County: Cumbria/Durham **Site Name: Moorhouse & Cross Fell**

District: Eden, Carlisle, Wear Valley

Status: Site of Special Scientific Interest (SSSI) notified under Section 28 of the Wildlife and Countryside Act, 1981. Part of the site is a National Nature Reserve.

Local Planning Authority: Eden District Council, Wear Valley District Council

National Grid Reference: NY 715365 **Area:** 13,707 (ha) 33,870 (ac)

Ordnance Survey Sheet 1:50,000: 86, 87, 91 **1:10,000:** NY 62 NE, 63 NE, 63 SE, NY 63 NW, 64 SE, 64 SW, NY 72 NE, 72 NW, 73 NE, NY 73 SE, 73 SW, 73 NW, NY 74 SE, 74 SW, 82 NW, NY 83 NW, 83 SW, 84 SW

Date Notified (Under 1949 Act):
Upper Teesdale & Appleby Fells: 1951
Cross Fell: 1963

Date of Last Revision:
Upper Teesdale & Appleby Fells: 1975
Cross Fell: 1975

Date Notified (Under 1981 Act): 1990 **Date of Last Revision:** 1990

Other Information:

1. At this revision parts of the two formerly separate sites of Cross Fell SSSI and Upper Teesdale and Appleby Fells SSSI, have been extended and amalgamated. The extensions also include Moor House National Nature Reserve (NNR) which covers 3,894 ha and was originally declared in 1952 under Section 19 of the National Parks and Access to the Countryside Act (1949), with subsequent revisions in 1969 and 1976.
2. The Moor House NNR was declared as the first British "Biosphere Reserve" by the United Nations Educational, Scientific and Cultural Organisation (UNESCO) in 1975.
3. The Moor House NNR was declared as a "Special Protection Area" in 1982 under the terms of the European Communities Council Directive (1979) on the Conservation of Wild Birds.
4. Parts of the site are listed in 'A Nature Conservation Review, edited by D. A. Ratcliffe, 1977, published by Cambridge University Press, as being of national importance.
5. The site lies within the North Pennines Area of Outstanding Natural Beauty (AONB).

Description and Reasons for Notification:

The Moorhouse and Cross Fell area forms an extensive upland block at the northern end of the Pennine system and lies between the villages of Milburn and Garrigill. The site stretches from Rotherhope Fell in the north to Knock Fell in the south and extends eastwards to Burnhope Seat on the Durham border. The area contains the most elevated part of the Pennine mountains rising to 893m (2,930 feet) on Cross Fell with the adjacent twin peaks of Great Dun Fell (847m = 2,779 feet) and Little Dun Fell (842m = 2,763 feet). These fells rise sharply from the Eden Valley up a scarp slope deeply dissected by river valleys into a tract of blanket bog. The summit ridge forms the divide between western and eastern climatic effects and from it flow streams, westward to the River Eden, eastward to the River Tees, and northwards to the River South Tyne. Underlying the area the geology comprises largely of Carboniferous sandstones, mudstones and limestones which variously affect the overlying vegetation. The importance of the area lies in its rich variety of representative upland habitats with associated animal and

plant species. Communities of particular interest are those of blanket bog, sub-montane and montane heathland, montane bryophyte heath, limestone grassland and flushes, and some of the ledge communities. Other habitats of subsidiary interest are areas of acid grassland, acidic flushes, open water, scree and metalliferous spoil sites.

Above about 600m (1,968 feet) and up to 760m (2,493 feet) blanket bog has developed over much of the area and is the most extensive habitat within the site. The most widespread community is that dominated by hare's-tail cottongrass *Eriophorum vaginatum* with heather. Much of these areas, particularly where there is grouse moor management, such as at the northern and western ends of the site, are in good condition and are much less modified than most of the blanket bog further south in the Pennines. In areas where the water table is higher, bog mosses such as *Sphagnum papillosum*, *S. magellanicum*, *S. capillifolium* and *S. cuspidatum* predominate with other mosses such as *Rhytidiadelphus loreus*, *Hypnum jutlandicum* and *Pleurozium schreberi*, either in lawns or with a mixture of common cottongrass, deer grass, cross-leaved heath and round-leaved sundew. Some areas also have stands of cowberry *Vaccinium vitis-idaea* and cloudberry *Rubus chamaemorus*, the latter being particularly common on Burnhope Seat. As with other areas of the Pennines there are large areas of blanket bog dominated by either pure or mixed stands of hare's-tail and common cottongrass with heath rush which flourish at the expense of dwarf shrubs due to modification by either over-grazing, over-burning, or drainage of the blanket bog, or a combination of these. Where these effects are severe, peat erosion and 'hagging' has occurred.

Blanket bog gives way to heathland where the peat is generally less than half a metre deep, such as on Melmerby Fell, Stony Rigg, Rotherhope Fell and parts of Cross Fell. Typically, there is a predominance of the dwarf shrubs of bilberry, crowberry *Empetrum nigrum* and heather, and in parts these are rich with lichens such as *Cetraria islandica*, *Cladonia impexa*, *C. arbuscula* and *Hypogymnia pysodes*. At higher altitudes above 550m (1,804 feet) the climate is more severe and this is reflected in the more montane nature of the vegetation with plants such as stiff sedge *Carex bigelowii* and the moss *Racomitrium lanuginosum* becoming increasingly dominant. Cross Fell in fact supports the best and most extensive example of this *Racomitrium* heath in England. The summit cap, on both north and west sides does in fact consistently hold the longest lasting snow-beds occurring south of Scotland.

Much of the heathland forms a variable mosaic with a variety of grassland types. At the highest levels, such as on Cross Fell, sheep's fescue *Festuca ovina* is common and grades into both species-rich and species-poor *Festuca-Agrostis* grassland; both of which occur widely throughout the site. The species-rich facies generally occurs where there are exposures of limestone such as on Melmerby Scar, Cross Fell, the Dun Fells, Knock Fell, Greencastle (Moorhouse), the Bullman Hills, Tyne Head Fell and Bellbeaver Rigg. Here blue moor-grass also becomes predominant with spring sedge and herbs such as wild thyme, limestone bedstraw and fairy flax *Linum catharticum*. Several rare and noteworthy montane and submontane species within these swards include hair sedge *Carex capillaris*, northern bedstraw *Galium boreale*, spring sandwort *Minuarta verna*, mountain everlasting *Antennaria dioica*, mountain pansy *Viola lutea*, autumn and spring gentians *Gentianella amarella* and *G. verna*, alpine cat's-tail *Phleum alpinum* and alpine forget-me-not *Myosotis alpestris*.

The species-poor *Festuca-Agrostis* facies occurs widely along the scarp tops, slopes and valley-sides and typically includes wavy hair-grass and sweet vernal-grass in association with heath bedstraw, tormentil and mosses such as *Polytrichum commune*. Mat-grass occurs sporadically throughout these areas on steeper, leached soils. In other areas, particularly those with slightly deeper soils, dense patches of bracken clothe the hill-sides.

Throughout the site, particularly at the periphery of the blanket bog there are important acid and base-rich flushes. Most of the acid flushes are typically species-poor and occur along stream and river valleys where there are gleyed peaty silts. These areas are dominated by soft rush and the mosses *Polytrichum commune* and *Sphagnum recurvum*. Other flushes, however, have a mixed carpet of bog mosses *Sphagnum* spp. with a variety of sedges such as common sedge *Carex nigra*, white sedge *C. curta* and star sedge *C. echinata*. The locally occurring tall bog sedge *C. magellanica* also occurs in flushed tracts within some areas of blanket bog such as on Tynehead Fell and Burnhope Seat. Base-rich flushes are found in areas where the drainage water is influenced by the underlying limestone, as seen at the head of Knock Ore Gill and below the caps of Cross Fell and both of the Dun Fells. Many of these communities grade into bryophyte-dominated spring and rill communities. Sedges are common with other local and rare species such as lesser clubmoss *Selaginella selaginoides*, starry saxifrage *Saxifraga stellaris*, marsh saxifrage *S. hirculus*, alpine foxtail *Alopecurus alpinus* and three-flowered rush *Juncus triglumis*. Brown mosses can be very abundant and include *Philinotis fontana*, *Cratoneuron commutatum* and *Scorpidium scorpioides*.

Tall herb ledge vegetation of the ungrazed crags and ledges is another important feature of the site. The ledges on the Whin Sill, such as at Black Doors are generally species-poor unless subject to flushing with base-rich water. Ledges on the limestone, such as at Melmerby High Scar, Great Fell, Crowdundle Beck, Allen's Cleugh, Lady Gill and Little Gill are species-rich and support plants such as green spleenwort *Asplenium viride*, brittle bladder fern *Cystopteris fragilis*, hoary whitlow grass *Draba incana*, hairy stonecrop *Sedum villosum*, roseroot *S. rosea* and the rare alpine cinquefoil *Potentilla crantzii*.

Gritstone and limestone boulder screes are well represented on the western escarpment with Cross Fell possessing the largest area of gritstone scree on an English mountain. The boulders provide valuable habitat for lichens and mosses. The gritstone screes support mosses such as *Racomitrium lanuginosum*, *Pohlia nutans*, and *Diplophyllum albicans*, whilst lichens include *Parmelia alpicola*, *P. incurva* and various *Umbilicaria* species.

Open water occurs on the site in the form of several upland streams, which include the headwaters of the River Tees, Knock Ore Fill, Crowdundle Beck, Cross Gill and Blackburn; as well as bog pools and tarns such as at Stony Rigg, Green Fell and Burnhope Seat. Knock Ore Gill represents one of the highest and most precipitous limestone streams in Britain and is a key example of a limestone stream also affected by peat water.

Lead mining has occurred in the past throughout the site, particularly within the Moorhouse NNR area. Many of the spoil heaps are floristically interesting having an abundance of spring sandwort, alpine pennycress *Thlaspi alpestre*, alpine scurvy-grass *Cochlearia alpina* and autumn gentian.

Studies of the invertebrate life of the site have concentrated largely on the Moorhouse NNR, where 27 endangered or vulnerable species and 71 nationally scarce species have been recorded. These include the vulnerable fungus gnat *Macrocera bipunctata* known only from four sites nationally. Many of the beetles are typical of upland moorland habitats, and include the endangered rare beetle *Olophrum assimile*, a species that has been found on only two mountain tops in Britain. The northern dart *Xestia alpicola* is also present at one of its few English stations.

The site is of regional importance for its upland breeding bird community. More than forty species of birds breed on the site including important breeding populations of merlin, peregrine, buzzard, kestrel, raven, short-eared owl, golden plover, dunlin, common sandpiper, lapwing,

redshank, curlew and snipe. The latter four wading species nest here at their record elevations in Britain. There are passage records of golden eagle, hen harrier and snow bunting.

Mammals recorded on the reserve include hedgehog, common pygmy and water shrews, water vole, mole, wood mouse, house mouse, brown rat, pipistrelle bat, brown hare, fox, badger, stoat, weasel, otter, and roe deer.

MoorHouse NNR has been the subject of intensive scientific study in the past and is the best documented area of upland peatland in Britain.

Five localities of particular geological interest have been included within the site:

Knock Fell Caverns:
Knock Fell Caverns lie at the head of Knock Ore Gill. The single cave system in this site is the most perfectly developed and most extensive maze cave system in Britain, formed by ponded water flowing under considerable pressure beneath the water table, in which the pattern of the cave passages has been strongly influenced by enlargement of natural fractures (joints) within the bedrock. Maze caves are typical features of the thin limestone layers of the Great Limestone bedrock, Knock Fell being the finest example. The cave system lies at a higher altitude than any other in Britain and contains well preserved calcite formations and deposits which offer very great potential for the study of the long history of its development.

Sir John's Mine:
Sir John's Mine lies below Tyne Head Fell on the River South Tyne just south of Tyne Head. Although Sir John's Vein is not of interest itself, a level driven on it from the east bank of the Tyne, was used as access to the Great Sulphur Vein as recently as 1941. The Great Sulphur Vein, seen some 400m along this level, comprises a north facing monocline, intensively sheared and faulted, in highly silicified shales at its northern end, below which, 6m of Tynebottom Limestone, dipping north at 40°, is entirely replaced by iron sulphides and quartz (average 9.5% sulphur). The Whin Sill underlying the Tynebottom Limestone is metasomatically altered and mineralised with pyrite in the upper 2m.

Specimens of sulphide ore containing pyrite, marcasite, pyrrhotite and chalcopyrite are localised on the dumps at the Sir John's level entrance and recently specimens of quartz have been found to contain small inclusions of bismuthinite and native bismuth. Some fragments are of brecciated shale in a quartz matrix, sulphide veining in the clasts being of particular interest genetically. All these specimens are clearly from the Great Sulphur Vein, which is believed to represent the root zone of a major fluorite-bearing North Pennine vein system. Some 300m upstream from Sir John's Mine, where the Great Sulphur Vein crosses the River Tyne, sulphide mineralisation is poorly developed at outcrop and therefore the dumps at Sir John's Mine are, at present, the most accessible source of material from this very interesting mineralisation.

Windy Brow:
Windy Brow Mine lies to the north of Burnhope Seat at the southern end of Windy Brow. The dumps from an old level driven on Windy Brow Vein beneath the Great Limestone, have yielded small but very fine specimens of aurichalcite in two distinct habits. Other secondary minerals are malachite, azurite, and smithsonite, and a small dressing floor at the dumps yields specimens of galena. The locality is of purely mineralogical interest in yielding the best aurichalcite in Britain.

Cross Fell:

Cross Fell, together with Little Dun Fell, Great Dun Fell and Knock Fell, is important for periglacial geomorphology in northern England. The area includes an excellent assemblage of landforms including gelifluction terraces, ploughing stocks, vegetated hummocks, patterned ground, nivational features and frost weathering features. In some cases the processes are currently active and the area forms part of a national network of sites representing the geographical variation in contemporary periglacial phenomena.

Black Burn:
At the north of the site a small section of the Black Burn, north of Shield Water is important for fluvial geomorphology. It is one of only a few sites in the northern Pennines where upstream input of coarse sediment produced by hushing can be clearly linked to downstream floodplain sedimentation. Below the confluence of Black Burn and Rowgill Burn there is an extensive low terrace with a complex sequence of high-sinuosity palaeochannels preserved on its surface. Comparatively high trace metal concentrations in these sediments suggest that their deposition was contemporaneous with upstream metal mining before the mid-19th century. More recent sedimentation and valley floor incision are also represented.

This reach of the Black Burn is also noted for its contemporary bar and bed forms. It is the most extensive, laterally mobile, low-sinuosity boulder-bed stream in the Tyne basin. Mid-channel bars, neck and chute cut-offs and boulder berms formed by historic floods are especially well-developed. Black Burn is therefore important for both contemporary and historic river process, landform and sediment inter-relationships.