



between the settlements of Warslow, Danebridge and Buxton. It represents an extensive tract of semi-natural upland and upland fringe vegetation typical of the southern Pennines and supports several plants and animals at the southern limits of their English distribution. Associated with this vegetation and the prevailing traditional livestock farming is an outstanding assemblage of upland breeding birds. The site is also of special interest for the high density of breeding golden plover *Pluvialis apricaria* and for the exceptionally large number of breeding snipe *Gallinago gallinago*. Many physical features of the Millstone Grit are of geological interest, particularly for the geomorphology of landslips and for rock sections exposed in stream valleys. There are four such localities of special interest which are described under the sub-title 'Geology'.

## Biology

The unenclosed hill grazings of acidic grassland, dwarf shrub heath and blanket mire are the major habitat types, occupying the higher, steeper and least fertile ground. Above 400 metres heather *Calluna vulgaris* is the dominant plant of the better drained and less rugged moors, formerly subject to regular burning for grouse management, eg Lum Edge and Middle Hills. On poorly drained soils or steeper, rocky terrain as at the Roaches and Oliver Hill, the heathland is more botanically diverse with grasses, sedges and a variety of ericaceous shrubs, eg bilberry *Vaccinium myrtillus*, crowberry *Empetrum nigrum*, cross-leaved heath *Erica tetralix* and cowberry *Vaccinium vitis-idaea*. Acid grasslands and grass heath mosaics are widespread, both on the open hill and in bordering enclosures. On freely draining soils fescues *Festuca* spp., bents *Agrostis* spp. and wavy hair-grass *Deschampsia flexuosa* predominate, sometimes invaded by bracken *Pteridium aquilinum*. Mat-grass *Nardus stricta* can be abundant where the soils retain moisture, and purple moor-grass *Molinia caerulea* or rushes *Juncus* spp. in the most ill-drained situations. The highest plateau, centred upon Axe Edge, is covered by blanket peat, dominated by bog vegetation mostly of heather and hare's-tail cottongrass *Eriophorum vaginatum*. This plant community is typical of northern British uplands but the Leek Moors represent its southernmost English station. Associated higher plants include deergrass *Tricophorum cespitosum*, common cottongrass *Eriophorum angustifolium*, heath rush *Juncus squarrosus*, purple moorgrass and several dwarf shrubs. Of the latter crowberry can be locally dominant, a feature characteristic of southern Pennine blanket bogs but without parallel elsewhere in the British uplands. Cloudberry *Rubus chamaemorus* occurs sparsely on Oliver Hill, here at the south-eastern limit of its British range. Parts of Axe Edge plateau are occupied by blanket mire dominated by hare's-tail cottongrass with few other higher plants and very little bog moss *Sphagnum* spp. This community, derived from the foregoing blanket mire type by a combination of long-continued and heavy grazing, burning and atmospheric pollution, is now the prevailing blanket bog vegetation of the southern Pennines. Though botanically impoverished, the mire communities of the Axe Edge support several uncommon breeding birds, including a large, regionally significant population of golden plover. [This species is listed in the European Commission Bird Directive as requiring special conservation measures.]

A variety of other vegetation types occur, generally at lower altitude and of smaller area, but collectively amounting to a major proportion of the site. These habitats differ in their naturalness and botanical interest, some being of most value for feeding or breeding birds, but all contribute to the mosaic of semi-natural upland vegetation. The enclosed grasslands are of

varied floristic character, sometimes little altered from adjoining hill ground, more often showing degrees of modification by agricultural practices. Seasonally or permanently high water tables give rise to rank swards of rushes and coarse grasses, providing food and cover for birds such as curlew *Numenius arquata*, whinchat *Saxicola rubetra* and snipe. Drier, acidic grasslands are often harder grazed with a limited flora typically including tormentil *Potentilla erecta*, heath bedstraw *Galium saxatile*, autumn hawkbit *Leontodon autumnalis* and mouse-ear hawkweed *Hieracium pilosella*. Where soils are less nutrient-poor, grasslands may be relatively rich in plants, a diversity sustained by light grazing and late hay cutting. The least-improved swards have plants such as devil's-bit scabious *Succisa pratensis*, quaking-grass *Briza media*, mountain pansy *Viola lutea*, moonwort *Botrychium lunaria* and wood anemone *Anemone nemorosa*. Wetter, more nutrient-rich ground, especially below seepage lines, often supports abundant sedges, eg glaucous and green-ribbed sedges *Carex flacca* and *C. binervis*. They are accompanied by a wide range of plants most commonly associated with acidic marshy conditions, eg marsh arrowgrass *Triglochin palustris*, sneezewort *Achillea ptarmica*, common spotted-orchid *Dactylorhiza fuchsii* and marsh cinquefoil *Potentilla palustris*. Springs and flush communities have an ecologically distinctive flora and occur in several locations at the junction between gritstones and shales. Area for area they are the most botanically diverse of all vegetation types within the SSSI and may contain locally common butterwort *Pinguicula vulgaris* and marsh lousewort *Pedicularis palustris*. Open, wet habitats of this nature are also important for invertebrates, particularly beetles *Coleoptera* and craneflies *Tipulidae*, a number of which are nationally restricted.

There is little woodland on the moors apart from occasional patches of willow *Salix* spp. and birch *Betula* spp. which provide food and shelter for birds and invertebrates. Some cloughs and stream sides retain remnants of oak *Quercus* spp. woodland or a light cover of birch, rowan *Sorbus aucuparia* and alder *Alnus glutinosa*. The Back Forest is the largest woodland within the site, its size together with areas of mature canopy provides an important habitat for mammals and invertebrates.

Goldsitch Moss is a shallow valley bog, a rare habitat within the Peak District, which locally and nationally has been much reduced by drainage. The Moss has a cover of cottongrasses and heather and contains several pools colonised by bog mosses and cranberry *Vaccinium oxycoccus*. The open water fauna includes certain caddis flies *Trichoptera* of restricted distribution, eg *Rhadicoleptus alpestris*. Goldsitch Moss is the only known site on the Leek Moors for bog-rosemary *Andromeda polifolia*.

Leek Moors is of great importance for upland breeding birds. There is an especially complete and representative range of species characteristic of the habitat for this southerly latitude in Great Britain. Several of these birds require large areas and/or little disturbance and are vulnerable to changes in land use and increased human activity, eg merlin *Falco columbarius*, dunlin *Calidris alpina* and black grouse *Tetrao tetrix*. The last species has seriously declined nationwide this century and the Leek Moors may retain the last viable breeding population with the Peak District. There are strong populations of twite *Acanthis flavirostris*, ring ouzel *Turdus torquatus* and red grouse *Lagopus lagopus* associated with the moorland. Curlew and snipe also occupy much of the hill ground but their numbers depend on the extent of ill-drained enclosed pastures. The snipe population has no equivalent elsewhere in the Peak District and is thought to represent one of the largest concentrations of this species in upland

England. Unlike the Eastern Moors SSSI, Leek Moors with its numerous watercourses also has river birds, eg dipper *Cinclus cinclus*, grey wagtail *Motacilla cinerea* and common sandpiper *Tringa hypoleucos*.

## Geology

Four areas of special geological interest are located within the site. These comprise three stream sections from the Namurian Series of the Carboniferous Period and a landslip phenomenon at Lud's Church.

The stream sections display important and complementary exposures of a related series of shales or shales and sandstone representing the middle and upper Namurian Series of the Carboniferous Period, formed around 325 millions years ago. At Blake Brook (SK 063612) the rock sequence represents the whole of one of the seven major divisions or Stages of the Namurian Series - the Alportian Stage of the middle Namurian. The rocks contain the fossilised remains of marine animals known as goniatites, which together with other abundant microfossils, provide a ready means of dating the rocks and correlating them with other sequences. In recognition of this Blake Brook has been proposed as the standard section for this interval of the geological record.

The stream bank outcrops near Orchard Farm (SK 023691) show a sequence of shales above the ringinglow Coal, including marine horizons with different goniatite faunas. The *Gastrioceras cancellatum* Marine Band marks a distinct change in the faunas and is used as the index for the base of the Yeadonian Stage, the topmost subdivision of the Namurian Series in the west European classification. The high quality of these exposures has led geologists to propose this site as the standard section for this geological boundary. Both Blake Brook and Orchard Farm are thus internationally important reference localities for geological studies of European Carboniferous rocks.

A stream section at Gib Tor (SK 012643 - SK 021648) displays the uppermost part of the Namurian, with the Roaches Grit, Chatsworth Grit and Rough Rock excellently exposed. These three prominent sandstone layers are each overlain by a marine shale band, associated with a bed of contorted shale of particular interest. Although the contortions appear to be a result of movements in the earth's crust, their association with the marine bands is not fully understood. This is thus a stratigraphic sequence of considerable research potential.

Lud's Church (SJ 987656) is a vertical open fissure in Roaches Grit (Upper Carboniferous). It is 4-5 metres wide and, including all its side passages, totals 220 metres in length. All but the upper third of the slope has slipped forward towards the River Dane. The backface of the slip forms a short steepening of the slope about 25 metres upslope from the fissure, which therefore lies within the slipped mass. The site includes other features associated with the same landslip, including hillside trenches downslope from the fissure, and Castle Cliff Rocks, a tor which owes its form, and possible its origin, to the landslip.