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Definition and location of woodland and scrub in the uplands

8.1 Definition of woodland and scrub in the uplands

Woodland includes all areas where trees are abundant in the vegetation and strongly determine the nature of the lower-growing plant communities and the animals. Woodland may be split into 'semi-natural' stands which are composed largely of trees and shrubs native to the site that have grown up from natural regeneration, coppice or stump regrowth; and 'plantations' where the trees are largely planted. Plantations are most commonly of non-native species (such as Sitka spruce *Picea sitchensis* or lodgepole pine *Pinus contorta*) but may be of locally native species such as oak *Quercus* spp. Woods (or parts of woods) are described as 'ancient' where there appears to have been continuity of woodland cover on the site since 1600 AD and as 'recent' where there is evidence that the site was, for example, open moorland, bog or grassland at some time in the last 400 years and that therefore the woodland has originated after 1600 AD. The terms 'ancient' and 'recent' refer to the history of the site as woodland, whereas 'semi-natural' and 'plantation' refer to the composition of the current crop of trees on the site. Ancient sites may now carry plantations, recent woods may be semi-natural, eg where birch is regenerating on drying-out bogs.

Woods that are both ancient and semi-natural tend to be the most important for nature conservation. Most ancient semi-natural woodland in the English uplands was formerly managed as 'coppice' (or coppice-with-standards), particularly for the oak bark and charcoal industries. These woods often still show signs of such working in their structure with many even-aged, multiple stemmed trees, whereas under more natural conditions trees would mainly be present as single-stemmed individuals growing as 'high forest'. High forest is the usual structure in recent woodland and plantations. A third type of woodland structure is 'wood-pasture' where the trees are usually wide-spaced, very old (veterans), and may have been pollarded in the past. This is more commonly found in lowland parks but occurs in places on the upland fringes. Some of these structural differences have become blurred because, following abandonment of coppicing in the nineteenth century, many upland woods now consist of grazed high forest. This has a different conservation interest to that of lowland wood pastures.

Scrub refers to low-growing communities where the major woody components are bushes (eg hawthorn *Crataegus monogyna*, juniper *Juniperus communis*, blackthorn *Prunus spinosa*) or undershrubs such as bramble *Rubus* spp, gorse *Ulex europaeus*, or broom *Cytisus scoparius*. Stands of young trees or of sallows *Salix* spp are usually treated as woodland. In the past foresters have also used the term scrub to refer to unproductive woodland of oak and birch. That usage is not followed here.

The term forest is used generally to mean any large area of woodland; or, with a capital F, to refer to a former Royal Hunting Forest. These Hunting Forests (eg at Bowland or Pickering) were areas defined by medieval kings and queens (occasionally other nobles) to which applied specific laws on hunting, mainly of deer. They might or might not have contained much woodland.

Further information: Kirby 1996a; Kirby & Patterson 1993; Rackham 1980, 1986, 1990; Ratcliffe 1977. Discussion of terms 'ancient' and 'semi-natural', and significance of ancient semi-natural woodland: Peterken 1977, 1993, 1996; Spencer & Kirby 1992.

8.2 Location of woodland and scrub in the uplands

Most of the uplands below 600 m were probably covered by woodland 7,000 years ago but thereafter clearance occurred to varying degrees and at varying times. However, by a thousand years ago, the woodland cover in the uplands was probably less than 20% of the land area and it continued to shrink, except in periods when locally there was a downturn in agricultural incomes or there was a thriving market for wood products. Interest in management might lead to fields being converted to coppices; in 1803 it was noted that 'proprietors of Colton (S. Cumbria) had ceased to breed sheep, so far were they involved in the cultivation of coppices.' Over the last 100 years, however, interest in woodland management has generally waned and most of the broadleaved woods are now used only for sheltered grazing, with consequent effects on their regeneration.

Ancient woodland sites are scattered throughout the uplands, although they are usually less common than in the lowlands, (see relevant county Ancient Woodland Inventories, Table 8.10). Recent semi-natural woodland and scrub tend to show a similar distribution pattern. The woods are generally small (less than 20 ha). Commonly, upland woods occur along steep valley sides, although the woods rarely extend above 350 m. Scattered trees occur at higher altitudes along gills and restoration of tree line woodland could be based around such fragments. Some woodland communities typical of the uplands also occur at lower altitudes, even down to sea level, for example the oak woods along the Fal Estuary or in the Forest of Dean. Therefore, although this chapter concentrates on the conservation of these woodland communities within the defined upland Natural Areas (Fig. 1.1), this must not be seen as separate from what is happening to (or being proposed for) these same communities elsewhere.

Most woodland in the uplands is recent. Large areas of coniferous plantations have been established over the last 100 years in the uplands because land for planting has generally been cheaper than in the lowlands. Their establishment has often been controversial, because they replaced open ground of high conservation value; in some cases these open habitats are being restored as the plantations come up for felling. However, some of these stands have now become a nature conservation resource in their own right.

Habitats and species of woodland and scrub in the uplands

8.3 Why upland woodland and scrub are important

Upland woods and scrub contain natural and cultural landscape features of national and international importance. These include a wide range of species and communities not found in lowland English woods and the transition zones between species with a broadly southern-continental versus a more northerly distribution.

Some, but not all, of these features are better represented in Scotland or Wales. The oak woods in England, for example, tend to be smaller and more fragmented than those in Scotland; the distinctive bryophyte communities associated with the mild, moist conditions of the west are less well developed. On the other hand the upland ashwoods, which contain many rare vascular plants, are more extensive and varied in England than in Wales and Scotland.

This chapter is mainly concerned with the conservation value and management of the woodland. However, in the uplands many of the species, features and processes are closely linked to their surroundings. Some upland birds may use woodland for nesting, but forage over the adjacent open ground; conversely open-ground nesting birds may sometimes be at risk from predators living within adjacent new plantations. Fires may be desirable to maintain some dwarf-shrub communities, but are damaging if they spread into adjacent woodland. Airborne pollutants may be deposited on tree leaves and subsequently be washed off, leading to increased acidification of forest streams. More work is needed on the distribution of existing and new woodland that best meets both woodland and open-ground conservation objectives.

8.4 Habitats and species in upland woodland and scrub, their nature conservation status and distribution

8.4.1 Vascular plants

The woodland communities on acid soils in the uplands are characteristically poor in vascular plants, but the woods as a whole are often rich because they also contain base-rich flushes and wet areas. These flushed areas may include nationally rare and scarce plants such as touch-me-not *Impatiens noli-tangere*, tall fescue *Festuca altissima* and Irish spurge *Euphorbia hyberna*. Upland woods on limestone, particularly those associated with limestone pavement, have also long been noted for their richness and occurrence of rarities including lady's slipper orchid *Cypripedium calceolus*, baneberry *Actaea spicata* and mezereum *Daphne mezereum*. North-western species such as marsh hawkweed *Crepis paludosa*, globe flower *Trollius europaeus* and hay-scented fern *Dryopteris aemula* may share woods with southern continental ones such as herb paris *Paris quadrifolia*. Upland woods are thus nationally important for higher plants.

Nationally rare and scarce vascular plants associated with upland woodland and scrub are listed in Table 8.1. The assignment to Natural Areas is a first approximation and species that occur close to the boundary between two areas may have been assigned to both. In addition the distinction between woodland and non-woodland plants is less clear-cut than in the lowlands: some plants elsewhere associated with wood-edge may in the uplands occur in open tall-herb communities such as on cliff ledges and limestone pavement.

8.4.2 Bryophytes and lichens

The western oak woods are amongst the richest for bryophytes in England and are of national and international importance. Some of the rare species found in these woods are listed in Table 8.2. The bryophyte richness and abundance of the woods comes from the combination of high rainfall and a suppression of the shrub layer and field layer cover by grazing. The occurrence of many boulders and other microsites which remain moist but do not develop higher plant cover is also important. Finally the

low level of felling in many of these woods over the last 100 years has helped to maintain humidity levels within the woods.

Many western woods and parkland also have a relatively high lichen diversity, despite the scarcity of very big trees in many of the woods. The relatively clean air and high light levels below the canopy are conducive to good lichen growth. Some nationally rare and scarce lichens associated with upland woodland and scrub are shown in Table 8.3.

Further information: Church *et al* 1996 ; Hodgetts 1996; Ratcliffe 1968.

8.4.3 Plant communities

In Table 8.4 the broad woodland groupings used in the Biodiversity Action Plans (BAP) are related to the main woodland National Vegetation Classification types along with their rough equivalents in other systems. The relationships are rarely one-to-one and so, while the most obvious links have been indicated, they are not exclusive in either direction. The listing of a Habitats Directive type against a set of NVC communities does not necessarily mean that all stands within these communities correspond to the Directive type, or, even if some do, that there are stands of sufficient quality to be considered for listing under the Directive.

Unlike in lowland woods the NVC types largely take account of most of the variations previously recognised in the Stand Type system. However, at the lowland / upland boundary and on base-rich soils special attention may need to be paid to the occurrence of wych elm (Stand Group 1), lime (Stand Groups 4, 5) and field maple (Stand Group 2). In addition, woods usually contain patches of open or wetland habitats which may be particularly important for various animal groups. Wood / scrub edges are, for example often particularly rich in higher plants and insects.

Virtually all woodland NVC types occur in the uplands, but some are at a much lower frequency than in the lowlands. For the purposes of this handbook the types of woodland most frequently encountered in the uplands have been grouped in the following way:

- upland oak woods;
- upland ash woodland;
- wet woodland;
- ancient wood pasture;
- scrub;
- replanted ancient sites;
- recent plantations.

The first four of these represent BAP priority habitats. Scrub is recognised as a separate Phase 1 category and, like the previous four, is contained within the Broadleaved and Yew BAP broad habitat type. The two plantation types have been highlighted because of their different management needs and priorities.

The assessment of the conservation significance of different classes of woodland has been done by these broad groups (Table 8.5).

The main woodland and scrub NVC communities occur in virtually all the upland Natural Areas, albeit sometimes in fragmentary form, because the majority of land in the sub-montane zone is only maintained in an open state through anthropogenic activity. Further information on the character of the ancient woodland in particular areas is given in the relevant profile reports and county ancient woodland inventories (Tables 8.8-8.10).

Further information on these communities and their significance in the uplands: Hall 1997; Kirby 1996a; Kirby & Reid 1997; Peterken 1993; Reid, Kirby & Cooke 1996; Rodwell 1991.

8.4.4 Birds

Upland oak woods have a distinctive bird assemblage which includes redstart *Phoenicurus phoenicurus*, wood warbler *Phylloscopus sibilatrix* and pied flycatcher *Ficedula hypoleuca*. Many of these woods are heavily grazed, usually by sheep, and hence lack dense undergrowth. Although this means that such woods lack many of the shrub-nesting species found in less heavily grazed lowland woods, some grazing appears to benefit the above three characteristic species of the oak woods. Reduction of grazing within these woods could generate a more complex vegetation structure that may lead to an increase in overall densities and numbers of breeding birds, but it is likely that these characteristic upland oak wood bird species would decline under such a regime.

Important bird populations, including goshawk *Accipiter gentilis*, crossbill *Loxia curvirostra* and siskin *Carduelis spinus*, are now found within some of the larger upland conifer plantations. These species have expanded their range and national populations largely in response to the creation of the new forests. Nightjar *Caprimulgus europaeus*, which have declined greatly in recent decades, have also colonised clear-fells and open areas in some upland plantations (although this species is not considered further because it is more associated the lowlands, Stillman & Brown 1998). Merlin *Falco columbarius* have also taken to nesting within the edges of some upland forests. There is considerable scope for integrating bird conservation into the management and design of these plantations.

Scrub is potentially important to species such as black grouse *Tetrao tetrix*, whitethroat *Sylvia communis*, grasshopper warbler *Locustella naevia*, whinchat *Saxicola rubetra* and stonechat *S. torquata*. Relaxation of grazing and burning in the uplands may be associated with scrub development which, depending on factors such as exposure and grazing patterns, may eventually develop into woodland or persist as some form of scrub. This vegetational change would trigger large changes in bird communities, although rather little is known about the current bird assemblages in scrub patches in the English uplands. In addition, by enhancing population densities of small songbirds it may serve to increase numbers of birds of prey such as merlin and hen harrier *Circus cyaneus*.

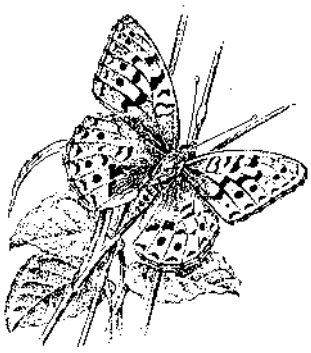
Birds associated with upland woodland and scrub are shown in Table 8.6, with their nature conservation status.

Further information: Currie & Elliot 1997; Fuller 1982, 1995, 1996; Petty & Avery 1990.

8.4.5 Invertebrates

Upland woods and scrub have been less well studied from an invertebrate point of view than lowland sites, so any overall assessment must be preliminary. Table 8.7 indicates those BAP priority species that are believed to be associated with upland oak and ash woodland, including for example the blue ground beetle *Carabus intricatus*, found in Britain only in two small woods on the edge of Dartmoor.

The oak woods are often notable for their wood ants and, as with other groups, northern *Formica lugubris* and southern *F. rufa* species meet in the English uplands. Woodland edges, very open glades and, in particular, broadleaved scrub are a very important habitat for a wide range of invertebrates in the uplands in that they can provide structural diversity and particularly warm microhabitats in the form of sheltered sun-traps and nectar sources. These habitats are particularly valuable for butterflies such as the heath fritillary *Mellicta athalia,* high brown fritillary *Argynnis adippe* and pearl-bordered fritillary *Boloria euphrosyne* in the south western peninsula uplands. The latter two species also use open scrub on calcareous grassland and coppice woodland on the carboniferous limestone around Morecambe Bay. The Duke of Burgundy butterfly *Hemearis lucina* uses cowslip and primrose plants in scrubby grassland in the same area and on the North Yorks Moors.



High brown fritillary

The netted carpet moth is another significant species which feeds on touch-me-not balsam in the woods of the Lake District; the orange underwing *Jodia croceago* is recorded from Dartmoor and the north Somerset coast and at least nine nationally scarce moths are associated with woodland in the south-west uplands. Upland juniper scrub supports a small number of upland species associated with this shrub, in particular the nationally scarce moths the juniper carpet *Thera juniperata* and chestnut coloured carpet *Thera cognata.* Both of these occur on juniper in the northern Pennines and Lake district, although the juniper carpet also occurs on the southern heathland juniper. Most other juniper feeding species of invertebrate occur only on juniper in the south of England. The nationally rare picture-winged fly *Platyparaea discoidea* is now almost entirely restricted to calcareous woodlands in the Craven Pennines where it feeds inside stems of giant bellflower *Campanula latifolia*, while the nationally rare fly *Pedicia robusta* occurs on Bodmin Moor.

Upland woods often support significant mollusc faunas. These include species restricted, in the lowlands, to top quality ancient woodland sites. Woodland molluscs are very prone to desiccation. The richness of uplands woods is mainly due to high rainfall, humidity and the cover of mosses. Snails include *Leiostyla anglica* (rare overall in Europe, with most of its range within Britain), *Zenobiella subrufescens, Spermodea lamellata* and *Ashfordia granulata* and the slugs *Limax tenellus* and *L. cinereoniger.* The same moist habitat supports the rare pill woodlouse *Armadillidium pictum* and local species *A. pulchellum*. Both occur in basic / calcareous woods in the uplands in the north and west. Abundant moss growing on trees can also support assemblages of local ground and rove beetles, false scorpions and craneflies while wet woodland soils, especially where calcareous, support rich cranefly and fungus-gnat communities.

Dead wood species are not well represented because the intensity of past coppice working has kept dead wood levels low. Dead wood levels are, however, now building up again because of the lack of recent management in many sites. Dead wood present within the old coppice stools can support a rich invertebrate fauna. One nationally scarce dead wood species that is more prevalent in the uplands, north and west, is *Hylecoetus dermestoides*, a beetle which bores into firm dead oak timber.

Further information: Kirby 1992.

8.4.6 Mammals, amphibians and reptiles

Upland woods are the last mainland refuge in England for the red squirrel *Sciurcus vulgaris* and efforts continue to try to prevent the establishment of grey squirrel *S. carolinensis* where not already present. Very large woods (in excess of 2000 ha) and composed mainly of coniferous species are likely to provide the best refuges for red squirrels because these provide the poorest habitat for grey squirrels. A diverse age structure is ideal with 50-60% of the trees being of cone bearing age. Young trees of 15-30 years provide good cover, and continuous belts of trees linking seed-bearing areas are desirable. In some areas coordinated control of grey squirrels by cage trapping may be desirable. Local squirrel projects should be contacted for details; Forestry Commission offices will have the relevant addresses.

In the south upland and upland fringe broadleaf woods with a good range of understorey shrubs can hold populations of dormice *Muscardinus avellanarius.* Young plantations are valuable habitats for small mammals, when there is a thick covering of ground vegetation. Later similar conditions may be provided along wide grassy rides. High populations of small mammals as well as being of value in their own right provide food for a wide range of predators.

Otters *Lutra lutra* may use riverside woodland strips and lines of trees. Native deer (roe *Capreolus capreolus* and red *Cervus elaphus*) occur in upland woods and both these and domestic stock (mainly sheep, ponies, cattle) can have very great impacts on the conservation management of the woods in both a positive and negative way. The main issue with deer is likely to be their control. Shooting and fencing combined with good forest design are the only generally effective methods.

Large upland woods in the north including conifer plantations, may become particularly important for pine marten *Martes martes.* Around 150 ha of woodland is needed for each territory, preferably with a range of ages and sizes of trees. Adjacent undisturbed rough moorland can provide places to which the animals retreat during forestry operations.

Newly planted forest can offer ideal habitats for reptiles. The early stages following digging of soils, especially where areas are ploughed, provide a wide range of topographical features and frequently a good flush of vegetation. The trees themselves, during the first five or so years, will ameliorate the climate at ground level (reducing wind chill). The large number of small mammals associated with these woods will also benefit snake populations. However, as the trees grow and the canopy begins to shade out ground vegetation, woodland especially coniferous plantations, become unsuitable for reptiles. Not only will the areas not sustain a population, but the forestry crop will create a barrier to dispersion. The value of woods for amphibians tends to be associated with the associated wetland areas, but they will disperse into and use woodland with a good ground cover and humid microclimate.

8.5 Habitat and management requirements of species of upland woodland and scrub

The habitat and management requirements of key upland woodland and scrub species are found in tables at the end of the chapter.

Further information: Fuller 1992, 1996; Fuller & Peterken 1995; Fuller & Warren 1993, 1995; Warren & Fuller 1993.

Management of upland woodland and scrub

8.6 Conservation objectives for habitats and species of upland woodland and scrub

8.6.1 Introduction

National government policies for forestry are aimed at:

- the sustainable management of our existing woods and forests;
- a steady expansion of tree cover to increase the many diverse benefits that forests provide.

These have been confirmed in the England Forestry Strategy which aims to encourage increases in:

- the role of forestry in the rural economy;
- the area of woodland created on derelict and former industrial land as well as a reduction in the cost of creating this woodland;
- the area of woodland available for access;
- the area of semi-natural and native woodland together with a reduction in the fragmentation of ancient semi-natural woodland;
- the resources available for forestry and woodland through new partnerships between public, private and voluntary sectors;
- integrated action across government to implement the strategy;
- people's involvement with England's woods and forests and a better understanding of the benefits they bring.

Sustainable forestry definitions based on the international forestry conferences held at Rio in 1992 and Helsinki in 1993 recognise that maintaining forest biodiversity is an essential part of the process and also that this must not be at the expense of important open ground habitats and species, whether associated with natural or cultural landscapes.

Further information: Forestry Commission 1998; HMSO 1994a; Kirby 1996b.

8.6.2 General objectives for upland woodland and scrub

General woodland conservation objectives are as follows:

- Maintain and expand (through restoration of replanted areas) the area of ancient semi-natural woodland with its distinctive plant and animal communities.
- Maintain and, if possible, enhance populations of rare woodland species.
- Maintain and enhance the populations of all native woodland species.
- Maintain the traditional range of native species and communities.

These are developed in the *Position statement on environmentally sustainable forestry and woodland management* produced by English Nature (1994b) (reconfirmed 1997):

- Ancient semi-natural woods are irreplaceable, and must be protected and managed so as to maintain and enhance their special character. The expansion of such woods on to adjacent land by natural regeneration should be encouraged.
- Many ancient woods have lost nature conservation value through being converted to plantations. Restoration of their native tree and shrub communities should be encouraged.
- More recent woods and plantations, especially semi-natural woodland, should also be managed so as to maintain and increase their value as wildlife habitat.
- Some woodland has grown up or been planted on important open ground habitats such as lowland heath, which is nationally and internationally scarce. Restoration of the former open habitat should be encouraged. An uplands example would be restoration of the Border Mires.
- New woodland should be created in appropriate locations, and the use of natural regeneration for this purpose should be encouraged. It is important that existing good wildlife habitat and features of geological and geomorphological interest are not damaged. New woodland in both uplands and lowlands should be targeted on land of low existing value for nature conservation and earth heritage features, such as arable farmland and intensive grassland, and located where it will do most to enhance the local habitat mosaic. More use should be made of locally native trees and shrubs, and woodland designs which favour wildlife. In the uplands bracken land and some acid grassland might also be suitable as sites for new woodland.

! In many woods management is necessary to maintain both timber production and nature conservation value. The use of management plans to coordinate economic, environmental and social objectives should be standard practice.

! There is also a case to allow some upland woods to develop naturally (ie minimum intervention) although often fencing would be required to exclude grazing.

The above apply across all upland Natural Areas.

Further information: English Nature 1994b; Good *et al* 1997; Kirby 1993; Kirby & Reid 1997.

8.6.3 Expansion of native woodland in the uplands

English Nature recognises that there is potential for some expansion in the uplands, and would welcome more new native woodland in most of the upland Natural Areas.

Within the uplands one of the reasons for wanting more woodland is to reduce the isolation of existing sites and to off-set the effects of past woodland fragmentation. New woodland can help to reduce such adverse effects by extending existing sites and by linking them up with others. New woodland formed next to existing woods or other features such as hedges and streams will also be richer than that created in isolated situations. However, the new woodland should avoid both the direct loss or increased isolation and fragmentation of other important habitats such as heather moorland. The following principles may help to judge the priority that should be attached to linking up existing woodland blocks.

! In areas that are rich in woodland and other semi-natural habitats, often with concentrations of SSSIs or other conservation areas, creating direct links between the woods is less critical than simply expanding the area of woodland and improving the management of what is there already. New woods, wherever they are put, are likely to be close enough to other semi-natural features for colonisation to be rapid, at least for the more mobile species.

! Where there are isolated patches of woodland, new woods should be added on to what exists. Existing woods and hedges should be encouraged to spread by natural regeneration on to suitable adjacent ground.

! In the long term there are parts of the country where widely separated blocks of woodland need to be linked to allow easier movement for species through the landscape. Initially this may be achieved more efficiently by creating a series of small stepping-stone woods through the gap rather than a single long thin corridor of woodland. A balance therefore needs to be struck between the advantages of linking up existing woodlands against the disadvantages of fragmenting other habitats.

! Some large new woods should be created as part of future forest expansion, but if they are in isolated locations they are unlikely to attract many of the specialist species that in theory would require large areas, because such species also tend to be poor colonists. Thus there may be a need to consider introduction or translocation of species in such circumstances.

Further information: Buckley & Fraser 1998; Good *et al* 1997.

8.6.4 Management objectives for woodland

No single management regime is correct for a given woodland type in all situations. Instead overall conservation objectives can only be met if a variety of treatments are applied to different woods, to provide the range of structures required by different groups of woodland species within the limited areas of woodland available. There is a need to bring together ideas on woodland expansion and the balance between different ways in which woods may be managed, with the needs of particular woodland types. The balance will also depend on how a wood has been treated in the past and its location. Boxes 8.1-8.3 indicate criteria for judging the likely value of restoring coppice or going for minimum intervention, two of the possible options.

Further information: Fuller & Peterken 1995; Fuller & Warren 1995.

8.6.5 Developing priorities for different woodland types

The various types of woodland feature are considered in turn below. Overall targets for maintenance and expansion of the four BAP priority types are set out in the relevant action plans and are being translated into indicative ones for different natural areas within the uplands.

Oakwoods. This was often managed as coppice in the past, but the future preferred management is likely to be high forest, either managed or minimum intervention, with only limited areas of coppice restoration. Most of the woods are grazed at present: some reduction in grazing is usually desirable, but complete and permanent exclusion of stock and deer is not always either possible or beneficial in conservation terms, particularly in the most oceanic woods. Rhododendron is a major threat to many sites and needs to be controlled / eliminated where possible (Tabbush & Williamson 1987).

Upland ashwoods. In the uplands the bulk of this is on the northern limestones, in the Dales and the southern Lake District (Morecambe Bay area). There is more scope and value in restoring coppice in some of these woods than in the oakwoods particularly as some have very good butterfly populations, but high forest (either managed and minimum intervention) is also likely to be beneficial. There is little benefit in keeping high levels of grazing in most of these woods.

Wet woodland. Alder *Alnus glutinosa*, willow and wet birch *Bertula* spp woodland is usually likely to benefit from minimum intervention with only light levels of grazing. Expansion of their area is desirable. In places there may be a case for clearing wet woodland, that has developed recently, to restore a more important open habitat. Such action needs to be well justified, since in the uplands all wet woodland is a scarce habitat and even recent examples may be very important for invertebrates.

Ancient wood pasture. Areas of veteran trees usually in a parkland setting tend to be less formal and less well-defined than in the lowlands. They are most likely to be found on the fringes of the uplands proper. Wherever it does occur the priority is to retain the existing old trees and to encourage a succession of younger ones which will eventually replace them. There is currently no national inventory

of these wood pastures, but it is likely that the highest concentrations in the upland Natural Areas are in the south-west, Welsh Borders and the margins of the Peak District.

Replanted ancient sites. Ancient woodland of a variety of types has been replanted, usually with conifers, but more locally with plantations of introduced broadleaves such as beech (outside its native range) and sycamore *Acer pseudoplatanus*. Restoration work is in its infancy and there are few studies as to how quickly the ground flora and other elements of the system can be restored (Kirby & May 1989; Radford 1998). The Habitat Action Plan targets include restoration from conifers to semi-natural woodland and much of this is likely to be in the uplands. Efforts should be concentrated on those woods that are most likely to show a strong response, for example:

- those that have only recently been replanted (during the last 30 years);
- where some of the former broadleaved cover and / or the ground flora survives within the crop;
- those with a species-rich ride system or other open habitats present which may serve as source of colonising species.

Scrub. Juniper scrub should be maintained where it occurs. Where stock is present, rubbing damage by grazing cattle or sheep can lead to the death of branches and whole bushes. Small mammals, hares and rabbits can also have a significant effect through the removal of young shoots and bark. Grazing, and also fire, can both play a part in juniper regeneration by creating bare soil where young plants can establish (Clifton, Ranner & Ward 1995). Care is required as heavy grazing of young seedlings, once established, will cause heavy losses while burning around existing bushes must be avoided.

Other scrub should be encouraged as part of the overall habitat mosaic, where it is not replacing more important open vegetation with the general aim of increasing its total extent. Spatial patchiness is an extremely important habitat feature for many plants and animals. Edges are particularly important and intimate mixtures of grass, scrub and woodland can be advantageous to insects (Mortimer *et al* 2000). In some cases the scrub may be a temporary stage that develops later into woodland; in other cases it may become a more-or-less permanent feature. In the higher upland areas we should seek to recreate areas of sub-montane scrub.

Recent plantations. These can contain a wide range of native species and habitat patches even where they are largely composed of introduced conifers. Some should be restored to open vegetation types - some 15,000-20,000 ha might be identified for conversion over the next 50 years. However, English Nature recognises and wishes to build on the diversity that exists in this new element in the landscape, particularly as its extent is likely to increase. Some uncommon species, particularly birds such as the goshawk, now have their upland strongholds in these plantations (Currie & Elliott 1997). As the forests are felled and restocked, opportunities exist to increase their structural diversity (without altering their main species) and to reduce their impact on, for example, the acidification of streams. Methods of assessing biodiversity within these new forests and setting targets for what should be achieved are being developed by the Forest Commission, and further work will be needed on this.

8.7 Managing upland woodland and scrub

The techniques used in the management of upland woods are likely to be broadly determined by whether they are being treated primarily for nature conservation, as part of a forestry regime, or are considered part of the agricultural holding. Nature conservation objectives must be integrated with other concerns to provide the basis for the long-term sustainable management of the woodland resource.

Key aspects to be considered for each woodland are:

- the impact on the overall species composition of the wood;
- the effects on the vertical structure (number of vegetation layers, ie ground, field, shrub, canopy);
- the effects on horizontal structure (variation between stands across the wood);
- what will happen to the amount of open space in the wood;
- what will happen to wet areas in the wood;
- implications for dead wood and old trees;
- management of large herbivores (usually deer and sheep);
- what will the wood be like if this approach is followed for the next 50 years?

In the big upland conifer plantations the aspects above should still be considered, but usually at a bigger scale of working. Further encouragement is needed to increase the use of native broadleaves on appropriate soils, some stands left as long-term retentions, more open space and the restoration of key open habitats such as bogs. Forest design plans should be used to encourage the development of structural variety at a landscape scale. The emphasis in the rest of the section is therefore on broadleaved woodland.

8.7.1 Management using forestry techniques

Silvicultural techniques can be used to create the types of structures and conditions that are needed from a nature conservation viewpoint and to meet the owner's objectives. Active management may be proposed, with the woods managed as coppice / coppice-with-standards or as high forest; high levels of grazing may be present as part of an ancient wood-pasture system or more commonly as a recent addition to former coppice woods; or sites may be assigned to minimum intervention. The effects of different systems and operations depend on the scale at which they are applied both in time and space. Boxes 8.1 and 8.2 illustrate the factors that should be used to judge the appropriateness of different options for particular sites, for example criteria in choosing either minimum intervention or coppice options. Box 8.3 compares different options in terms of which elements of the woodland system are likely to benefit or be disadvantaged.

Further information: Evans 1984; Forestry Commission 1994; Kirby 1984; Watkins 1990.

Box 8.1 Desirable characteristics for woods that are to be put into minimum intervention

- Large area
- Compact shape
- Little recent treatment or unnatural disturbance
- Few introduced species and no highly invasive ones
- No major external deleterious factors operating, eg spray drift from neighbouring agricultural land
- Not noted for rare or unusual species that depend on management for their survival on site
- Stable ownership
- Diversity of age structure.

Source: Kirby & Rush 1994

Further information: Mountford 2000; Peterken 2000.

Box 8.2 Criteria for or against restoration of coppicing of stands in ancient woods
(Note: individual woods may contain both coppiced and non-coppiced stands)

For coppice restoration:

- Woods with a history of coppicing and which have been cut over since 1900, preferably during the last 40 years.
- Woods in regions where coppice management has been common until recently.
- Woods likely to produce a diverse ground flora and / or food plants for invertebrates requiring open glades or young scrubby stands. Woods on base-rich or poorly drained soils are more likely to produce a rich response to coppicing than species-poor woods on acid soils.
- Woods with a wide variety of trees and shrubs or distinct patterns in their distribution and abundance. In many cases this diversity is likely to be best maintained by restoring coppice, rather than by allowing high forest to develop.
- Woods with large old coppice stools - a feature of interest in their own right.
- Woods with elements of open grassland, scrub or heath communities that have been largely lost from the surrounding landscapes.
- Woods particularly noted for rare and unusual species that depended in the past on coppice regimes.
- Practical considerations: deer damage on regrowth can be kept within bounds; or the coppice cycle once started can be kept going.

Against coppice restoration:

- Woods with communities of epiphytic lichens and bryophytes that may not tolerate the sudden changes in light and humidity associated with coppicing.
- Long-neglected woods that have developed a mature high forest structure with much dead wood and many veteran trees.
- Woods with high levels of either domestic or wild grazing animals which cannot be controlled easily (see Fuller & Peterken 1995 and Fuller & Warren 1995).
- Practical considerations: regrowth cannot be protected; or cycle cannot be maintained.

Preliminary estimates are that a two- to three-fold increase in the area of ancient semi-natural woodland that is being worked as coppice, ie to about 60,000-70,000 ha, should be the target for 2010. However, most of this is likely to be in the lowlands.

Box 8.3 Likely impact on selected nature conservation features of different management systems (from notes prepared by Dr G F Peterken)

This box summarises in general terms the impact of different management approaches on different elements of the woodland system. o = neutral impact; + positive; - negative. Note that in all cases the appropriate scale of management, type of coppicing, level of grazing is needed for the benefits to be realised. The significance of the impacts will also vary from situation to situation: at times regeneration may be critical; in other circumstances the maintenance of open space may be more important.

Different management types can be complementary in conservation terms. Although each may have negative aspects identified it does not mean that a particular type is undesirable because each have complementary positive aspects (Fuller & Warren 1995).

Minimum intervention stands

+ accumulation of dead wood as dead wood in old stools and pollards replaced by dead wood from branches, suppressed trees and dying underwood
+ mature stands
+ natural processes operate producing increasingly natural structure
+ irregularity of structure
- no young growth in the short term
- composition unstable
- invasive species may spread
- negligible or low gap creation rate for decades
- rides shaded; often with no permanent open spaces

Grazed upland woodland

+ usually some large dead wood
+ bryophyte carpets
+ mosaic of woodland and pasture common, especially on margins
+ mature stands
+ open understorey suits birds such as pied flycatchers, wood warblers
+ less shade on the tree trunks so better opportunities for lichen growth
+ light grazing reduces dominance of species such as bramble, greater woodrush *Luzula sylvatica* and so promotes species diversity
- lack of low shrubby cover limits populations of small mammals and many birds
- shrub stratum thinned
- regeneration lacking, or biased to shade-bearing shrubs ground vegetation dominated by grasses; woodland herbs mainly in stream sides and other inaccessible places

Wood-pasture, parkland or unenclosed forest

o soils sometimes podzolised
+ numerous old trees
+ much dead wood, particularly within old trees
+ mosaic of trees and open areas
- lack of succession of main tree species
- composition simplified to mainly oak and shrubs
- structure artificial
- ground vegetation strongly modified by grazing
- lack of low shrubby cover limits populations of small mammals and many birds

High forest, even aged, moderate to large wood

o summer-growing species predominate
o natural age structure is unusual
o temporary open space formed in pulses separated by decades
o rides semi-shaded; often totally shaded at end of rotation
+ mature structure which may be relatively natural at end of rotation
+ ground flora of woodland species
- composition simplified by planting and competition
- abrupt changes in composition are usual
- dead wood mostly of small dimensions
- soil drainage often made more effective

Coppice/coppice-with-standards, moderate to large wood

o ground flora biased to spring-flowering species
o stand composition biased to oak, shrubs and shade intolerant woody species
+ much young growth
+ diverse, semi-natural stand composition
+ stable stand composition
+ diverse structure within stands
+ temporary open space permanently present
+ high rate of gap creation
+ permanently open rides
+ long internal edges
+ ground flora of woodland species
+ dead wood in old stools and boundary pollards
- no mature stands
- few old trees and little fallen dead wood
- artificial stand structure

Box 8.4 Possible approaches to grazing management in upland woods

Using woodland vegetation to assess grazing level

Heavy grazing or browsing, look for:

- an absence of shrubs
- 'topiary' effects on remaining shrubs
- a browse line on mature trees
- ground vegetation <10 cm tall, mostly grasses and mosses
- tree seedlings not above ground vegetation height
- abundant dung from grazing animals

Moderate grazing or browsing, look for:

- patchy shrubs showing evidence of pruning or a browse line
- ground vegetation up to 30 cm, as a mixture of grasses, herbs or heaths. Localised close-cropped lawns where there is a concentration of grazing
- tree saplings projecting above ground vegetation in a few areas

Light or no grazing or browsing, look for:

- well developed shrub layer, with no obvious browse line
- a lush ground vegetation, where shrub layer is not too dense (eg 30-50% cover), dominated by grazing-sensitive species eg bramble and honeysuckle or greater woodrush
- ground mosses uncommon
- tree seedlings / saplings common in gaps.

Management scenarios

Site/management objective	*Appropriate management*
Promote tree regeneration on wood margins where it is restricted by bracken.	Use cattle, if available, to trample bracken and achieve a good seed bed; remove stock to allow seedling to establish, then change to light sheep grazing.
Promote regeneration and develop ground flora and shrub layers in a heavily grazed oak coppice with a gappy canopy and little understorey.	Initially (first 10 years) try complete exclusion of stock or deer; aim to reduce surrounding deer populations when fencing is removed.
As above, but where bryophytes are an important feature (wetter areas in west).	Total exclusion is undesirable as strong ground flora and understorey growth might shade out bryophytes; try fencing small area under canopy gaps or individual tree protection; reducing the level of grazing by deer culling or stock reduction would also be useful.
Promote regeneration in heavily grazed woodland with a closed canopy.	Regeneration may be limited as much by shade as by grazing. Reducing grazing may be unhelpful as a grass mat will develop over the potential seed bed; some gaps will need to be created in addition to other grazing measures (above).

Box 8.4 Possible approaches to grazing management in upland woods (cont.)

The appropriateness of individual techniques will thus vary with the site and the grazing species which is having most effect. Fencing against deer will not solve a rabbit grazing problem. The manager will, therefore, require a flexible approach which may have to be coordinated with other land users.

Techniques used in grazing management

! **exclusion of grazing animals from the wood by fencing (seasonal, rotational, etc)**
(Further information on forestry fencing in Pepper 1992)

Permanent exclusion may not be ideal for nature conservation and restricts value as stock shelter; fencing off smaller areas for 10 (or 20) years then moving the fenced area after regeneration can be successful and will maintain the grazed structure required by some plants and animals.

! **individual tree protection**

Using plastic tubes to protect trees will be successful provided they are the correct height (taller for red deer and cattle) and are maintained; ground flora is not protected by this means.

! **reducing density of grazing animals by culling (deer) or herd/flock reduction (domestic)**

Deer culling may need to be coordinated across wide areas to achieve significant results (eg through local Deer Management Groups organised under the England Deer Initiative).

! **reducing use of a wood by animals**

By building a winter barn for stock shelter; moving supplementary feeding areas out of woods.

Hawthorn

8.7.2 Management through grazing control

Large herbivores are a natural part of woodland systems and have effects on them from the landscape level down to their effect on the balance between bryophytes and higher plants in the ground flora. Many upland woods, even where not historically treated as wood-pasture, have been heavily grazed by stock over the last 100 years, and deer pressures are also increasing. In most woods therefore some reduction in grazing pressure is likely to be desirable, if not immediately, then at least at some time in the next 20 years. In some cases it may be appropriate to exclude stock completely to promote regeneration and allow the ground flora to develop.

How and when this is achieved depends on the particular objectives of management and whether it is domestic stock or deer whose pressure needs to be regulated. Box 8.4 sets out a series of possible models for grazing management that may help people to decide on appropriate measures for any particular wood. Temporary fencing around gaps, for example, may be appropriate where the primary concern is with regeneration; wholesale reduction of grazing pressure may be needed where impacts on the ground vegetation are significant. Maintenance of walls around woods may reduce the pressure from stock sufficiently that damage from deer browsing is light enough to be acceptable.

Where fences are used care needs to be taken in their siting to ensure that they do not lead to deaths of grouse through collisions (Currie & Elliot 1997).

Further information: English Nature 1996b, 1997c; Kirby,Mitchell & Hester 1994; Hester, Mitchell & Kirby 1996; Hester *et al* 1998; Mitchell & Kirby 1990; Mitchell *et al* 1996; Pepper 1992; Putman 1996.

8.7.3 Recreation and game management in upland woods and scrub

In most sites disturbance and damage from recreational use of woods tends to be localised, for example around popular beauty spots or along major trails. There may be more significant disturbance to some breeding birds; colonial nesters and raptors may be particularly at risk. Guidance based on forestry operations can be applied to likely impact of disturbance to nest sites in such circumstances.

Intensive pheasant rearing and release pens tends to be more of a lowland activity, but can be locally important on the upland fringe woodland. Widespread damage to semi-natural vegetation can occur in pens, around feeding areas and along rides and tracks, especially if straw is put down. Therefore pens and feeding areas should be located away from areas of nature conservation interest. There should be no introduction of non-native shrubs or use of straw bales to provide cover or shelter for the pheasants. There has been concern about predation on butterfly larvae although this impact has not been proven.

Further information: Anderson & Radford 1992; Carroll & Robertson 1997; Currie & Elliot 1997.

8.7.4 Burning in upland woodland and scrub

Burning is commonly used on the open moor to manage grouse habitat and improve the grazing for sheep. This practice has prevented the natural spread of woodland over a long period. Burning has no place at all in the management of broadleaved woods and fires should not be allowed to run into them. If fires get into coniferous stands major commercial damage will be caused.

There may be some case for very small-scale controlled burning to promote the regeneration of juniper scrub: for example Tynron juniper wood in southern Scotland regenerated well after fire. This should not normally be considered, however, where the fire would affect existing juniper bushes. At one site regeneration was stimulated in a different way; the bushes were cut and dragged across the site.

Further information: Clifton, Ranner & Ward 1995

8.7.5 Techniques to re-create upland woodland and scrub

Ancient semi-natural woods cannot be re-created, but there is an increased interest in creating new species-rich and semi-natural woodland, to diversify upland plantations and as 'new native woods' in their own right. In the National Parks there is a specific programme to promote new native woodland run by both the Forestry Commission and the National Parks Authority. This is currently supported by a specific 'challenge fund' element to the forestry grants.

New woodland is best created or encouraged on sites which are adjacent to other woodland or semi-natural vegetation (stream sides, hedges, rock outcrops) from which species may colonise the new wood. Very nutrient-rich soils, for example on old arable, are unlikely to develop an interesting woodland flora quickly because of competition from tall grasses and weedy species. Occasionally there will be circumstances where stripping off the topsoil should be considered. This is, however, unlikely to be the case in the uplands. Variations in geology, topography or drainage on the site provide for potentially greater variation in the wood that develops.

Allowing a new wood to develop by natural regeneration often produces the most varied and species-rich result. It also helps to perpetuate the local genetic stock of native trees. The higher the altitude and the more exposed the site, the longer it may take for colonisation to occur, even in the absence of grazing. Some forms of dense vegetation such as deep bracken *Pteridium aquilinum* beds may also slow down colonisation.

If local seed sources of native trees and shrubs are lacking it may be necessary to plant them. The following planting procedures help to mimic the patterns that occur in semi-natural woodland.

- Use mixtures of native species rather than single species stands.
- Use groups (10-30 m across) rather than line mixtures.
- Include shrubs as well as trees.
- Leave 20% of the ground unplanted.

! Vary the planting density from blocks where 2 x 2 m spacing is used to others with 10 x 10 m or wider spacing. The wide spaces leave scope for future natural regeneration and the creation of an uneven aged stand while the denser plantings create shade conditions more rapidly in which a 'woodland' flora may develop.

Techniques for introducing other elements of the woodland system, such as ground flora, invertebrates and dead wood, are being explored, but are not sufficiently well established to be recommended. Creating woodland in this way is not a substitute for retaining existing semi-natural stands.

Further information: Good *et al* 1997; Rodwell & Patterson 1994; Thompson *et al* 1999; Watkins 1991.

Table 8.1 Some nationally rare and scarce vascular plants associated with upland woodland and scrub

Plant species	Status	Habitat requirements	Management requirements	Distribution by upland Natural Area
Aconitum napellus monk's-hood	LR-ns	Shady wet hazel *Corylus avellana*, alder and oak woodland, mostly near or along the banks of streams. Occasionally found where there are only scattered trees.	! Protect sites from drainage. ! It is poisonous to stock.	Clun & North-West Herefordshire Hills Shropshire Hills
Actaea spicata baneberry	LR-ns	Woods, grikes and shaded ledges on limestone. It will tolerate dense shade, but not competition from more vigorous plants, for example bramble.	! Where populations seem to be threatened by more competitive species, these should be controlled. ! It is reputed to be toxic to stock.	Yorkshire Dales Cumbria Fells and Dales North York Moors and Hills
Bromopsis benekenii lesser hairy-brome	LR-ns	Woods on shallow limestone or other calcareous soils in steep valleys, in deciduous woods, woodland margins and scrub, on moderate humus in light shade. This species is hard to identify and is thought to be under-recorded.	! Protect sites from habitat destruction.	Yorkshire Dales Shropshire Hills

Plant species	Status	Habitat requirements	Management requirements	Distribution by upland Natural Area
Campanula patula spreading bellflower	LR-ns	Open woodland, wood borders and rock outcrops. On disturbed ground on grassy banks by rivers or roads, in hedgerows, edges of fields, woodland and scrub and green lanes; on dry, sandy stony or loamy soils. It requires some warmth and favours dry, well-drained, sunny, mildly acidic to neutral sites with a low nutrient status. It can tolerate partial shade but not competition; any management which favours a closed sward is damaging (K. Hearn pers comm). It is intolerant of heavy grazing but may persist in lightly grazed places such as open horse-grazed swards and orchards. It is seldom found far from ancient woodland. The seed, which appears to be long-lived in the soil, may need disturbed and sunny ground to germinate; plants can reappear in old stations following disturbance of the soil. The increased use of agricultural fertilisers and herbicides and the cessation of traditional woodland management, including coppicing, have contributed to its decline.	! The use of chemical fertilisers or pesticides should be avoided. ! Sites where woodland or tall vegetation have developed should be cleared by careful cutting, to open up the vegetation and provide bare soil for germination. ! Sites where the species is known to have grown in the past would also benefit from this management. ! Where sites are or have been grazed, light or moderate levels of grazing should be maintained.	Black Mountains and Golden Valley Clun and North West Herefordshire Hills Shropshire Hills
Cardamine impatiens narrow-leaved bitter-cress	LR-ns	Shady woodland, rocks, grikes, screes, banks of rivers and streams, or damp roadsides, often on moist limestone soils. Dormant seed can retain their viability buried in the soil for many years and populations can be unpredictable in appearance. In woodland, it can appear in cleared sites after felling, thrive for two to three years, and then dwindle leaving no plants but a renewed seed bank.	! Where relevant, protect sites from drainage.	Yorkshire Dales Clun and North West Herefordshire Hills Shropshire Hills White Peak Cumbria Fells and Dales Dark Peak

Plant species	Status	Habitat requirements	Management requirements	Distribution by upland Natural Area
Carex digitata fingered sedge	LR-ns	Open woods and on scree and the shaded ledges of limestone quarries.	! Protect sites from habitat destruction.	Cumbria Fells and Dales North York Moors and Hills Pennine Dales Fringe Shropshire Hills White Peak
Carex elongata elongated sedge	LR-ns	Usually in sites which flood in winter and dry out in summer.	! Protect sites from habitat destruction.	Cumbria Fells and Dales
Carex flava large yellow sedge	VU	One site along the transition between the base of a limestone slope supporting ash woodland and the edge of a raised mire supporting downy birch *Betula pubescens-Molinia* woodland. The peaty mineral soil is kept moist by seepage from neighbouring limestone outcrops. In light shade.	! Selective felling and thinning of the canopy have allowed the population to increase. ! Protect the hydrological conditions at the site to maintain water levels and water quality.	Cumbria Fells and Dales
Cephalanthera longifolia narrow-leaved helleborine	LR-ns SCC	Woods on hard limestone, often under ash, oak or beech *Fagus sylvatica.* Often on steep slopes where the canopy of trees is naturally thin and patchy, including limestone gorges and woodland on limestone ridges or outcrops. Also in woodland rides and margins. It is light-demanding, but not adapted to rapidly changing light intensities such as occur in coppicing regimes. The species is thought still to be vulnerable to damage by collecting, but most of its decline is attributed to natural, changes in woodland composition and changes in forestry which result in reduced levels of insolation.	! Research is needed into the best methods to manage sites of this species.	North Pennines

Plant species	Status	Habitat requirements	Management requirements	Distribution by upland Natural Area
Circaea alpina Alpine enchanter's-nightshade	LR-ns	Open and usually shaded or north-facing seepage areas and stream sides. In the Lake District, it is characteristic of rocky, bryophyte-rich submontane sessile oak *Quercus petraea* woodland. The main method of reproduction is probably by rhizome but it does fruit freely. It may have declined due to competition with the closely related and much more vigorous hybrid, *C.* x *intermedia*.	! Protect sites from drainage.	North Pennines White Peak Yorkshire Dales Cumbria Fells and Dales
Corallorhiza trifida coralroot orchid	LR-ns	Amongst moss cushions and thick leaf mould in damp pine plantations and birch woods and in willow and alder carr. It seems to have exacting requirements for the water table. The plants are saprophytic and, except for a few weeks flowering, survive as underground rhizomes. Fluctuating numbers of flower spikes can make populations appear to vanish in some years.	! Protect sites from changes in surface or ground waters.	Border Uplands Yorkshire Dales Forest of Bowland
Cypripedium calceolus lady's-slipper orchid	Annexes II + IV CR Priority Sched 8	On well drained soil in herb-rich limestone grassland on a fairly steep slope adjacent to woodland.	! Continue to protect the site from unauthorised interference and disturbance by gardeners and botanists. ! Continue to control levels of grazing to avoid heavy grazing pressure. ! The species is covered by the Species Action Plan (UK Steering Group 1995), the Lady's Slipper Orchid Advisory Committee and by a species recovery project, which is reviewed annually and includes the use of wardening and techniques of micropropagation.	Yorkshire Dales

Plant species	Status	Habitat requirements	Management requirements	Distribution by upland Natural Area
Daphne mezereum mezereon	LR-ns	Woodland on calcareous soils. It probably requires open ground for germination; as a dense canopy develops, it may fail to flower. Native populations have declined, perhaps because of habitat destruction and collecting.	! Protect sites from destruction of the habitat. ! Where the woodland canopy has become closed, selected thinning may be beneficial. ! The plant is poisonous.	Yorkshire Dales Cumbria Fells and Dales White Peak
Epipactis atrorubens dark-red helleborine	LR-ns	Carboniferous and magnesian limestone woodland and grikes, also scree. Tends to be associated with open glades, wood-edge and scrub rather than closed-canopy woodland.	! Protect sites from habitat destruction.	Yorkshire Dales Cumbria Fells and Dales North Pennines White Peak
Epipactis leptochila var. *leptochila* narrow-lipped helleborine	LR-ns	Under birch on well drained stony substrates kept open through such influences as the presence of lead and zinc tailings, runways of old aerodromes and coal spoil. It is a perennial species which irregularly appears above ground; subterranean population sizes may be more stable and much greater. In the north, where most upland populations are found, it appears in temporarily disturbed sites but fails to flower and then disappears as shade increases with development of tall vegetation, scrub and woodland.	! Where populations are threatened by the growth of taller plants, these should be cleared.	Border Uplands North Pennines Pennine Dales Fringe Shropshire Hills
Epipactis phyllanthes green-flowered helleborine	LR-ns	Bare, dry shaded sites under trees on well drained, usually somewhat acidic soils with relatively low humus content. It disappears from well known sites and appears in totally new areas in an unpredictable manner; site occupancy rarely exceeds 30 years.	! Protect sites from habitat destruction.	Border Uplands Pennine Dales Fringe Shropshire Hills
Epipactis youngiana Young's helleborine	Sched. 8 of WCA EN, EE Priority	Woodland on heavy, often heavy-metal-polluted soils, but the habitat requirements are not clearly understood.	! Protect the remaining populations from habitat loss and damage, such as clear-felling or extraction of spoil. ! See Species Action Plan (UK Biodiversity Group 1998).	Border Uplands

Plant species	Status	Habitat requirements	Management requirements	Distribution by upland Natural Area
Equisetum pratense shade horsetail	LR-ns	River banks.	! Protect sites from habitat destruction.	North Pennines
Euphorbia hyberna Irish spurge	VU	Ancient, formerly coppiced, oak woodland, in openings and other places which receive dappled sun. It grows and flowers early, before the trees are in full leaf; individual plants can live for at least 20 years.	! Protect sites from destruction of the habitat.	Exmoor and the Quantocks
Goodyera repens creeping lady's tresses	LR-ns	In a moist layer of moss and pine-needles in coniferous woodland, both semi-natural and planted, usually with Scot's pine *Pinus sylvestris* and some birch. Within colonies, vegetative reproduction seems to predominate, by stolons spreading just below the surface of the moss. It is vulnerable to clear-felling and replanting with different conifers and is also susceptible to shading by scrub and brambles.	! Protect sites from clear-felling and unsuitable replanting. ! Where populations are threatened by encroachment of scrub or brambles, these should be controlled by cutting.	Border Uplands North Pennines
Helleborus foetidus stinking hellebore	LR-ns	Shallow soil over calcareous clay. It grows in both exposed and partially shaded places but rarely in deep shade and it avoids dense competition. Where surrounding vegetation creates a humid atmosphere in winter, growth and reproduction are significantly reduced by fungal attack. Spread to new sites is limited. Many hedgerow sites have been lost to hedgerow removal, herbicide drift and damage by tractors during flailing of hedges.	! Hedgerows containing important populations of this species should be protected from destruction, from drift of agricultural chemicals and careless trimming of hedgerows. ! Wherever possible sites should be protected from habitat destruction.	Oswestry Uplands

Plant species	Status	Habitat requirements	Management requirements	Distribution by upland Natural Area
Hordelymus europaeus wood barley	LR-ns	On calcareous wood banks and hedgerows, often on or near mediaeval boundary banks. Typically under light shade such as high elm *Ulmus glabra* canopies or shrubs near the edge of a wood. It persists in woods that are managed by coppicing or periodic clear-felling	! Protect sites from habitat destruction.	Border Uplands Cumbria Fells & Dales Yorkshire Dales North Pennines North York Moors and Hills Pennine Dales Fringe Shropshire Hills White Peak
Impatiens noli-tangere touch-me-not balsam	LR-ns	In woods in damp, nutrient-rich soil in stream side silt, mainly under alder and oak, and valley seepage areas under oak and sometimes ash. The seeds probably have only a short viability and there is little evidence of a seed bank.	! All sites should be protected from habitat destruction and from changes in levels of surface and ground waters.	Border Uplands Clun and North West Herefordshire Hills? Cumbria Fells & Dales Shropshire Hills
Maianthemum bifolium May lily	VU SCC	In the ground layer of oak-birch woods on well drained acidic soils. It is tolerant of shade, and at one site management to create dappled rather than total shade has been successful in encouraging the vegetative spread of May lily. This was achieved by removing holly *Ilex aquifolium* from the site.	! Where the spread of plants is thought to be limited by heavy shade, consideration should be given to opening up but not completely removing the canopy.	North Pennines North York Moors and Hills
Melittis melissophyllum bastard balm	LR-ns	Within and at the edges of woodland, on hedge banks in sheltered river-valleys and in scrub, on moisture-retentive, base-rich soils. It responds well to coppicing and can be abundant in cleared areas of woodland. It appears to benefit from high humidity and light shade. Populations can be large, especially in wooded areas, if the habitat is kept somewhat open.	! Protect sites from habitat destruction. ! Sites which have become overgrown with dense trees or scrub may benefit from coppicing or clearing.	Bodmin Moor Dartmoor Exmoor and the Quantocks

Plant species	Status	Habitat requirements	Management requirements	Distribution by upland Natural Area
Orobanche rapum-genistae greater broomrape	LR-ns SCC	A root parasite of leguminous shrubs, especially broom and gorse, in hedge banks and scrubby areas on rough hillsides. Its vigour is often increased after burning of the host plants. Colonisation of new sites is rare. The parasitic lifestyle of the broomrape can fatally reduce the vigour of its host, even leading to its own extinction from sites where its host is not abundant. Scrub clearance may have led to the species decline. The species can reappear when afforested areas are opened up, as for example in southern England following the great storms of 1987.	! Ensure that the population of the host plants is healthy, with plants of a range of ages. ! Where sites have become overgrown by trees, selected clearing may restore the broomrape. ! At some sites, controlled burning of the host plants may be beneficial.	Border Uplands Clun and North West Herefordshire Hills Cumbria Fells and Dales Dartmoor Exmoor and the Quantocks North Pennines Shropshire Hills
Orobanche reticulata thistle broomrape	Sched. 8 of WCA LR-nt SCC	Parasitic on thistles *Cirsium* and sometimes *Carduus* species in clearings in woodland and scrub on calcareous soil. Appears to avoid the most dense patches of thistles and may require high levels of light for germination. It is thought that rivers may be important to the species for dispersal of seed.	! The main host plant, *Cirsium arvense*, is a notifiable weed. Where control by herbicides is unavoidable, patches should be controlled in rotation so that there are always some expanding colonies of thistle. ! Scrub and woodland should be controlled so that the thistles and broomrape have enough light. ! Protect sites from damage by developments such as flood defence works and gravel extraction. ! Continue the experimental management and monitoring at a woodland site.	Pennine Dales Fringe

Plant species	Status	Habitat requirements	Management requirements	Distribution by upland Natural Area
Physospermum cornubiense bladderseed	VU SCC	Open woodland, European gorse scrub on heaths, rough grassy slopes (often in stream valleys), scrubby *Molinia* heath and roadside banks where there is sheltering scrub or woodland. It does well in open habitats but fails to flower in dense shade and plants heavily overgrown with other vegetation may not even produce leaves. The rootstock, however, can be remarkably persistent and seed can remain viable in the soil for many years: after burning or clearance, hundreds of plants can appear. Factors contributing to its decline have been agricultural neglect, including the cessation of gorse-cutting, regular burning and grazing, as well as changes in woodland management such as lack of clearance, afforestation and tree-planting accompanied by heavy use of herbicides.	! The best management will be different at different sites, but in general should be such as to create and maintain open vegetation. ! The creation of clearings on a five-year cycle has been found to benefit the species in one wood.	Bodmin Moor
Polemonium caeruleum Jacob's-ladder	LR-nt SCC	Cool, moist, north-facing slopes of Carboniferous limestone, often with an open canopy of ash, also on clay soils along river banks. Grassland species in the Peak District. It is sensitive to drought and relies on a damp microclimate, often on damp north-facing slopes with a light canopy of trees or scrub, on thin organic soils. Grazing suppresses flowering and is thought generally to be undesirable, but on those sites prone to succession to woodland, very light and occasional grazing might be needed to maintain the appropriate structure of the vegetation. Cattle are thought to cause less damage than sheep.[1]	! The following management prescriptions are thought appropriate but are still experimental. ! Where sites are part of grazing units, grazing by cattle between early September and the end of December for one in every three years; density of stock should be low enough to prevent poaching. ! Occasional mowing or strimming, for example once every three years, may be a substitute where grazing is not practicable. ! Where populations are confined by grazing to ledges, fencing off the adjacent vegetation and reducing grazing there may allow the population to expand. ! Where plants grow in dense shade, thinning of the canopy may benefit the plants.	Border Uplands Yorkshire Dales White Peak

Plant species	Status	Habitat requirements	Management requirements	Distribution by upland Natural Area
Polygonatum odoratum angular Solomon's-seal	LR-ns	Ancient woodland on limestone and limestone pavement, well drained steep slopes or small cliffs. Plants do not appear readily able to colonise new sites.	! Protect sites from quarrying of limestone and removal of limestone pavement.	Yorkshire Dales Cumbria Fells and Dales White Peak Border Uplands
Pyrola media intermediate wintergreen	LR-ns	Damp mossy habitats in old woods or plantations, also in heaths under *Calluna* and *Vaccinium myrtillus.* Mildly acidic to slightly basic, well drained soils. The species can recover successfully following moorland fires. Some colonies have been lost to afforestation. Grazing which is heavy enough to damage the dwarf shrub heath under which this species sometimes grows would be expected to damage it.	! Sites that are grazed should be grazed only lightly. ! Sites should not be planted with non-native trees.	North Pennines North York Moors and Hills
Pyrola rotundifolia subsp. *rotundifolia* round-leaved wintergreen	LR-ns	Damp, calcareous habitats, often under a canopy of willows or pine. It is reliant on mycorrhizal fungi for seedling growth and establishment.	! Maintain the water regime, including water quality and periodicity of water levels.	Shropshire Hills White Peak Yorkshire Dales
Ribes alpinum mountain currant	LR-ns SCC	An under-shrub of steeply sloping ash woodland on Carboniferous or, more rarely, magnesian limestone, which often forms trailing mats over the edges of vertical rocks and small cliffs and in ravines. Most colonies are in the sheltered, damper dale bottoms. It is a dioecious species which requires both species to be present for good seed to be set; it can spread vegetatively and by fruit dispersal. Seedlings thrive only where grazing and competition from other shrubs are removed.	! Where populations are thought to be threatened by grazing or larger shrubs, these should be removed.	Yorkshire Dales North York Moors and Hills Pennine Dales Fringe South West Peak White Peak Yorkshire Dales

Plant species	Status	Habitat requirements	Management requirements	Distribution by upland Natural Area
Ribes spicatum downy currant	LR-ns	Rocky woods on basic soils, usually over Carboniferous limestone, in scrubby woodland and in the deeper grikes of limestone pavement. Also along streams and rivers in wooded ravines and where a thin strip of trees has been left along rocky river banks. The species is hard to identify except when in flower and is thought to be under-recorded.	! Protect sites from habitat destruction.	Border Uplands Yorkshire Dales North Pennines Pennine Dales Fringe Cumbria Fells and Dales
Sesleria caerulea blue moor-grass	LR-ns	Limestone ash woodland (but may also form extensive stands of open grassland).	! Protect sites from habitat destruction.	Border Uplands Cumbria Fells and Dales Pennine Dales Fringe North Pennines White Peak Yorkshire Dales
Sorbus anglica	E SCC VU	Scrub and woodland, mainly on Carboniferous limestone.	! Protect sites from habitat destruction and damage to individual trees.	Exmoor and the Quantocks Oswestry Uplands
Sorbus devoniensis	LR-ns	Hedgerows on non-calcareous Devonian and Carboniferous shale, slates and grits, also in steep rocky oak scrub over Old Red Sandstone. Occasionally in scrubby heath and moorland. The species establishes readily from seed and young trees are frequent in suitable habitats.	! Protect sites from destruction of the habitat and of individual trees.	Dartmoor Exmoor and the Quantocks
Sorbus lancastriensis	LR-nt, EE	Rocky scrub and woodland on Carboniferous limestone.	! Protect sites from habitat destruction and damage to individual trees.	Cumbria Fells and Dales
Sorbus subcuneata	VU, EE	In open rocky woodland of sessile oak on Old Red Sandstone. It reproduces from seed, which are abundant in good years, and young trees are frequent.	! Protect sites from habitat destruction and damage to individual trees.	Exmoor and the Quantocks

Plant species	Status	Habitat requirements	Management requirements	Distribution by upland Natural Area
Sorbus vexans	VU, EE	Open woodland of sessile oak on steep slopes of Old Red Sandstone or slate near the sea. Seed are abundant in good years, and small trees are frequent. It will also regrow from the base following damage.	! Protect sites from habitat destruction and damage to individual trees. ! Where *Rhododendron ponticum* also grows at the site, its spread should be controlled.	Exmoor and the Quantocks
Thelypteris palustris marsh fern	LR-ns	Mesotrophic mires, fens and fen carr.	! Protect sites from habitat destruction.	Dark Peak Yorkshire Dales
Tilia platyphyllos large-leaved lime	LR-ns	Usually a large tree or coppice stool in old woodland with a mixed canopy, also on ledges of cliffs. Mostly on calcareous soils; more rarely on acid soils derived from volcanic rocks. It is very long-lived, probably reaching 500-700 years of age, and reproduces vegetatively by shoots from the base of the trunk or fallen branches. Fruits are usually fertile and seedlings are frequent, although saplings are rare. Saplings survive in deep shade but strong growth of young trees occurs mainly in gaps. It is tolerant of neglect and is lost only when woodland is grubbed out. Young coppice growth and seedlings are intolerant of grazing.[2]	! Protect sites from habitat destruction and damage to individual trees. ! Young growth which is accessible to livestock should be protected from grazing.	Black Mountains and Golden Valley Clun and North West Herefordshire Hills North York Moors and Hills Pennine Dales Fringe Shropshire Hills White Peak

Key to status

Annex IIb - listed on Annex IIb of the EC Habitats and Species Directive
Sched. 8 of WCA - listed on schedule 8 of the Wildlife & Countryside Act.

Red list categories

CR - critically endangered
EN - endangered
VU - vulnerable
DD - data deficient
LR -nt - lower risk - near threatened
LR-ns - lower risk - nationally scarce
E - endemic to Great Britain

EE - endemic to England.

Biodiversity Action Plan (BAP)

Priority - Priority species from UK Steering Group 1995 and UK Biodiversity Group 1998.

SCC - Species of conservation concern from UK Steering Group 1995 and UK Biodiversity Group 1998.

Sources

Most information from Hodgetts, Palmer & wigginton 1996; Porley & McDonnell 1997; Stewart, Pearman & Preston 1994 and Wigginton 1999.

1. Rich 1997.
2. I. Taylor, pers comm.

Jacob's ladder

Table 8.2 Nationally rare and scarce bryophytes associated with upland woodland and scrub

Plant species	Status	Typical habitat	Distribution by upland Natural Area
Amblystegium jungermannioides	LR-ns	Damp basic rocks and rock crevices in shaded locations, often in moist woodlands or wooded ravines, but also on montane rocks. On limestone, calcareous sandstone and schist and occasionally on tufa or other basic rocks. Also on basic soil on rock surfaces or in crevices.	Yorkshire Dales White Peak
Anastrophyllum hellerianum	LR-ns	A dwarf and often inconspicuous species of damp rotting, usually decorticated logs and stumps in shady situations in subalpine woodlands and wooded ravines.	Cumbria Fells and Dales
Brachythecium appleyardiae	LR-nt, EE Priority	On shaded rocks of Carboniferous Limestone, on a thin layer of soil overlying rock-ledges in wooded valleys.	White Peak
Brachythecium salebrosum	LR-ns	On rotting wood in wet shady woodlands.	Southern Pennines
Buxbaumia aphylla	LR-ns	A calcifuge of sporadic and often ephemeral occurrence. See Table 6.2.	Shropshire Hills Southern Pennines
Calypogeia integristipula	LR-ns	Rocks in woodland and other shaded sites. See Table 10.2	Border Uplands North Pennines South West Peak Yorkshire Dales
Campylium calcareum	LR-ns	A strong calcicole, growing on limestone rocks, on flints, on roots and stumps and on hard basic earth in well drained situations, often in deep shade. Rarely on walls.	Border Uplands North Pennines North Yorkshire Moors & Hills White Peak Yorkshire Dales
Campylium elodes	LR-ns	Calcareous swamp woodland, sometimes on tree-bases.	Cumbria Fells and Dales Yorkshire Dales

Plant species	Status	Typical habitat	Distribution by upland Natural Area
Cephalozia catenulata	LR-ns	On damp, rotting tree-trunks in humid woodlands in the west. Also on peaty soil and banks, often in sheltered rocky ground.	Border Uplands Cumbria Fells and Dales Dartmoor North Yorkshire Moors & Hills Southern Pennines Yorkshire Dales Bodmin Moor
Cryptothallus mirabilis	LR-ns	A parasitic liverwort of wet acid peat, growing a few centimetres below the soil surface. Most commonly under *Sphagnum* in boggy birch woods, but also between the tussocks in wet *Molinia* communities and under *Pellia*.	Cumbria Fells and Dales Dartmoor Distribution not well known.
Dicranum flagellare	LR-ns	On decaying logs and stumps in woods.	Yorkshire Dales
Dicranum polysetum	LR-ns	A lowland species found principally on the ground in coniferous (especially *Pinus*) woods and plantations, but also in birch woodland, on heaths and in raised bogs. It appears to be spreading.	Cumbria Fells and Dales Pennine Dales Fringe
Dumortiera hirsuta	VU	Forming extensive patches on well shaded, continuously moist and often dripping rocks and steep banks of soil in wooded glens at low elevations. Tends to favour mildly basic substrates.	Exmoor and the Quantocks
Ephemerum sessile	LR-nt SCC	An ephemeral species of neutral and acid soils, mainly on woodland rides and on mud at the edge of reservoirs.	Border Uplands Dark Peak Exmoor and the Quantocks Forest of Bowland
Eurhynchium striatulum	LR-ns	A strict calcicole confined to chalk and limestone, where it grows on dry, shaded stones, rocks, walls and tree-roots.	Cumbria Fells and Dales White Peak Yorkshire Dales

Plant species	Status	Typical habitat	Distribution by upland Natural Area
Fissidens limbatus	LR-ns	On calcareous to slightly acid substrates in sheltered but not wet habitats, growing on compacted soil or on thin soil over rock. Most frequent on banks in woods and hedgerows or by streams and ditches, especially near the coast. Also on shaded boulders, on mortar in stone walls, on soil between limestone rocks and in rabbit-holes.	Cumbria Fells and Dales Exmoor and the Quantocks Forest of Bowland White Peak
Fissidens taxifolius subsp. *pallidicaulis*	LR-ns	On rocky stream-banks.	Cumbria Fells and Dales
Habrodon perpusillus	EN	A slender epiphyte, found in tightly appressed patches or occasionally creeping through other bryophytes on well illuminated trunks or branches of trees and shrubs, usually on basic bark, sycamore being the most frequent host with records also from ash, elm and more rarely aspen *Populus tremula*, birch, blackthorn *Prunus spinosa*, elder *Sambucus nigra*, hawthorn, lime *Tilia* sp, oak and willow.	Forest of Bowland
Hennediella macrophylla[1]	LR-ns	Shaded trampled ground, in cultivated flower beds and under trees on river banks.	Border Uplands
Hennediella stanfordensis	LR-ns	On shaded, trampled ground by footpaths and under trees on the banks of rivers.	Shropshire Hills
Homomallium incurvatum	EN	A calcicole on rocks, walls or sometimes soil-banks in sheltered and shaded situations in valley woodlands, particularly on limestone.	Yorkshire Dales
Jamesoniella autumnalis	LR-ns	Favours damp, decaying, decorticated logs and stumps in oak or birch woods on steep, block-strewn slopes with a range of aspects. Also occurs on damp, shaded acid or mildly basic blocks and low outcrops of rock that are periodically flushed in sheltered oak or mixed oak-birch woods, wooded valleys and on steep slopes.	Bodmin Moor Cumbria Fells and Dales Dartmoor

Plant species	Status	Typical habitat	Distribution by upland Natural Area
Jubula hutchinsiae	LR-ns	As pure, dark green patches in shady rock crevices in cascading streams. It sometimes occurs epiphytically on other bryophytes in dripping caves by waterfalls and in wooded ravines. It occurs on a wide range of rock types including limestone but is very rare on the most acidic rocks.	Cumbria Fells and Dales Dartmoor Southern Pennines
Jungermannia leiantha	EN	On wet rocks and flushes in woodland and other shaded habitats, most of the records being from sheltered valleys and ravines. The wide variety of rock types includes sandstones, shales and slates, but always with some base content.	Yorkshire Dales
Kurzia sylvatica	LR-ns	Occasional in woodland. See Table 6.2.	Border Uplands Cumbria Fells and Dales South West Peak
Leptodon smithii	LR-ns	An epiphyte of tree-boles in woods, parks, churchyards, on roadsides and in hedgerows, also occurring on branches of shrubs in laid hedges. It is most frequent on hosts with acid bark, commonest until recently on elm. It is also often found on ash and sycamore and sometimes recorded from beech, elder, field maple *Acer campestre*, hawthorn, lime, oak, poplar *Populus* sp, rhododendron *Rhododendron ponticum*, sallow and spindle *Euonymus europaeus*. It is notably tolerant of dry shade and can grow on the underside of leaning trees. Rarely on walls and calcareous rocks.	Cumbria Fells and Dales Exmoor and the Quantocks
Leucobryum juniperoideum	LR-ns	Most records are from acidic oak and beech woodland. It is sometimes locally abundant, forming dense cushions at soil level and extending onto rock outcrops, tree bases and occasionally stumps, trunks and branches. It has also been found in wooded ravines, sweet chestnut *Castanea sativa* coppice, conifer woodland and rarely in open habitats such as heathland. Poorly drained soils are generally avoided.	Bodmin Moor Forest of Bowland South West Peak Yorkshire Dales
Lophozia longidens	LR-ns	On the bark of living trees in sheltered situations, sometimes also on rocks.	North Pennines

Plant species	Status	Typical habitat	Distribution by upland Natural Area
Lophozia obtusa	LR-ns	Basic turf, flushes and woods. See Table 6.2.	North Pennines
Myrinia pulvinata	LR-nt	Confined to tree-boles and roots, often of alder, on banks in the middle and lower reaches of streams and rivers where there is a well defined flood zone. Usually embedded in silt or sand.	Shropshire Hills
Orthotrichum pallens	CR Priority	On the bark of ash, hazel, sycamore, willow and wych elm, often in rather open sites such as river sides.	Dark Peak
Orthotrichum sprucei	LR-ns Priority	Confined to the exposed roots, trunks and branches of trees and shrubs by streams and rivers, growing above the normal water-level in a zone which is usually dry but liable to occasional flooding. The lower parts of the plant are often embedded in fine silt. Usual hosts are alder, ash and willow; also recorded from wooden palings.	Border Uplands Clun and North West Herefordshire Hills Cumbria Fells and Dales Forest of Bowland North Yorkshire Moors & Hills Oswestry Uplands White Peak Yorkshire Dales
Philonotis arnellii	LR-ns	Sometimes in woodland rides. See Table 10.2.	Border Uplands Cumbria Fells and Dales Forest of Bowland Shropshire Hills
Plagiothecium laetum	LR-ns	Non-calcareous sites on tree-bases, stumps, rotten logs and soil in broad-leaved woodland; seldom under conifers. In the mountains also on banks and among boulders.	Cumbria Fells and Dales Border Uplands Clun and North West Herefordshire Hills North Yorkshire Moors & Hills Shropshire Hills South West Peak
Plagiothecium ruthei	LR-ns	Generally a calcifuge plant of wet shady places, especially in woodland.	Yorkshire Dales

Plant species	Status	Typical habitat	Distribution by upland Natural Area
Pohlia lescuriana	LR-ns	Preferring moisture-retentive soils, usually clay, although not those that are strongly basic.	Dark Peak Dartmoor Forest of Bowland Shropshire Hills Southern Pennines
Pseudobryum cinclidioides	LR-ns	Forming bright green patches or swards, green below, in marshes, carr and wet woodland by the shores of lakes, in flushes and springs and by peaty pools in the hills.	North Pennines
Pylaisia polyantha	LR-ns	Epiphytic on the trunks and branches of a range of broadleaved trees and shrubs in lowland hedgerows and open woodland, very rarely on stumps or logs. Most frequent on hawthorn, ash, elm and lime.	Border Uplands
Rhynchostegiella curviseta	LR-ns	Damp stones and tree-roots, especially on wooded stream-banks. Also in artificial habitats such as bridge supports and retaining walls by rivers, canals and lakes and on the banks of shaded lanes and cuttings. Natural substrates include sandstone and limestone; absent from very acid situations.	Exmoor and the Quantocks
Riccia subbifurca	LR-ns	On moist, thinly vegetated soil. See Table 10.2.	Bodmin Moor Yorkshire Dales
Schistostega pennata	LR-ns	A calcifuge species of deep shade on soft, often crumbling acid soil in dark recesses of shaded lanes and hedge banks, especially in southwest England, under overhanging banks in woodland and quarries, entrances to caves and mine shafts, disused rabbit burrows and deep crevices between granite blocks and in granite tors and sandstone cliffs.	Bodmin Moor Dartmoor Exmoor and the Quantocks Shropshire Hills Southern Pennines South West Peak Yorkshire Dales
Sematophyllum micans	LR-ns	As pure patches or mixed with other bryophytes on periodically irrigated, lightly to moderately shaded, acid or mildly basic, gently sloping slabs and boulders with incomplete bryophyte cover. Most usually in deciduous woodland (mainly oak or birch) on steep rocky slopes facing north to east, less often on intermittently flushed rocks in north- or east-facing wooded ravines and by waterfalls.	Cumbria Fells and Dales

Plant species	Status	Typical habitat	Distribution by upland Natural Area
Sphagnum angustifolium	LR-ns	On flushed ground in moorland and open woodland.	Border Uplands
Sphagnum flexuosum	LR-ns	In marshes, in wet open woodland and on rock-ledges. See Table 6.2.	Cumbria Fells and Dales This species is thought to be under-recorded.
Tortula subulata var. *graeffii*	LR-ns	Calcareous habitats on light soils and about tree-bases, growing on roadside and woodland banks, on ledges and crevices of rocks and on old walls. Also on tree-bases and roots in the flood zones of rivers and streams.	Yorkshire Dales
Tortula virescens	LR-ns	On the boles and bases of mature trees in open situation, less often on smaller trees such as elder.	Yorkshire Dales White Peak
Tritomaria exsecta	LR-ns	Woods, especially in sheltered ravines where it inhabits stumps and logs, more rarely mossy rocks and peaty banks.	Cumbria Fells and Dales
Weissia microstoma var. brachycarpa	LR-ns	On wet non-calcareous clay, loam or marl.	Dark Peak Forest of Bowland

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Sources

Most information from Hill, Preston & Smith 1991, 1992 & 1994; Hodgetts, Palmer & Wigginton 1996 and Porley & McDonnell 1997.

[1] *Hennediella macrophylla* is thought to have been introduced from New Zealand.

Table 8.3 Selected red list lichens associated with upland woodland

Plant species	Status	Typical habitat	Distribution
Biatoridium monasteriense	EN	Sheltered ancient woodland, mostly on base-rich bark of elm, ash and elder.	Cumberland
Bryoria smithii	CR	Acid bark of oak and mossy boulders in fairly well-lit situations.	Dartmoor
Graphina pauciloculata	VU	Smooth bark of hazel, holly and young oak in moist open woodland and carr.	Dartmoor Bodmin Moor
Schismatomma graphidioides	VU	Slightly nutrient-enriched bark of old or mature deciduous trees, including ash, beech and oak; woodland edges and sheltered parkland.	Exmoor and Devon
Sclerophora nivea	VU	Sheltered sites in dry bark crevices.	Northumberland
Usnea madeirensis	VU	On deciduous trees, shrubs and rock outcrops in windy situations.	Bodmin Moor

Key to status

Red list categories

CR - critically endangered
EN - endangered
VU - vulnerable

The information in this table was supplied by P. Lambley, pers comm. See also Church *et al* 1996 and Purvis *et al* 1992.

Table 8.4 Relationships between the various different types of woodland (minor types in brackets)

BAP Priority Habitat (those enboldened are most likely to be of significance in the English uplands)	Forestry Commission Guide Type	CORINE	Habitats Directive Annex 1 Type	NVC Type	Stand Types
Lowland beech and yew woods	1. Lowland acid beech and oakwoods 2. Lowland beech-ash woods	42.A71 41.13 41.12 (41.16)	*Taxus baccata* woodland *Asperulo-Fagetum* beech forests Beech forests with *Ilex* and *Taxus*	W13 W12 W14, W15	No direct equivalent 8C 8A, 8B, 8D, 8E
Lowland oak and mixed deciduous woodland	1. Lowland acid beech and oakwoods 3. Lowland mixed broadleaved woods	41.23, 41.32 (41.24) (41.51) 41.52	(*Tilio-acerion*) (*Stellario-Carpinetum*) (Old oakwoods on sandy plains)	W8a-d (e-g) W10a-d (e), W16	1(A), B, 2, 3A, B, 4, 7C, 9, 10 5, 6C, D, 9, 12
Lowland wood-pasture and parkland	Referred to particularly in Lowland acid beech and oakwoods guide (1), but no real equivalent	84.5 (but not a good equivalent)	Includes examples of beech forests with *Ilex* and *Taxus*. Old oakwoods on sandy plains	W14, W15 W10, W16	Group 8 Group 6
Upland mixed ash	4. Upland mixed ashwoods	41.31, 41.32, 41.41, 42.A71 (62.3)	*Tilio-Acerion* *Taxus baccata* woodland limestone pavement	(W7c) W8(a-c) d-g , W9 W13	1A, C, D, 3C, D, 4C, 7D No direct equivalent
Upland oak woodland	5. Upland oakwoods	41.53, 41.52	Old oakwoods with *Ilex* and *Blechnum* in the British Isles	W10(a)e, W11, W16b, W17	6A, 6B (8A, 8B)
Northern birchwoods	6. Upland birchwoods	41.53, 41.52	Old oakwoods with *Ilex* and *Blechnum* in the British Isles	W10e, W11, W17 W4a, b	Mainly stand group 12

BAP Priority Habitat (those enboldened are most likely to be of significance in the English uplands)	Forestry Commission Guide Type	CORINE	Habitats Directive Annex 1 Type	NVC Type	Stand Types
Native pinewood	7. Native pinewoods	42.51 44.A2	Caledonian forest Bog woodland	W18, (W19) W4(a), b, c	11
Wet woods	8. Wet woodland	44.A1 44.31 44.13 44.92	Bog woodland Residual alluvial woodland	W4(a), b, c W5, W6, W7 W1, W2, W3	(12) 7A, B, D, E No equivalent
Scrub	No equivalent	31.883 31.81	Juniper formations on grasslands	W19 (acid soils), W21d W21, W22,W23, W24,W25	No equivalent

Notes

Lowland wood-pasture includes some non-woodland habitats as well as overlapping with various other Priority Habitats.

Upland birchwoods in England are usually best referred to the upland oakwood category rather than to the northern birchwoods which are mainly a Scottish type.

Table 8.5 Conservation significance of different broad groupings

Feature	Conservation priority (A high, B medium)	Description (W10, W11 etc = NVC types)	Significance (HSD = the EU Habitats and Species Directive)
1. Upland oak woodland		Predominantly acid oak-birch woodland (mainly W10e, W11, W16, W17), but with associated base-rich (W9) and wet communities (W4, W7). Usually ancient or at least with an ancient core.	Includes the HSD category (Old oakwoods with *Ilex* and *Blechnum* in the British Isles). Many species of non-vascular plants and ferns are best represented in England in these woods. Some of these appear to be very slow to colonise new sites. Distinctive woodland bird community. Their structure and to some extent their composition has been modified by past treatment often as coppice, and by heavy grazing but recent neglect (in most sites) is leading to a more natural state developing.
	A	All extensive (>20 ha) ancient stands and smaller areas (5-20 ha) where they are in good condition or in areas where extensive stands are scarce.	
	B	Smaller stands of the above, particularly those of predominantly recent origin.	
2. Upland ash woodland		Predominantly ash woodland with some elm, lime (mainly W8d-g W9), with locally yew (W13). Usually ancient or with an ancient core. Associated with and sometimes developed on limestone pavement.	Includes the HSD categories *Tilio-Acerion* and *Taxus baccata* woodland (both also occur in the lowlands) and the limestone pavement category. Can be extremely rich in higher plants including national rarities (eg *Daphne mezereum*). Structure heavily modified by past treatment (both silvicultural and grazing) but locally developing towards a more natural state.
	A	All extensive (>20 ha) ancient stands and smaller areas (5-20 ha) where they are in good condition or in areas where extensive stands are scarce.	
	B	Smaller stands of the above, particularly those of predominantly recent origin.	

Feature	Conservation priority (A high, B medium)	Description (W10, W11 etc = NVC types)	Significance (HSD = the EU Habitats and Species Directive)
3. Wet woodland		Woodland mainly composed of alder, willows and sometimes birch on wet soils (both mineral and organic substrates) (mainly W7, W4, W3, less often in the uplands W1, 2, 5, 6). Some stands are ancient and are usually found in association with other types (eg as part of upland oakwoods), many are, however, recent and in some cases may be invading important fen and bog habitats.	Residual alluvial woodland and bog woodland have been identified in the HSD and some upland stands show some of these characteristics. More generally wet woodland is a nationally scarce resource, usually present only as very small stands. The sites tend to be particularly rich is higher plants and insects.
	A	Ancient stands over 5 ha and recent stands over 20 ha where these are in good condition and not replacing important open wetland.	
	B	Other stands of this type.	
4. Ancient wood pasture	A	This does not include grazed western oakwoods (see 1 above). Rather it includes stands of large old trees, often widely spaced forming parkland, but sometimes with younger growth or plantations in between. They are more likely to occur on the upland fringes than in the uplands proper.	This is a rare habitat on a European scale and England has the bulk of the UK resource. The stands are notable for their epiphytic flora and for the saproxylic invertebrates, particularly those found in the rotting hearts of the trees.
5. Replanted ancient sites	B	Ancient woodland of a variety of types that has been replanted, usually by conifers, less often non-native broadleaves.	These sites usually still contain remnants of the former vegetation and some of the fauna. They have a high potential for restoration to native woodland communities. They have been given ‘medium priority’ not because the area of them needs to be maintained (the ideal is that it should be reduced as they are converted back to native broadleaves) but because the overall interest of plantation sites should not be reduced - ie by total clearance or by further replanting.

Feature	Conservation priority (A high, B medium)	Description (W10, W11 etc = NVC types)	Significance (HSD = the EU Habitats and Species Directive)
6. Scrub	A	Juniper scrub (W19) and other high altitude (>300 m) stands.	Juniper is a rare habitat type in England, although locally extensive stands exist as for example in Teesdale. Juniper scrub on heath or calcareous grassland has been identified in the HSD. High altitude stands are important because although there is no longer a natural tree line anywhere in England, these could form the nucleus for trying to re-create one. Dwarf montane willow stands (W20) are also a vegetation type that should be considered for restoration in appropriate places.
	B	Other scrub	Scrub is a natural component of upland vegetation which is rarely allowed to develop because of grazing pressure and burning. The development of scrub in the uplands would diversify invertebrate and bird populations, particularly where allowed to develop as a mosaic with grassland, moorland and woodland.
7. Recent plantations	B	Mainly composed of introduced conifers (particularly Sitka spruce), grown in large even-aged stands.	Some recent plantations in the uplands will be removed to restore open semi-natural habits or broadleaved woodland. Elsewhere there may be some expansion of plantations where these do not affect significant semi-natural habitats. In any new stands and in existing forests there is considerable scope for integrating nature conservation into their design and management.

Table 8.6 Birds associated with upland woodland and scrub in England

Bird species[1]	Birds of conservation concern in the UK[2]	Listed on Schedule 1 of the 1981 Wildlife & Countryside Act	Listed on Annex 1 of the EC Birds Directive	No of British 10 km squares with breeding records 1988-90	% of breeding records in upland ITE squares[3]	Main upland habitat association	Principal Natural Areas supporting the species *=major/important areas[4]
Red kite *Milvus milvus*	Red list	!	!	45	71.1	Woodland	Extinct in English uplands
Goshawk *Accipiter gentilis*	-	!	-	91	52.7	Woodland	2*, 4, 8, 14, 15, 17, 25, 29, 30, 41, spreading fast
Buzzard *Buteo buteo*	-	-	-	1,174	47.6	Woodland and moorland	2, 4*, 8, 10*, 41*, 42*, 58*, 60*, 87*, 92*, 94*
Merlin *Falco columbarius*	Red list	!	!	386	87.3	Moorland and enclosed land	2. 4*, 8*, 10*, 12*, 14*, 15, 17*, 25*, 29, 42, 58, 87
Black grouse *Tetrao tetrix*	Red list Priority BAP species	-	-	278	86.0	Moorland and enclosed land	2, 4*, 8, 29, extinct elsewhere
Short-eared owl *Asio flammeus*	Amber list	-	!	381	70.9	Moorland	2*, 4*, 8*, 12*, 14*, 15, 17*, 25*, 29
Tree pipit *Anthius trivialis*	-	-	-	1,215	46.0	Woodland and scrub	2, 4*, 8, 10*, 12, 14, 15, 17, 25*, 29, 30, 41, 42, 58, 60, 87*, 92*, 94
Redstart *Phoenicurus phoenicurus*	Amber	-	-	1,019	51.9	Woodland	All areas
Whinchat *Saxicola rubetra*	-	-	-	1,062	59.9	Moorland and scrub	2*, 4*, 8*, 10*, 12*, 14*, 15*, 17*, 25, 29*, 30, 41, 42, 60, 87*, 92*, 94*
Stonechat *Saxicola torquata*	Amber	-	-	847	47.7	Moorland and scrub	10*, 42, 58, 87*, 92*, 94
Ring ouzel *Turdus torquatus*	Amber	-	-	401	93.5	Moorland and scrub	2, 4*, 8*, 10*, 12, 14*, 15(?), 17, 25, 29, 30, 42, 87, 92*

Bird species[1]	Birds of conservation concern in the UK[2]	Listed on Schedule 1 of the 1981 Wildlife & Countryside Act	Listed on Annex 1 of the EC Birds Directive	No of British 10 km squares with breeding records 1988-90	% of breeding records in upland ITE squares[3]	Main upland habitat association	Principal Natural Areas supporting the species *=major/important areas[4]
Wood warbler *Phylloscopus sibilatrix*	-	-	-	859	46.7	Woodland	2, 4*, 8, 10*, 12, 14, 15, 17, 25, 29, 30, 41*, 42*, 58*, 60*, 87*, 92*, 94*
Pied flycatcher *Ficedula hypoleuca*	-	-	-	547	45.5	Woodland	2, 4*, 8, 10*, 12, 14, 15, 17, 25, 29, 30*, 41*, 42*, 58*, 60*, 87*, 92*, 94*
Siskin *Carduelis spinus*	-	-	-	728	65.7	Woodland	2*, 4*, 8, 10, 12, 17, 41, 42, 58, 60, 84, 92*
Redpoll *Carduelis flammea*	-	-	-	1,184	42.2	Woodland	2*, 4*, 8, 10, 12*, 14, 15, 17, 25, 42, 87*, 92
Crossbill *Loxia curvirostra*	-	!	-	364	57.7	Woodland	4, 8, 12, 14*, 25*, 29*

Key

1. Upland breeding bird species as identified in Stillman & Brown 1994.
2. From RSPB 1996.
3. From Bunce & Barr 1988, using the 13 ITE land classes which were regarded as upland (information not available on an English basis).
4. The following 18 Natural Areas are classed as upland by English Nature:

No	Natural Area name
2	Border Uplands
4	North Pennines
8	Yorkshire Dales
10	Cumbria Fells & Dales
12	Forest of Bowland
14	Southern Pennines
15	Pennine Dales Fringe
17	North York Moors and Hills
25	Dark Peak
29	South West Peak
30	White Peak
41	Oswestry Uplands
42	Shropshire Hills
58	Clun and North West Herefordshire Hills
60	Black Mountains and Golden Valley
87	Exmoor and the Quantocks
92	Dartmoor
94	Bodmin Moor

Table 8.7 Biodiversity Action Plan listed invertebrates associated with upland woodland or upland scrub in England (UK Steering Group 1995)

Scientific name	English name	Typical habitat	Importance of this habitat
Lipsothrix nervosa	a cranefly	Wet woodland	P
Lipsothrix ecucullata	a cranefly	Wet woodland	P
Lipsothrix errans	a cranefly	Wet woodland	P
Lipsothrix nigristigma	a cranefly	Wet woodland	P
Eustroma reticulata	netted carpet moth	Wet woodland	P
Formica lugubris	a wood ant	Upland oak woodland	S
Mellicta athalia	heath fritillary butterfly	Light scrub on grassy hillsides	S
Carterocephalus palaemon	checkered skipper butterfly	Upland oak woodland	x
Boloria euphrosyne	pearl-bordered fritillary butterfly	Scrub / coppice	P
Argynnis adippe	high brown fritillary butterfly	Scrub / coppice / bracken	P
Carabus intricatus	blue ground beetle	Upland oak woodland	P
Rheumaptera hastata	argent and sable moth	Upland oak woodland	x
Procas granulicollis	a weevil	Upland oak woodland	P

Key

P = primary habitat

S = significant habitat

x = also occurs in this habitat

Table 8.8 Significance of each Natural Area for different National Vegetation Classification (NVC) types

Natural Area		Types of national significance	Types of local significance	Other types believed to be present
2	Border Uplands	W19	W7, W9, W11, W16	W3, W4, W6, W10, W17
4	North Pennines	W7, W19	W5, W8, W9, W10, W11	W4, W6
8	Yorkshire Dales	W8	W7, 9, 11, 13, 17, 19	W6, 10
10	Cumbria Fells and Dales	W3, 7, 8, 9, 11, 13, 16, 17, 19	W5, 6	W1
12	Forest of Bowland	W11	W7, 9, 10, 17	W1, 6, 16
14	Southern Pennines	-	W4, 7, 8, 9, 10, 11, 16, 17	W6
15	Pennine Dales Fringe	-	W10, W8, W16	W2, W4, W5, W6, W7, W9, W11, W12, W13, W15
17	North York Moors	-	W7, 8, 10, 16	W3, 4, 6, 9
25	Dark Peak	-	W7, 10, 16	W1, 6, 8, 11
29	South West Peak	-	W4, 7, 11	W6, 8, 10, 16
30	White Peak	W8	W7, 9, 11	W6, 10
41	Oswestry Uplands	-	W8	W6, 10
42	Shropshire Hills	W16	W7, 8, 9, 10	W6
58	Clun and North West Herefordshire Hills.	W10, 16	W6, 7, 8, 9, 17	W1, 11
60	Black Mountains and Golden Valley	-	W7, 8, 9, 10, 11	W1, 6
87	Exmoor and the Quantocks	W11, 16, 17	W4, 7, 8, 10	W1, 6, 9
92	Dartmoor	W7, 11, 17	W1, 4, 9, 10	W6
94	Bodmin Moor	-	W1, 7, 8, 10, 16, 17	W4, 6, 11

Table 8.9 Upland Natural Areas which contain nationally significant areas of different woodland groupings

Upland Natural Area		Upland oakwoods	Upland mixed ash	Wet woodland	Lowland wood pastures	Replanted ancient sites	Scrub	Recent conifer plantations
2	Border Uplands						✔	✔
4	North Pennines			✔			✔	✔
8	Yorkshire Dales		✔					✔
10	Cumbria Fells and Dales	✔	✔	✔		✔	✔	✔
12	Forest of Bowland	✔						
17	North York Moors					✔		✔
30	White Peak		✔					
41	Oswestry Uplands				✔			
42	Shropshire Hills	✔			✔			
58	Clun & North West Herefordshire Hills	✔		✔	✔	✔		
60	Black Mountains / Golden Valley				✔			
87	Exmoor and the Quantocks	✔			✔			
92	Dartmoor	✔		✔				✔
94	Bodmin Moor			✔				

Note

This table only considers the upland Natural Areas as defined in Figure 1.1. Equally important areas for most of these types occur elsewhere in the country.

Table 8.10 List of relevant county ancient woodland inventories (AWI)

Natural Area	County AWI	Date
Border Uplands	Northumberland	1988
North Pennines	Northumberland	1988
	Durham	1987
	Cumbria	1994
Cumbria Fells and Dales	Cumbria	1994
	Lancashire	1994
North York Moors	Cleveland	1987
	North Yorkshire	1994
Yorkshire Dales	Cumbria	1994
	North Yorkshire	1994
	Lancashire	1994
Forest of Bowland	North Yorkshire	1994
	Lancashire	1994
Southern Pennines	North Yorkshire	1994
	Lancashire	1994
	West Yorkshire	1994
	Greater Manchester	1988
Dark Peak	West Yorkshire	1994
	Greater Manchester	1988
	South Yorkshire	1986
	Derbyshire	1992
Pennine Dales Fringe	Durham	1987
	Richmondshire	1994
	Harrogate, Hambleton	1994
	West Yorkshire	1994
White Peak	Derbyshire	1992
	Staffordshire	1993
South West Peak	Derbyshire	1992
	Staffordshire	1993
	Cheshire	1988
Oswestry Uplands	Shropshire	1988
Shropshire Hills	Shropshire	1988
Clun and North West Hereford Hills	Herefordshire	1986
	Worcestershire	1986
	Shropshire	1988
Black Mountains and Golden Valley	Herefordshire	1986
	Worcestershire	1986
Exmoor and the Quantocks	Devon	1986
	Somerset	1986
Dartmoor	Devon	1986
Bodmin Moor	Cornwall	1986

Table 8.11 Habitat and management requirements of non-vascular plants associated with upland woodland and scrub

Plants	Habitat requirements	Management requirements
All woodland non-vascular plants	All species require an appropriate canopy and woodland structure, which will be site-specific. Most species need medium shade and reasonably constant, high humidity. Many rare lichens are restricted to single trees and are therefore vulnerable to extinctions from accidental events such as gales or fires; lichens may require higher levels of light than other groups.	! Avoid clear-felling. ! Avoid coppicing, especially in those parts of a wood which are identified as containing good populations of bryophytes. These are often ravines or north-facing slopes. ! Where invasive species, which may include beech, are a problem, these should be controlled. ! At most sites, levels of grazing need to be high enough to control the growth of rank vegetation, but low enough to prevent damage to non-vascular plants and to allow regeneration of woodland trees. It may be advisable to fence parts of the wood to allow regeneration, or to protect individual saplings.
Plants of wet and dry rocks	Such species generally require some shade and may have retreated to the shade of rocky places during previous large-scale felling in a wood. Lichens on rocks are vulnerable to damage by fire (P. Lambley pers comm).	! Retain a canopy in these areas to encourage the spread of species back into other woodland habitats. ! Protect important populations from damage by climbers and encourage walkers to keep to paths. ! Prevent or control fires and the spread of fire.
Plants of rotting wood	Rotting stumps and branches, both standing and fallen, generally with a canopy providing some shade.	! Ensure that dead wood is allowed to rot on site where it falls and that dead trees are allowed to stand wherever possible. ! Where trees are felled or thinned, at least some of the wood should be left on the ground.

Plants	Habitat requirements	Management requirements
Plants of living bark on branches, trunks and roots	Live trees of native species, including a range of ages. Different groups have requirements for different intensity of shade: generally lichens are likely to favour the lighter shade of woodland edges and clearings; bryophytes typically require higher levels of shade and humidity.	! Protect trees with a rich epiphytic flora from felling, lopping or damage by drifting agricultural chemicals. ! Ensure that such trees have an intensity of shading appropriate to their epiphytes. ! In some circumstances, it may be of use to prolong by pollarding the life of ancient trees which carry a rich epiphytic flora. ! Ensure that young trees are able to regenerate, by controlling grazing levels or protecting individual tree seedlings and saplings.
Plants of tree-boles and roots in the flood-zone of rivers	Live trees usually of native species and periodic flooding by unpolluted water.	! Maintain natural morphology and vegetation in the stream bed and river corridor. ! Protect streams from upstream developments which would affect flows and water quality, including agricultural and forestry operations.
Plants of swampy woodland	Wet ground with appropriate water chemistry, live trees usually of native species and little or no disturbance.	! Non-vascular plants of wet woodland, including flushes and stream sides, are particularly vulnerable to damage by heavy livestock such as cattle, which should therefore be excluded. ! Maintain the water table and surface waters in as natural a state as possible, with regard to water quality, levels and flows, and the annual pattern of levels and flows.

Plants	Habitat requirements	Management requirements
Pasture woodland and parkland	Usually very old trees which receive some direct sunlight. These populations are vulnerable to chance events such as wind-throw or fire, which can remove important trees. They are also sensitive to drift of agricultural fertilisers and pesticides.	! Prevent or reduce the use of agricultural chemicals around the site. ! Attention needs to be given to providing the next generation of very old trees, preferably by allowing regeneration from seed produced on site, or by replanting with carefully selected saplings. Seedlings and saplings will need protection from grazing animals. ! Prolong the life of existing host trees as long as possible, possibly by careful pollarding by workers who understand where all the important colonies of non-vascular plants are located.

Sources

Most information from *The conservation of lower plants in woodland* (Hodgetts 1996).

Table 8.12 Habitat requirements of birds associated with upland woodland and scrub

Woodland birds	Habitat requirements
Red kite	! Strong association with native woodland ! Nests placed high in native woodland tree ! Adults forage widely for carrion across road sides and hillsides and for earthworms in improved and semi-improved pastures and tilled land ! Food brought to dependent young in nest by adults ! Present throughout year but extinct in English upland
Goshawk	! Nest placed high in tree in native or plantation forest ! Adults forage for small to medium-sized birds along woodland rides, clearings, in enclosed fields and across open moorland ! Adults bring food to dependent young in nest ! Present throughout the year
Buzzard	! Strong association with woodland and enclosed grassland at the moorland fringe ! Nest placed in isolated or woodland trees or occasionally on rock ledges, usually within woodland ! Adults feed over all types of open country - moors, acid grasslands, tilled land, pastures and meadows, taking earthworms from pastures and tilled land and small mammals, road kills and other carrion from hill and road sides ! Adults bring food to dependent young in nest ! Present throughout the year
Merlin	See Chapter 6
Black grouse	See Chapter 6
Short-eared owl	See Chapter 6
Tree pipit	! Strong association with scattered trees on moorland fringe, with light woodland and woodland clearings and isolate trees often over grass or bracken ! Nest placed on ground in grass tussock or other herbage ! Adults forage for invertebrates on sparsely vegetated ground in open areas near to light, open (often heavily grazed) woodland coppice and shrubby hillsides ! Adults bring food to dependent young in nest ! Present late April to end August
Redstart	! Strong association with native upland woodland (oakwood, birch and alder woods), upland copses, tall hedgerows and also isolated roadside or field corner trees or trees in lightly wooded ghylls or stream sides ! Nest placed within tree holes and holes in walls ! Adults forage for invertebrates on ground and amongst canopy of woodland and scattered trees at moorland edge ! Food brought to dependent young in nest ! Present late April to end August
Whinchat	See Chapter 7

Woodland birds	Habitat requirements
Stonechat	See Chapter 7
Ring ouzel	See Chapter 10
Wood warbler	! Strong association with closed canopy deciduous woods with little understorey, principally oakwood but also birch ! Nest placed on ground amongst tall herbage and leaf litter ! Birds forage for a wide diversity of invertebrate prey both on ground and in canopy of woods ! Adults bring food to dependent young in nest ! Present late April to end August
Pied flycatcher	! Strong association with grazed, native upland oak and ash woodland in valleys, ghylls and at moorland edge ! Nest placed in tree hole in oak-dominated woodland. Birds also take readily to nesting in nest boxes ! Adults forage amongst canopy and mid-levels of open, grazed woodland ! Adults bring food to dependent young in nest ! Present late April to end August
Siskin	! Strong association with upland woodland, both native and of introduced conifer ! Adults feed on deciduous and coniferous tree seeds ! Adults bring food to dependent young in nest ! Present throughout the year
Redpoll	! Strong association with deciduous native woodland, particularly early birch and conifer growth ! Adults forage for birch and other small tree seeds in upland woods ! Adults bring food to dependent young in nest ! Present throughout the year
Crossbill	! Strong association with introduced conifer plantations ! Nest placed in outer branches of mature conifers ! Adults forage for conifer seeds in forest, mainly pine but also larch and spruce ! Adults bring food to dependent young in nest ! Present throughout the year

Table 8.13 Management guidelines for birds associated with upland woodland and scrub

Woodland	Scrub
! Manage the wood according to the appropriate objectives (see 8.6) and management practices (see 8.8).	! Retain existing scrub, such as gorse and juniper, and scattered trees such as hawthorn and rowan.
! Maintain a mixture of tree and shrub age classes.	! Encourage the development of scrub wherever possible on areas of low wildlife interest, by:
! Manipulate grazing in wood pasture and grazed woodland to create a mosaic of grazed and ungrazed patches. This will allow regeneration and so maintain the wood, while benefiting species requiring open conditions, such as pied flycatchers, wood warblers, redstarts and some rare non-vascular plants.	Reducing grazing in areas where there is some scrub, to allow natural regeneration. Fencing off areas where there is some scrub, to allow natural regeneration.
! Retain old trees and dead wood to provide nest sites and invertebrate food.	! Where grazing levels are low enough to allow regeneration, and slopes are gentle:
! Maintain natural drainage and wetland features such as pools and flushes.	Graze existing scrub on rotation to create a range of growth stages. Or cut about 10% of scrub each year, when it is about 10 years old, to provide a range of habitats.
! Consider management or creation of woodland rides, glades and varied external edges, to increase the diversity of habitats present.	Scarify the ground where old stands of scrub have been removed and regeneration is poor.
! Plant native trees on areas of low wildlife interest.	Plant shrub species native to the area and preferably of local provenance, but only where no natural regeneration is likely.