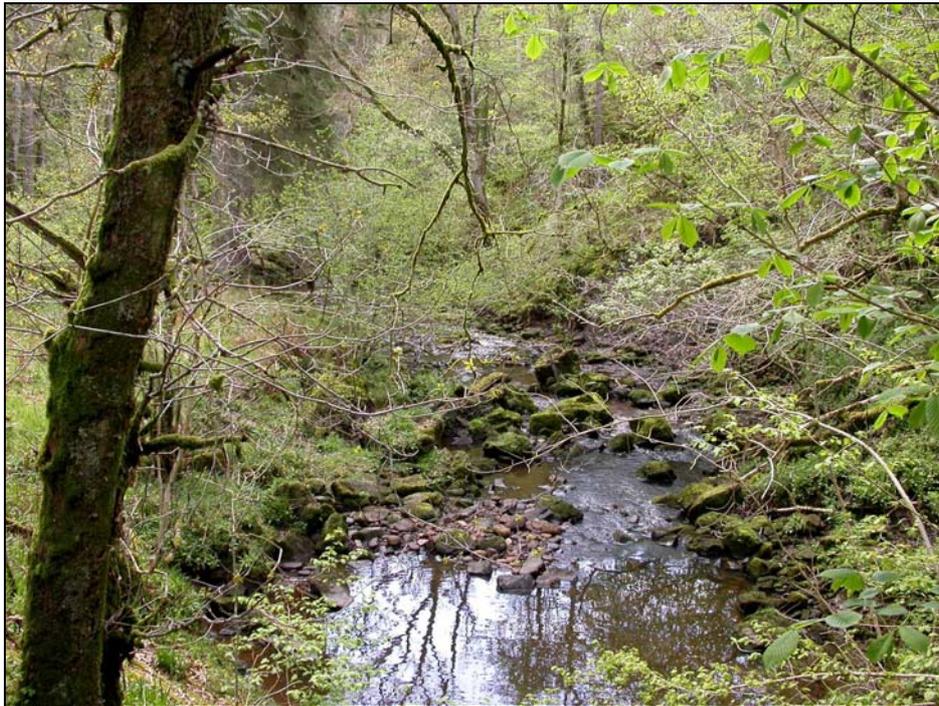


**LICHEN and BRYOPHYTE SURVEY
of HARESHAW DENE SSSI, NORTHUMBERLAND**



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For: Northumberland National Park Authority and English Nature

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1. Introduction

1.1 Location

Site:	Hareshaw Dene
Location:	Bellingham
Grid ref.:	NY843841-NY842854
Vice County:	67 South Northumberland
Status:	SSSI
Altitude:	160-200m
Area:	19.58ha (48.38 acres)

Hareshaw Dene is an area of ancient semi-natural deciduous woodland, in a tributary of the North Tyne valley, near Bellingham. It follows the course of the Hareshaw Burn as if flows through a steep-sided gorge, and includes Hareshaw Linn, a spectacular waterfall.

The SSSI was notified in 1975 for its botanical interest, including the rich lichen and bryophyte flora. It is listed in "A Nature Conservation Review" (Ratcliffe 1977).

1.2 History and management

The walk from Bellingham to Hareshaw Lin has been popular since at least the 19th century, and conifers and other trees have been planted at points along the valley to improve the landscape. Most of these are positioned on the steeper slopes and cliffs above the Hareshaw Burn, and some of the trees are now of considerable size. The route of the woodland walk has changed several times, and it now stays close to the stream and crosses it several times.

The First Edition Ordnance Survey map of 1866 shows two plantations on the gentler slopes of the valley, Blakelaw Plantation on the east side of the valley and Linn Plantation at the north end of the site around the waterfall. How old these are, and whether the land was previously pasture or pasture-woodland, is unclear. Since then there have been further phases of felling and replanting, with considerable extraction of timber during the 1st and 2nd world wars.

The steep slopes of the rest of the dene were not suitable for timber planting, but much of the hazel and some rowan was coppiced. There are few trees over 120 years old, so it seems likely that valuable trees such as oak and elm were removed individually for timber as they reached maturity. Most of the older wych elms have been lost since the 1980s to dutch elm disease, but there is considerable regeneration.

There is little sign of woodland management in the recent years, other than management for conservation. Old trees are now allowed to fall, and there are large areas of fallen timber on some of the steeper slopes. The woodland is no longer used for winter stock grazing. There is some disturbance from visitors, but they keep to the path and most of the site is unaffected.

An iron works was built at the foot of the dene in the 1820s, but it was not a success and ceased operation in 1840. Some of the old tracks in the woodland may date from this time. Most of the land adjoining the dene is farmed, and there is a golf course to the west.

1.3 Environment

The climate in this part of Northumberland can be harsh, with cold winters, strong winds and annual rainfall approaching 900mm, but the woodland is in a steep-sided and sheltered valley and the microclimate along the burn is still and humid.

The underlying geology is a complex of acid and mildly basic Lower Carboniferous sandstones and shales, overlain in places by glacial till. The soils on the lower slopes of the valley are base-rich and poorly drained. Higher on the slopes the soils vary from neutral to acid and are sandy, well-drained, and somewhat leached. Wet flushes may be neutral or slightly basic., depending on their position.

Hareshaw Dene is some distance from the major sources of industrial and urban atmospheric pollution on Tyneside, but the Bellingham iron works must also have been a source of contamination for the short time it was in operation and atmospheric SO₂ will have been produced by coal fires in the village until very recently. Although SO₂ pollution is now much reduced, levels of atmospheric ammonia and nitrogen oxides from nearby agricultural units may be increasing.

2. Method

2.1 Survey

The survey work was carried out during May 2003, with four days being spent on site in good but showery weather conditions. A further visit was made in July to confirm identifications, take photographs, and tag a number of trees for future monitoring.

A brief inspection of the site was carried out first to identify the habitats present and the areas most likely to be of lichen and bryophyte interest. Each habitat was then sampled, with effort being concentrated on the rocks and trees most likely to be of interest. The species present were recorded, with their substrates and an estimate of abundance using the DAFOR scale of dominant, abundant, frequent, occasional and rare. This scale is subjective and can be difficult to apply to species not named in the field, but it is commonly used in this type of survey and is appropriate to the evaluation of lichen and bryophyte communities. Ecological and habitat notes were also made, and sketch maps drawn to locate landmarks and areas of particular interest.

Most species were identified in the field, but those that could not be identified were collected for examination under a microscope. For the lichens, chemical spot tests (using sodium hypochlorite, potassium hydroxide, iodine in potassium iodide, and p-phenylenediamine solutions) and ultraviolet light were also used to assist in identification. Specimens were wrapped in paper tissue and stored in paper packets, where they were allowed to dry.

2.2 Limitations

The site is large and many of the lichens and bryophytes sought are far from conspicuous. In the time available it was only possible to sample the various habitats present. Effort was concentrated on the rocks and trees likely to be most productive, but even these could only be sampled at intervals and some of the most interesting locations (the cliffs above Hareshaw Linn, other rock outcrops on very steep slopes, and many of the boulders in the Hareshaw Burn) were inaccessible. It is likely that some less common species will have been missed, especially the smaller bryophytes.

Canopy species could only be sampled from branches that had fallen to the ground and are likely to be under-recorded.

2.3 Historical records

Historical records and habitat information have been obtained from a number of sources:

- Bryophyte Flora of Northumberland (Duncan 1950)
- Survey by Francis Rose, 1968
- Bryophyte species list provided by E.M.Lobley, 1971
- Visit report by Oliver Gilbert, 1971
- Surveys by C.Brewster et al, 1976-7
- Lichen Flora of Northumberland (Gilbert 1980)
- Visit report by R.Tapper, 1981
- Survey by L.Alexander, 1992
- Survey by D.McCutcheon, 2000

2.4 Nomenclature

Species names used in this report are in accordance with the British Lichen Society Checklist (Coppins 2002) and the British Bryological Society Census Catalogue (BBS 1998).

3. Vegetation

Oak (*Quercus robur*), hazel (*Corylus avellana*) and ash (*Fraxinus excelsior*) dominate much of the woodland, with some rowan (*Sorbus aucuparia*) and silver birch (*Betula pendula*) on the drier slopes, and wych elm (*Ulmus glabra*) and downy birch (*B. pubescens*) on the valley floor. Sycamore (*Acer pseudoplatanus*) is invading in places, and there is some hawthorn (*Crataegus monogyna*).

Most of the mature wych elms appear to have been killed in the last 20 years by Dutch elm disease, but a few large trees still survive and there is considerable regeneration from the roots. Most of the regrowth is succumbing to the disease again at a height of 5-15m.

Both hazel and rowan have been coppiced in the past, and there are some large coppice stools in more accessible parts of the woodland.

Beech has been planted in places around the boundary of the woodland, and there are scattered plantings of "landscape" conifers including spruce (*Picea abies*), larch (*Larix decidua*) and scot's pine (*Pinus sylvestris*).

The field layer contains a variety of woodland herbs, depending on the soil conditions. The wetter neutral-basic areas are dominated by ramsons (*Allium ursinum*) and dogs mercury (*Mercurialis perennis*), with wood anemone (*Anemone nemorosa*), greater stitchwort (*Stellaria holostea*), wood stitchwort (*Stellaria nemorosa*), wood sage (*Teucrium scorodonia*), wood sorrel (*Oxalis acetosella*), lesser celandine (*Ranunculus ficaria*) and woodruff (*Galium odoratum*). Larger plants include bramble (*Rubus fruticosus*), raspberry (*Rubus idaeus*) and honeysuckle (*Lonicera periclymenum*). Wetter areas are dominated by dog's mercury and opposite leaved golden saxifrage (*Chrysosplenium oppositifolium*). Nitrogen-rich soils support large stands of nettles (*Urtica dioica*).

Ferns are abundant and include male fern (*Dryopteris filix-mas*), scaly male fern (*Dryopteris affinis*), lady fern (*Athyrium filix-femina*), brittle bladder fern (*Cystopteris fragilis*) and hard fern (*Blechnum spicant*). Polypodies (*Polypodium vulgare*) are common on trees, and there is some intermediate polypody (*Polypodium interjectum*).

Acid areas have a ground flora of bracken (*Pteridium aquilinum*), bilberry (*Vaccinium myrtillus*), woodland grasses (*Brachypodium sylvaticum*, *Deschampsia flexuosa* etc.), with small areas of heather (*Calluna vulgaris*) and woodrush (*Luzula sylvatica*).

The pond referred to in some previous survey reports could not be located during this survey and may have been lost.

The six main vegetation types found are shown on the following map and described below.

Birch scrub

This is an area of birch scrub and developing woodland at the south end of the site (NY844843), above the path on the east side of the burn. The slopes are gentle but poorly drained. The birch is single-aged, about 60 years old, but there are some older oak standards and self-sown thickets of young birch, hazel, ash and oak. The understorey is grassy.

Oak-ash woodland

Further into the dene the slope woodland is more mature and dominated by oak, ash and hazel. There is also some rowan, wych elm and birch. On the east side of the valley this includes a line of mildly basic boulders and rock outcrops (NY843844) that follows the contour just above the path. The soils in this area form a complex mosaic of neutral and basic soil types, some of which are very wet. Toothwort (*Lathraea squamosa*) occurs along the path.

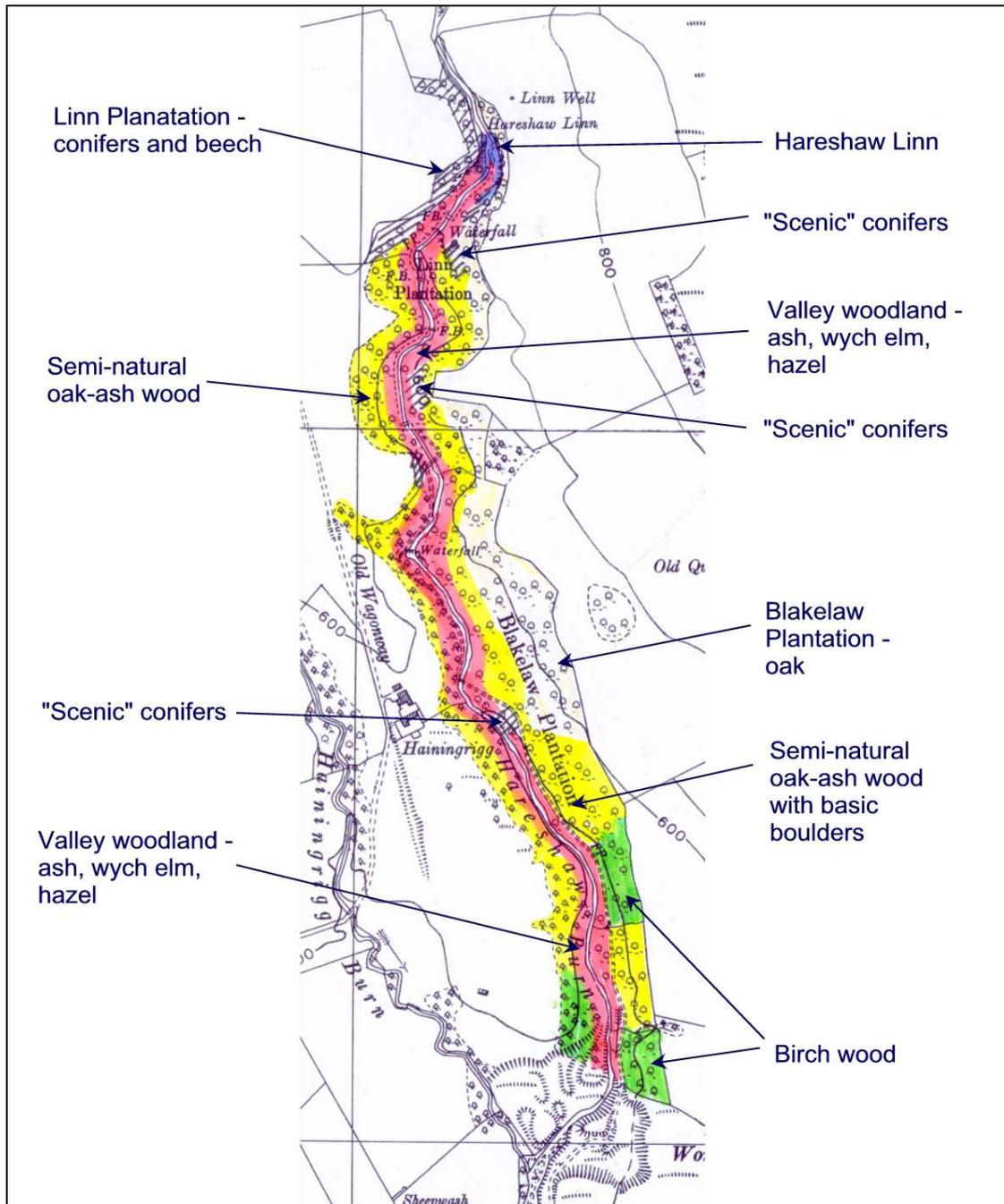


Fig 1. Vegetation types at Hareshaw Dene.

Key: green – birch wood; yellow – semi-natural oak-ash-hazel wood; red – valley woodland dominated by ash, wych elm and hazel; pale yellow – planted oak wood; blue – cliffs and waterfall; hatched – planted conifers and beech.

On the west side of the valley below Hainingrigg Farm (NY842845) the slopes are steep and densely wooded, with scrub developing in the clearings left by fallen trees and landslips. In places the slopes are eutrophicated by run-off from the farmland above and the field layer is dominated by thickets of brambles and nettles.

Valley floor woodland

Below the waterfall the Hareshaw Burn is in a deep gorge, and is fast flowing and rocky. The woodland canopy above maintains a still atmosphere and high humidity. The trees here are mostly wych elm, ash, alder and hazel, with some rowan and willow. Standing timber of wych elms killed by dutch elm disease is common, but there is plenty of regrowth from the roots.

Ferns are common in the understorey, with patches of brambles and honeysuckle. In places the slopes are unstable and there are frequent landslips.

Hareshaw Linn

The waterfall (NY842854) enters a deep ravine with vertical cliffs on either side or some impressive rock overhangs. Close to the waterfall the cliffs are very wet, as are the rocks in and along the stream. Away from the waterfall the cliffs are dry, especially those that are protected from rainfall by rock overhangs, but they are still in a shaded and humid situation. This area is rich in ferns and bryophytes.

Plantations

The Blakelaw Plantation on the east side of the valley (NY843846) has single aged stands of oak, 100-120 years old, well-spaced on a gentle slope. The soil is acid and bracken dominates the ground layer in summer, but bilberry and woodrush and grasses are also common. Younger trees of birch and rowan appear to be self-sown. Willow and alder has colonised some of the wet flushes.

The thinner soils on the bluffs have been planted with scot's pine and other conifers, apparently for their landscape value. The ground layer here is grassy, with small areas of heather and woodrush.

Above the waterfall (NY841853) the flat ground of the Linn Plantation has been planted with a mixture of conifers including spruce, larch and scot's pine, with some beech along the woodland boundary. The soils here are well-drained and acidic, with a sparse ground flora of bilberry, woodrush and woodland grasses.

4. Species found

4.1 Species list

127 species of lichens, 74 mosses and 30 liverworts were found within the SSSI during this survey. The full modern species list, including species found by the author and others during previous visits to the site since 1992, is 134 lichens, 74 mosses and 31 liverworts. The richest habitat for both lichens and bryophytes is the valley woodland, with 86 species of lichens, 51 mosses and 26 liverworts.

Habitat	Lichens	Mosses	Liverworts
Birch scrub	31	26	12
Oak-ash woodland (east)	50	48	18
Oak-ash woodland (west)	37	24	6
Valley woodland	86	51	26
Hareshaw Linn	21	45	17
Blakelaw Plantation	56	27	10
Linn Plantation	26	10	3
Total for Hareshaw Dene SSSI	127	74	30

The full species list from this survey, broken down by habitat and including details of substrate and abundance, is attached, together with other recent and historical records.

4.2 Lichen species of interest

Several lichen species of interest have been found since 1998. Some of these are considered to be indicators of ecological continuity (Coppins and Coppins 2002), used in the Revised Index of Ecological Continuity (RIEC), New Index of Ecological Continuity (NIEC) or East of Scotland Index of Ecological Continuity (ESIEC). Others are nationally scarce (Woods and Coppins 2003), or scarce in Northumberland (Gilbert 1980).

- *Arthonia arthonioides* is nationally scarce (recorded from 16-100 hectads), but is known from several sites in Northumberland, all in similar situations on dry rock faces or beneath underhangs. Elsewhere it also occurs on trees. At Hareshaw Dene it has been confirmed

from beneath an underhang on a sandstone outcrop near the top of the eastern slope, and it is thought to be present on several other, less accessible, outcrops. A new record for this site and an indicator of ecological continuity (NIEC).

- *Arthonia didyma* occurs on several hazel stools close to the Hareshaw Burn. This species is restricted to smooth-barked trees in sheltered valley woodlands, and it is considered to be an indicator of ecological continuity in Northumberland.
- *Arthonia elegans* was found on hazel close to the Hareshaw Burn. It has only been recorded from Northumberland since 2000 but is now known from eight woodland sites in the county. An indicator of ecological continuity (ESIEC).
- *Arthonia spadicea* was found on the deeply cracked bark towards the base of a single ash in deep shade on the slope below the Linn Plantation. This species used to be frequent on elm.
- *Arthonia vinosa* is common on the trunks of mature oak and ash in shaded, humid areas of the valley floor. An indicator of ecological continuity (RIEC, NIEC, ESIEC).
- *Biatora epixanthoides* occurs on the trunk of a single ash in a humid situation close to the Hareshaw Burn. A new record for this site, and an indicator of ecological continuity (NIEC, ESIEC).
- *Biatora sphaeroides* occurs on the trunk of the same ash as *B.epixanthoides*, in a humid situation close to the Hareshaw Burn. A new record for this site, and close to the eastern limit of its range. An indicator of ecological continuity (RIEC, NIEC, ESIEC).
- *Calicium salicinum* was recorded from this site in 1970 by Oliver Gilbert, and again by Janet Simkin in 1998. The dead elm on which it occurred in 1998 was not relocated during this survey. An indicator of ecological continuity (ESIEC).
- *Chaenotheca brunneola* was found in vertical cracks on two ash trees, both on the east-facing slopes well above the path. A new record for this site, rare in Northumberland and an indicator of ecological continuity (NIEC, ESIEC).
- *Chaenotheca furfuracea* occurs in vertical cracks on the trunks of oak and ash, on steep east-facing slopes above the path. Local in Northumberland and an indicator of ecological continuity (NIEC, ESIEC).
- *Chaenotheca trichialis* was found on two ash trees on the east-facing slopes, in vertical cracks on the trunks. An indicator of ecological continuity (NIEC, ESIEC).
- An undescribed *Chaenothecopsis* was found associated with the *Arthonia arthonioides* on the east side of the site. B.J.Coppins considers it to be the same species as that collected from Tod Law, 12km to the north, by D.McCutcheon in 2000 (shown on the record card for that site as *Calicium corynellum*). Both specimens have been lodged in the herbarium at the Royal Botanic Gardens Edinburgh (E). An indicator of ecological continuity (ESIEC).
- *Enterographa crassa* was found a single oak below Hainingrigg Farm. A new record for this site of a species that is rare in Northumberland and an indicator of ecological continuity (RIEC, ESIEC).
- *Lecanora conizaeoides* used to be abundant throughout north-east England, but it is one of the few lichens that is favoured by high levels of atmospheric SO₂ and is now declining rapidly. It persists here on the acid bark of some of the conifers in the Linn Plantation.
- *Gyalecta truncigena* grows with *Biatora sphaeroides* on the trunk of a single ash in a humid situation close to the Hareshaw Burn. This species has a western and southern distribution in Britain and is rare in Northumberland. A new record for this site.

- *Lepraria rigidula* was only found once, on the trunk of a mature birch in deep shade on the east-facing slopes. It is easily overlooked and may be on other acid-barked trees, particularly the conifers of the Linn Plantation. Rare in Northumberland.
- *Peltigera horizontalis* occurs on fallen timber in several parts of the site, generally in humid positions close to the stream. Very local in Northumberland and an indicator of ecological continuity (RIEC, NIEC).
- *Pertusaria hemisphaerica* was found on oak, ash and hazel on the valley floor and on the east-facing slope below Hainingrigg. Very local in Northumberland and an indicator of ecological continuity (ESIEC).
- *Thelotrema lepadinum* is frequent on the older oak and ash trees, and is also present on birch, elm and hazel in both the semi-natural woodland and the planted areas. It is spreading successfully to young branches and trees. Local to sheltered valley woodlands in Northumberland, and an indicator of ecological continuity (RIEC, NIEC, ESIEC).

4.3 Bryophyte species of interest

Although a high diversity of bryophytes was found in this survey, most are species that are widespread in similar woodland and wet rock habitats in Britain. Many of the smaller species, especially the leafy liverworts, have a strongly oceanic distribution in Britain and are here at the edge of their ecological range, making them scarce or local in Northumberland. Records of particular interest from this survey include:

- *Apometzgeria pubescens* – normally found on basic rocks, at this site it occurs below a rock overhang and also on an ash tree nearby.
- *Conardia compacta* (formerly known as *Amblystegium compactum*) – this was recorded from Hareshaw Dene in the 1970s but the precise location is not known. During this survey effort was concentrated on the two most likely areas, the basic rocks in woodland (at NY843844) and the basic cliffs by the waterfall (NY842854). The rocks in the woodland are now too overgrown by bracken in summer to support the variety of bryophytes that historical records suggest they once did, and *C.compacta* was not found there. The wet cliffs by the waterfall are a more suitable habitat, but again the moss could not be located there in the field. It is, however, extremely small and inconspicuous, and fragments were found amongst other material collected from the waterfall. Some of these were poorly developed but this is not surprising if the moss is now being overgrown by other, more competitive species. The identification was confirmed by comparison with a herbarium specimen. Only a small part of the east cliff was accessible at the time of the survey, so it is quite possible that populations in better condition are still present higher up, or on the western cliff.
- *Frullania tamarisci* – this species has a strongly western and northern distribution in Britain and is here close to its range limit. It is rarely found in Northumberland.
- *Hylocomium brevirostre* was known by Miss E.M.Lobley from only two other localities in south Northumberland, and is absent from north Northumberland. It is still present.
- *Hypnum hamulosum* – nationally rare with a northern distribution, this *Hypnum* grows on basic montane rocks. There is a small population on a slightly basic rock in the oak-ash woodland on the east side of Hareshaw Burn.
- *Nowellia curvifolia* – this liverwort has a limited habitat range, growing on logs in an advanced state of decay in humid situations, and a strongly western distribution in Britain. It is local in Northumberland but unusually common in Hareshaw Dene.
- *Polytrichum strictum* – normally a species of boggy moorland, there is a small population on acid, peaty soil towards the top of the slope in the Blakelaw Plantation. It is also known from a similar location in Northumberland woodland, Briarwood Banks.

- *Schistidium platyphyllum* – nationally rare, this species grows on basic rocks by water and has a northern distribution in Britain. At Hareshaw Linn it occurs on the wet rocks by the waterfall.
- *Thuidium delicatulum* – similar to *T.tamariscinum*, this species is scattered through the sheltered valley woodland and is common close to the waterfall at Hareshaw Linn. Nationally it is occasional in western and northern Britain. Miss E.M.Lobley recorded this as one of only two localities in Northumberland.

5. Lichen and bryophyte communities

The lichen and bryophyte communities of Hareshaw dene can be broken down by substrate, into epiphytic (on trees), terricolous (on soil), lignicolous (on wood) and saxicolous (on rocks) communities. These are described below, together with a list of the typical and interesting lichen and bryophyte species found in them at this site.

5.1 Epiphytic communities

Epiphytic communities occur throughout the site, but they are particularly rich in lichens in the semi-natural woodlands of the steeper slopes and on the valley floor. The community on any particular tree depends on the age of the tree, the pH of the bark, shade and other factors.

5.1.1 Twigs and smooth bark in shade

Young branches of oak and ash, and the trunks and larger branches of smooth-barked trees such as hazel and birch support a wide variety of corticolous lichens, many of which are growing largely within the bark of the tree. The most frequent species in shade are *Graphis scripta*, *Lecanora chlarotera*, *Pertusaria leioplaca*, *P.pertusa* and *Thelotrema lepadinum*, with the bryophytes *Ulota bruchii* and *U.crispa*.

Hazel and birch trunks support patches of *Frullania dilitata*, *Hypnum andoi*, and towards the base *Brachythecium rutabulum*, but these are much less abundant than on rough-barked trees.

Lichens

Anisomeridium biforme
Arthonia didyma
A.elegans
A.radiata
Arthopyrenia punctiformis
Fuscidea lightfootii
Graphis scripta
Lecanora chlarotera
Melanelia fuliginosa subsp. *glabratula*
Opegrapha atra
O.varia
O.vulgata
Parmelia sulcata
Pertusaria amara
P.leioplaca
P.pertusa
Porina aenea
Thelotrema lepadinum

Bryophytes

Brachythecium rutabulum
Dicranoweisia cirrata
Dicranum scoparium
Frullania dilitata
Lophocolea bidentata
Hypnum andoi
Metzgeria furcata
Orthotrichum affine
Ulota bruchii
U.crispa

A number of lichen species that are common in other Northumberland woodlands are scarce or absent from Hareshaw Dene. These include *Fuscidea lightfootii*, *Lecidella eleochroma*, *Melanelia fuliginosa* subsp. *glabratula* and *M.subaurifera*, as well as species that favour nutrient-enriched bark, such as *Phycia tenella*, *Xanthoria parietina* and *X.polycarpa*.

5.1.2 Canopy

In the canopy the lichens *Usnea subfloridana* and *U.filipendula* are abundant, with *Platismatia glauca*, *Pseudevernia furfuracea* and *Hypogymnia furfuracea*, and the mosses *Hypnum andoi* and *Ulota crispa*.

Lichens

Evernia prunastri
Hypogymnia physodes
Melanelia fuliginosa subsp. *glabratula*
Melanelia subaurifera
Parmelia sulcata
Pertusaria amara
Platismatia glauca
Pseudevernia furfuracea
Usnea filipendula
U.subfloridana

Bryophytes

Hypnum andoi
Ulota bruchii
U.crispa

5.1.3 Rough bark

Older branches and the trunks of rough barked trees, particularly oak and ash, support a very different community of epiphytic lichens and bryophytes. This varies with the humidity and the pH of the bark, but *Hypnum andoi* is abundant on the trunks of many trees, often with *Dicranum scoparium* and *Bryum capillare*. Towards the base of the tree bryophytes dominate, particularly *Hypnum resupinatum*, *Brachythecium rutabulum* and *B.velutinum*. These may be overgrown by the leprose lichens *Lepraria incana* or *L.lobificans*. Areas of bark that are free of mosses may support one or more of the liverworts *Metzgeria furcata*, *Frullania dilatata* and *Radula complanata*.

Lichens on rough bark include a scattering of *Evernia prunastri*, *Hypogymnia physodes* and *Parmelia sulcata*, although none of these do particularly well in the deep shade of the lower parts of the dene. The crustose lichens *Lecanactis abietina*, *Opegrapha atra* and *Thelotrema lepadinum* are common on the dry sides of trees, and *Chrysothrix candelaris* is frequent on oak trunks. *Cladonia coniocraea* and *C.macilenta* grow amongst the mosses on horizontal branches and trunk bases. Few lichens were found on wych elm, presumably because the regrowth is too young.

The species of most interest tend to be restricted to mature trees, often those in particularly shaded and humid situations. These include the lichens *Arthonia spadicea*, found towards the bases of trees, *A.vinosa* further up the trunk, *Biatora sphaeroides*, *Gyalecta truncigena*, *Pertusaria hemisphaerica*, and *Pyrrhospora quernea* on tree trunks, and *Chaenotheca brunneola*, *C.furfuracea*, *C.trichialis* in vertical cracks in the bark.

Oaks in drier situations with more light support large populations of *Chaenotheca ferruginea* and *Lecanactis abietina*. *L.abietina* and the occasional *Dimerella pineti* indicate some acidification.

Lichens

Anisomeridium polypori
Arthonia radiata
A.spadicea
A.vinosa
Biatora epixanthoides
B.sphaeroides
Chaenotheca brunneola
C.ferruginea
C.furfuracea
C.trichialis
Chrysothrix candelaris
Cladonia coniocraea
C.macilenta
C.polydactyla
Dimerella pineti
Evernia prunastri

Bryophytes

Bartramia pomiformis
Brachythecium rutabulum
B.velutinum
Bryum capillare
Dicranella heteromalla
Dicranoweisia cirrata
Dicranum scoparium
Frullania dilatata
Hypnum andoi
H.cupressiforme
H.resupinatum
Isothecium alopecuroides
Isothecium myosuroides
Lepidozia reptans
Lophocolea bidentata
Metzgeria furcata

<i>Gyalecta truncigena</i>	<i>Mnium hornum</i>
<i>Graphis elegans</i>	<i>Neckera complanata</i>
<i>G.scripta</i>	<i>Plagiothecium undulatum</i>
<i>Hypogymnia physodes</i>	<i>Radula complanata</i>
<i>Lecanactis abietina</i>	<i>Rhytidiadelphus triquetrus</i>
<i>Lepraria incana</i>	<i>Ulota bruchii</i>
<i>L.lobificans</i>	<i>Ulota crispa</i>
<i>Melanelia fuliginosa</i> subsp. <i>glabratula</i>	
<i>Ochrolechia androgyna</i>	
<i>Opegrapha atra</i>	
<i>Parmelia sulcata</i>	
<i>Pertusaria amara</i>	
<i>P.hemispherica</i>	
<i>P.hymenea</i>	
<i>P.pertusa</i>	
<i>Pyrrhospora querneae</i>	
<i>Thelotrema lepadinum</i>	

Species of the *Lobarian* lichen community, associated with undisturbed valley woodlands in parts of Northumberland and more commonly in the west and north of Britain, are absent from Hareshaw Dene.

The only lichens common on the acid bark of the conifers were *Hypogymnia physodes* and *Lecanora conizaeoides*.

5.2 Terricolous communities

These communities of earth banks, soil over rocks and dead wood occur throughout the site. The species present depend on the degree of shade, slope, soil moisture, disturbance, and the pH of the substrate, and vary over short distances. They can be roughly divided into communities associated with the basic soils towards the foot of the slopes, and the acid soils higher up.

5.2.1 Neutral-Basic soil

The shaded earth banks and wet flushes over slightly basic rocks support a rich bryophyte flora. The most common mosses are *Atrichum undulatum*, *Eurhynchium praelongum*, *Mnium hornum* and *Thuidium tamariscinum*. *Thuidium delicatulum* is restricted to the deep shade of the valley floor. Amongst these thick carpets of mosses there are often scattered plants of smaller species such as *Amblystegium serpens* and *Plagiomnium rostratum*, and leafy liverworts such as *Lepidozia reptans* and *Lophocolea bidentata*. *Pellia endiviifolia*, *Plagiomnium undulatum* and *Rhizomnium punctatum* are common on wet ground. The dog lichens *Peltigera hymenina* and *P.membranacea* grow in shaded places, often amongst grass.

<u>Lichens</u>	<u>Bryophytes</u>
<i>Cladonia fimbriata</i>	<i>Atrichum undulatum</i>
<i>Peltigera hymenina</i>	<i>Brachythecium rivulare</i>
<i>P.membranacea</i>	<i>B.rutabulum</i>
	<i>Bryum capillare</i>
	<i>Dicranum scoparium</i>
	<i>Eurhynchium praelongum</i>
	<i>Fissidens bryoides</i>
	<i>Lophocolea bidentata</i>
	<i>Mnium hornum</i>
	<i>Pellia endiviifolia</i>
	<i>Plagiochila asplenoides</i>
	<i>P.porelloides</i>
	<i>Plagiomnium rostratum</i>
	<i>P.undulatum</i>
	<i>Rhizomnium punctatum</i>
	<i>Rhytidiadelphus loreus</i>
	<i>R.triquetrus</i>
	<i>Thamnobryum alopecurum</i>
	<i>Thuidium delicatulum</i>
	<i>T.tamariscinum</i>

5.2.2 Acid soil

This bryophyte dominated community is restricted to planted areas where the soil is thin, acidic and leached. The flora is typical of the uplands, with *Leucobryum glaucum*, *Dicranella heteromalla*, *Dicranum scoparium*, *D.majus*, *Hylocomium brevirostre*, *Mnium hornum*, *Polytrichum formosum* and *Rhytidiadelphus triquetrus* all common. *Pellia epiphylla* grows on acid-neutral soils in wet places. The lichens *Cladonia ciliata*, *C.furcata*, *C.macilenta* and *C.portentosa* are frequent amongst grass and heather.

Lichens

Cladonia ciliata var. *tenuis*
C.coniocraea
C.diversa
C.furcata
C.macilenta
C.portentosa
Trapeliopsis pseudogranulosa

Bryophytes

Dicranella heteromalla
Dicranum scoparium
D.majus
Hylocomium brevirostre
Hypnum cupressiforme
Leucobryum glaucum
Mnium hornum
Pellia epiphylla
Plagiothecium undulatum
Pleurozium schreberi
Polytrichum strictum
Polytrichum formosum
Rhytidiadelphus loreus
R.triquetrus

5.3 Lignicolous communities

Fallen and cut timber is to be found throughout the woodland, and some has persisted for many years. The flora depends on the situation and the species of tree, but generally it is dominated by bryophytes, particularly *Mnium hornum*, *Polytrichum formosum* and *Nowellia curvifolia*. Leafy liverworts are frequent, including *Lepidozia reptans*, *Lophocolea bidentata* and *L.heterophylla*. Other mosses often include *Bryum capillare*, *Plagiomnium undulatum* and *Tetraphis pellucida*. If mosses are prevalent, the lichen flora is restricted to the fast-growing *Cladonia* and *Peltigera* species, with *Cladonia macilenta*, *Peltigera horizontalis* and *P.praetextata* the most common.

Lichens

Cladonia coniocraea
C.macilenta
C.polydactyla
Micarea denigrata
M.lignaria
M.prasina
Peltigera hymenina
P.horizontalis
P.membranacea
P.praetextata

Bryophytes

Brachythecium rutabulum
Bryum capillare
Calyptogeia muellerana
Dicranella heteromalla
Dicranum scoparium
D.majus
Eurhynchium praelongum
Frullania dilatata
Hypnum cupressiforme
Lepidozia reptans
Lophocolea bidentata
L.heterophylla
Mnium hornum
Nowellia curvifolia
Plagiochila porelloides
Plagiomnium rostratum
P.undulatum
Plagiothecium undulatum
Pleurozium schreberi
Pseudotaxiphyllum elegans
Polytrichum formosum
Rhytidiadelphus loreus
R.triquetrus
Tetraphis pellucida
Thuidium tamariscinum

5.4 Saxicolous communities

The rock outcrops and boulders in Hareshaw Dene are generally shaded and in a humid situation, but some are subject to spray or even inundation by the stream, while others are protected even from rainfall by rock overhangs. The rocks themselves vary from siliceous to slightly basic sandstones and shales.

5.4.1 Basic rocks

Basic rock outcrops and boulders occur in the lower parts of the oak-ash woodland and throughout the length of the valley floor. They are thickly covered with bryophytes, including large colonies of *Isothecium myosuroides*, *Thamnobryum alopecurum* and *Thuidium tamariscinum*. Smaller patches of *Bryoerthrophyllum recurvirostrum*, *Calliergonella cuspidata*, *Ctenidium molluscum*, *Hypnum hamulosum*, *Neckera crispa* and *Pseudotaxiphyllum elegans* are frequent, and leafy liverworts such as *Scapania nemorea* are also present.

The vertical cliff faces are generally too dry for bryophytes, especially those in overhung by rocks in the ravine. These support a variety of leprose and crustose lichens, particularly *Lepraria incana* and *L.lobificans*, together with *L.lesdainii*, *Leproloma membranacea* and *Leproplaca chrysodeta*. A limited range of crustose species is also present, mainly *Lecanora campestris*, *Lecidella stigmatea* and *Verrucaria muralis*, with in places sheets of *Lecanora expallens* and *Psilolechia lucida*. Dry vertical faces, and these and the undersides of any overhangs have the lichens *Enterographa zonata* and *Arthonia arthonioides*, with an undescribed species of *Chaenothecopsis*. Deeply shaded crevices under overhangs have both the black filamentous lichens *Cystocoleus ebeneus* and *Racodium rupestre*.

Lichens

Arthonia arthonioides
Caloplaca flavescens
Caloplaca citrina
Chaenothecopsis sp.
Cystocoleus ebeneus
Enterographa zonata
Lecanora campestris
L.expallens
Lecidella stigmatea
Lepraria incana
L.lobificans
L.lesdainii
Leproloma membranaceum
Leproplaca chrysodeta
Opegrapha calcarea
Peltigera rufescens
P.praetextata
Protoblastenia rupestris
Psilolechia lucida
Racodium rupestre
Trapelia coarctata
T.placodioides
Verrucaria muralis
V.nigrescens
V.viridula

Bryophytes

Brachythecium plumosum
Brachythecium rutabulum
Bryoerthrophyllum recurvirostrum
Bryum pallens
Calliergonella cuspidata
Ctenidium molluscum
Dicranum scoparium
Eurynchium striatum
Fissidens taxifolius
Hypnum cupressiforme
Isothecium alopecuroides
Isothecium myosuroides
Lepidozia reptans
Lophocolea bidentata
Lophocolea heterophylla
Mnium hornum
Neckera complanata
Neckera crispa
Plagiochila asplenoides
P.porelloides
Pseudotaxiphyllum elegans
Scapania nemorea
Tetraphis pelucida
Thamnobryum alopecurum
Thuidium tamariscinum

5.4.2 Wet rocks

A different community is found on the boulders and cliffs close to the stream and waterfalls, where they are kept moist all the time by spray and in places are frequently inundated. They are dominated the large thalloid liverwort *Conocephalum conicum*. Mosses include *Bryum pseudotriquetrum*, *Thuidium delicatulum*, *Brachythecium rivulare*, *Fissidens bryoides*, *F.taxifolius*, *Mnium hornum*, *Rhizomnium punctatum* and *Thamnobryum alopecurum*. Liverworts do well on the wet rocks, with conspicuous patches of *Blepharostoma trichophyllum*, *Scapania nemorea* and *S.undulata*, and scattered plants of other species.

The lichen *Bacidia inundata* forms neat orbs where the rock face is steeper or overhanging. Siliceous rock boulders in the stream also support another lichen of damp habitats, *Porpidia hydrophila*. Damp rocks nearby often have *Peltigera hymenina*, *P.horizontalis*, *Baeomyces rufus* and *Trapelia coarctata*.

Rocks that are sometimes submerged support a limited aquatic flora, dominated by the moss *Rhynchostegium riparioides*, with the lichens *Bacidia inundata*, *Verrucaria aquatilis* and *V.funckii*.

Lichens

Bacidia inundata
Porpidia hydrophila
Verrucaria aquatilis
V.funckii

Bryophytes

Amphidium mougeotii
Brachythecium plumosum
B.rivulare
Bryum pseudotriquetrum
Cirriphyllum piliferum
Conardia compacta
Conocephalum conicum
Fissidens bryoides
F.osmundoides
F.taxifolius
Gymnostomum aeruginosum
Heterocladium heteropterum
Hookeria lucens
Hyocomium armoricum
Pellia endiviifolia
P.epiphylla
Plagiomnium affine
Racomitrium aciculare
Rhizomnium punctatum
Rhynchostegium riparioides
Scapania undulata
Schistidium platyphyllum
Thamnobryum alopecurum
Thuidium delicatulum
T.tamariscinum

5.4.3 Acid rocks

Siliceous rocks in dry situations on the higher slopes and in the boundary wall of the Blakelaw Plantation support a typical upland flora, dominated by large specimens of *Parmelia saxatilis*, *Pertusaria corallina*, *Platismatia glauca* and *Pseudevernia furfuracea*. *Xanthoria parietina* occurs on bird perching sites but is unusually scarce here. (The bryophytes of the boundary wall were not recorded).

Lichens

Lecanora gangaleoides
Lecanora sulphurea
Ochrolechia androgyna
O.parella
Parmelia saxatilis
Pertusaria corallina
Platismatia glauca
Porpidia crustulata
P.tuberculosa
Pseudevernia furfuracea
Xanthoria parietina

6. Locations of interest

6.1 Habitats

Basic boulders

The line of slightly basic boulders in the oak-ash woodland on the east side of the valley supports an interesting bryophyte flora, and remnant populations of a few lichens that are not

found elsewhere on the site. These boulders are best visited in winter as they are overgrown by bracken in summer.

Valley woodland

The lowest slopes of the valley, especially humid situations close to the Hareshaw Burn, support a number of large oak and ash trees with an interesting lichen flora. The most important are those with the rarer indicators of ecological continuity, and these are shown on the map. Many trees have good populations of *Thelotrema lepadinum*, and there are several living and fallen trees with *Peltigera horizontalis*.

Hareshaw Linn

The steep vertical cliffs on either side of the waterfall, and the rocks in the stream below it, support a rich and interesting bryophyte flora, including the rare *Conardia compacta*.

Below Hainingrigg

On the steep slopes below Hainingrigg there are several large oak and ash trees in a dry situation that support three rare species of *Chaenotheca* in deep vertical crevices in the bark of their trunks.

East hillside

Close to the boundary wall a small rock outcrop with a slight overhang supports *Arthonia arthonioides* and the undescribed *Chaenothecopsis* sp.

6.2 Tagged trees

Ten trees have been tagged so that they may be relocated for future monitoring. These were selected either for their particular interest, or as supporting a flora typical of their habitat and location.

The locations of these trees are shown on the map above. From north to south:

- Tag 401 Ash on steep slope above the path just before it reaches the linn. Only the base of the tree is accessible, but that has *Chaenotheca trichialis* and *Chrysothrix candelaris*.
- Tag 406 Ash on the new path up the western slope towards the plantation, just as it peters out under fallen trees, with *Chaenotheca brunneola*, *Pertusaria coccodes* and *Thelotrema lepadinum*.
- Tag 402 Oak by the fourth bridge, partly overgrown by honeysuckle, but with small amounts of *Arthonia vinosa*, *Chrysothrix candelaris* and *Thelotrema lepadinum*.
- Tag 404 Ash in a humid situation, overhanging the Hareshaw Burn (NY8404985075). *Brachythecium rutabulum* dominates the base of the trunk, with scattered *Hypnum andoi*, *Metzgeria furcata* and *Bryum capillare* higher up. *Opegrapha atra* dominates the river side of the trunk, but the west-facing side has healthy populations of *Gyalecta truncigena*, *Biatora epixanthoides* and *B.sphaeroides*.
- Tag 408 Oak at junction of the main path with the path to Hainingrigg, typical of other less accessible oaks in the area. *Lecanactis abietina* and *Hypnum andoi* dominant, also *Arthonia vinosa*, *Thelotrema lepadinum* and *Pyrrhospora quernea*.
- Tag 409 Ash on the slope between the main and Hainingrigg paths. Dominated by *Hypnum* sp. and *Opegrapha atra*, with fragments of *Arthonia vinosa*, *Pyrrhospora quernea*, *Thelotrema lepadinum* and *Chrysothrix candelaris*.
- Tag 405 Oak, a large double-stemmed tree above the path. *Lecanactis abietina*, *Hypnum* and *Brachythecium* sp. are dominant, also *Arthonia vinosa*, *Chrysothrix candelaris* and *Pyrrhospora quernea*.

- Tag 403 Oak in Blakelaw plantation, typical of this area of open acid oak wood with a grassy ground layer with bracken, heather and woodrush. *Lecanactis abietina* is dominant, also *Evernia prunastri*, *Chaenotheca ferruginea* and *Parmelia sulcata*.
- Tag 407 Hazel, an old coppice stool overshadowed by oak, on a steep slope just by the path and close to the river. Typical of this part of the wood and worth monitoring as it gets older. Bryophytes include *Hypnum andoi*, *Brachythecium rutabulum* and *Frullania dilatata*. Corticolous crusts include *Lecanora chlorotera*, *Arthonia didyma*, *Thelotrema lepadinum*, *Pertusaria leioplaca*, *Pertusaria pertusa* and *Graphis scripta*.
- Tag 410 Oak in the valley woodland by the entrance gate, typical of the south end of the site with *Lecanactis abietina* and *Hypnum andoi* dominant, *Chaenotheca ferruginea* and *Evernia prunastri*.

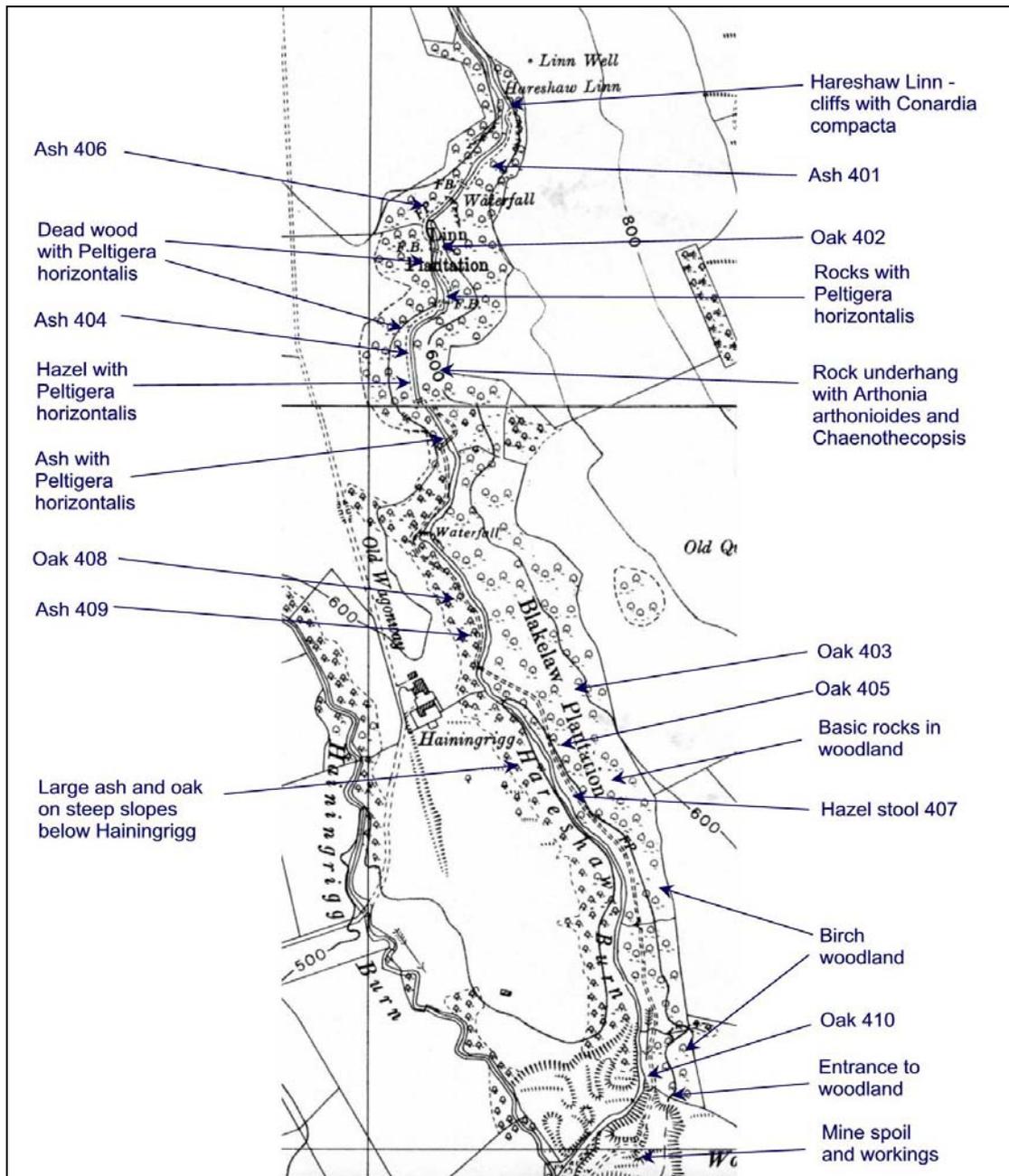


Fig. 2. Locations of interest and tagged trees at Hareshaw Dene.

Photographs of some of these locations and tagged trees are included in Appendix B.

Other trees of interest include mature ash and a fallen elm below Hainingrigg Farm. These could not be accessed in July for tagging because of the impenetrable thickets of brambles and nettles that develop in this area, but this can be done later in the year if required.

7. Discussion

7.1 Ecological continuity

The lichen flora can be used to calculate indices of ecological continuity, three of which are applicable in this area

- the Revised Index of Ecological Continuity (RIEC)
- the New Index of Ecological Continuity (NIEC)
- the East of Scotland Index of Ecological Continuity (ESIEC).

The calculation of these is standardised (Coppins and Coppins 2002) and provides a means to compare sites across Britain (RIEC, NIEC) and within this climatic region (ESIEC). The scores for species found since 1998 in the woodland as a whole are shown below:

Index of Ecological Continuity	Score for Hareshaw Dene	Score that indicates national conservation importance
RIEC	25	30
NIEC	7	20
ESIEC	8	10

Although these scores do not indicate any particular conservation value for the site in the national context, when it is being compared to much richer sites in more oceanic climates, they do indicate some degree of ecological continuity with the natural elm-ash woods of the area.

7.2 Recent changes

Comparison of the modern and historic species lists requires some caution as the dene itself extends beyond the SSSI boundary and includes a number of habitats that are not found within the SSSI. Some of the older records are likely to from these areas. However, some conclusions can be drawn from those records that are clearly from the woodland.

7.2.1 Changes in the lichen flora

Only 16 of the lichen species known from Hareshaw Dene before 1982 have not been found since. These include *Diploicia canescens*, recorded by Oliver Gilbert on the cliffs near the waterfall, and *Bryoria subcana*, *Usnea florida* and *U.glabrescens* on trees. *Protopannaria pezizoides* is a species of damp, humid situations, and has not been seen here since 1886. The 1981 record of *Chrysothrix chlorina* seems unlikely as this species is restricted in Britain to the Scottish Highlands.

Cladonia subulata and *Dibaeis baeomyces* are typical of acid, sandy soils. The acid bluffs would seem a likely location for these, before the trees were as tall as they are now, but they were not found during this survey.

Two species, *Calicium viride* and *Hypocenomyce carodensis* are typical of polluted areas and may have been lost as the air quality improved. *Lecanora conizaeoides* is now restricted to the acid bark of pines and is decreasing rapidly for the same reason.

86 species have been added to the lichen list in recent years. Previous surveys had only noted species of particular interest, so there is no full species list to compare with. However, it is unlikely that the earlier surveyors would have missed species such as *Arthonia arthonioides*, *Biatora epixanthoides*, *B.sphaeroides*, *Gyalecta truncigena*, *Chaenotheca brunneola* and *Enterographa crassa*, so these may indicate an improvement in the lichen flora as the woodland has matured.

7.2.2 Changes in the bryophyte flora

Miss E.M.Lobley recorded 211 species of bryophytes, 158 mosses and 53 liverworts, from Hareshaw Dene in the mid-20th century. Of these, only 95 were relocated during the surveys of 2000 and 2003, and another 10 species have been added to the list.

It is apparent from the historic species list that many of the records relate to parts of the dene above or below the present SSSI boundary, where the habitats include moorland, mine spoil and derelict buildings. Those relating to the woodland include:

- Acid woodland, in the Blakelaw and Linn Plantations – mosses *Dicranodontium denudatum*, *Plagiothecium denticulatum*, *P.succulentum*, *Pogonatum aloides*, and liverworts such as *Bazzania trilobata*, *Lophozea ventricosa*, *Nardia scalaris*, *Plagiochila spinulosa* and *Jungermannia gracillima*.
- Wet woodland – *Sphagnum palustre*, *Trichocolea tomentella*, *Riccardia multifida* and *Aneura pinguis* were probably associated with the pond.
- Basic woodland – mosses *Anomodon viticulosus*, *Brachythecium populeum*, *Eurhynchium crassinervum*, *E.pumilum*, *Homalia trichomanoides*, *Plagiothecium nemorale* and *Weissia controversa*, and liverworts such as *Porella platyphylla*.
- Wet rocks – mosses *Bartramia ithyphylla*, *Blindia acuta*, *Dichodontium flavescens*, *D.pellucidum*, *Distichum capillaceum*, *Eucladium verticillatum*, *Fissidens adiantoides*, *F.dubius*, *Hygrohypnum ochraceum*, *Philonotis fontana*, *Pohlia wahlenbergii*, *Tortella tortuosa*, and *Trichostomum tenuirostre*.

Some of these species may have been overlooked in the present survey. The addition of 10 species to the list in recent years may reflect the increasing maturity of the woodland and changes in its management.

7.2.3 Changes in the habitat

The changes to the species lists described above suggest that the woodland floor may now be less humid than it was. Similar changes have been noted in other Northumberland woodlands, and are consistent with the poor condition and gradual loss of *Lobarian* species throughout the county. At this site, however, it seems likely that the lack of the *Lobarian* community is mainly the result of the repeated removal of mature trees for timber over at least 200 years, and also atmospheric pollution from the Bellingham iron works and nearby village.

In the plantations the canopy is becoming higher and more closed as the trees mature, the soil is becoming leached and acid, and bracken and other ground cover is spreading over the woodland floor. There is no longer any disturbance by stock, although there are signs of browsing by deer.

In the valley woodland the hazel stools have not been coppiced for some time and are growing up, creating a dense understorey in places. The widespread loss of mature elms since the 1980s, due to dutch elm disease, and the demise of some of the older ash trees, has reduced the availability of the most interesting epiphytic habitats and left gaps in the canopy which have now been filled by dense scrub.

The pond mentioned in some earlier survey reports appears to have been lost. Local changes in the climate and in drainage into the valley may also be significant.

7.3 Site assessment

Lichens

This is an important lichen site in the Northumberland context, with several species that are locally rare and an unusually high diversity for this part of the country. As well as the trees,

the cliffs and crags support several interesting species and would bear further investigation. One species has already been found there which is undescribed.

The presence of one ash tree with lichens typical of humid ancient woodland is of particular interest. Although this tree is by the path and easily accessible, these species had not been recorded by earlier surveyors. This is not one of the oldest ash trees in the wood, so it seems likely that the lichens have colonised it from other, older and less accessible trees nearby. These sources may still exist. This could be an indication that the lichen communities are recovering as the woodland matures and is now managed for conservation.

Bryophytes

Hareshaw Dene is particularly rich in bryophytes with an unusually high diversity of species, both in the woodland and in particular on the cliffs and boulders around Hareshaw Linn and along the Hareshaw Burn. A remnant population of the national rare *Conardia compacta* persists near the waterfall, and it is very likely that there are other rare species still to be found.

7.4 Conservation

The current management of the main areas of woodland, with little intervention other than the maintenance of paths and the removal of dangerous timber, is appropriate to the habitat and no immediate changes are suggested to benefit the lichen and bryophyte flora.

In the longer term it may be beneficial to create some woodland glades on the higher slopes by the removal of some of the planted oaks and conifers. As the old hazel stools continue to grow, a resumption of coppicing would help maintain the diversity of habitats needed by the lichens of the *Graphidion* community. Both these activities should be restricted to small areas, and care should be taken to avoid those areas that already have an interesting lichen or bryophyte flora.

The valley woodland along the Hareshaw Burn should not be thinned as the lower plant flora here is dependent on continuity of habitat, with deep shade and high humidity. In particular any activity in the area around tree 404 should be avoided if at all possible.

7.5 Monitoring

Monitoring every 10 years against the baseline data of this survey is recommended to detect any detrimental changes to the habitat that might require a change to the management of the woodland.

8. References

- BBS (1998). UK Bryophyte Census Catalogue, British Bryological Society.
- Coppins, A. M. and B. J. Coppins (2002). Indices of Ecological Continuity for Woodland Epiphytic Habitats in the British Isles, British Lichen Society.
- Coppins, B. J. (2002). Checklist of Lichens of Great Britain and Ireland, British Lichen Society.
- Duncan, J. B. (1950). "A List of the Bryophytes of Northumberland." Transactions of the Natural History Society of Northumbria **Vol.10**(Part 1): 80.
- Gilbert, O. L. (1980). "Lichen Flora of Northumberland." Lichenologist **12**: 325-395.
- Ratcliffe, D. A. (1977). A Nature Conservation Review.
- Woods, R. G. and B. J. Coppins (2003). A Conservation Evaluation of British Lichens. London, British Lichen Society.

Appendix A Survey Data

Appendix B Photographs