish**.

Rookery at Kirkton. (Richard Mearns)

6. Strategic Actions

6.1 Recent and current activity

- Some farm woods have been fenced from livestock under agri-environment schemes.

6.2 Other recommended actions

- **Carefully plan new farm woods** to avoid habitats that are already of biodiversity interest, such as wetlands or unimproved grasslands, and archaeological sites. Maximise biodiversity and other benefits, by linking existing habitats, such as ponds and hedgerows.
- **Aim for several small woods** on the farm, especially when managing for game birds.
- Consider **reversion of conifer woods to broadleaved or mixed woods**. Small conifer plantations rarely have an economic value.

FARM PONDS

Priority Action (FP1)

Create new pond landscapes (several ponds linked by wildlife-rich habitats) in farmland areas known to support important pond species.
Lead Partner: Regional Proposal Assessment Committee.

Priority Action (FP2)

Provide training in the management of farm ponds.
Target: Arrange 2 training courses by 2012.
Lead Partner: Farming & Wildlife Advisory Group.

A recently created sustainable farm drainage pond at Barnboard Farm, Bridge of Dee, August 2006. (Peter Norman)

1. Habitat Description

1.1 Physical Characteristics

Natural ponds occur on farms, but the majority of farm ponds have been artificially created. They vary in size from puddles of one square metre to deep lochans of 1-2 hectares or more, but this variation adds to their value. The water can be permanent or seasonal. Many originally served a specific purpose in farm management, but the majority now only provide amenity, wildlife or sporting value.

Unlike many other habitats, there is little ecological difference between man-made and semi-natural ponds. Factors such as geology, water depth, exposure to pollution and location in the landscape are much more important than the origin of the pond.

New ponds have also recently been created for **Sustainable Farm Drainage Systems.** Such ponds are designed to treat and store runoff from farm steadings, to prevent damage to natural watercourses. They should, however, also provide biodiversity and amenity benefits.

1.2 National and International Context

Scotland is estimated to have at least 150,000 waterbodies up to 2ha, around half of the British total. Their number and extent in Dumfries & Galloway is unknown.

2. Dumfries & Galloway Status

2.1 Recent Trends

In the last few decades there has been a trend to create new farm ponds for angling, shooting, wildlife or amenity purposes. However this has not yet resulted in a pond density anywhere near that seen at the beginning of the 20th century. Indeed, on a UK scale the number of new ponds is estimated only to match those still being lost, although it is suspected that this is not the case in south west Scotland where there has been relatively little loss of farm ponds in recent years.

2.2 Current Distribution

Ponds are believed to be widespread in all farming areas across Dumfries & Galloway, but there has been little research into variations in pond density.

2.3 Site Examples

Carrick Ponds (SSSI) are some of the most important in Scotland for water beetles.
A network of farm ponds at **Burrow Head** (SAC/SSSI) forms one of the most important breeding areas in Britain for Great Crested Newts.

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with farm ponds, and the following action plans may also contain relevant information: Eutrophic Lochs, Mesotrophic Lochs, Swamps, Marshes, Native Wet Woods, Forest Ponds.

3. Importance for Associated Species

3.1 Reptiles and Amphibians (very high importance)

Common Frogs *Rana temporaria*, Common Toads *Bufo bufo* and all three species of newt – Great Crested *Triturus cristatus*, Smooth *Lissotriton vulgaris* and Palmate *Lissotriton helvetica* regularly breed in farm ponds. Natterjack Toads *Epidalea calamita*, though of limited distribution, also breed in a few farm ponds.

Common Toads benefit from larger ponds. Kirkconnel, February 2006. (Greg Baillie)

3.2 Invertebrates (high importance)

Many aquatic invertebrates are found in farm ponds. Typical species include moths such as Bulrush Wainscots *Nonagria typhae* that feed on Reedmace, water beetles such as Great Diving Beetles *Dytiscus marginalis,* and dragonflies such as Large Red Damselflies *Pyrrhosoma nymphula.*

A number of locally important species have also been recorded from a few ponds in the region. These include Water Spiders *Argyroneta aquatica,* the only spider to live an almost entirely submerged existence, and Variable Damselflies *Coenagrion pulchellum* that have a restricted UK distribution.

3.3 Birds (high importance)

Mallards *Anser platyrhynchos* and Moorhens *Gallinula chloropus* are the typical breeding birds of farm ponds, with Sedge Warblers *Acrocephalus schoenobaenus* and Reed Buntings *Emberiza schoeniclus* in the surrounding marsh and scrub. However, farm ponds may be of critical importance in providing food for birds that may nest elsewhere on the farm, including Lapwings *Vanellus vanellus*, Redshanks *Tringa totanus* and Tree Sparrows *Passer montanus.*

3.4 Flowering Plants (medium importance)

A wide variety of flowering plants is found in farm ponds. Mudwort *Limosella aquatica,* an annual of the muddy edges of ponds, if found only erratically in Dumfries & Galloway. Lesser Reedmace *Typha angusifolia*, of restricted distribution in Scotland, grows in slightly deeper water on the edge of ponds than its larger and commoner relation.

3.5 Mammals (medium importance)

Larger farm ponds, especially where they connect to wetland, are used by aquatic mammals such as Otters *Lutra lutra*, Water Voles *Arvicola terrestris* and Water Shrews *Neomys fodiens*. They will also be used for drinking by terrestrial mammals.

3.6 Non-flowering Plants (low importance)

Algae are a natural part of ponds and form rich habitats for many invertebrates and the basis of many food chains. However nutrient enrichment can cause dense algal growth and blooms, to the detriment of other species.

3.7 Fishes (low importance)

Though farm ponds may be stocked with fish for angling or amenity purposes, the species involved are of low conservation importance. It is damaging, and potentially illegal, to stock ponds with fish that are currently fishless.

4. Environmental, Economic & Social Importance of Biodiversity

- Water creates a focal point in farm landscapes.
- Ponds have a cultural and archaeological value. Mill ponds and other farm ponds provide valuable information about the history of a place.
- Ponds may be of considerable amenity value: some are used for shooting or fishing, others for boating or part of a nature reserve.

5. Factors affecting the Habitat

- On a national scale, **pollution** may be more of a threat to ponds than actual loss. This includes nutrient over-enrichment (eutrophication) from fertiliser and slurry runoff and accidental chemical contamination.
- Excessive **cattle poaching** on the banks of

ponds can cause turbidity and decreased dissolved oxygen concentrations as a result of sediment and excrement entering the water.

- Well-intentioned **mismanagement** may be more damaging than doing nothing. For example, dredging silt and removing vegetation for the sake of creating open water may in some circumstances damage the conservation interest of ponds.

6. Strategic Actions

6.1 Recent and current activity

- The Working Towards Best Practice Project, led by **FWAG**, is carrying out a number of wetland projects on farms and promoting best practice to other farmers and landowners.
- The **Pond Monitoring Network** is establishing an online database of ponds throughout the UK.

6.2 Other recommended actions

- **Link new ponds to other habitats** within the landscape. Avoid open semi-natural habitats that are likely to already have a high biodiversity value, and important archaeological sites.
- Maintain **habitat mosaics**. Ponds associated with semi-natural habitats such as unimproved grasslands or native woods are likely to be of higher conservation value.

Extensive network of ponds within farmland at Carrick, Gatehouse of Fleet, June 2007. (Peter Norman)

PUBLIC OPEN SPACES

Priority Action (POS1)

Work with local communities to increase management and interpretation of biodiversity in public open spaces.
Target: Implement projects on 10 sites by 2011.
Lead Partner: Sulwath Connections.

Participation is the best way to learn - tree-planting day at Rhonehouse Fair Green, November 2007. (Ruth Paterson)

1. Habitat Description

1.1 Physical Characteristics

Amenity grassland is the main habitat of public open spaces, the majority of which is newly created by seeding imported topsoil and is regularly and frequently close mown. It therefore is subject to very high nutrient levels. **Sports grounds** are also uniform in character, but usually cover a much larger area than the actual playing pitch with potential for other habitats in these areas.

Town parks also usually contain large areas of amenity grassland, but these tend to have been established longer and may therefore contain remnants of previous habitats. Other influences on their value for biodiversity, apart from their management, are their size and proximity to areas of semi-natural habitat. Though there are many exceptions, the typical **park pond** is artificially created, concrete lined with vertical banks, and used for intensive activities such as boating and feeding of domestic, or semi-tame, wildfowl.

Municipal **flowerbeds** occur both within parks and in other urban areas. They tend to be intensively managed, sometimes being dug and bedding plants changed two or three times a year. However, woodchip mulch has provided a new habitat that has attracted a few specialist species, mostly fungi.

At first glance **churchyards** are merely pieces of land surrounding churches, given a different status from any garden simply because of their role as the burial grounds. But they can be significantly more species-rich than other urban environments. The main type of habitat found in churchyards is grassland, but because of their age and lower intensity management may support greater diversity than surrounding areas. In some cases this may take the form of long meadow grasses amongst which floral plants such as ox-eye daisy, common poppy and yellow rattle grow, giving the effect of a hay meadow. In other cases the grass may be much shorter allowing bird's-foot trefoil or orchids to grow. This variation in management and subsequent species diversity make carefully managed churchyards so important. **Cemeteries** are often similar in terms of wildlife and management.

Urban Trees are covered by a separate action plan, and urban ponds (other than park ponds) are included in the action plan for Urban Watercourses and Wetlands

1.2 National and International Context

Public open spaces are widespread and common throughout Britain. The rural nature of Dumfries & Galloway means that there is a lower density of such sites than in more urban environments, but there are more than 20 town parks and 130 churchyards.

2. Dumfries & Galloway Status

2.1 Recent Trends

Over the past 30 years management of public open space has become more uniform. Whilst there has been a tendency for reduced management of parks, some churchyards have become more highly managed. This has involved movement of headstones, intensification of mowing regimes, increased use of chemicals and use of machine-made black polished headstones upon which lichens cannot grow. Management of churchyards and cemeteries has therefore become more like that in amenity grasslands and parks.

2.2 Current Distribution

Public open spaces are predominantly within towns and villages and are therefore concentrated in the coastal lowlands and river valleys.

2.3 Site Examples

A number of town Parks include features of high biodiversity interest, such as the pond at **Blairmount** in Newton Stewart, grassland at **Castledykes in Kirkcudbright**, and trees at **Castledykes in Dumfries**.

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with public open spaces, and the following action plans may also contain relevant information: Scrub Woods, Broadleaved and Mixed Plantations, Traditional Field Boundaries, Wood Pastures and Parklands, Urban Trees, Gardens, School Grounds, Walls and Buildings, Roads and Verges, Urban Watercourses and Wetlands.

3. Importance for Associated Species

3.1 Fungi and Lichens (high importance)

Churchyards and **cemeteries** are known to support important lichen communities. Different species occur on the front, back and tops of headstones, with some 300 species recorded from British churchyards. One of the most common lichen species, the bright orange *Xanthorias* thrive on the nutrient-rich tops where bird droppings accumulate. If headstones are moved to ease management, the likelihood is that the lichens will not survive.

Leafy lichens Platismatia glauca on headstone. Durisdeer Church, March 2008. (Peter Norman)

In built-up or agriculturally improved areas, old **churchyards** and **cemeteries** that are closely mown at regular intervals can form the most important long-established grassland habitats for fungi, especially when nitrogenous fertilisers have not been applied. Some well-studied British sites have recorded more than 200 species, including important species such as Pink Meadow Waxcap *Hygrocybe calyptriformis*. However, little work has been carried out to assess such sites in Dumfries & Galloway. In **parks** and other municipal **flowerbeds**, the increasing use of woodchip mulches has encouraged the spread of several species of fungi, and even created a habitat for new species, such as *Agrocybe rivularis*.

Larch Bolete Suillus grevillei on mown grassland beneath ornamental larch. The Crichton, September 2007. (Peter Norman)

3.2 Birds (medium importance)

The mix of open grassland and trees and shrubs in many public open spaces can lead to a high density of breeding birds. Typical species include Blackbirds *Turdus merula*, Song Thrushes *Turdus philomelos*, Dunnocks *Prunella modularis* and Spotted Flycatchers *Muscicapa striata*.

3.3 Invertebrates (medium importance)

Large numbers of invertebrates are associated with public open spaces, though most tend to be species that are also common and widespread in other habitats. Typical butterflies include Small Tortoiseshells *Aglais urticae*, and where there is longer grass Meadow Browns *Maniola jurtina.* Holly Blues *Celastrina argiolus,* on the northern edge of their UK range, have been seen in the Crichton grounds. Other common invertebrates include ladybirds, hoverflies and bumblebees.

3.4 Flowering Plants (medium importance)

Over 100 species of plant may occur in an average sized **churchyard**. Typically, older churchyards have more native species, with mature Yew *Taxus baccata* and Beech *Fagus sylvatica* dominating, mixed with exotic conifers often planted in Victorian times. Shrubs including Holly *Ilex aquifolium* and climbers like Ivy *Hedera helix* are also typical.

3.5 Reptiles and Amphibians (medium importance)

Great Crested Newts *Triturus cristatus* occur in at least two ponds within towns and villages in Dumfries & Galloway at Newton Stewart and Gatehouse of Fleet. In **churchyards** and **cemeteries**, older headstones laid on their side provide basking sites for reptiles such as Common Lizards *Zootoca vivipara* and Slow Worms *Anguis fragilis*.

3.6 Mammals (medium importance)

The proximity of public open spaces to buildings, which offer bats many roosting opportunities, makes them valuable feeding areas for Pipistrelles *Pipistrellus* spp. and occasionally other species. Where dense cover is available, they may also be used by Hedgehogs *Erinaceus europaeus*.

3.7 Non-flowering Plants (low importance)

In contrast to lichens, little information has been collected on mosses and liverworts in **churchyards**, but such sites are likely to be important where the surrounding area is built-up or intensively farmed. Most species are found on headstones or other hard surfaces, such as paths. *Bryum argentum* is probably the most widespread plant in the world, growing between paving stones in virtually every town and city in the world.

Rustyback, an uncommon fern in Scotland, growing in the lime mortar of Dunscore churchyard, August 2008. (Peter Norman)

4. Environmental, Economic & Social Importance of Biodiversity

- Biodiversity enhances the interest and enjoyment of visitors.
- The different greys, greens and yellows of headstone lichens give a sense of age to the churchyard and a feeling of warmth to the stones.

5. Factors affecting the Habitat

- **Lack of knowledge** of existing value of urban habitat in the planning of developments/re-developments.
- The **threat of development** encroachment onto parks and old cemeteries.
- **Simplification of the management** of parks, cemeteries and amenity grassland. This can involve clearing of shrubs, filling-in of ponds and levelling land with hillocks and hollows making them less attractive to wildlife.
- The **use of invasive species in landscaping schemes** where this could pose a threat to existing natural habitats.

6. Strategic Actions

6.1 Recent and current activity

- **Sulwath Connections Community Biodiversity Action Project has worked with several communities to enhance public open spaces.**
- **Green Flag Awards**, judged by the Civic Trust on the quality of park and greenspace management in England and Wales, has recently been launched in Scotland.
- Judging for **Eco-congregation Awards** can include conservation management of church grounds.
- Community volunteers have created **Garries Park wildflower meadow** in Gatehouse of Fleet.
- **Lochside Park** in Castle Douglas, on the shores of Carlingwark Loch, includes wildlife interpretation and a no-boating zone to prevent disturbance to nesting birds and other wildlife.
- The **Crichton grounds** are well maintained with large areas of mown grassland and specimen trees, but minimal use of chemicals leads to an interesting range of fungi.

6.2 Other recommended actions

- Carry out an **audit of urban biodiversity information** in Dumfries & Galloway. Identify and map important areas for biodiversity within public green spaces, including parks and cemeteries.
- **Incorporate the conservation and enhancement of wildlife** into the design and management of urban greenspace.
- **Reduce negative biodiversity impacts** resulting from grounds maintenance contracts in public open spaces, parks and sports grounds (e.g. the use of herbicides, the timing and extent of grass cutting and the type of equipment used).
- **Encourage community and individual action** to survey, plan for and manage urban wildlife habitats. Consider designation as Local Nature Reserves.
- **Promote wild space in urban areas as an educational resource** to inform communities about local wildlife in the context of the wider environment.
- **Organise basic biodiversity training for staff** in order to ensure that biodiversity is considered during their everyday work.

URBAN TREES

Priority Action (UT1)

Complete a survey of all street trees in public ownership, including their location, species, approximate age and condition.
Target: Complete survey by 2015.
Lead Partner: Dumfries & Galloway Council.

Horse Chestnut and other trees are the dominant feature at Mill Green, Dumfries. September 2007. (Peter Norman)

1. Habitat Description

1.1 Physical Characteristics

Urban and suburban woodland is uncommon, but small groups and single urban trees are frequent in many towns and villages. Often these consist of non-native species, typically Common Lime, Beech, Horse Chestnut, and Sycamore. A number of ornamental forms may also have been planted.

The environment experienced by urban **tree roots** is critical to their continued existence. Roots perform three important functions: stability, absorption of water and essential mineral nutrients, and storage of food. The majority of a tree's roots are in the top six centimetres of the soil. Urban trees also usually have to cope with higher levels of airborne pollutants than those in rural situations, particularly if they are located in areas of high traffic density.

1.2 National and International Context

Although there are many trees in the urban areas of Britain, it is believed that numbers are rapidly declining. For example, in London an estimated 40,000 urban trees were lost between 2001 and 2006.

2. Dumfries & Galloway Status

2.1 Recent Trends

There has continued to be a gradual loss of urban trees through development or perceptions of safety. Though there has been a considerable interest in tree planting in recent decades, many of these have not been maintained or have been smaller growing species. Few mature urban trees have been adequately replaced.

2.2 Current Distribution

The best examples of urban trees are found in long-established towns and villages. Trees in settlements of more recent origin, or recent expansion, tend be restricted to areas such as parks and churchyards.

2.3 Site Examples

Avenues of urban trees are a notable feature of the centre of some towns and villages, including **Thornhill** and **Moffat**. Trees are also a notable feature of the centre of **Kirkcudbright** and **Wigtown**.

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with urban trees, and the following action plans may also contain relevant information: Veteran Trees, Public Open Spaces, Golf Courses, Holiday Parks and Caravan Sites.

3. Importance for Associated Species

3.1 Invertebrates (medium importance)

Ivy growing on trees can be very important for invertebrates. Other **climbing plants** such as Honeysuckle and Traveller's Joy are of lesser value, but still provide food and habitat for many invertebrates. Horse Chestnut is prone to producing sap runs which support an interesting invertebrate fauna, whilst Common Lime has a good foliage fauna and bark-boring beetles.

3.2 Birds (medium importance)

Urban trees that are remote from semi-natural habitats generally support fewer birds than those in the countryside, but Waxwings *Bombycilla cedrorum* are remarkable exceptions. These birds, which breed in remote Siberia, occasionally winter in Britain in large numbers and in Dumfries & Galloway have been recorded on trees in car parks at the Council Offices and Morrisons supermarket in Dumfries, and the M74 services at Gretna. They favour bearing-bearing trees. More typical species include Starlings *Sturnus vulgaris*, House Sparrows *Passer domesticus* and Greenfinches *Carduelis chloris*.

3.3 Mammals (medium importance)

Bats find many roosting opportunities in urban areas, and in some locations street trees provide the only opportunity to find insect food they need to survive.

3.4 Fungi and Lichens (low importance)

In Dumfries & Galloway's towns, air quality is much better than in other urban areas, but still may be sufficient to prevent colonisation by the most sensitive lichen species.

4. Environmental, Economic & Social Importance of Biodiversity

- Urban trees contribute to the landscape character, setting and local distinctiveness of towns and villages.
- Trees improve people's quality of life and reduce everyday stress through their aesthetic qualities, by providing shade and humidity, by reducing noise levels and by providing privacy.
- Trees provide summer shade and winter shelter enabling the saving of energy.
- Trees affect air quality, both negatively by emitting gases known as volatile organic compounds (VOCs) that contribute to the production of pollutants, and positively by removing pollutants, especially ozone, nitrogen dioxide, and particles from the air. Different tree species in different locations perform differently, but generally Ash, Alder, Larch, Silver Birch, Scot's Pine are best, oaks and willows are worst, in terms of improving air quality.
- Particles in the air have an impact on human health. Mature, mixed woodland captures airborne particles at approximately three times the rate of grassland. A study in the West Midlands predicted that doubling the number of trees could reduce excess deaths due to particles in the air by up to 140 per year.
- Trees also remove carbon dioxide from the atmosphere, but in Dumfries & Galloway this is a very minor contribution to carbon sequestration.

Urban trees include some unusual species, such as this Indian Bean Tree at St.Michael's Church, Dumfries. (Peter Norman)

- Trees positively affect property values.
- Several urban trees are local landmarks and have been the subject of local artists.

5. Factors affecting the Habitat

- Newly planted trees may struggle to grow and survive in towns due **poor growing conditions** as a result of compacted soils and a shortage of mineral nutrients.
- **Above average air temperatures** created by heat radiating off tarmac, paving, glass and buildings can cause already drought-stressed trees to lose even more water.
- **Neglect**, including lack of water, weed infestation, constricting ties on standard trees (which restrict the flow of water and sap), strimmer and mower damage (which damages and removes the bark), overdosing/misuse of herbicide and de-icing salt (which then becomes toxic to trees).
- **Vehicles** that accidentally drive into trees damage bark, break stems and snap roots. Guards, fencing and posts can help trees to avoid vehicle damage.
- **Service runs** including drains, sewers, water, electricity, gas, telephone and cable TV laid via open trenching can cause serious disruption to existing trees by damaging or severing roots, making the tree unstable and reducing its capacity to absorb water, oxygen and essential mineral nutrients. Leaks from some of these

services, such as gas and water, can harm or kill roots.

- **Engineering work**, including installation and maintenance of paving slabs and tarmac, kerbs and private driveways may cause severance or damage to roots.

Pollarded Lime trees are a feature of the centre of Thornhill. May2008. (Peter Norman)

- Trees growing in certain locations may be a source of **conflict with the public**. Complaints usually involve blocking of light, fear that they may fall and damage people or property, or seasonal problems such as leaf fall. These may result in pruning or removal of these trees.
- Pressure to fit as many houses as possible on development sites can bring trees into direct **conflict with building projects**. As sites become crowded during construction, and trees are subsequently damaged by machinery, fires and storage of materials. In the long-term such trees may become unstable and/or diseased and may be felled.
- Even where trees are successfully retained on a site, often **consideration is not given to their long-term growth requirements**, in terms of height and width. As a result, residents of the site may become concerned as these trees begin to reach above the roof tops, block increasing levels of light and drop more leaves.
- Long-term management of urban trees **can be expensive** if carried out to the correct professional standard, and therefore may be neglected. As a result drastic action is often taken such as lopping/topping, heavy crown reduction or removal, as this provides an immediate quick fix solution, even though these options are not good for the tree and the safety of people.
- **Vandalism** of trees can take two main forms: Opportunistic snapping of side branches, breaking off crowns, uprooting and pulling whole trees out of the ground, and premeditated ring barking, sawing off branches/crowns of young trees and poisoning roots. It is illegal to damage a public/protected tree, but this often fails to perturb the vandal. Tree vandalism is a social problem, not a tree problem.
- **Deliberate removal of Ivy** from trees destroys a valuable wildlife habitat. However, dense ivy can restrict tree safety surveys and increase the tree's susceptibility to windthrow. Each case should be considered individually, but it may be best to prevent a dense covering being created.
- Future **colonisation of Grey Squirrels** in urban areas, parks and cemeteries may cause damage through bark stripping.

6. Strategic Actions

6.1 Recent and current activity

- Tree Preservation Orders, Conservation Area Orders and Planning Conditions serve to ensure that trees are retained and protected during and after construction works.
- British Standard 5837 'Trees in relation to Construction' provides guidance, in respect of development sites. It applies to applications for most developments where construction work is involved, but will not generally be applied to householder applications unless the site contains a large number of trees.

6.2 Other recommended actions

- Strengthen protection for urban trees, including the use of **Tree Preservation Orders** in areas where they will safeguard biodiversity.
- Ensure the successful **retention of trees in development works**.
- Encourage owners and occupiers of land to **safeguard and re-instate hedgerows and trees of biodiversity value** where these are affected by development or re-development proposals.
- **Report contractors** who are suspected of carrying out unauthorised works to protected trees.
- **Education and raising awareness** of trees is the best way to reduce vandalism.

TRADITIONAL ORCHARDS

Priority Action (TO1)

Compile a database of traditional orchards, including any known historical and biodiversity information, to determine their extent, distribution, composition and status in Dumfries & Galloway.
Lead Partner: Dumfries & Galloway Orchard Network.

1. Habitat Description

1.1 Physical Characteristics

Orchards are collections of cultivated fruit trees such as apples, pears and plums and/or damsons although nut-bearing trees such as Walnuts and Hazelnuts can also be present. Traditional orchards are those which have been planted and managed less intensively than modern commercial orchards and therefore have high ecological value. The combination of old individual trees within grassland gives a habitat with similarities to wood pasture or parkland. Trees within old orchards can be over 60 years old and as fruit trees decay more quickly than most British hardwoods they can provide crevices and hollows for nesting birds.

Traditional orchards are also important reservoirs of genetic diversity in supporting locally distinctive varieties of fruit such as the Galloway Pippin that are increasingly rare.

1.2 National and International Context

There are no readily available statistics for orchard numbers, areas and production within Scotland but it is clear that the Clyde Valley has always been the most significant orchard area. Other areas with a tradition of significant orchard cultivation include Dumfries & Galloway, the Borders and the area around Carse of Gowrie on the Firth of Tay. Elsewhere in the UK there are many orchard areas, where as well as growing commercial eating fruit, significant acreage is given over to cider apple production, not a tradition in Scotland. Most of these orchards are in the south of England. Figures suggest that in 1997 there were 22,400ha of commercial orchards in the UK, a 64% decline in 27 years.

2. Dumfries & Galloway Status

2.1 Recent Trends

During the 20th Century apple growers were encouraged to use a range of apple that was more productive and this led to a decline in varieties traditionally grown in Dumfries & Galloway. Today there are very few orchards left in Dumfries & Galloway, with occasional remnants remaining in gardens of country estates or large houses, farm houses and Victorian back gardens.

2.2 Current Distribution

Dumfries & Galloway is not an area renowned for large-scale commercial apple growing due to the unreliable weather conditions. However, the UK BAP distribution map suggests that there are six 10x10km grid squares in Dumfries & Galloway which have traditional orchards within them. Further survey work is required to assess these sites and to establish current distribution.

2.3 Site Examples

Some country estates and houses have remnants of old orchards such as **Galloway House Gardens** and **"Croft-an-Righ" House** in Wigtown, another possible location of the original Galloway Pippin known locally as the Croft-angry apple.

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with traditional orchards, and the following action plans may also contain relevant information: Neutral Grasslands, Native Woods, Wood Pastures and Parklands.

3. Importance for Associated Species

3.1 Flowering Plants (high importance)

Species rich unimproved grassland is often associated with traditional orchards, especially where applications of fertilisers have been kept to a minimum. Species likely to be found in these grass swards include Yellow Rattle *Rhinanthus minor,* Meadow Cranesbill *Geranium pratense*, Devil's-bit Scabious *Succisa pratensis* and various orchid species.

Peacock butterfly. (Paul McLaughlin)

3.2 Invertebrates (high importance)

The blossom of fruit trees can also provide a source of nectar for invertebrates such as bees, butterflies and hoverflies, whilst the dead wood of mature trees orchards can form important refuges for dead wood (saproxylic) invertebrates.

3.3 Birds (medium importance)

Bullfinch. (Paul McLaughlin)

Flower buds and leaf buds provide food for birds such as Bullfinches *Pyrrhula pyrrhula*, whilst windfall fruit is eaten in autumn and winter by Fieldfares *Turdus pilaris,* Redwings *Turdus iliacus* and other thrushes. Birds such as Woodcocks *Scolopax rusticola*, Green Woodpeckers *Picus viridis* and Spotted Flycatchers *Muscicapa striata* that are associated with wood pastures are also attracted to orchards, along with Buzzards *Buteo buteo*, Barn Owls *Tyto alba* and Tawny Owls *Strix aluco* that may roost in mature trees and forage over open grassy areas.

3.4 Fungi and Lichens (medium importance)

A diverse fungus flora is associated with old or dead trees. Several species of waxcap, including the Pink Waxcap *Hygrocybe calyptraeformis* are among many small fungi characteristic of such pastures. *Sarcodontia crocea* is a rare fungus that seems to specialise in old apple trees, though has not yet been recorded in Dumfries & Galloway.
The bark of fruit trees can support a good cover and range of lichens such as *Parmelia sp.*

3.5 Mammals (medium importance)

Various species of bats use orchards. Pipistrelles *Pipistrellus spp.* and Brown Long-eared Bats *Plecotus auritis* find the open scrub habitat provided by some orchards suitable as foraging habitat, and if the trees are old enough to produce crevices, then species such as Pipistrelle and Noctule *Nyctalus noctula* may also use them as roosting sites. Other mammals such as Red Squirrels *Sciurus vulgaris*, Badgers *Meles meles* and deer are attracted to this habitat type, and a range of small mammals such as mice and voles is also found.

3.6 Non-flowering Plants (medium importance)

Many mosses and liverworts grow on fruit trees, and species associated with damp unimproved grasslands are found in orchards in the region.

3.7 Reptiles and Amphibians (low importance)

If ponds are present within orchards then it is likely that amphibians will be present.

4. Environmental, Economic & Social Importance of Biodiversity

- Traditional varieties of fruit, produced with high environmental standards, can be marketed to a specific, high spending market.
- Traditional orchards can be grazed by sheep or cattle.
- Many invertebrates act as biological control agents against pests of fruit. For example the mirid bugs *Blepharidopterus angulatus* and *Psallus ambiguu* are predators of Fruit-tree Red Spider Mite, the flower bugs *Anthocoris nemorum* and *Anthocoris nemoralis* feed on aphids, and the Common Earwig *Forficula auricularia* is an important predator of Codling Moths. The Whirligig Mite *Anystis baccarum* impacts on Apple-grass aphid populations and has also proved compatible with various fungicides commonly used for apple scab control. It therefore offers much potential to be integrated into pest control programmes for apple orchards.
- Sites can be used for educational activities, guided walks and talks.

5. Factors affecting the Habitat

- **Lack of information and understanding** about the distribution, quality and importance of this habitat leading to poor appreciation of its value.
- Loss of habitat due to **grubbing out or death of mature trees**.
- **Agricultural improvement** through drainage, cultivation and fertiliser applications.
- **Agricultural abandonment**, leading to rankness and scrub encroachment through lack of management.
- **Inappropriate management**, including overgrazing by horses.
- Most beneficial invertebrates are susceptible to **agrochemicals** and cannot survive in intensively managed orchards.
- **Development** of land adjacent to village or estate orchards.

6. Strategic Actions

6.1 Recent and current activity

- The **Dumfries & Galloway Orchard Network** was set up in 2000 to promote the understanding and enhancement of traditional apple varieties in the region.

6.2 Other recommended actions

- **Encourage the enhancement and reinstatement of orchards** on traditional orchard sites.
- **Promote greater awareness** of the importance of this habitat and its sensitivity to land use changes.
- **Arrange activities** such as Apple Days and Budding Days through the Dumfries & Galloway Orchard Network.

GARDENS

Priority Action (GA1)

Encourage public gardens and garden centres to promote wildlife gardening by installing garden wildlife interpretation.
Target: Interpretation at 3 sites by 2015.
Lead Partner: Dumfries & Galloway Biodiversity Partnership.

Priority Action (GA2)

Promote a garden that demonstrates good practice for wildlife management.
Target: Establish demonstration garden by 2012.
Lead Partner: Solway Heritage.

1. Habitat Description

1.1 Physical Characteristics

Private gardens are small in size, subject to high levels of disturbance, and being most common in urban areas, tend to be subject to higher levels of air pollution than the countryside. Individual gardens therefore have limited biodiversity potential. However, their value is considerably enhanced by the fact they are highly clustered, resulting in habitat mosaics that cover a significant area and are considerably more diverse than much of the surrounding countryside. **Public gardens** are similar in many respects, but tend to be much larger and contain larger patches of different habitats.

Vegetable plots are sometimes a feature of private gardens, but vegetables are more commonly grown on **allotments**. These are larger than private gardens and tend to have less intensive management. **Market gardens** commercially grow fruit vegetables and flowers in greenhouses or polytunnels.

Garden **lawns** are usually planted with just one or two species of grass, but other plants quickly colonise all but the most intensively managed lawns. All are adapted to frequent and short cutting with a lawnmower. **Flower beds** are usually stocked with non-native flowers and subject to regular digging, weeding, and sometimes regular replacement of plants. The use of wood chip mulches to reduce the need for weeding has provided a garden habitat that has attracted some species associated with dead wood. **Shrubs and trees** mimic more natural woodland habitats, at least in terms of their structure. **Compost heaps** are also a feature of some gardens, and a few have installed **log piles**, specifically for biodiversity reasons.

Garden Ponds are typically very small and shallow, and are often subject to rapidly fluctuating water levels and temperatures, and high inputs of nutrients from adjacent grass cutting and chemical use. However, as with gardens generally, aquatic biodiversity benefits from the close proximity of ponds to each other, allowing rapid recolonisation of many species.

1.2 National and International Context

There are some 16 million UK gardens covering more than 1.2 million hectares (3 million acres). In Dumfries & Galloway there are approximately 60,000 households, the majority of which have gardens, resulting in an estimated area of almost 5,000ha (12,000 acres). This is larger than the combined total of all wildlife reserves in the region managed by RSPB, SWT and WWT.

2. Dumfries & Galloway Status

2.1 Recent Trends

Although the average size of private gardens has probably not increased in recent years, there has been a continued increase in number. There has also been an increasing tendency for hard surfacing, with more paving, tarmac and gravel, and an increase in the use of garden chemicals. However, wildlife gardening has also become much more popular, especially a dramatic increase in the number of bird feeders and nest boxes.

2.2 Current Distribution

The majority of Dumfries and Galloway's **private gardens** and **allotments** are located in the main urban areas of Dumfries and Stranraer, with smaller numbers in other towns and villages. In contrast, **public gardens** generally have a more rural location. **Market gardening** is not an important activity in Dumfries & Galloway. Nevertheless, in 2006 there were 12,755 square metres of glasshouses/ polytunnels on 22 sites, mostly growing bedding plants and pot plants.

2.3 Site Examples

Glenwhan Gardens at Dunragit has created and promoted wildlife habitats, and biodiversity has been promoted by special wildlife events at **Blackstone Garden Plants** in Kippford.

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with gardens, and the following action plans may also contain relevant information: Walls and Buildings, Public Open Spaces, Urban Trees, Traditional Orchards.

3. Importance for Associated Species

3.1 Reptiles and Amphibians (high importance)

Garden ponds are extremely valuable for amphibians. Even the smallest pond can support breeding Common Frogs *Rana temporaria,* Smooth Newts *Lissotriton vulgaris* and Palmate Newts *Lissotriton helvetica.* Common Toads *Bufo bufo* prefer larger ponds. **Log piles** provide essential hibernation sites.

Garden ponds provide a valuable habitat for Common Frogs. Kirkconnel, June 2007. (Greg Baillie).

Slow Worms *Anguis fragilis* occur in suitable gardens in greater density than in many semi-natural habitats, although populations may be seriously affected by cat predation. **Compost heaps** are a favoured egg-laying site for Grass Snakes in southern England, though the presence of this species in Dumfries & Galloway is not confirmed.

3.2 Invertebrates (high importance)

More than 11,000 species of invertebrate has been recorded from a single British garden. The average for a garden in Dumfries and Galloway will be considerably lower, but will nevertheless be counted in the thousands.

Flower beds, even those composed entirely of non-native species, can be rich in nectar sources for bees, butterflies, moths and hoverflies and can provide such nectar (and pollen) early and late in the season when natural sources are not abundant.

Wool Carder Bees *Anthidium manicatum* are striking medium-sized bees that are common in southern England. However the only Scottish records come from Dumfries & Galloway where they can be found hovering around patches of labiates, including those in garden flower beds. Other garden bees include Red Mason Bees *Osmia rufa*, Rose Leaf-cutter Bee *Megachile centuncularis,* Honey Bees *Apis mellifera* and the bumble bees *Bombus pratorum, B. pascurum,* and *B.terrestris.* The first Scottish record of a mining bee *Lasioglossum morio* came from Threave Gardens in 2006, although this species is not generally a garden specialist.

Garden butterflies are mainly common widespread species such as whites, Small Tortoiseshells *Aglais urticae* and Peacocks *Inachis io*, but the first recorded breeding of Holly Blue *Celastrina argiolus* in Scotland came from a Rockcliffe garden in 2004.

The average suburban garden in Dumfries & Galloway is likely to support in excess of 200 species of moth. One species, Blair's Shoulder-knot *Lihophane leautieri*, is virtually confined to gardens, as its caterpillars feed on planted **shrubs and trees** of the cypress family. First recorded in Britain in 1951, it reached Kirkcudbright in 2001 and is now found in gardens across the region. Conversely, the decline of Currant Clearwing Moth *Synanthedon tipuliformis* may be linked to fewer currant plants being grown in **vegetable plots** and **allotments**.

Most **garden ponds** will support common species of breeding damselflies, as well as pond skaters, water beetles, pond snails and other aquatic invertebrates.

3.3 Birds (medium importance)

Much time and money is spent erecting nest boxes and feeders for garden birds, but of much greater importance is the structure of garden vegetation. **Shrubs and trees** provide food, nest sites and protective cover from predators such as cats for Dunnocks *Prunella modularis* and Robins *Erithacus*

House Sparrows, in rapid national decline, are still common in local gardens. (Gordon McCall)

rubecula; **lawns** offer feeding opportunities for Blackbirds *Turdus merula* and Song Thrushes *Turdus philomelos*; **garden ponds** provide essential drinking and bathing opportunities for many species.

Blackbirds nest in high densities in gardens. (Paul McLaughlin)

Spotted Flycatchers *Muscicapa striata* are declining across the UK, but populations in gardens seem to be fairing better than those in woodland or farmland. There has also been a dramatic reduction in numbers of House Sparrows *Passer domesticus* in Britain, though local declines have not been detected. Reasons for the national trend are unclear, but increased use of garden chemicals and the corresponding reduction in weed seeds has been implicated as a contributory factor.

Agrocybe rivulosa on garden woodchips. Nunholm, Dumfries, August 2007. (Peter Norman)

3.4 Fungi and Lichens (medium importance)

Few species of fungus are specifically associated with gardens. Perhaps the Fairy Ring Champignon *Marasimus oreades*, though not restricted to garden **lawns**, is one species best known from this habitat. Old lawns that are regularly mown but have not received fertilisers or herbicides are now rare, but where they occur they can provide a nationally important habitat for uncommon species of fungi, especially waxcaps *Hygrocybe* spp. Lawns with moss are particularly valuable.

The practice of using wood chips for mulching **flower beds** and on garden paths has introduced a new fungal habitat to Britain in recent years. *Agrocybe rivularis*, new to science in the Pennines in 2003, was discovered on a pile of wood chips at Nunholm, Dumfries in 2007. Other species have been introduced with exotic plants. The False Truffle *Hydnangium carneum,* known in Britain since 1875, has been found in association with eucalypts at Logan Botanic Garden.

Common species of lichen may be found on **shrubs and trees**, as well as garden paths, walls and fences.

3.5 Mammals (medium importance)

Hedgehogs *Erinaceus europaeus* occur in a greatest density where grassland and woodland is found in close proximity. A mosaic of garden shrubs and trees, together with lawns therefore provides an ideal habitat. They can occur here at a density of more than 1 per 5-10ha, compared with 1 per 15-20ha in plantations and farmland.

Common and Soprano Pipistrelle bats *Pipistrellus pipistrellus* and *Pipistrellus pygmaeus* regularly roost in houses and feed over gardens.

3.6 Non-flowering Plants (low importance)

A typical suburban garden may support more than 20 species of bryophyte, though most are common species. Common Liverwort *Marchantia polymorpha* is a frequent garden species, often sharing plant pots with garden flowers, whilst Crescent-cup Liverwort *Lunularia cruciata* may be found on paving and patios. Few species occur in flower beds, but Springy Turf-moss *Rhytidiadelphus squarrosus*, a ubiquitous species usually at home in grassland, is found on **lawns** where the grass is kept short through mowing. Here it can form extensive, almost pure swards of moss. Several species of bryophyte have been introduced with imported plants, though none have yet had a significant impact on wild populations.

3.7 Flowering Plants (low importance)

Many wildlife garden publications recommend planting predominantly native flowers to benefit garden wildlife. However, such plants can never replace or support wild populations, and recent research has even suggested that native species do not necessarily offer greater benefits to insects and birds than exotic plants. A mix of native and introduced flowers may be most beneficial, especially

if these are nectar-rich plants. A high variety of plant structures from low-growing creepers to tall shrubs and trees, supports the greatest diversity of wildlife.

3.8 Fishes (low importance)

As well as ornamental fish, **garden ponds** may support some species of native fish, such as sticklebacks. However, garden populations make an insignificant contribution to fish conservation and for the benefit of amphibians and insects all fish are best kept out of garden ponds wherever possible.

4. Environmental, Economic & Social Importance of Biodiversity

- Wildlife adds to the interest and enjoyment of gardens.
- Insects are responsible for the pollination of many garden plants. Bumblebees are particularly important for fruit trees and soft fruits.
- Other insects are important predators or parasites of garden pests. Less than 1% of insects are garden pests.

5. Factors affecting the Habitat

- **Intensive lawn management** involving moss removal, fertiliser and herbicide application reduces biodiversity value. Various species of microfungi are associated with grasses and in natural grasslands they present no special problems, but in the artificial monocultures of ornamental lawns they can attack and damage seedlings of fine grasses and established turf. Nevertheless, care should be taken in the application of fungicides, since many other microfungi play a vital role in recycling nutrients and form mutually beneficial associations with grasses.
- Garden plants have sometimes been **sourced from the wild**, either in Britain or abroad, weakening native populations.
- The introduction of **non-native varieties of British native wildflowers** has the potential to threaten on wild populations.
- The use of **peat** in gardens damages rare and important semi-natural peatlands that support species not found in other habitats.
- The use of **limestone** in gardens damages rare and important semi-natural limestone pavements that support species not found in other habitats.
- **Predation by domestic cats** can cause local reductions of some birds and mammals.
- **Poor hygiene and overfeeding of garden birds** can result in potentially lethal bird diseases building up in uneaten food and unwanted garden pests, such as rats.

6. Strategic Actions

6.1 Recent and current activity

- Advice on wildlife gardening has been published by many organisations including the **Royal Horticultural Society.**
- **Garden Wise** garden centre in Dumfries has promoted biodiversity during special weekends.

6.2 Other recommended actions

- Encourage garden owners to **contribute to national garden wildlife surveys** such as RSPB's Big Garden Birdwatch, BTO's Garden Bird Survey and Butterfly Conservation's Garden Butterfly Survey.
- Promote garden biodiversity through **garden open days, walks, talks and lea**flets.

White-tailed Bumblebee Bombus lucorum. Dalry garden, April 2007. (Maggi Kaye)

SCHOOL GROUNDS

Priority Action (SG1)

Encourage schools to establish and maintain school wildlife areas and use these areas as part of the curriculum-based teaching programme.
Target: Organise in-service training day for teachers by 2012.
Lead Partner: Eco Schools/Dumfries & Galloway Biodiversity Partnership.

Pupils at Port William Primary admire a new pond. (EcoSchools)

1. Habitat Description

1.1 Physical Characteristics

School grounds vary widely in size, but this has little bearing on their biodiversity or environmental educational value. Of much greater importance is the variety of habitats and features within the grounds, together with their soil type and proximity to natural habitats. The type of school also has an influence. Research has shown that primary schools are the most likely to have a school wildlife area, but that greatest demand for such areas is from nursery schools. Secondary schools are least likely to develop part of their grounds for wildlife, but around 5% of all Scottish schools also maintain grounds in the wider community.

Most schools have existing features that can be enhanced for wildlife, but there are also opportunities to create new ones from scratch. Hard surface areas such as **playgrounds** dominate the school landscape, and these have only limited opportunities for enhancement. **Playing fields** offer more biodiversity benefits, but opportunities for enhancement are also limited without affecting their primary purpose. However there are usually significant areas around the edges of playing fields that are underused. Most tend to be unnecessarily flat, which restricts their aesthetic and wildlife value, but most have **trees and shrubs** - the most commonly occurring wildlife habitat in Scottish school grounds.

2. Dumfries & Galloway Status

2.1 Recent Trends

In recent decades there has been more recognition of the importance of school grounds to the educational development of children. Many have planted trees and created gardens and wildlife areas. New schools often have such features built into their design.

2.2 Current Distribution

School grounds are located in all the main towns in the region.

2.3 Associated Habitats

A number of habitats occur in close association and/or overlap with school grounds, and the following action plans may also contain relevant information: Public Open Spaces, Gardens, Walls and Buildings, Urban Trees.

3. Importance for Associated Species

3.1 Reptiles and Amphibians (high importance)

Common Frogs *Rana temporaria* and possibly newts breed in quite small ponds in school grounds, so long as there is sufficient adjacent long grass for feeding.

3.2 Invertebrates (high importance)

Many attractive invertebrates that are likely to appeal to children can be attracted to school grounds through planting of nectar-rich species. Foremost almost these are the butterflies, such as Small Tortoiseshells *Aglais urticae*, Painted Ladys *Vanessa cardui* and Red Admirals *V. atalanta.* Others include ladybirds, bumblebees and dragonflies on ponds.

3.3 Birds (medium importance)

Traditional features of school grounds attract several species of birds: **Playgrounds** are visited by House Sparrows *Passer domesticus* and Pied Wagtails *Motacilla alba*; **playing fields** attract Blackbirds *Turdus merula* and Rooks *Corvus frugilegus*. **Trees and shrubs**, particularly if close to woods, attract Chaffinches *Fringilla coelebs*, Greenfinches *Carduelis chloris* and tits. Most stay well hidden, but can easily be attracted to feed in front of classroom windows by bird tables and feeders. Oystercatchers *Haematopus ostralegus* have nested on the roof of Dalbeattie School.

Blackbirds find food on school playing fields. Minnigaff, April 2008. (Gavin Chambers)

Robins are shy woodland birds in much of Europe, but in Britain can become quite tame with regular feeding. (Gordon McCall)

3.4 Mammals (medium importance)

A range of mammals is present in most school grounds, but most tend to be nocturnal. Hedgehogs *Erinaceus europaeus* and bats benefit from areas of longer grass that support more insects.

3.5 Flowering Plants (low importance)

School grounds are unlikely to support any important species of wildflower, but common species such as thistles, and garden flowers, are important food sources for insects and birds.

4. Environmental, Economic & Social Importance of Biodiversity

- School grounds have the potential to contribute to schemes that promote wider environmental stewardship, such as through Eco Schools and Forest Schools. The way school grounds are developed and used can have a significant impact on pupils' attitudes and behaviour, towards school, towards each other and towards the wider environment and society.
- Much of the formal curriculum can be taught outside. Indeed some can only be taught outside.

5. Factors affecting the Habitat

- Pupils spend as much as 25% of their time at school in school grounds, but wildlife usually adapts to such disturbance and **noise and activity** is rarely a problem.
- **Long-term maintenance** requires commitment from enthusiastic staff, as well as assistance from grounds staff.
- Most school grounds have **subsoil that has been compacted** by heavy machinery, a drainage system intended for playing fields, and rich topsoil dominated by a few very vigorous grasses. This hinders good root development by trees and shrubs and the encouragement of wildflowers.

6. Strategic Actions

6.1 Recent and current activity

- All 125 state schools in Dumfries & Galloway are registered for the **Eco Schools** programme and more than 100 of them have won the Bronze Eco School Award or higher. Most have done work on their school grounds as part of this award.

6.2 Other recommended actions

- Encourage **promotion of biodiversity in environmental education** by Ranger visits to schools, visits by schools to biodiversity sites, and support for the establishment of school nature clubs.

GOLF COURSES

Priority Action (GC1)

Prepare or update environmental statements for golf courses in Dumfries & Galloway.
Target: 5 courses by 2012.
Lead Partner: Scottish Golf Environment Group.

Priority Action (GC2)

Improve biodiversity knowledge and training for golf course staff by holding a golf and biodiversity training day.
Target: Hold training day by 2012.
Lead Partner: Dumfries & Galloway Biodiversity Partnership.

1. Habitat Description

1.1 Physical Characteristics

The range of wildlife found on golf courses depends upon the locality of the course, its soils, topography, and range of habitats. All have extensive areas of mown grass, but golf courses have a range of other features such as bunkers and '**rough**', as well as substantial 'out-of-play' areas such as **water hazards**, **trees and small woods**. Coastal courses can have additional features, sometimes including dunes and coastal grasslands. All can be enhanced by relatively small changes that cost little or nothing and may enhance playing conditions.

Bloody Cranesbill in the rough at Glenluce Golf Course, 1999. (Peter Norman)

1.2 National and international context

There are some 27,000 hectares of golf course in Scotland. The area in Dumfries & Galloway is not accurately known, but there are 31 courses/driving ranges in the region.

2. Dumfries & Galloway Status

2.1 Recent Trends

A number of new courses and driving ranges have become established in Dumfries and Galloway in recent years, and others have expanded. This increase has taken place predominantly on farmland.

2.2 Current Distribution

Most golf courses are located close to the major towns and villages. Almost a third of all courses include elements of coastal habitats.

2.3 Site Examples

Several local golf courses have carried out biodiversity enhancement work, including **Brighouse Bay Holiday Park Golf Course** and **Southerness Golf Course** (SSSI/LWS).

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with golf courses, and the following action plans may also contain relevant information: Coastal Sand Dunes, Broadleaved and Mixed Plantations, Wood Pastures and Parklands, Farm Ponds, Public Open Spaces, Urban Trees.

3. Importance for Associated Species

3.1 Flowering Plants (medium importance)

Though closely mown fairways are of little importance for wildflowers, there may be more botanical diversity in areas of light **rough** than in unmanaged grasslands. In such cases, occasional cutting reduces competition from coarse grasses, allowing species such as Pignut *Conopodium majus* and Cuckoo Flower *Cardamine pratensis* to grow. Unimproved grasslands are rare, though excellent examples are found at Glenluce. Creation of **water hazards** can provide conditions for aquatic plants to colonise, such as the locally scarce Lesser Bulrush *Typha angusifolia* at Brighouse.

3.2 Mammals (medium importance)

Mature **trees and small woods** provide excellent roost sites for bats. Younger trees currently dominate most local courses, but even here the mosaic of trees,

rough and **water hazards** provides many feeding opportunities for bats. Daubenton's Bats *Myotis daubentonii* make nightly feeding forays over ponds at Cally during the summer.

3.3 Birds (medium importance)

The intricate mix of open grassland, trees and small woods on golf courses can lead to a higher density of breeding birds that are more usually found on woodland edges. Typical species include Song Thrushes *Turdus philomelos*, Dunnocks *Prunella modularis* and Spotted Flycatchers *Muscicapa striata*. More open courses, often those on the coast, may have Skylarks *Alauda arvensis* nesting in the rough.

3.4 Reptiles and Amphibians (medium importance)

Water hazards provide breeding opportunities for Common Toads *Bufo bufo,* Common Frogs *Rana temporaria* and Palmate Newts *Lissotriton Helvetica*, the adults of which feed in areas of **rough**.

3.5 Invertebrates (medium importance)

Regular cutting of fairways and rough prevents flowering, whilst unmanaged rough is dominated by grasses. Therefore opportunities for nectar-feeding invertebrates are often few, unless there are areas of nectar-rich grassland. Likewise, bunkers are too heavily managed for most sand-nesting solitary bees. **Trees and small woods**, especially mature trees, provide the best invertebrate habitats, though common aquatic species are also found in **water hazards.**

Ponds can attract a range of dragonflies, such as Emerald Damselflies. (Richard Mearns)

3.6 Fungi and Lichens (low importance)

Trees and small woods on golf courses potentially provide a good fungus and lichen habitat, with light and humidity conditions not dissimilar to those in wood pastures. However, this is presently limited by the relatively young age of most such features on golf courses in Dumfries & Galloway. Short grassland, away from intensively managed areas, may also be good for waxcap fungi, but the presence of such areas in the region is currently not known.

4. Environmental, Economic & Social Importance of Biodiversity

- Integration of sound environmental principles should ensure that golf clubs reduce over-management and minimise maintenance costs.
- Biodiversity enhances the aesthetic character, atmosphere and challenge of the course.

Small Copper butterfly in the rough at New Galloway Golf Course, August 2008. (Peter Norman)

5. Factors affecting the Habitat

- The **loss of semi-natural habitats during course creation** has not been a major issue in Dumfries & Galloway where recent courses have been created on improved farmland.
- **High levels of fertilisers and chemicals** may runoff or seep into watercourses, causing nutrient over-enrichment and pollution.
- **Intensive grassland management** around the roots of mature trees damages root systems leading to poor tree health and premature death.

6. Strategic Actions

6.1 Recent and current activity

- The **Scottish Golf Environment Group** has assisted several courses in Dumfries & Galloway to prepare holistic environmental management plans, so that all relevant environmental issues are recognised for different parts of the golf facility.
- A biodiversity survey of selected courses was carried out by a student from **Scottish Agricultural College** Auchincruive in 2002/3.
- **Brighouse Bay** was the overall winner of the Scottish Award for Environmental Excellence on Golf Courses in 2006.

6.2 Other recommended actions

- **Develop partnerships** with local clubs to carry out projects to enhance biodiversity.

HOLIDAY PARKS & CARAVAN SITES

Priority Action (HPCS1)

Raise awareness of biodiversity for visitors to holiday parks and caravan sites by organising wildlife interpretation and/or events.
Target: 10 events by 2015.
Lead Partner: Dumfries & Galloway Biodiversity Partnership.

Guided walk looking at shells on the beach at Sandyhills Holiday Park. (2007)

1. Habitat Description

1.1 Physical Characteristics

Holiday parks and caravan sites consist of wooden chalets, caravans and sometimes a camping area, located on an extensive area of mown grassland. A few sites are located within open mature woodlands, but even those that are not usually have areas of planted trees and shrubs. Additional features found on some sites include play areas, sports facilities, more formal garden areas, ponds and sometimes areas that are managed specifically for wildlife.

A key feature that influences the biodiversity of holiday parks and caravan sites is their proximity to semi-natural habitats such as coasts and woods. However, management should be used to increase the value of all sites.

2. Dumfries & Galloway Status

2.1 Recent Trends

Over the last 10 years, holiday parks and caravan sites have continued to increase in size and the range of facilities offered. There has also been an increase in the number and size of semi-permanent wooden chalets.

2.2 Current Distribution

Holiday parks and caravan sites are widespread across Dumfries and Galloway, but tend to be concentrated on the coast.

2.3 Site Examples

Several holiday parks and caravan sites have already carried out enhancements for wildlife and promoted wildlife attractions for their visitors. These include **Brighouse Bay Holiday Park, Kippford Holiday Park** and **Barnsoul Farm** at Shawhead.

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with holiday parks and caravan sites, and the following action plans may also contain relevant information: Walls and Buildings, Public Open Spaces.

3. Importance for Associated Species

3.1 Birds (medium importance)

Bullfinch, a colourful species that can be attracted to nest in dense trees and bushes. (Gordon McCall)

The mosaic of grassland and trees and shrubs attracts a high density of common birds more typical of woodland edges. These include Blackbirds *Turdus merula,* Song Thrushes *Turdus philomelos,* Robins *Erithacus rubecula* and Starlings *Sturnus vulgaris*. Dunnocks *Prunella modularis* and Willow Warblers *Phylloscopus trochilus* use scrub, whilst Spotted Flycatchers *Muscicapa striata* benefit from scattered trees.

3.2 Invertebrates (medium importance)

Though most invertebrates likely to be found on holidays parks and caravan sites are common and

widespread species, these can include some very attractive species that are likely to appeal to visitors. Foremost amongst these are the butterflies, and it should be possible to attract Small Tortoiseshells *Aglais urticae*, Painted Ladys *Vanessa cardui* and Red Admirals *V. atalanta* to most sites. Others include ladybirds, bumblebees and dragonflies on ponds.

3.3 Reptiles and Amphibians (medium importance)

Common Toads *Bufo bufo,* Common Frogs *Rana temporaria* and Palmate Newts *Lissotriton Helvetica* have all been recorded breeding in ponds within holiday parks. Great Crested Newts *Triturus cristatus* may also occur. All require suitable terrestrial habitats, such as long grass, as well as breeding ponds.

A mix of woodland and grassland provides good habitat for Hedgehogs. Loch Ken, June 2006. (Peter Norman)

3.4 Mammals (low importance)

Caravans are rarely suitable roost sites for bats. However, if alternative roosting locations are available nearby, the mix of trees, shrubs and open areas makes holiday parks valuable feeding areas for bats. For example, one of the few known Noctule *Nyctalus noctula* roosts in the region is at Loch Ken Holiday Park. Dense cover is also attractive to other mammals, such as Hedgehogs *Erinaceus europaeus*.

3.5 Flowering Plants (low importance)

A high intensity of management usually means that holiday parks are rarely rich in native wildflowers unless there are remnants of previous semi-natural habitats. The locally rare Slender Trefoil *Trifolium micranthum* has been recorded at a holiday park in Newton Stewart.

4. Environmental, Economic & Social Importance of Biodiversity

- Adding biodiversity features to holiday parks and caravan sites can considerably increase their appearance and attractiveness to visitors.
- Trees and shrubs can be used to screen unsightly features such as bin stores, and can add to the privacy of the site.

5. Factors affecting the Habitat

- Most holiday parks were created on farmland are still **relatively young in ecological terms**. They therefore have not yet developed many mature trees or other habitats.
- Biodiversity management is not simply less management. It requires new **skills and training** for maintenance staff, which may not be available in-house.
- Many park visitors are urban based and biodiversity features such long grass, log piles and scrub may be **perceived as untidiness**.

6. Strategic Actions

6.1 Recent and current activity

- In 2007, 11 holiday parks and caravan sites in Dumfries & Galloway held **David Bellamy Conservation Gold Awards** for their wildlife and environmental management.
- A number of holiday parks and caravan sites have **wildlife interpretation**, including information panels, leaflets, guided walks and family events.
- Several parks have contributed to the **Dumfries & Galloway Wildlife Festival**.

6.2 Other recommended actions

- Encourage parks to enter for **environmental awards.**
- **Provide training** in biodiversity management for maintenance staff.

WALLS & BUILDINGS

Priority Action (WB1)

Encourage greater public awareness of the value of walls and buildings for biodiversity by publishing a guide to the species and management.
Target: Publish and distribute to architects, builders and householders by 2015.
Lead Partner: Dumfries & Galloway Biodiversity Partnership.

1. Habitat Description

1.1 Physical Characteristics

The biodiversity of walls and buildings is influenced by their location. Farm buildings in the countryside often have different species to those in towns, especially if they are located close to semi-natural habitats such as woodland, and walls and buildings on the coast have different species again. However, this does not mean that walls and buildings in towns and villages are without interest.

The biodiversity of exterior **wall faces**, whether free-standing or part of a building, is strongly dependent upon construction materials, location and aspect. The former influences chemical composition and physical structure of walls; the latter two largely control their microclimate. **Wall ledges**, where they exist, add another dimension to biodiversity, providing a habitat for species of plants and animals that are unable to survive on vertical faces.

Roofs offer a slightly different habitat to walls – they are usually composed of a different material and this, together with the angle of slope, influences biodiversity interest. Slate and tile roofs offer many small holes and crevices that offer opportunities for several species.

The **interior spaces** of buildings provide a further habitat for biodiversity. Most species occupy the spaces not permanently occupied by people, but a few have shared our living spaces ever since we first constructed them.

1.2 National and International Context

Western Britain contains some of the finest wall vegetation in Europe, as a result of a mild, wet climate. Only north-western France has a comparable flora.

2. Dumfries & Galloway Status

2.1 Recent Trends

Modern materials provide fewer external opportunities for biodiversity, though just as many, if not more, internal habitats. Numerically, most of the region's walls and buildings comprise of 20th century houses.

2.2 Current Distribution

Outside of the main urban centre of Dumfries, walls and buildings are relatively evenly spaced in the lowlands, becoming less common in the uplands.

2.3 Site Examples

There is a wide range of buildings and walls in Dumfries & Galloway. Some of the most important for biodiversity includes castles, churches and other historic walls and buildings, and farm steadings.

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with walls and buildings, and the following action plans may also contain relevant information: Traditional Field Boundaries, Bridges and Tunnels, Industrial and Post-industrial Sites, Urban Watercourses and Wetlands.

3. Importance for Associated Species

3.1 Mammals (very high importance)

Long-eared Bats prefer older buildings close to woodland. Cally Woods, June 2000. (Peter Norman)

Large numbers of bats rely on buildings, especially roofs, to provide them with shelter for breeding, roosting and hibernating. Few species hang in exposed positions - most tuck themselves out of sight, so their presence may not be obvious. The design and construction of buildings influences the type of bats present. For example Long-eared Bats *Plecotus auritus* usually

fly around roof spaces prior to leaving the building to hunt in woodland. Therefore they are most frequently found in older, rural buildings. Conversely, Pipistrelle Bats *Pipistrellus pipistrellus* and *P. pygmaeus*. are frequently found in new houses in urban areas. Of Dumfries & Galloway's eight species of bat, only the Noctule *Nyctalus noctula* does not make extensive use of buildings.

Although other wild mammals may occasionally use buildings, none are of significant conservation importance in Dumfries & Galloway.

3.2 Fungi and Lichens (high importance)

Lichens are common on many **wall faces**, but species composition is strongly influenced by the wall substrate and associated chemical attributes and textures. In south east England the rare Churchyard Lecanactis lichen *Lecanographa grumulosa* is entirely restricted to limestone walls of medieval churches and castles. It has been recorded in Dumfries & Galloway, but only from natural rock faces on the coast. A few non-lichenised microfungi also grow on walls, but they are not of high conservation importance.

3.3 Non-flowering Plants (high importance)

Ferns, liverworts, mosses and algae are more tolerant of lower light levels that other plants and therefore frequently dominate shadier **wall faces**. Species include Wall Rue *Asplenium ruta-muraria,* Maidenhair Spleenwort *Asplenium trichomanes* and Revolute Beard-moss *Pseudocrossidium revolutum* on lime-mortared walls. Wall Screw-moss *Tortula muralis* is the commonest moss on many mortared or base-rich walls, both brick and stone, and can tolerate some shade and pollution. It also grows on concrete, roof tiles and other man-made structures, but is rarely found away from human habitation. Rough-stalked Feather-moss *Brachythecium rutabulum* is typical on wall-tops.

Grey-cushioned Moss Grimmia pulvinata, common on urban walls. (Peter Norman)

Joints and cracks on otherwise smooth slate and tile **roofs** enable species such as Capillary Thread-moss *Bryum capillare* and Grey-cushioned Grimmia *Grimmia pulvinata* to get a hold, whilst Great Hairy Screw-moss *Syntrichia ruralis* might be found on flat asphalt roofs.

Churches and castles are important habitats for non-flowering plants in many parts of Britain, but in Dumfries & Galloway they are not constructed on the most valuable building stone (limestone), and are usually located in areas that have many natural rock outcrops. As a result they rarely support notable species.

3.4 Flowering Plants (medium importance)

A few species, such as Biting Stonecrop *Sedum acre,* favour the tops of walls, but the upper and middle zones of **wall faces** generally support the most distinctive vegetation, including Herb Robert *Geranium robertianum* and the introduced Ivy-leaved Toadflax *Cymbalaria muralis* and Yellow Corydalis *Corydalis lutea*. Another introduced species Fairy Foxglove *Erinus alpinus* is known from a few walls, including the abbeys at Glenluce and Dundrennan, whilst Wallflower *Erysimum cheiri* was lost from the walls of Sweetheart Abbey through cleaning by the Ministry of Works in the 1950s. Navelwort *Umbilicus rupestris and* Pellitory-of-the-wall *Parietaria judaica* are locally rare native species, growing on just a few walls. Walls with lime mortar are especially rich, with even granite walls supporting lime-loving plants.

Yellow Corydalis, a native of the Alps, on sandstone wall at Castledykes Park, Dumfries. September 2007. (Peter Norman)

Lower zones and wall bases usually receive excessive nutrients and moisture, and support a less interesting flora, whilst woody species are able to establish on poorly maintained walls with missing mortar.

3.5 Invertebrates (medium importance)

Old walls provide good nesting sites for bees, wasps and ants if the mortar is soft enough for burrowing. Indeed relict populations of some species may survive only in walls after loss of their natural nesting sites. Ants play an important part in the seed dispersal of many wall plants.

The Zebra Spider *Salticus scenicus*, a jumping spider that hunts on sunny wall faces, occurs more frequently along the Solway coast than in other parts of Scotland, and the first Scottish record of a large long-legged spider *Tegenaria parietina* came from the **interior space** of a house in Dumfries in 2006.

Swallows are almost entirely reliant on buildings for nest sites. (Gordon McCall)

3.6 Birds (medium importance)

House Martins *Delichon urbica* make use of the underside of wall **ledges**, especially eaves, to build their nests. Barn Owls *Tyto alba*, Swallows *Hirundo rustica* and Swifts *Apus apus* rely much more on **interior spaces**, the first two predominantly in unoccupied rural buildings, and the latter in the **roofs** of urban buildings.

4. Environmental, Economic & Social Importance of Biodiversity

- A covering of flowering plants, mosses and lichens add to the aesthetic appeal of many walls and buildings.
- Some lichens break down stone, but there is evidence that others protect some types of stone by providing a shield against water erosion.

5. Factors affecting the Habitat

- Over-zealous **removal of all plant species** reduces biodiversity.
- The **use of biocides** to control mosses and lichens. This is rarely necessary and should be limited to very exceptional circumstances.
- Certain mosses and lichens have declined as a result of the **reduction in the use of lime mortar.**
- If not sympathetically carried out, **roofing repairs** may reduce bat habitat and directly lead to the death of some bats. In such circumstances a criminal offence may be committed.
- **Bat roosts may be unknowingly destroyed**, possibly resulting in the death of those bats using the roost at the time.
- There is a **negative perception** of the wildlife associated with built habitats, including mice, rats, pigeons and roof nesting gulls, although these habitats also support a number of other species of conservation value including Barn Owls, Swifts and Swallows.

6. Strategic Actions

6.1 Recent and current activity

- It is a legal requirement that any building works take account of known bat roosts, but only a small proportion of the roosts have been discovered or recorded. **SNH** therefore request surveys to be completed where there is a risk to bats.

6.2 Other recommended actions

- **Provide advice** on incorporating design for biodiversity into new buildings and other structures, such as ‘bat bricks’ and bird nesting platforms.
- **Survey and record** flora on walls.
- **Consult** SNH prior to re-roofing if there is any likelihood of bats being present, or if bats are found during roofing work.
- Ensure **nesting Barn Owls are protected** during barn conversions or other relevant building repairs, and subsequent provision is made for them.
- **Consider turf and *Sedum* roofs** on appropriate new buildings.

PORTS, HARBOURS & MARINAS

Priority Action (PHM1)

Encourage greater awareness of biodiversity and environmental issues amongst the users and managers of ports, harbours and marinas by providing wildlife information/interpretatio.
Target: Interpretation at 3 sites by 2015.
Lead Partner: Dumfries & Galloway Biodiversity Partnership/Solway Firth Partnership.

Seaweed at Isle of Whithorn Harbour, April 2008. (Peter Norman)

1. Habitat Description

1.1 Physical Characteristics

Ports, harbours and marinas, by their very nature, are located in sheltered coastal waters, but this shelter is usually enhanced by **harbour walls**. The seaward sides of these walls are poorest in terms of species composition as they are relentlessly battered by waves, sand and pebbles. Hard sea defences provide a similar habitat. The quieter, siltier and more turbid conditions of the inner harbour walls are usually richer in species. These are usually constructed from stone, but like the rocky shores they resemble, gradations of hardness are found from concrete and iron to wood. These structures also provide secure moorings for vessels, but in marinas (where there are usually many small boats to accommodate) this is usually augmented by **floating pontoons**.

2. Dumfries & Galloway Status

2.1 Recent Trends

Commercial and fishing vessels remain at a low level, but there has been a recent increase in recreational craft. Both of the region's marinas are at full capacity. At the time of writing it is planned to relocate all ferry traffic from Stranraer to Cairnryan, and increase recreational use of Stranraer.

2.2 Current Distribution

The largest of the Dumfries & Galloway's ports and harbours are in the west of the region. There are few hard sea defences of any extent in the region.

2.3 Site Examples

The principal commercial ports in Dumfries and Galloway are **Stranraer** and **Cairnryan** in Loch Ryan, which both deal principally with ferry traffic to Ireland. Small harbours are found in several towns and villages including **Portpatrick, Port Logan, Drummore, Port William, Isle of Whithorn, Garlieston, Kirkcudbright** and **Annan**. Most support a combination of small inshore fishing vessels and recreational craft, though a small offshore shellfishing fleet is based at Kirkcudbright. Other harbours in the region now receive little or no traffic. Marinas are present at **Kirkcudbright** and **Kippford**.

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with ports, harbours and marinas, and the following action plans may also contain relevant information: Intertidal Rocky Shores, Walls and Buildings.

3. Importance for Associated Species

3.1 Birds (medium importance)

Apart from gulls, Black Guillemots *Cephus grylle* are the birds most closely associated with harbours. They nest in Portpatrick **harbour walls**. Offshore structures that are less susceptible to disturbance can be very valuable for nesting birds. The abandoned Mullberry

Harbour at Garlieston is one of the biggest breeding Cormorant *Phalacrocorax carbo* colonies in the region, whilst terns (as well as Black Guillemots) have nested on the disused South Deep jetty at Cairnryan.

Black Guillemots nest in several harbours and ports. (Gordon McCall)

3.2 Non-flowering Plants (medium importance)

Typical seaweeds of **harbour walls** include Spiral Wrack *Fucus spiralis*. Another seaweed *Callithamnion tetragonum* is mostly restricted to kelp fronds the west coast of Britain including Wigtownshire, but regularly occurs on marina **pontoons** and may move into such a habitat in Dumfries & Galloway.

3.3 Invertebrates (medium importance)

The invertebrates of ports, harbours and marinas are not particularly specialised, usually reflecting those found on adjacent shores of a similar sediment type. **Harbour walls** support a similar range of species to rocky shores, often under the curtain of seaweeds, including Common Limpets *Patella vulgata,* Barnacles *Balanus crenatus*, Beadlet Anemones *Actinia equina* and another anemone *Sagartia elegans*. Their predators are also similar, including Shore Crabs *Carcinus maenas* and Harbour Crabs *Liocarcinus depurator*. The latter is not restricted to harbours despite its name. The Shipworm *Teredo nivalis* may bore into wooden structures.

3.4 Flowering Plants (low importance)

There are no flowering plants found in the waters of ports, harbours and marinas. Some species are able grow on the upper parts of **harbour walls** and on land-based structures. The typical species of inland walls are augmented by maritime specialists such as Common and Danish Scurvygrass *Cochleria officinalis & C. danica*, Thrift *Armeria maritima* and Buck's-horn Plantain *Plantago coronopus.*

3.5 Fishes (low importance)

Though several species of fish enter harbours and find productive feeding areas around walls and other structures, species composition is the same as adjacent coastal areas.

3.6 Mammals (low importance)

Despite their name, Harbour Porpoises *Phocoena phocoena* rarely visit the shallow waters of inner harbours, though they may be seen close to the harbour entrance. Seals are also infrequent visitors, but Otters *Lutra lutra* may visit on a nightly basis.

4. Environmental, Economic & Social Importance of Biodiversity

Wildlife and interpretation enhances ports, harbours and marinas for passengers and visitors.

5. Factors affecting the Habitat

Risks of accidental oil spillage or other **pollution** are greater in ports, harbours and marinas.

6. Strategic Actions

6.1 Recent and current activity

- **Kirkcudbright Marina** was the first in Scotland to receive a Blue Flag award.
- **Wigtown Harbour** is a principal access point and car park for Wigtown Bay Local Nature Reserve, with wildlife interpretation and a bird bide.

6.2 Other recommended actions

- **Raising awareness** of biodiversity amongst users and managers of ports, harbours and marinas would benefit not only the wildlife of these sites, but would encourage increased reporting of marine species.

ROADS & VERGES

Priority Action (RV1)

Provide special management of roads and verges at sites known to be important for biodiversity through designation of new Conservation Verges.
Target: 10 new Conservation Verges by 2015.
Lead Partner: Dumfries & Galloway Council/Amey Highways.

1. Habitat Description

1.1 Physical Characteristics

Modern road construction techniques and traffic levels mean that the **carriageway** is an inhospitable habitat for virtually all wildlife, other than on very minor roads. **Verges** offer more opportunities. They usually consist of improved grassland created during, or shortly after, construction of the road. However, some stretches of minor roads may pass through semi-natural habitats such as unimproved grassland, heathland or native woods, which now constitute the verge. Both are subject to operational safety requirements with regard to cutting and other management and both receive, as an unintentional result of their location, relatively high levels of pollutants such as de-icing salt, oil and vehicle emissions.

Danish Scurvygrass, a plant fast expanding its range due to road salting. A75 near Annan, April 2007. (Peter Norman)

Roadside **ditches** need to have a water level well below the ground level in order to keep the surrounding land dry. They are therefore often deep and steep sided.

Traditional field boundaries on roadsides are covered in a separate plan.

2. Dumfries & Galloway Status

2.1 Recent Trends

Increased concern regarding the wider environmental impact of roads and road building in recent decades has helped to heighten awareness about biodiversity issues on roads. As a result, much greater thought has been given to such issues.

2.2 Current Distribution

There are some 2,900miles (4,666km) of road in Dumfries & Galloway, most of which has a verge. The major roads are located in the lowlands and river valleys with fewer, more minor roads in the uplands.

2.3 Site Examples

The only section of motorway in the region is the **A74(M)** through Annandale. The **A75** Euroroute traverses most of the region's river valleys that are regular movement routes for many species.

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with roads and verges, and the following action plans may also contain relevant information: Neutral Grasslands, Scrub Woods, Traditional Field Boundaries, Urban Trees, Bridges and Tunnels.

3. Importance for Associated Species

3.1 Flowering Plants (high importance)

Most road **verges** that are important for wildflowers of are remnants of habitats that existed before the road was constructed, especially neutral grasslands. Greater Broomrape *Orobanche rapum-genistae*, which is rare in Scotland but known from a few sites in the region including a verge in Dumfries, is associated with Gorse and Broom scrub.

On minor roads, flowers such as Wild Thyme sometimes grow directly on the carriageway. The Machars, July 1999. (Peter Norman)

A few plants occur on verges, not because they were present prior to the road, but because road management has encouraged them. Perhaps the best example

is Danish Scurvygrass *Cochlearia danica*, a plant of the cliff-tops, sand dunes and sea walls that first started appearing inland on the central reservations of motorways and dual carriageways in the late 20th century as a result of salt treatment. The distribution map in the New Atlas of British and Irish Flora (2002) clearly shows this plant along the route of the A74(M), but it has since spread westwards along the A75 to Dumfries. Although now frequent on single carriageways, it is seldom seen below A-class roads.

3.2 Invertebrates (medium importance)

The first Scottish colony of Narrow-bordered 5-spot Burnet Moth *Zygaena lonicerae* subsp. *latomarginata* was found on a verge of the A711. It remains the only site for this species in Dumfries & Galloway.

Narrow-bordered 5-spot Burnet moth. Dalskairth road verge, July 2004. (Peter Norman)

3.3 Mammals (medium importance)

Other than mice and voles, roads and verges support few mammal species. However roads are a significant cause of death for several species of conservation concern, including Hedgehogs *Erinaceus europaeus,* Otters *Lutra lutra* and Badgers *Meles meles.* Fortunately it currently appears that these deaths are not limiting local populations.

3.4 Reptiles and Amphibians (medium importance)

There are recorded instances of reptiles basking on warm **carriageways** of very minor roads, but more often roads pose a threat to reptiles and amphibians. Toads in particular tend to use the same routes between feeding areas and breeding ponds and on damp evenings at certain times of the year can be highly susceptible to traffic. Nevertheless populations of other species prosper on certain **verges**, including Slow Worms *Anguis fragilis* on the A713 beside Loch Ken.

3.5 Birds (medium importance)

Rooks *Corvus frugilegus*, Crows *C. corone* and sometimes Buzzards *Buteo buteo* attempt to feed on carrion on the **carriageway.** Few species nest on the **verge** itself, though Oystercatchers *Haematopus ostralegus* are recorded doing so most years. A number of birds, including Barn Owls *Tyto alba*, are regularly killed by traffic as they hunt along verges or fly over the road.

3.6 Non-flowering Plants (low importance)

Unlike flowering plants, there are few salt and heavy metal-tolerant mosses that are specialists of road verges.

3.7 Fungi and Lichens (low importance)

Road verges are rarely of significant interest for fungi, although a limited range of nitrogen-tolerant species occur, such as Shaggy Ink-cap *Coprinus comatus* and the Horse Mushroom *Agaricus arvensis*. Potentially of more importance are upland verges with unimproved grassland.

Pestle Puffball Handkea excipuliformis by the A762 near Mossdale. August 2008. (Peter Norman)

4. Environmental, Economic & Social Importance of Biodiversity

- Road verges that are high in biodiversity, especially wildflowers, add to the landscape and enhance the area for tourists.
- Some types of roadside vegetation reduce noise and pollution from traffic.

5. Factors affecting the Habitat

- **Road safety** must always take priority in the management of roadside verges and hedges.
- **Fragmentation** of habitats as a result of roads acting as barriers to movement.

- A high incidence of wildlife **road kills** in Dumfries & Galloway involving mammals and birds of conservation importance, including Otters, Badgers, Red Squirrels and Barn Owls. Other species can be affected by noise, movement or light disturbance.
- Excessive **grass cutting, shrub and hedge brashing** can change habitat structure.
- **Over-use of chemicals** to control weeds can affect non-target species, and run-off of chemicals and oil can pollute watercourses.
- Road construction and maintenance can result in **alterations to the natural drainage pattern** of a locality.
- Treatment of verges on new roads or following carriageway alterations may not benefit biodiversity. **Top-soiling and inappropriate planting** produces poor results. Usually the outcome is a missed opportunity for biodiversity, but in some cases can lead to potentially invasive species. For example, Bird's-foot Trefoil is usually a valuable foodplant for butterflies, but much of it on the A75 is a non-native vigorous subspecies of limited value that has spread from introduced seed mixes.
- **Flailing roadside scrub** may look untidy but has little detrimental impact on biodiversity as long as it is not carried out in the bird breeding season.

6. Strategic Actions

6.1 Recent and current activity

- **The Scottish Executive** drafted a Trunk Road Biodiversity Action Plan for trunk roads across Scotland.
- **Dumfries & Galloway Council** drafted a Roadside Biodiversity Action Plan in 2000 and has implemented most of its recommendations. As part of this, several conservation verges have been identified in the region and received special management.

6.2 Other recommended actions

- **Enhance populations** of nationally and regionally uncommon plants and invertebrates that occur on road verges through modifications to management or timing of management.
- **Identify blackspots** for wildlife road kills.
- Include proactive design measures to safeguard against animal kills on new roads such as the installation at appropriate locations of **animal underpasses and culverts**.
- Implement measures to safeguard against animal kills on existing roads, by carrying out works to encourage animals to use existing culverts, such as **fencing, reflectors and culvert modification**.

Cow Parsley display on verge by minor road near Dundrennan. June 2006. (Peter Norman)

RAILWAYS

Priority Action (RA1)

Assess the biodiversity of the rail network in Dumfries & Galloway by providing safety training to enable access for volunteer surveyors.
Target: Survey 10 selected sites by 2015.
Lead Partner: Network Rail/Dumfries & Galloway Environmental Resources Centre.

Trees and shrubs beside working railway, Dumfries. August 2007. (Peter Norman)

1. Habitat Description

1.1 Physical Characteristics

Virtually all of Britain's railways were established in the Victorian age of steam. Gradients were minimised to allow steam trains to operate at maximum speed; **cuttings** were excavated through higher ground and **embankments** constructed across low ground. The orientation of these features exerts a significant influence on their micro-climate, and therefore their biodiversity; the sunnier south-facing embankments support different species to north-facing slopes or shady cuttings. Although less obvious in the landscape, a number of other habitats were created: **ballast** on the track bed and drainage **ditches** by the rail side. The masonry of platforms, walls and bridges, and the highly specialised habitat of tunnels are covered by a separate action plans.

Some embankments were planted with trees, occasionally grass, to prevent them washing away, but the majority of wildlife colonised naturally from the surrounding countryside which, at the time of railway construction, was less affected by agricultural intensification. Therefore many areas along the railway line contain communities that are the remnants of habitats that have now almost disappeared in the surrounding area due to changes in land use. Furthermore, the rail network provides natural corridors through the intensively-managed agricultural areas, linking other habitats such as woods and grasslands.

The turbulence created by the trains was responsible for the spread of some species, whilst management of vegetation exerted a significant influence on biodiversity. Initially this involved regular hand cutting of vegetation growing through the ballast, and removal scrub on the rail sides to prevent it being ignited by sparks. Later it involved greater use of herbicides, but regular disturbance has always been and remains a feature of working railway lines.

1.2 National and International Context

There are over 30,000 hectares of lineside vegetation along the 21,000 miles of the national rail network. There is approximately 125 miles of working railway line in Dumfries & Galloway, and at least 160 miles of disused railway.

2. Dumfries & Galloway Status

2.1 Recent Trends

Over the last 10 years, a number of short stretches have been turned into walking and cycling routes, especially in Dumfries.

2.2 Current Distribution

Working railway line in Dumfries & Galloway is restricted to the lines from Carlisle to Glasgow via Dumfries, Carlisle to Glasgow via Lockerbie and Stranraer to Glasgow. The majority of the disused railway lines are still discernible on the ground.

A disused railway line providing habitat linkages through an urban area. Caledonian Cyclepath, Dumfries, August 2007. (Peter Norman)

2.3 Site Examples

The **Caledonian Cycleway** in Dumfries is the longest stretch of disused railway in the region to be turned into a walking/cycling route.

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with railways, and the following action plans may also contain relevant information: Neutral Grasslands, Acid Grasslands, Inland Rock Outcrops Scrub Woods, Traditional Field Boundaries, Bridges and Tunnels, Walls and Buildings, Industrial and Post-industrial Sites.

Dog Rose, a typical plant of railway banks. (Peter Norman)

3. Importance for Associated Species

3.1 Flowering Plants (medium importance)

Studies have found around 70% of the native British flora from railway land. **Ballast** is typically colonised by a range of plants that are resistant to moisture stress, such as Procumbent Pearlwort *Sagina procumbens*. On working lines, these are regularly removed, allowing the process of colonisation to start all over again, but if the line ceases to be used, a grassland habitat forms that can be very species-rich. On acidic sites, a Heather *Calluna vulgaris* community may develop, but on neutral sites a more diverse, taller vegetation dominates. This includes species such as Red Fescue *Festuca rubra*, Tansy *Tanacetum vulgare,* Common Toadflax *Linaria vulgaris* and Black Knapweed *Centaurea nigra.* Rare species recorded from railway lines in Dumfries and Galloway include Common Wintergreen *Pyrola minor.*

Cuttings tend to support the richest grassland, due to their slopes being composed largely of unfertilised soil. Drifts of Rosebay Willowherb *Chamerion angustifolium,* and Ox-eye Daisy often dominate long sections, but less common species such as Meadow Crane's-bill *Geranium pratense* and Common Spotted Orchid *Dactylorhiza maculata* are also found. Eventually scrub invades. One of the first woody species to colonise, particularly in more urban areas, is Buddleia *Buddleja davidii*, but Hawthorn *Crataegus monogyna*, Blackthorn *Prunus spinosa* and Elder *Sambucus nigra* often form dense thickets.

3.2 Invertebrates (medium importance)

A number of butterflies, such as Common Blue *Polyommatus icarus* and Wall *Lasiommata megera*, are found on railway lines. The bare ground of the **ballast** and some **embankments** is especially valuable for them and their foodplants, whilst cuttings (as long as they are not too shady) provide shelter.

3.3 Reptiles and Amphibians (medium importance)

Slow Worms *Anguis fragilis* and Adders *Vipera berus* bask on ballast and south-facing embankments that heat up quickly, and make use of the surrounding vegetation for shelter.

3.4 Birds (medium importance)

Although none of the rarer species of bird is dependent on railway lines, there is a diverse range of birdlife found on the network. Typical species are those associated with scrub, such as Dunnocks *Prunella modularis,* Common Whitethroats *Sylvia communi,* Willow Warblers *Phylloscopus trochilus,* Bullfinches *Pyrrhula pyrrhula,* and Linnets *Carduelis cannabina.*

Goldfinch, a colourful species that feeds on thistle and other seeds. (Gordon McCall)

3.5 Non-flowering Plants (medium importance)

Field Horsetail *Equisetum arvense* is a frequent invader of **ballast**, being somewhat resistant to herbicides. Other typical ballast species include Capillary Thread-moss *Bryum capillare* and Common Cord-moss *Funaria hygrometrica*, but it has been known to support species more typical of upland areas, including Green Mountain Fringe-moss *Racomitrium fasciculare.* Shady Earwort *Scapania umbrosa* and several other liverworts are found in deep **cuttings**

3.6 Mammals (low importance)

Many mammals are found on railway lines, and several use them as corridors to move through the countryside, but no species are dependent on this habitat.

4. Environmental, Economic & Social Importance of Biodiversity

The biodiversity of the railway network, both working and disused, adds to the interest and enjoyment of users and contributes to the landscape.

5. Factors affecting the Habitat

- Safety obligations are of paramount importance on working railway lines. Biodiversity management of these areas must be **compatible with safety issues**.
- Safety restrictions restrict access to working railway lines, which means that **few wildlife surveys** have been carried out.
- In many areas, particularly on disused lines, **scrub growth** has affected species rich grassland.

6. Strategic Actions

6.1 Recent and current activity

Network Rail has developed a Biodiversity Action Plan for their UK operations.

BRIDGES & TUNNELS

Priority Action (BT1)

Assess bridges in need of remedial work to allow unimpeded passage of fish by compiling, and making available, an inventory.
Target: Complete by 2012.
Lead Partner: District Salmon Fisheries Boards.

Priority Action (BT2)

Install integral bird and/or bat boxes into bridges during any scheduled maintenance or upgrading work.
Target: 10 bridges by 2015.
Lead Partner: Dumfries & Galloway Council.

Bridge over Nith at Thornhill. (Paul McLaughlin)

1. Habitat Description

1.1 Physical Characteristics

The date of construction of bridges and tunnels greatly influences their design, the materials used in construction, and therefore their physical characteristics. Early bridges were simple wooden constructions but few are in use today, other than short footbridges. Nineteenth century bridges were largely constructed of stone or brick, and many of these are still in use. The range from short single-span bridges to large **viaducts**, consisting of a series of short masonry arched spans supported on towers. The type of stone and mortar, and the number and position of ledges/holes influences their biodiversity. More recent bridges have mostly been constructed of concrete, including **flyovers** that support a main road, often crossing another road. They generally have fewer opportunities for biodiversity. A few metal bridges have also been constructed.

Whether the bridge crosses a watercourse, a road, a railway or some other obstacle affects its physical characteristics. River bridges experience more humid conditions, whilst those over roads and operational railways are affected by emissions. Orientation is also important, with the south facing, exposed side of the bridge experiencing greater extremes of light and temperature, in comparison to the north-facing or shadier areas of the bridge.

Though tunnels are also influenced by their age, construction techniques, materials and location, they have very different physical characteristics to bridges. This largely results from a more stable temperature regime and permanently dark, humid conditions within the tunnel.

2. Dumfries & Galloway Status

2.1 Recent Trends

A number of new bridges, particularly footbridges, have been built in recent years. However, of much more significance to biodiversity, is the large number of bridges that have been upgraded.

2.2 Current Distribution

There are more than 1,400 bridges in Dumfries and Galloway, spread throughout the region.

2.3 Site Examples

A number of large viaducts are found in the region, such as at **Big Water of Fleet** (1861), near Gatehouse. Notable bridges include **Devorgilla's Bridge** (c1432) and **Tongland Bridge** (1804-8). The latter supports the largest colony of House Martins in the region. However, many of the smaller bridges are equally, if not more important from a biodiversity perspective. There is only one major tunnel in Dumfries & Galloway, slightly over 1km in length, on the operational railway line between Dumfries and Kirkconnel, near Drumlanrig.

Virtually every compartment under the ledge of Tongland Bridge has a House Martin nest each summer. (Peter Norman)

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with bridges and tunnels, and the following action plans may also contain relevant information: River Headwaters, Lowland Rivers and Backwaters, Lowland Burns and Ditches, Exposed River Shingle, Walls and Buildings, Urban Watercourses and Wetlands, Reservoirs.

3. Importance for Associated Species

3.1 Fishes (high importance)

Freedom of movement, both upstream and downstream, is essential for the survival of many species of fish, and this can be severely affected by bridges. Both young and adults of migratory species such as Salmon *Salmo salar*, Sea Trout *Salmo trutta* and Eels *Anguilla anguilla* travel hundreds of miles between freshwater spawning grounds and the sea, but even non-migratory species require a variety of aquatic habitats and may travel several miles up and down a watercourse.

3.2 Mammals (high importance)

Bridges and tunnels are important hibernation and roost sites for most species of bat, with Daubenton's Bat *Myotis daubentonii* particularly associated with bridges. Otters *Lutra lutra* frequently mark their territory with spraints (droppings) under bridges.

3.3 Fungi and Lichens (medium importance)

The lichen flora of bridges is, as on other walls, strongly influenced by the wall substrate and associated chemical attributes and textures. A wide range of species is found.

3.4 Non-flowering Plants (medium importance)

The masonry of bridges and tunnels was particularly suitable for a range of ferns during the steam age, when the additional moisture encouraged growth wherever trains were regularly halted. For example, Rusty-back *Ceterach officinarum* occurred on Little Water of Fleet Viaduct prior to its demolition. Others ferns still persist. The lower sections of bridges over water also support a range of mosses, liverworts and algae.

3.5 Birds (medium importance)

Dippers *Cinclus cinclus* regularly nest under bridges that span watercourses. The largest House Martin *Delichon urbica* colony in Dumfries & Galloway occurs on Tongland Bridge.

3.6 Invertebrates (low importance)

Construction of a new bridge over a river may impact on aquatic invertebrates as much as fish. A diving beetle *Bidessus minutissimus*, at one of its few UK sites, is believed to have been affected by construction of a flyover over the River Nith for the Dumfries bypass.

3.7 Flowering Plants (low importance)

A similar range of flowering plants is found on bridges as on other walls.

4. Environmental, Economic & Social Importance of Biodiversity

Bridges that cross watercourses and affect fish passage impact on the economic and recreational benefits of local fisheries.

5. Factors affecting the Habitat

- Fish passage at river crossings is important in the planning, design, installation and upgrading of bridges. Improperly designed culverts and other river crossing structures act as a barrier to fish movement. Problems include inadequate water depth, excessive water velocities, vertical barriers and works carried out at an inappropriate time of year.
- Repointing of masonry bridges not only reduces opportunities for roosting bats, but has the potential to entomb and kill any bats using the structure at the time of the work being carried out.

6. Strategic Actions

6.1 Recent and current activity

- A pro-active approach has been taken on a number of bridges being renovated by **Dumfries & Galloway Council**, with a check for bats being carried out by a countryside ranger prior to work commencing.
- Renovation of the disused Goldilea Viaduct involved special measures to cater for Common Wintergreen plants and bats that were found on the bridge.
- **Forestry Commission Scotland** has built bat and bird boxes into the construction of bridges for forest roads.
- In parts of Europe, specially designed green bridges have been constructed over major roads specifically to enable wildlife to cross.

6.2 Other recommended actions

- **Incorporate well-designed and effective wildlife underpasses** into all new roads wherever required. If the location is appropriate, consider more effective structures such as green bridges.
- **Assess bridges** in need of remedial work to allow unimpeded passage of fish.
- Give consideration, where feasible, to the **installation of integral bird and/or bat boxes** into bridges during scheduled maintenance or upgrading work.

An old, unpointed bridge with many opportunities for roosting bats. Kirkconnell Bridge, Ringford. May 2008. (Peter Norman)

INDUSTRIAL & POST INDUSTRIAL SITES

Priority Action (IPIS1)

Encourage industrial businesses to manage their landholdings for biodiversity through preparation of a site Biodiversity Action Plan.
Target: Encourage 1 industrial business to prepare plan and begin implementation by 2015.
Lead Partner: Dumfries & Galloway Biodiversity Partnership/Business Environment Partnership.

Former lead mine at Wanlockhead. August 2007. (Peter Norman)

1. Habitat Description

1.1 Physical Characteristics

Bownfields are sites that have previously been developed, usually for industrial use but sometimes other land-uses. In the early post-industrial years, sites are characterised by an abundance of bare ground, often mixed with building stone, bricks, concrete, metal and other artificial substrates. Several scarce and threatened open vegetation communities occur here, and over time may develop into areas of grassland, heathland and scrub, but the habitat can often persist for decades without active intervention because of the severity of the chemical or physical properties of the soil. **Second World War** sites, including abandoned airfields, munitions factories and military ranges often support similar habitats to post-industrial brownfields.

Deep mines have little ecological interest, but are often associated with extensive surface features, including ponds and **mine spoil** (bings) that can be of value, depending on their physical and chemical composition, and any restoration techniques employed. The combination of toxic metal concentrations and low nutrients, produces an extreme environment for plant colonisation, but species that are tolerant of such conditions can thrive, free from competition. Shallow disused **mine shafts** share similar physical characteristics to natural caves, and can support specialised flora and fauna. Open cast mines are included in the habitat action plan for quarries and mineral workings.

1.2 National and International Context

In 2006 there was 7,480ha of derelict land in Scotland, defined as damaged by development and incapable of development for beneficial use without rehabilitation. 216ha (2.9%) of this was in Dumfries and Galloway.

2. Dumfries & Galloway Status

2.1 Recent Trends

A number of further industries have become established in recent decades, including timber and food processing. Coal mining remained important in the Sanquhar-Kirkconnel field until the 1960s. It has since recommenced, but employing open cast, rather than deep mining methods. A number of agencies have been involved in the provision of mainly greenfield light industrial/business sites since the 1950s.

2.2 Current Distribution

Much of the post-industrial land in Dumfries and Galloway is associated with military sites. Although these are largely restricted to lower altitudes, there are also some post-industrial sites in the uplands. Active industrial sites are predominantly lowland, usually close to larger settlements.

2.3 Site Examples

The site of a former explosives factory at **Royal Ordnance Powfoot** (SSSI) retains much of the old infrastructure, such as abandoned stores, railway sidings and lagoons. The wide range of habitats from wetlands, through grasslands and heaths to scrubby woodland, combined with the sandy substrate, make the site outstanding for amphibians. Ponds, boardwalks and wildlife interpretation have been installed on a community nature reserve at **Gatehouse Brickfields**.

Wanlockhead (SSSI) contains the most important lead-zinc deposits in Scotland, which were actively worked for over 400 years. The area contains old mine workings and spoil heaps. The lead mines at **Blackcraig** have influenced the ecology of a range of habitats. The adjacent woods, now a reserve of the Scottish Wildlife Trust, were described on the mine plan of c1760 as 'Oak wood fit for all kinds of work underground'. They would have been managed and modified by the miners.

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with industrial and post-industrial sites, and the following action plans may also contain relevant information: Walls and Buildings, Railways, Quarries and Mineral Workings.

3. Importance for Associated Species

3.1 Invertebrates (very high importance)

Brownfields are probably the single most important invertebrate habitat away from semi-natural habitats. Sites can support important invertebrate communities, including rare species of beetles, butterflies, moths, bees and wasps that require bare substrate, sandy burrowing or nesting sites, and nectar sources. Common 'weeds' such as Pineappleweed *Matricaria discoidea* are important to invertebrates as larval foodplants and nectar supplies for adults.

Rhizocarpon petraeum, one of the many lichens on mine spoil at Wanlockhead. August 2007. (Peter Norman)

3.2 Fungi and Lichens (high importance)

Mine spoil is colonised by a number of lichens tolerant of the extreme conditions. A critically endangered nationally rare lichen *Gyalidea roseola* was found on a block of calcareous sandstone amongst rubble in the lead mining workings at Wanlockhead in 2006, its only current UK site (previously recorded only in Argyll in 1962).

3.3 Non-flowering Plants (high importance)

Mine spoil can support rare bryophytes that are tolerant of heavy metals.

3.4 Mammals (high importance)

Disused **mine shafts**, including some at Wanlockhead, provide the most important bat hibernation sites so far discovered in Dumfries & Galloway, although this undoubtedly partly reflects the difficulty in locating tree hibernacula.

3.5 Reptiles and Amphibians (high importance)

Natterjack Toads *Epidalea calamita* breed in ponds at the disused industrial site at Powfoot. Indeed, this is possibly the only site in Scotland to support all Scottish native reptiles and amphibians.

3.6 Flowering Plants (medium importance)

Brownfields that have not been reclaimed can be rich in wildflowers, including former agricultural weeds that are now rare on farms, such as Mugwort *Artemisia vulgaris* and poppies *Papaver* spp. Metal-rich **mine spoil** supports interesting species, such as at Wanlockhead. Habitats that more closely resemble semi-natural environments also occur, such as orchid rich grassland within the Du Pont industrial compound at Cargenbridge.

Common Spotted Orchids are found at several industrial sites. Kirkconnel, June 2007. (Greg Baillie)

3.7 Birds (low importance)

Species that feed on weed seeds, such as Linnets *Carduelis cannabina* and Goldfinches *C. carduelis* are frequently found in large numbers on **brownfield** sites that have not been restored to a uniform land use.

4. Environmental, Economic & Social Importance of Biodiversity

- High biodiversity on working industrial sites increases adds interest and can even improve the health, job satisfaction, and therefore productivity, of the workforce.
- The biodiversity of post-industrial sites often reflects a long history of management. It should be viewed as an integral part of their industrial archaeology.

5. Factors affecting the Habitat

- Sites of high biodiversity interest on post-industrial land are at risk of destruction and serious degradation. Major factors threatening it include redevelopment, unsuitable reclamation, eutrophication, lack of appropriate management and natural succession.
- The biodiversity of post-industrial sites is easily over-looked as they are rarely visited and species may persist in low numbers.
- Few previously developed sites have been afforded SSSI protection and creation of new sites is limited.

6. Strategic Actions

6.1 Recent and current activity

- **Dumfries & Galloway Council** is required to assess significant harm to ecological systems, especially on designated sites, as part of its identification of contaminated land.
- The **Museum of Lead Mining** at Wanlockhead has produced interpretation of the wildlife of the area.
- **Magnox North** has carried out an assessment of the biodiversity interest around Chapelcross and published a Biodiversity Action Plan in 2008.
- The **Wildlife Trust's** Biodiversity Benchmark award enables businesses to assess the quality of their land management, improve their contribution to the environment and demonstrate their commitment to biodiversity.

6.2 Other recommended actions

- Encourage businesses to carry out **ecological audits** of large industrial sites and modify activities to reduce their impact.
- Encourage businesses to carry out **practical biodiversity projects** on industrial sites.
- Promote the use of **vacant and derelict land**, either temporarily or permanently as wildlife habitats.

Former brickworks at Gatehouse of Fleet, now a nature reserve. October 2004. (Peter Norman).

QUARRIES & MINERAL WORKINGS

Priority Action (QU1)

Ensure that any new restoration plans for quarries and mineral workings contribute to LBAP habitat expansion objectives.
Lead Partner: Dumfries & Galloway Council.

1. Habitat Description

1.1 Physical Characteristics

Quarries and mineral workings are common features in most landscapes. **Disused quarries** that were abandoned many years ago tend to be small-scale features that have been colonised by natural vegetation to such an extent that their previous use is not always immediately obvious. More recently abandoned quarries and **working quarries** tend to be larger and more prominent in the landscape. Perhaps the biggest single influence on their value for biodiversity is the nature of the material being worked. This not only affects the chemical composition of the soil, but the type of extraction technique employed and the landform changes that result from it. For example **hard rock quarries** tend to have high vertical rock faces, whilst **open-cast coal workings** and **sand and gravel pits** usually have a greater range of contours but cover a wider area.

Kirkmabreck Quarry at Creetown includes some of the highest rock faces in the region. July 2004. (Peter Norman)

Open water is a feature of many disused and working quarries. However, as this is usually a result of the flooding of former workings, most open waters in quarries are deep and steep-sided, with limited marginal vegetation, which limits their biodiversity value.

Dyke Farm Quarry near Moffat, formerly a sand & gravel works, now a nature reserve. October 2007. (Peter Norman).

Bare ground or bare rock is a feature of most quarries, even those long since disused. This supports a specialised for flora and fauna, though once again the physical and chemical composition of the material is critical. Quarry faces can mimic natural rock outcrops with ledges and wet seepages, but even relatively smooth surfaces can be colonised by lichens. Even where material has been excavated, but not removed from the site, it can be of biodiversity value. **Piles of large stones** with plentiful nooks and crannies can be particularly valuable.

Grasslands in quarries and mineral workings tends to be agriculturally unimproved and this, together with the shallowness of soil, often leads to a high species richness.

Scrub and woodland often colonises disused quarries and mineral workings and may be present around active ones. Willows, birches and oaks are the commonest species on the thin soils, but a wide range of woodland types is possible depending on local conditions.

1.2 National and International Context

In 2005, over 64,000 ha of land in England was under planning permission for the active working of minerals. Equivalent figures for Scotland and Dumfries & Galloway are not known.

2. Dumfries & Galloway Status

2.1 Recent Trends

Although a finite resource, demand for minerals is ongoing and every year nearly four tonnes of aggregates are needed per head of the population in the UK. The use of recycled aggregate is increasing, but there is still considerable demand for primary aggregate. The main markets now for hard stone quarrying are for aggregates and concrete products resulting in the distinctive landmarks of quarry plants such as those at Locharbriggs, Dalbeattie and Kirkcudbright. Gravel and coal extraction also contributes to the region's economy.

2.2 Current Distribution

There are at least 14 active quarries or mineral workings and many disused ones in the region. Active quarries tend to be in lower river valleys or on the coast, but disused quarries are widespread in both the uplands and lowlands. The great majority of quarrying is for hard rock, with a few open cast coal workings in Upper Nithsdale, and sand and gravel workings in Lower Nithsdale, Annandale and Wigtownshire.

2.3 Site Examples

Two disused quarries have been designated as Sites of Special Scientific Interest for their geological importance; **Clatteringshaws Dam Quarry** and **Talnotry Mine**. The biodiversity potential of quarries has so far been little explored, but live CCTV images of nesting Peregrines in **Creetown Quarry** are transmitted to Creetown Heritage Centre and **Kelhead Quarry** is a designated Local Wildlife Site. **Dyke Farm Quarry** at Moffat has recently been restored for amenity and nature conservation use.

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with quarries, and the following action plans may also contain relevant information: Calcareous Grasslands, Inland Rock Outcrops, Scrub Woods, Industrial and Post-industrial Sites.

3. Importance for Associated Species

3.1 Flowering Plants (high importance)

Studies on the colonisation of plants in disused limestone quarries found that species diversity approached that found in much older semi-natural calcareous grassland within only 10-20 years.

Common Centaury *Centaurium erythraea* thrives on the well-drained, disturbed bare ground of quarries and Common Cudweed *Filago vulgaris*, which has undergone a dramatic national decline as a result of agricultural change, is known from similar habitats in at least one disused quarry. Orchids, including Common Spotted *Dactylorhiza maculata* and Common Twayblade *Listera ovata* can be abundant, depending on local conditions.

3.2 Invertebrates (high importance)

Bare ground (especially composed of soft material such as sand) combined with species-rich **grassland** makes an ideal combination for many invertebrates, particularly butterflies, bees and wasps. Quarry faces, scrub or woodland provides an additional benefit in the form of shelter from wind. A ground spider *Zelotes apricorum*, virtually restricted in Scotland to stony areas of the Solway coast, is regularly recorded from quarries in England.

Large Skipper butterfly. Clatteringshaws disused quarry, July 2007. (Peter Norman)

3.3 Birds (high importance)

Several pairs of Kestrels *Falco tinnunculus*, Peregrines *Falco peregrinus* and Ravens *Corvus corax* nest on **quarry faces** of both working and disused quarries. At Portpatrick, the extensive cliff faces quarried for the harbour works in the late 18th and early 19th centuries have been colonised by Fulmars *Fulmarus glacialis.*

Gravel works provide nest sites for Oystercatchers *Haematopus ostralegus*, Ringed Plovers *Charadrius hiaticula* and occasionally Little Ringed Plovers *Charadrius dubius*, the latter a very rare breeding species in Scotland.

Extensive areas of **grassland** may be used by Skylarks *Alauda arvensis*, whilst a wide range of birds frequent areas of scrub and woodland. **Open water** in the region's quarries is not of major importance for its bird life.

3.4 Non-flowering Plants (medium importance)

Quarries, even active ones, can support an interesting and varied bryophyte flora, though usually just a version of the natural communities found on nearby rock outcrops, rather than a specialised flora. Thick-set Earwort *Scapania compacta*, a common liverwort in rocky situations in western Britain, often grows in disused quarries.

Wet ground on disused quarry floors is good for mosses and liverworts in the few years immediately following closure, until flowering herbs and eventually scrub and trees become dominant.

3.5 Reptiles and Amphibians (medium importance)

Sir William Jardine's collection of fossil reptile

footprints found in the 1850s at the sandstone quarry at Corncockle is now in Royal Museum of Scotland in Edinburgh. More recently, the combination of **bare ground** for basking, **grassland** for hunting and **piles of stones** for hibernation makes many quarries and mineral workings good habitats for Common Lizards *Zootoca vivipara*, Slow Worms *Anguis fragilis* and Adders *Vipera berus*. Quarries are therefore valuable reptile habitats, and may be critical for their survival in areas of otherwise intensive agriculture or forestry. This habitat combination can also be good for frogs, toads and newts, but these species also require relatively shallow, well-vegetated, predominantly fishless areas of **open water**, which are often lacking from hard rock quarries, being common only in some sand and gravel workings.

3.6 Mammals (low importance)

Roosting bats use crevices and caves in **quarry faces**, and the presence of open water, grassland, woodland and scrub is also of benefit to them. However, few bat surveys of quarries have been completed in Dumfries & Galloway. Other mammals tend to be widespread and common species, for which quarries are of minor importance in relation to other habitats.

3.7 Fungi and Lichens (low importance)

Bare rock on **quarry faces** and other places is readily colonised by lichens, though few notable species are known. Other fungi associated with quarries and mineral workings tend to be generalist species, though some old quarry floors in other parts of Britain are developing good waxcap mycotas.

3.8 Fishes (low importance)

Though a number of disused quarries and mineral workings have been restored as recreational and commercial fisheries, species are generally of low conservation value.

4. Environmental, Economic & Social Importance of Biodiversity

- Features of geological interest are often exposed in quarries and mineral workings and offer opportunities for education and interpretation.
- Quarries and mineral workings restored for wildlife have the potential to be managed as nature reserves, offering recreational and educational facilities, along with associated landscape and economic regeneration benefits.

5. Factors affecting the Habitat

- **Restoration to agricultural land** has been the main after use of mineral workings, and most active sites have restoration to agriculture built into their planning consent.
- An RSPB study identified the main reasons for not restoring quarries and mineral workings to a nature conservation after-use as being a **lack of support from the landowner, a perceived inadequate financial return, a difficulty in securing long-term conservation management** and the proximity of the site to an airfield (threat of bird strike). The last reason is not relevant to Dumfries & Galloway, but all the others probably apply. The willingness of the mineral company is usually not a problem.
- **Rock climbing** can disturb nesting birds or damage flora in some quarries.
- Disused quarries and mineral workings are prone to **waste dumping**, usually unofficially and illegally. In particular, small disused quarries are a frequent location for farm dumps, though the impact on amenity value is usually greater than that on biodiversity.

6. Strategic Actions

6.1 Recent and current activity

- Dyke Farm Quarry, near Moffat, has been restored to a nature reserve following sand and gravel extraction by **Patersons of Greenoakhill Limited.**
- **Tarmac** has prepared Biodiversity Action Plans for all its quarries in Dumfries & Galloway.
- The **Mountaineering Council of Scotland** has produced an information sheet about birds and climbing, which contains guidance on responsible climbing.

6.2 Other recommended actions

Create new habitats on disused quarries and mineral workings. There is enormous potential to create a range of habitats. In England, RSPB has calculated that restoration of mineral sites for biodiversity could, in itself, meet all of the targets for at least seven UK BAP priority habitats.

URBAN WATERCOURSES & WETLANDS

Priority Action (UWW1)

Incorporate biodiversity into Sustainable Urban Drainage Systems in new developments.
Target: 10 SUDS schemes for new developments to include design enhancements for biodiversity by 2015.
Lead Partner: Dumfries & Galloway Council.

Brieryhill sustainable urban drainage scheme. Lockerbie, July 2006. (Peter Norman)

1. Habitat Description

1.1 Physical Characteristics

Urban rivers are often the focal point of settlements. Houses that overlook them are much in demand, and sometimes their name is even incorporated into the name of the town. Nevertheless, most are highly modified from their natural form - usually straightened with pools, riffles and gravel beds removed, hemmed in by walls and embankments and cut off from their natural floodplain (upon which the settlement is often built). In contrast, smaller **urban burns and ditches** are frequently hidden from view. They are also usually straightened and often culverted, or at least lined with concrete or steel. Although they are now much less polluted than they once were, many still receive oil and other pollutants that runs-off surrounding hard surfaces, and high nutrients levels from adjacent grass cutting and other urban activities. From an aesthetic perspective, urban watercourses are often marred by refuse and litter.

A number of other wetlands can be found in urban areas. **Ponds** were created for a range of purposes including curling ponds, distillery ponds, and mill ponds. Where this use has been lost, these ponds are often neglected. Ponds in gardens, public open spaces and industrial & post-industrial sites have separate action plans.

Sustainable Urban Drainage Systems (SUDS) are a relatively new kind of urban wetland. They are deliberately designed and constructed as an alternative to conventional urban drainage systems to reduce pollution and flood risk. They include detention basins, retention ponds, constructed wetlands, infiltration devices, swales and permeable surfaces. Some of these can be designed to improve biodiversity.

1.2 National and International Context

Many rivers and wetlands in highly industrial parts of Britain and Europe, such as the Rhine, Mersey and Tyne were highly polluted and became virtually lifeless in the mid-late 20th century. They are still recovering. None of Dumfries & Galloway's urban watercourses compare with the scale or extent of the problems in these areas.

2. Dumfries & Galloway Status

2.1 Recent Trends

There is now a better understanding of the complexity and importance of urban watercourses, and several recently installed schemes have aimed to work with nature, rather than against it. Soft engineering schemes protect banks with natural materials and avoid piped outlets. The introduction of SUDS deals with potential contaminants at source, rather than passing them downstream as quickly as possible, contributing to flood risk. These new techniques can also be used to create habitats and enhance biodiversity.

2.2 Current Distribution

There are urban watercourses and wetlands in all of Dumfries & Galloway's towns and villages.

2.3 Site Examples

A number of Dumfries & Galloway's main rivers flow through urban areas, notably the River Annan in **Annan**, Nith in **Dumfries**, Fleet in **Gatehouse**, Cree in **Newton Stewart**.

2.4 Associated Habitats

A number of habitats occur in close association and/or overlap with urban watercourses and wetlands, and the following action plans may also contain relevant information: Lowland Burns and Ditches, Public Open Spaces, Walls and Buildings, Industrial and Post-industrial Sites, Bridges and Tunnels.

3. Importance for Associated Species

3.1 Fishes (very high importance)

All fish of rural rivers, including Salmon *Salmo salar* and Trout *Salmo trutta* are also found in urban watercourses, including small burns, unless local factors have affected their habitat or food supply. The only spawning bed in Dumfries & Galloway of the nationally rare Sparling *Osmerus eperlanus* is located within Newton Stewart. The fact that towns and villages are often located on the lower reaches of rivers means that any problems here may limit the free movement of migratory fish throughout the catchment.

3.2 Reptiles and Amphibians (high importance)

Urban ponds wetlands, rather than flowing watercourses, support high populations of most native amphibians, particularly Common Toads *Bufo bufo,* Common Frogs *Rana temporaria* and Palmate Newts *Lissotriton Helvetica*. A few ponds, such as those at Gatehouse of Fleet and Newton Stewart, also have Great Crested Newts *Triturus cristatus.*

3.3 Mammals (high importance)

Although domestic cats undoubtedly take some Water Voles *Arvicola terrestris*, it has been suggested that they are less susceptible to predation on urban watercourses, due to the deterrent effect of cats on Mink. Otters *Lutra lutra* make frequent, often nightly, use of all urban rivers and on occasion even quite small burns.

Bats, which find many roosting opportunities in urban buildings and bridges, use watercourses for feeding. Pipistrelles *Pipistrellus sp.,* Noctules *Nyctalus noctula* and Daubenton's *Myotis daubentonii* bats are regularly recorded on the River Nith in Dumfries town centre.

3.4 Non-flowering Plants (high importance)

Polluted urban watercourses are associated with masses of Blanket-weed *Cladophora* on the surface or bottom, but such a sight is now rare. Instead, freshwater algae form the basis of aquatic foodchains and are essential for a healthy watercourse.

3.5 Birds (medium importance)

Mute Swans *Cygnus olor*, Mallards *Anser platyrhynchos,* Moorhens *Gallinula chloropus*, Kingfishers *Alcedo atthis* and Grey Wagtails *Motacilla cinerea* are residents or frequent visitors to many urban watercourses and wetlands. Dippers *Cinclus cinclus*, although usually associated with river headwaters, are also associated with some urban rivers, nesting annually in the centre of Dalbeattie and Gatehouse of Fleet.

Mallard, the typical duck of urban watercourses. (Peter Norman)

3.6 Invertebrates (medium importance)

Some species such of invertebrates, such as the larvae of *Chironomus* midges and *Tubifex* worms will survive in even highly polluted watercourses but in cleaner water mayfly and stonefly nymphs may be found. Indeed the species composition of watercourses is an accurate measure of pollution levels, and these species provide the food supply of many fish and birds. Variable Damselfly *Coenagrion pulchellum* has a restricted UK distribution but has been found on a number of ponds in Dumfries & Galloway, including some close to urban locations.

Mute Swans and Cygnets, Paul McLaughlin

3.7 Flowering Plants (medium importance)

The banks of urban watercourses and wetlands have been highly managed for many years, usually giving

rise to a plant community dominated by opportunist invaders such as Monkey Flowers *Mimulus* spp. and Himalayan Balsam *Impatiens glandulifera.* Both were introduced as garden flowers in the 19th century, but spread rapidly along watercourses during the late 20th century. Complete eradication of them is now impossible. Instead they should be appreciated for the urban colour, bank stabilisation and nectar sources they provide. A few less common species have been recorded, including Yellow Bartsia *Parentucellia viscosa* on the banks of the Nith in Dumfries.

4. Environmental, Economic & Social Importance of Biodiversity

- More natural management of urban watercourses and wetlands reduces flood risks.
- Unpolluted and biodiverse watercourses and wetlands provide landscape, recreation and quality of life benefits for urban residents.
- Shallowly sloping banks with marginal vegetation are safer than canalised watercourses, as they limit access to deep water.

5. Factors affecting the Habitat

- There is a **perception** that all watercourses in urban areas are a safety hazard and an inconvenience. As a result they have often been hidden from public view with little or no access. This is especially the case with smaller burns.
- **Previous management** has focussed on increasing flow capacity. This has resulted in embanking, straightening, mechanical excavating, lining with concrete or steel, and culverting of watercourses in urban areas.
- **Management of urban infrastructure**, such as bridges, footpaths and street lighting can affect some species.

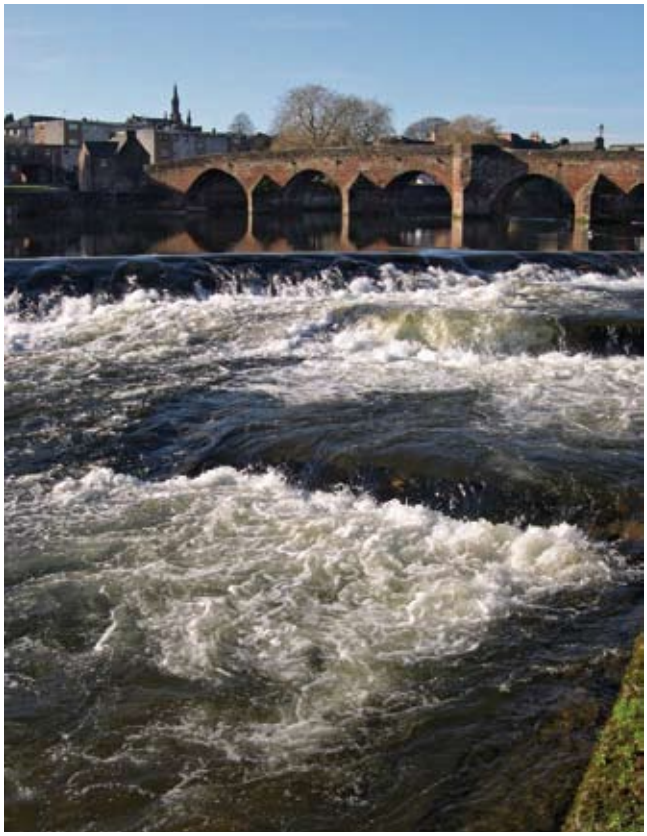
6. Strategic Actions

6.1 Recent and current activity

- **Dumfries & Galloway Council** has published Supplementary Planning Guidance on the Flooding and the use of Sustainable Urban Drainage Schemes. Several SUDS have been installed in urban developments and under the Controlled Activities Regulations they are now required for all new development except for surface water discharging into coastal waters and for single dwellings. In certain locations it is possible to design such schemes to enhance biodiversity.

6.2 Other recommended actions

- **Protect all existing stretches of semi-natural river and burn** corridor and other wetlands in urban areas.
- Encourage designers and developers to use **alternatives to culverts** on rivers and burns through urban and other areas.
- Where feasible and realistic, **restore degraded sections of watercourse**, particularly weirs, underground and concrete-lined sections. Provide variation in stream and bank habitats, such as riffles, pools, gravel beds and vegetation.
- **Enhance SUDS** to provide biodiversity benefits, as well as preventing pollution from surface water drains entering watercourses and reducing peak flows.



The River Nith in Dumfries town centre supports a wide range of species. February 2008. (Peter Norman)

RESERVOIRS

Priority Action (RE1)

Increase the availability of biodiversity information relating to reservoirs, in order that it can be used in maintenance and management programmes.
Target: Collect and collate all biodiversity information relating to reservoirs by 2015.
Lead Partner: Dumfries & Galloway Environmental Resources Centre.

Grassland at Glenkiln Reservoir, dominated by Pignut. June 2007. (Peter Norman)

1. Habitat Description

1.1 Physical Characteristics

Water supply and water power are the two main reasons for the reservoir construction. Reservoirs for both purposes are designed to catch and maintain water from watercourses and catchments, and release it under controlled conditions. The largest reservoirs are usually in upland areas where dams have flooded extensive valleys, sometimes expanding natural lochs, but sizeable lowland reservoirs also exist. Some have been made by damming shallow valleys, others are sited on fairly flat land with earth banks lined with concrete used to retain the water. Lowland reservoirs tend to have greater biodiversity than upland ones, usually because the latter are sited over more acidic geology, the water is deep, and the banks are steep-sided.

The **draw-down zone** is a feature common to most reservoirs, but rare in natural waterbodies. As water is pumped in and out, areas of bare mud and rock may be regularly flooded and exposed. Depending on the use of the reservoir, cycles of exposure can vary from days to months, creating harsh ecological conditions that can support only specialised plants and animals.

Dams take a variety of forms, from simple earth banks to major stone or concrete walls.
It is a legal requirement to install effective **fish passes** on all new dams, but older dams may have only rudimentary passes.

1.2 National and International Context

Reservoirs are widespread throughout Britain. There are at least 14 reservoirs in Dumfries & Galloway currently used for hydro-power or water supply, in addition to a number of small or disused reservoirs.

2. Dumfries & Galloway Status

2.1 Current Distribution

Most reservoirs in Dumfries & Galloway tend to be modified natural lochs. The greatest concentration is the series that powers the hydro-electric stations of the Dee-Ken valley. Elsewhere, they are well scattered across the region, mainly in the upland fringe.

2.2 Site Examples

Clatteringshaws Loch, with its large dam, may appear to be the region's largest reservoir but it feeds,

via a pipeline, into the Dee-Ken system where the long, narrow **Loch Ken** (SPA/SSSI) covers a larger area. This reservoir lacks a major dam, appears very natural and has high biodiversity. Other sizeable reservoirs include **Penwhirn, Loch Whinyeon, Lochinvar, Glenkiln, Black Esk** and **Winterhope**, as well as several smaller dams on other waterbodies. **Blates Mill Dam** (LWS), near Laurieston, now shows little of its artificial origins, the small dam being barely discernible amongst natural vegetation.

2.3 Associated Habitats

A number of habitats occur in close association and/or overlap with reservoirs, and the following action plans may also contain relevant information: Eutrophic Lochs, Mesotrophic Lochs, Oligotrophic Lochs, Swamps, Industrial and Post-industrial Sites.

3. Importance for Associated Species

3.1 Fishes (very high importance)

The most significant impact of reservoirs on fish populations is caused by dams that lack properly functioning fish-passes. These prevent free movement of all species of fish up and down the watercourse, but migratory species such as Salmon *Salmo salar* and Sea Trout *Salmo trutta* can be especially affected. There are no Eels *Anguilla anguilla* upstream of Tongland Dam, due to the difficulty of adults passing downstream though the power station.

In the reservoirs themselves, there are few resident species of conservation importance. Typical species include Pike *Esox lucius* and Perch *Perca fluviatilis*.

3.2 Non-flowering Plants (high importance)

The exposed **draw-down zone** of reservoirs is an important habitat for several species of mosses and liverworts. Many are tiny and ephemeral, but grow in profusion when conditions are right. The wet mud nearest the water's edge is likely to produce the rarest species. Species of this habitat include Clay Earth Moss *Archidium alternifolium*, Delicate Earth Moss *Pseudephemerum nitidum* and Drummond's Thread Moss *Pohlia drummondii*. Although only the latter species has been recorded from a reservoir in Dumfries & Galloway (Clatteringshaws) this probably reflects a lack of survey work.

Dumfries & Galloway's best known plant of reservoirs is a grass-like fern Pillwort *Pilularia globulifera,* with the reservoirs of the Dee-Ken hydro scheme providing one of its UK strongholds. Though largely submerged, it benefits from fluctuating water levels.

3.3 Birds (medium importance)

Loch Ken is the outstanding reservoir in the region for bird life, with a wide range of wildfowl and waders. Unlike some other parts of Britain, Dumfries and Galloway has few other large reservoirs that attract large numbers of waterfowl, only small numbers of Great Crested Grebes *Podiceps cristatus* and common species of duck, sometimes with night-time roosting of geese and Whooper Swans *Cygnus cygnus.*

Common Sandpipers *Actitis hypoleucos* often feed and nest in the **draw-down zone**. Ringed Plovers *Charadrius hiaticula* have also known to frequent the draw-down zone and previously nested at Clatteringshaws, but inland breeding is now rare.

A number of species, including Kestrels *Falco tinnunculus*, have been known to nest on **dams**, usually in cavities or on associated infrastructure.

3.4 Flowering Plants (medium importance)

Typical plants of the **draw-down zone** include Shoreweed *Littorella uniflora,* Amphibious Bistort *Persicaria amphibia,* Marsh Yellow-cress *Rorippa palustris* and Marsh Cudweed *Gnaphalium uliginosum.* The locally scarce Trifid Bur-marigold *Bidens tripartita* is found at Loch Ken.

3.5 Mammals (medium importance)

The mammal fauna of Dumfries & Galloway's reservoirs differs from their more natural freshwater counterparts. Otters *Lutra lutra* are present on all such waterbodies.

3.6 Invertebrates (low importance)

Though rare beetles, spiders and other invertebrates are found on Loch Ken, they are not typical of reservoirs in the region, which generally have a restricted range of common aquatic invertebrates.

3.7 Reptiles and Amphibians (low importance)

Most large reservoirs are too deep and have too many fish to support amphibian populations, though common species occur at a few locations.

4. Environmental, Economic & Social Importance of Biodiversity

Blue-tailed Damselflies breed in a wide range of waterbodies, including well-vegetated reservoir margins. (Gavin Chambers)

- Reservoirs can attract tourists and other visitors to watch wildlife. Several of the most popular nature reserves in Britain are based around reservoirs.
- Well-managed fisheries can produce income and enhance biodiversity.

5. Factors affecting the Habitat

- **Poorly designed dams and fish passes** restrict or prevent fish movement. Other problems may result from altered flow velocities and changes to water temperatures and oxygen levels in reservoirs, and in the release of stored water from reservoirs.
- Some deliberately **introduced species**, including non-native fish introduced for angling, pose a threat to other species. North American Signal Crayfish are present in Loch Ken and could spread to adjacent catchments.
- **Recreational activities** such as boating, walking and angling can disturb wildlife, though such disturbance is rarely significant in Dumfries & Galloway.

6. Strategic Actions

6.1 Recent and current activity

- **Scottish Power** has prepared a Biodiversity Action Plan for the Galloway Hydros Scheme. For example, work with Galloway Fisheries Trust is underway to improve fish passage.
- Recreational activities on Loch Ken are strictly zoned to minimise disturbance to wildlife, and **Scottish Power** has an agreement with RSPB to manage water levels, as far as possible, in order to benefit breeding birds.

6.2 Other recommended actions

- Assess the biodiversity of all reservoirs and, where feasible, **incorporate biodiversity** conservation and enhancement into maintenance and management programmes.

Willow scrub below Clatteringshaws Dam. July 2007. (Peter Norman)