The Lichen Communities of The Stiperstones NNR and The Hollies

Changes in diversity over the past 19 years and the implications of Nitrogen Hypertrophication.

Ivan Pedley October 2009
For Natural England

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General summary of findings:

The diversity of the lichens across the site has dramatically increased, when compared with the survey by Gosling in 1990. Gosling recorded 103 lichens; this survey lists 174, including 7 new county records and a number of species which were not refound from the original survey**.** Five of these are important in terms of the county list, i.e. members of the genera *Bryoria, Stereocaulon* and *Umbilicaria,* and have probably been lost from the site. This is possibly due to the impact of hypertrophication across the site as a result of increased nitrogen deposition (see discussion page 8).

None of the taxa recorded are rare on a national scale, but several are county rarities, and the saxicolous community on the quartzite tors and screes is remarkable, and important, not only for the county, but also for the UK. The corticolous lichen community [epiphytes on trees] is improving, and a number of relatively recent habitats—fence posts, wooden seats and concrete structures—are also adding to the lichen diversity.

There is also evidence of damage to the outcrops caused by fire, and the detrimental erosion caused by the feet of the many visitors who walk the NNR's paths.

It is difficult to determine if the present conditions on the reserve will be unfavourable to lichens in the long term, but clearly there is rapid environmental change occurring and, for the lichen community, a group of organisms that demand ecological continuity, this is of concern.

Summary of the condition of the main communities:

The saxicolous lichens [those growing on natural stone and built structures]

In spite of the important loses mentioned above, this community appears to be essentially unchanged since Gosling's survey—several additional species have been added as a consequence of extending this survey to sites not visited in 1990. The lichens on the quartzite outcrops reflect a long period of ecological continuity, perhaps several centuries—judging from the diameters of the largest thalli of the dominant yellow coloured lichen *Rhizocarpon geographicum* [a slow growing and particularly long lived species]. However, as mentioned above, of greater concern is the number of lichens, recorded in 1990 as rare or scarce, which were not refound during the present survey and may have been lost. This may be linked to an increase in nitrogen across the site—*Bryoria* species are amongst the first to disappear when nitrogen enrichment is a factor [van Herk 2003 in Lambley and Wolesley 2004]

Heather burn, whether accidental or managed has also had a detrimental effect on a number of the lesser outcrops e.g. Sites 1 &14 This is a management issue that must be addressed and it is encouraging to see heather mowing as a method of heathland management on the lower slopes.

The Corticolous Lichen Communities [composed of lichens growing on trees etc] have increased in diversity. Many of the recent colonisers are nitrophytes—members of the genera *Physcia* and *Xanthoria*—which reflect the nitrogen deposition that is an obvious feature of the site. But some are more exciting arrivals—*Graphis scripta* on *Ilex* above Perkin's Beach and *Flavoparmelia soredians* (new to the county), on a mature *Acer* at the same site, are two such examples

The Terricolous Community [growing on the peat and soil] appears to be unchanged. The species common to this community, e.g. *Cladonia, Placynthiella* and *Trapeliopsis* spp., come and go from areas in response to heather burn. Species of *Cladonia,* in particular, are lost when "leggy" heather is burnt and recolonise ground that is subsequently recovering. This cycle of loss and recolonisation is probably in balance, although a number of the species of the *Cladonia* subgenus *Cladina* group of terricolous lichens e.g. *Cladonia arbuscula* are perhaps rarer now than is indicated by the 1990 report.

The Lichens growing on Anthropogenic Structures [dry stone walls, brick buildings, gates, fence posts, wooden seats, and mine spoil] are becoming an important feature of the site and need to be included in any management plan.

The Stiperstones remains a remarkably arresting area of natural beauty—its lasting effect on the psyche of people walking the ridge may not be quantifiable, but in terms of its natural history and ecology, it is a site of vital importance to the county and to the UK generally. The impressive lichen communities reflect, and add to, its interest and charm.

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1: Site Details.

Site Name: The Stiperstones NNR and The Hollies

Map Details: Topographical: The Ordnance Survey Maps: Explorer Series— No 216 Welshpool and Montgomery 1:25,000 scale**.**

Geological: Institute of Geological Sciences Map: Sheet 152 Shrewsbury and Sheet 166 Church Stretton

Grid Reference: Contained within hectads SJ 30 and SO 39

Area: Approximately 520ha

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2.1Habitats to be surveyed:

- All outcrops of Stiperstones Quartzite along the entire ridge, together with detached boulders and stone scree stripes extending down from the crest.
- Outcrops of Mytton Flags on the northern slopes of Mytton Dingle.
- Moorland covered mainly with heather and bilberry; heather stems.
- Trees—The Hollies, Resting Hill Wood, Perkins Beach and individual trees in various other compartments.
- Worked timber fence posts, gates and seats.

- Dry stone walls.
- Concrete and mortar associated with: The Triangulation Point on Manstone Rock; the ruined buildings in compartment 61; concrete posts running north-south through the Hollies pasture and north-east below Upper Vessons Farm.
- The mine chimney on Lordshill
- Mine cast-outs composed of Mytton Flags.

2.2 Geology:

The Stiperstones NNR is dominated by a spectacular ridge of hard, acid, "quartzite", which has been eroded by a periglacial climate into a series of frost shattered tors. The quartzite forms part of the Ordovician sequence of rocks (492 million years old) and is sandwiched between Shineton Shales to the east (not surveyed during the survey) and Mytton Flags—dark grey siltstones and sandstones—to the west. The later formation is exposed in the sides of a number of valleys and was visited during the present survey. All these rocks show conspicuous jointing, which has encouraged pockets of soil to develop that support interesting lichen communities. In addition, within the Mytton Flags these lines of weakness are followed by commercially important mineral veins which have been mined in the area over many years. The waste tips associated with these mines, together with the metalliferous nature of the rock generally, have also encouraged colonisation by lichen metallophytes.

The quartzite ridge erodes to form acidic and nutrient-poor soils resulting in upland heather moorland.

2.3 Objectives of the survey:

- To repeat the survey of The Stiperstones NNR carried out by Gosling in 1990 using his choice of sites and his records as base lines.
- To include a survey of promising sites not included in the earlier report—within the time and financial limitations of the contract.
- To evaluate any changes which have occurred to the lichen communities since 1990, in particular, the appearance, or loss, of any species that might be due to nitrogen enrichment at the site from the nearby New House Farm unit and from other sources.
- To evaluate the importance of the lichens recorded with respect to the County List.

- To suggest management techniques that will conserve those lichens recorded at the Reserve and encourage further colonisation.
- To provide a survey report which includes a summary of findings, introduction, methods, results and discussion.

In addition to the above, work was jointly carried out with Dr Eleanor Hewins (over three days) to record higher and lower plants in 24 ground flora quadrats in Resting Hill Woodland, and 20 heathland quadrats across the NNR.

3: Methodology:

3.1 Field Work:

Prior to the survey a risk assessment was carried out. The main risks were perceived to be working on steep, heather covered slopes, on steep rocks and mobile scree, and in an exposed hill environment. Risks were also considered inherent in the use of chemicals needed to determine lichen species in the field—namely Potassium Hydroxide, Sodium Hypochlorite and Para-phenylenediamine (Pd). With respect to these risks, responsible people were made aware of the position of the surveyor during each of the 5 days. Care was taken on steep and broken ground; the more dangerous cliffs were not included in the survey; dry stone walls were not climbed upon; and the considerable experience of the surveyor made the dangers associated with the chemicals used in the field negligible.

The Reserve was surveyed in good weather during five days in October 2009. In addition further lichen records are included in this report as a result of three days advising on Bryophytes and Lichens during a higher and lower plant survey carried out by Dr Eleanor Hewins MIEEM. This involved quantitative analysis of quadrat data from Resting Hill Wood, and various moorland sites across The Reserve.

Laboratory work on collected specimens included the use of both dissecting and compound microscopes. An ultra violet light was also used to determine a number of lichen species and two Lepraria species were determined by Thin Layer Chromatography.

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Introduction

The Stiperstones form a high craggy ridge of hard, acid "quartzite" a few km to the south west of Shrewsbury. These spectacular outcrops rise above acid heather moorland and, together with the spectacular views from the ridge, contribute to making this a favourite walking area for numerous visitors.

The lichen flora of the site has been surveyed by a number of very eminent lichenologists over the years, and has been the venue for two field meetings of The British Lichen Society (Lewis 1963, and Gilbert and Lambley 1980). The last official survey was carried out in 1990 by Mike Gosling for English Nature. Ivan Pedley visited the site in 2001 as preparation for a further BLS field meeting which never came to fruition. More recently J. Ricketts, C. Smith, R. Woods and M. Lawley, have looked at specific areas of the site and have deposited records with Natural England. All these surveys have resulted in mainly descriptive accounts—the report by Gosling being more extensive and giving some indication as to the abundance of the notable species. The present survey was commissioned by Natural England to revisit the sites surveyed by Gosling—in part to determine any changes that have occurred to the various lichen assemblages but also to establish a more objective basis for lichen distribution in order that future monitoring may be able to detect temporal change.

A secondary aim of the survey was to determine if hypertrophication attributable to nutrient enrichment, specifically from nitrogen compounds associated with animal husbandry, is indicated by the presence of lichen nitrophytes (lichen taxa that are known to respond positively to increased nitrogen). And furthermore to determine whether these taxa, if present, are distributed in a manner that might indicate a point source for the nitrogen pollutants –recent work by Kok van Herk [2003] indicates that the effects of Ammonia NH3 are strongest near to the animal source.

Gosling recorded very few nitrophytes during his survey, a result which may well have been the result of less nitrogen pollution in the immediate area, at that time, than is presently the case. However, the complexity of environmental factors which effect lichen colonisation counsels a more cautious conclusion—higher historic levels of sulphur dioxide SO2, a factor known to suppress lichen growth whether they are nitrophytes or not, may have been equally to blame. And, indeed, environmental changes due to global warming may also be implicated.

Discussion of Findings:

Nitrogen input across the NNR:

Preamble:-

Excessive nutrient enrichment of the environment due to nitrogen compounds is now recognised as a widespread phenomenon which is influencing the natural environment--particularly in rural areas close to intensive animal husbandry. The main sources of nitrogen are ammonia from animal waste and plant decomposition, and also the oxides of nitrogen produced by the burning of fuels.

The effect of these pollutants on the growth of lichens and higher plants has been masked until recently by the deleterious effects of sulphur dioxide and its subsequent acidification of the environment. Large areas of the UK became "Lichen Deserts", particularly industrial urban areas, with only the most acid tolerant species surviving, and then only on basic substrates such as concrete, mortar, and asbestos, which tended to chemically buffer the effects of acidification. The dramatic reduction in SO2 following the clean air acts of the 1950's onwards has permitted lichens to re-colonise these depauperate areas. The process has been remarkably rapid and continues to be so.

A number of lichen species are now responding to nitrogen in the environment (the Xanthorion Community, characterised by the orange coloured species of *Xanthoria* and the grey species of *Physcia*) and are a noticeable feature of trees, buildings etc., in areas having high levels of atmospheric nitrogen.

This community is uniquely useful in acting as a bio-indicator of hypertrophication. It is a feature of the present lichen assemblages across The Stiperstones NNR. Furthermore the community provides a useful indication of the sources of nitrogen pollutants. These nitrophylous species were not a feature of the reserve in 1990 when the previous survey was carried out (other than, to a limited extent, the bird perching site at the summit of Manstone Rock) and this present survey, 19 years later, provides an interesting ecological comparison and indicates profound environmental change.

There is general scientific agreement that implicates ammonia from animal husbandry as the main cause of this change (de Bakker 1989, van Dobben and de Bakker 1996, van Herk 2002), with lesser contributions from oxides of nitrogen. The effect is not only to provide additional nitrogen as a metabolite, but also to raise the pH of tree bark. Lichen species ("acidophytes") adapted to porophytes such as *Quercus* and *Fagus* (having bark with a low pH) are lost and species diversity is decreased. At the present time there is uncertainty about the relative importance of these two factors (i.e. additional nitrogen as a metabolite versus its effects on substrate pH) in producing the change in lichen communities. Indeed, both factors acting together may be responsible.

Lichenologists now recognise two assemblages of common lichens that may be used to assess nitrogen impact. “Nitrophytes” is the term given to species which respond positively to nitrogen pollution with increased colonisation and growth. “Acidophytes” is a term used to describe a group of common lichens that are negatively affected by increased nitrogen. Other, rarer, lichens have also been shown to be sensitive to nitrogen but, because of their rarity, have little use as general indicators of nitrogen pollution and are usually omitted from the list of “Acidophytes”. This applies to *Bryoria chalybeiformis* and *Umbilicaria torrefacta* that appear to have been lost from Site 6.
Within the NNR the species considered to be sensitive to nitrogen pollution (“Acidophytes”) are:
Cladonia-all species, *Evernia prunastri, Hypocenomyce scalaris, Hypogymnia physodes*, *H. tubulosa, Lecanora conizaeoides, Parmelia saxatilis, Parmeliopsis ambigua, Placynthiella icmalea, Platismatia glauca, Pseudevernia furfuracea, Trapeliopsis flexuosa, T. granulosa* and *Usnea*—all species.
Those species responding positively to nitrogen hypertrophication (i.e. “Nitrophytes”) are:
Caloplaca citrina, C. holocarpa s.l., Candelariella aurella, C. reflexa, C. vitellina s.l., Lecanora muralis, L. dispersa, Phaeophyscia orbicularis, Physcia adscendens, P caesia, P. tenella, Rinodina gennarii, Xanthoria candelaria, X. calcicola, X. parietina, X. polycarpa

Significance for the NNR:-
For the Stiperstones and The Hollies the location and abundance of epiphytic nitrophytes, together with an understanding that most ammonia is deposited close to its source; and that the direction of prevailing winds (assumed to be from the south west for this site) produces a “compression” to the south-west and an elongation to the north-east; may be used to map patterns of ammonia pollution across the reserve (van Herk 1999)
The following may be reasonable suppositions deduced from the report’s findings:

•The nitrogen input is from several sources, and originates partly from outside the NNR and partly from within.
•Nitrophytes are particularly noticeable on trees in the south-west compartments and the Beaches, when compared with other trees on the site, indicating that a significant component of the ammonia may be from the south west. It was noticeable that, during the survey, the fields stretching out up-wind towards Corndon Hill were predominantly

used for intensive sheep and cattle grazing, and are close enough to be a significant contributory source of nitrogen.

This hypothesis, of wind directed nitrogen input from farming practices to the south west, is supported by the fact that Mytton Dingle appears to be less affected by nitrogen pollution (the trees support fewer nitrophytes). This might be due to the sheltering effect of Buxton Wood out to the west, both providing a barrier and also an area of reduced grazing, and hence reduced ammonia production.

•Significantly, the woodland showing less signs of nitrophication than other corticolous sites—other than the remarkable growth of the orange coloured alga of the genus *Trentapolia* on many of the boles—is on Resting Hill, above Snailbeach, and yet this wood is closest to the intensive poultry unit whose effects were a contributory factor in commissioning both this report and the associated report by Dr. Eleanor Hewins MIEEM, Hewins Ecology. The lichen communities at two other sites, just as close to the unit, show different degrees of nitrogen enrichment. For Site A5, The Hollies South, the effects of hypertrophication are very noticeable on both trees and concrete posts, but much of this is probably associated with Upper Vessons Farm (see below). The mine chimney, Site A7, is a saxicolous habitat and cannot be directly compared with Resting Hill woodland, but a few species reflecting nitrogen enrichment are present on the structure.

•The greatest effects of nitrophication are associated with Upper Vessons Farm. The concrete fence posts, lining the road running north east from this farm to Habberley, show a noticeable decrease in % cover of nitrophytes with increasing distance from the buildings. A similar effect is noticeable, but less so, on the longer row of concrete posts running south up the Hollies pasture. These disused posts provide a remarkable indicator of hypertrophication and should be retained in situ. (Photo 1)

•Although grazing within the survey areas is generally low, localised effects of animal waste is clearly an issue where stock congregate in areas of more nutritious grazing, e.g. on the west side of The Hollies. Here the smell of ammonia from sheep grazing under many of the mature trees is palpable. A similar effect is occurring on the strip of hawthorn woodland south east of Cranberry Rock and running down to the car park.

•The filamentous green alga (*Klebsormidium crustulatum*), known to be indicative of hypertrophication, is a noticeable feature of all the tors but particularly the southern ones. This alga is seen as green coloured streaking on the more sheltered eastern faces of the tors where the nitrogen compounds are precipitated out, as the winds blowing over the ridge lose velocity and carrying potential. Rain wash on the western faces may also be a factor dissolving away excess nitrogen.

The above conclusions are tentative. During the survey nitrophytes and acidophytes were often found growing on the same branches in many of the corticolous sites and this is an indication that the environment is actively and rapidly changing—to be certain of the direction of this change will require regular temporal monitoring. This could be done by NE staff when familiarised with the 30 or so indicator lichen species listed above.

Other Findings not associated with hypertrophication:

Heather control:

It is generally accepted that managing heather moorland by rotational burning can play an important role in maintaining the diversity of lichens. On a well managed moor not only are high numbers of game birds sustained (particularly red grouse), but important areas of lichen-rich heathland are encouraged. The areas where burning has recently occurred subsequently show a catastrophic reduction in lichen diversity, but this steadily recovers with time—although this period may well extend to 15 or 20 years.

Unmanaged moors, with older stands of heather, have a much lower diversity of lichens—i.e. management is essential to retain a diverse moorland lichen community.

Heather Management of The Reserve, to retain the current distribution and diversity of lichen species within the context of their respective habitats requires that the number fires, their size, location, and frequency are recorded. Mapping the areas of burn is vital, and with GPS technology relatively inexpensive. I have subsequently been made aware by The Senior Reserve Manager that this may not be possible.

Areas with vegetation that represents 3-10 years of regeneration are ideal for lichens—as a simple rule of thumb, if the moorland sward is easy to walk through, with plenty of clear patches of peat, it will support an interesting lichen community. Particularly good areas at the moment are both the valley above Crowsnest Dingle as it climbs out to Blakemoor flat, and the west facing slope down to this area from the ridge. Other areas show equally good promise.

Lichen members of the subgenus *Cladina* each have their own specific requirements and exhibit interesting spatial and temporal patterns. *Cladonia portentosa* is the first coloniser and survives exposed conditions—it is by far the most abundant of this group. When shelter is available in the form of young heather and bilberry “tufts” *C. arbuscula* subsp. *squarrosa* appears in small quantity, followed by the slender *C. ciliata* var *ciliata,* which seems to persist deep within older heather.

During the survey “moorland” lichens were recorded from the sites originally visited in the 1990 survey but extending this approach (of recording lichens from specific sites) to other areas of the moorland was considered to be inappropriate. The communities are in constant flux and, if this survey is repeated again in the future, sites that are presently important will have deteriorated as the heather swath closes, but new sites of diversity will have developed elsewhere.
There is an interesting lichen succession study to be done on these moors in the future.

Cladonia cervicornis subsp. *verticillata* (not found during the 1990 survey) was recorded at several places on the moor whilst taking part in the associated higher and lower plant quadrat study carried out parallel to this lichen survey.

Damage to the Tors by uncontrolled fire.
The effect of “wild-fires” and deliberate fires which have got out of control is apparent on the lower faces of a number of Tors. The diversity of the lichen communities on the rocks above the effects of fire, together with the size of individual thalli indicate a considerable period of ecological continuity, which might extend to hundreds of years.
Any action which threatens these ancient associations is to be deplored—a similar climax would take this length of time to develop! Deliberate burning must only occur on calm days, well away from the rocks, and under the supervision of enough staff to control any unwanted change of direction or ferocity.

Anthropogenic Habitats:
These include mine spoil tips, walls, buildings, concrete and wooden posts, seats and gates. Their relative importance and individual management is discussed below but there are a number which support such an important lichen assemblage that their management should also be mentioned here.


Photo 1

•**The walls** at sites 19 & 29 are important habitats—any disturbance would seriously damage the lichen communities that they support. The walls should not be rebuilt at this stage.
•**The concrete posts** at The Hollies should be retained in position; they are important “barometers” of hypertrophication as well as contributing a number of species to the SSSI (Photograph 1)

•**The wooden posts, rails, gates and seats** have a very interesting, developing flora. Inevitably they will need to be replaced and when this occurs the old structure should be retained on site. Posts and rails can be attached to the new fence by black plastic ties; gates can be similarly attached adjacent to the new structure. This will ensure that the lichen communities on the old structure can colonise the new. Many of these wooden structures are at present sound but the single post at site A11 is in urgent need of stabilisation—it is the only site where *Hypocenomyce scalaris* and *Cyphelium inquinans* are found. It is loose and should be pulled out of the soil and attached to the wire fence a few metres to the west leaving as much of the wood exposed and retaining the same aspect.

The Lichen Communities of The Stiperstones NNR and The Hollies
A discussion of the sites and management implications.

Site 1. SO 36483 97978. Duration of survey 1hour
A small unnamed quartzite tor at the southern limit of the ridge:

The lichen flora is generally good but there is localised damage caused by heather burn which has effectively cleared some of the lower sections of the southwest face and also boulders emerging from the heather.
The base of the east face of the tor is a good site for the genus *Cladonia*—a number of species are associated with the heather and bilberry stems and exposed roots. *Parmelia incurva* is still found on the boulder field to the northeast.
Lecanora sulphurea and *Ochrolechia androgyna,* two species recorded in the 1990 were not re-found but may still be present—time limitations precluded a longer survey. A new understanding of the distribution of *Cladonia coccifera* in the UK confines this species to mainly Scotland and the North of England. This taxa was recorded for the Stiperstones in 1990 but was probably a misnaming of *Cladonia diversa,* which is at present frequent on the outcrops.
Several species not previously found at this site were recorded. These include two orange-red coloured lichens associated with iron rich rocks—*Rhizocarpon oederi* and *Tremolecia atrata. Lecidea grisella,* a species new to the reserve is present in small quantities. This is a recently recognised species, previously included within the taxa *Lecidea fuscoatra* (which was recorded in 1990 from other outcrops)
Management: Heather burn must be kept well away from the base of the tor. The lichen flora on these rocks indicates several hundred of years of ecological continuity, to lose this by uncontrolled fire would be lamentable.

Site 2: SO 36512 98035. Duration of survey 1hour.
Quartzite ridge 100metres north of Site 1 but linked to it by a boulder field.
The general flora is similar to the previous site but *Umbilicaria polyphylla,* a species scarce in Shropshire, is found on boulders –the map reference above was taken at one of its locations.
Numerous species not recorded from this ridge in 1990 were added during this survey including several additional species of *Cladonia.* These additions reflect a longer survey and in all probability they would also have been present in 1990.

Miriquidica leucophaea is a species that is a new record for the reserve.

Management: Caution during heather burn also applies to this ridge of rock—it is low and hence more vulnerable.

Site 3: SO 36562 98112. Duration of survey 2 hours.

Cranberry Rock—A major tor with associated boulders and screes.

This tor has a good overall quartzite flora. Soil pockets in the cracks facing west have a good *Cladonia* assemblage and this is also true at the edge of the boulder fields. Algal slime (*Klebsormidium crustulatum*) is noticeable over much of the sheltered eastern face. Under the hand lens many of the crustose species—the *Rhizocarpon, Fuscidea* species etc are also partially covered in this alga and whether this will prove to be detrimental needs to be assessed in 2-5 years time. It is not possible to suggest a way of reducing the vigour or the coverage of this alga as it is probably caused by nitrogen as ammonia(NH3) emanating from surrounding farming practices—possibly the high numbers of sheep and cattle in fields out to the west.

Management: A similar cautious approach needs to be taken with heather burn as was mentioned in the previous sites. Although this is a more substantial tor, and hence much of its surface is above the fire zone, there is considerable lichen interest at the base of the rocks and at the edge of the stone scree stripes, both are areas vulnerable to fire.

Site 4: SO 36607 98231. Duration of survey 1 hour.

A low, linear, crag at the junction of the paths across the ridge.

The species recorded as *Parmelia omphalodes*, recorded from this site in 1990, was possibly *Parmelia discordans* as the latter was the only species found during this survey. The two species are morphologically similar but may be separated chemically. Several species were recorded from the base of bilberry and heather stems and are hence vulnerable to fire damage.

Numerous other species, common to the whole ridge, were added to the list for this site, and again, this probably reflects a longer survey time rather than new colonisation.

Green algal growth is also a feature of this crag—particularly on the sheltered eastern face.

Management: As for many of the sites on the Stiperstones ridge, heather burn must be undertaken with great caution.

Site 5: SO 36654 98466: Duration of survey 2 hours.

A crag with substantial scree stripes to the west.

Based on records from the 1990 survey, this was previously an important site, supporting a number of rare Shropshire lichens. It is still notable in spite of several of the great rarities not being re-found. These include *Bryoria chalybeiformis* and

Umbilicaria cylindrica, although *U. polyphylla* and *U. torrefacta* are still present, and in good condition, on the boulder stripes North West of two obvious Rowans west of the tor.

These Rowans (ref. **SO 36696 98461)** are an important habitat and support a developing corticolous flora (including 16 species which had not previously been recorded from this site). A number of these species are nitrophytes—indicative of considerable hypertrophication at the site—and the upper tree is notably covered in the green alga *Klebsormidium* sp., a further indication of nitrogen enrichment. The main outcrop is similarly streaked with the alga, particularly on the eastern face. The base of these trees shelter a number of *Cladonia* species including *C. luteoalba* (notably pale yellow under its curled back squamules)—a rare Shropshire lichen.

A small dead Rowan 50 metres north of this site and 15 metres west of the main ridge path was covered in a good corticolous community that was still surviving. This included several thalli of *Flavoparmelia caperata*. One of these was later transplanted by the Senior Reserve Manager onto a Rowan close to the main car park. The original tree had been sawn down and left on site, an act that, in terms of management, should be questioned. These trees are few in number, do not present a threat to the ecology of the moorland, and yet add so much more to the lichen list for the NNR.

Parmelia discordans was again found on the outcrop—possibly mistaken for *P omphalodes* in 1990. On the trees *Parmeliopsis ambigua* was an interesting find.

Management: The heather at this site is "leggy" and hence any fire allowed to get close to the faces of the "Rock" itself and the edges of the stone stripes would be serious.

Site 6: SO 36660 98481. Duration of survey 3 hours.

Manstone Rock—the main quartzite outcrop and triangulation point.

This is possibly the most interesting site on the ridge, not least because of it sheer grandeur—the highest point! Its ecological importance, however, lies in the conditions provided by the concrete plinth to the triangulation point and the associated pillar; a base rich habitat on a ridge solely composed of hard acid rock. It has become a refuge for basiphilous lichen species in an area of unrelenting acidity. In addition, the pillar provides a fine perching spot for the ravens that soar above the ridge and their guano has further encouraged a number of "ornithocoprophylous" lichen species (literally, "lovers of bird excrement!"), to colonise this spot. Yellow species of the genera *Caloplaca* and *Candelariella* cascade down below the point in a fascinating ecology.

Sadly *Bryoria chalybeiformis* appears to have been lost from this site—almost certainly due to nitrogen enrichment, to which it is particularly sensitive. The same is true of *Umbilicaria torrefacta.*

Hypertrophication is again a notable feature across the whole of the site—a small Rowan tree, (ref **SO 36690 98640)**, mentioned in the 1990 report, supports an abundant Xanthorion community, characterised by the nitrophytes, *Physcia tenella, Phaeophyscia orbicularis* and *Xanthoria parietina.* These species were not recorded by Gosling at the time and, as he reported lichens from similar trees within the SSSI, it is probable that they were not present. The green alga *Klebsormidium crustulatum* covers the tree and the tor, and is overwhelming some of the crustose lichens on the surface of the rock itself.

In spite of the loses the site is important, particularly the area surrounding the trig point

Management: The triangulation point appears to be sound, at the present, but will require replacement in the distant future. It would be valuable to retain the old pillar and its lichens and perhaps break up the base concrete into lumps and add them to the surface of any replacement concrete "raft"—the lichens positioned with the same orientation.

Heather burning around the tor should again be carried out with great care.

Site 7: SO 36831 98646. Duration of survey 2 hours.

Quartzite boulder field in heather to the east of Manstone Rock

Stereocaulon vesuvianium mentioned in the 1990 report was not re-found. It may still be present, but the difficulty of the terrain—mobile quartzite boulders—and the vague directions as to its location in Gosling's report, "200 m east of the path", make the prospect of discovery small. The Cladonia flora, described as "nice" in that report was rather depauperate, reduced in quantity if not in diversity. Heather burn may well be the cause, as the fires have cut back the heather from the edge of the boulder field—a site which is favoured by several species of *Cladonia.* A number of taxa are present on peat and soil pockets between the blocks.

Two common species were added to the list for this site.

Management: The need to burn so close to the boulder field should be considered in any heather management programme.

Site 8: SO 36690 98640. Duration of survey 2 hours.

Stone stripes north and west of Manstone Rock:

Stereocaulon evolutum and *Parmelia omphalodes* was not refound at this site otherwise it remains unchanged.

Site 9:"Devil's Chair Tor". Duration of survey 1 hour.
East of the dividing path running between the tors.

This is the smaller of the two outcrops comprising Devil's Chair Tor and the least important in terms of its lichen communities. A few species were added to the list for this site, all common on the ridge. *Lecanora conizaeoides,* recorded by Gosling in 1990, has probably been lost. This species is dramatically falling in abundance throughout the country as both sulphur dioxide levels and hence acid rain have fallen, following the clean air acts of the last half of the 20th century. It is now confined to acid worked timber—fence posts and gates (as it is within the reserve) and to acid sandstone headstones in churchyards.
The green coloured alga, *Klebsormidium crenulatum*, is a notable feature of the north and eastern faces of this outcrop.
Management: Heather management by burning, if thought necessary, should be carried out with caution.

Site 10: SO 36845 99183. Duration of survey 3 hours.
"Devil's Chair Tor" –West of the path running between the two outcrops forming the tor.
This is by far the better of the two outcrops in terms of both diversity and abundance. Two species, *Hypocenomyce scalaris* and *Lecanora conizaeoides,* have almost certainly been lost from the site as a consequence of changes to the environment (reduction in acidification across the reserve) but several other species were added to the list.
Fuscidea lygaea on the east face is a new record for the NNR.
An ecologically interesting niche, which was not mentioned in the previous report, is the presence of a bird perching site at the very summit of the rock, with its associated guano enrichment. Several ornithocoprophylous species (see Site 6 for additional discussion) are found at this point including *Candelariella coralliza, Xanthoria ucrainica* (with yellow upright overlapping fan-shaped lobes) and *X. ulophyllodes,* with horizontal, more orange coloured, lobes. This latter species is a new county record.

Green alga is again a noticeable feature of the rock surface—particularly the eastern face—and indicates nitrogen enrichment.

Management: Heather control, by fire, should be carried out with great caution—particularly on the western and southern sides.

Site 11: No location or details are given for this site in the 1990 report—there is a comment on the Compartment map which indicates that "there is no site 11 & 23"

Site 12: Stone Stripes north-west of Manstone Rock. Duration 1 hour.
This site is mislabelled in the 1990 report as "Stone Stripes West of Devil's Chair but is marked on the compartment map of that report as north of Manstone Rock. This survey looked at the stripes north west of Manstone Rock. **SO 3675 9870**
Steriocaulon vesuvianium s.l., an important species recorded from one rock at this site in 1990 (and hence vulnerable) was not found, but may still be present. All the dark brown *Parmeliaceae* at the site were either *Melanelixia fuliginosa* f. *fuliginosa* or *Parmelia discordans*. None tested chemically K+ yellow-red, indicative of *P. omphalodes*—previously recorded from the site and possibly misidentified as such.
Management: Heather control at the edge of the stripes should be carried out with caution, if burning is thought necessary.

Site 13: SO 37190 99658. Duration of survey 2 hours.
"Scattered Rock" A series of small quartzite outcrops and boulders—the survey commenced at the map reference above.
The saxicolous community on the rocks themselves is still a good representation of the lichens found on quartzite rock. Two saxicolous lichens, mentioned in the 1990 report—*Ochrolechia androgyna* and *Umbilicaria polyphylla*—were not relocated, but are possibly still present. The "nice stands of *Cladonia"* have been lost from the heather but are still frequent amongst quartzite blocks below a steep west facing exposure to the west of the main outcrops (at **SO 37180 99783**).
The heather about the rocks is "leggy" and has probably overwhelmed the *Cladonia* community mentioned by Gosling. Two species that are members of this community were not re-found –*Cladonia arbuscula* and *Cladonia ciliata.* They will undoubtedly re-colonise this area after the next burn—should one be planned.
Green alga is a noticeable feature of a moribund birch tree to the west of the block field mentioned above and, more generally, of dead heather stems.

Management: Heather burn would open up the sward and encourage species of *Cladonia* to return, but this action should be carried out with caution.

Site 14: SO 37380 99960. Duration of survey 2 hours
"Shepherds Rock" A "quartzite" outcrop with block scree on the east side.

This is one of the few outcrops on the ridge that has been seriously damaged by fire. The damage to the southern slopes is extensive with much of the rock surface effectively sterilised. Over one hundred years of ecological continuity has been lost (possibly considerably longer) which is lamentable. The fire also funnelled round the south east side of the outcrop, until stopped by the block scree, and has caused further damage to this area. The loss of lichens can be quantified by the high quality of the flora that remains on the tops of the outcrops, facing upwards, and hence effectively sheltered from the rising flames.
There is still some interest on the east and north faces of the outcrop and, of course, the block scree, an effective fire brake, still supports good stands of all the scarce lichens mentioned in the previous report—*Arctoparmelia incurva* and *Umbilicaria polyphylla* in particular. Several other lichens common to the ridge were added to the list
Management: The damage caused by heather burn to this outcrop stands as stark example of how not to manage heather.

Site 15: SJ 37256 00568 Duration of survey 2 hours.
"Oak Hill" South facing bedded sandstone outcrops (Mytton Flags) at the head of Mytton Dingle.

These rocks have a remarkable and untouched lichen community which probably represents a climax for this type of geology. Surveying is difficult (very steep slopes and friable rock) and undoubtedly more taxa are present for future lichenologists to find. The structure of the rocks, with numerous cleavage planes providing fissures and underhangs; together with nutrient run off from the soil above; as well as more base enrichment inherent in the rocks themselves, has encouraged a much greater diversity of lichens than that found on the quartzite of the ridge above. *Trapeliopsis pseudogranulosa* was not re-found but is probably still present. Several species, new to the site, were recorded, which included *Baeomyces placophyllus* (re-found from the 1963 BLS visit)*, Trapelia coarctata, Trapelia glebulosa,* and *Porpidia crustulata.*

One noticeable feature is the association between *Lepraria neglecta* and the bryophyte *Andreaea* sp. with the light-grey coloured lichen often covering the centre of the moss cushion and contrasting with the "black perimeter" of exposed moss.

Management: No management is required at this site other than light grazing to prevent scrub development. Natural erosion will progressively expose fresh rock for colonisation. Accidental fire is unlikely and, in any event, would not damage the large areas of exposed rock

Site 16: This site, mentioned in the 1990 report as "scattered boulders in east corner of compartment 23a and supporting 4 common saxicolous species", was not visited.

Site 17: SO 36156 98581. Duration 15 minutes.
A group of Hawthorns surrounding a ruined farm building west of compartment 23b.
Hypocenomyce scalaris and *Lecanora conizaeoides*, previously recorded from the hawthorns, have been lost from the site but a number of other species were added. Amongst these was *Parmeliopsis ambigua* on the trees and ruins within the area.
Management: Hawthorn has its own lichen community and this will develop on these trees with time. They should be conserved.

Site 18: SO 36062 98484. Duration of survey 15 minutes.
Two mature beech trees and an Elder in compartment 61c
The compartment also contains several hawthorns and a low stone and turf wall that has collapsed.
This is an interesting site, not particularly because of the quality or diversity of the lichens, but because it was one of the few corticolous sites to be surveyed by Gosling in 1990 and hence provides a valuable insight into the dramatic change, due to a reduction in acidification and now to nitrogen enrichment, that has occurred to these trees in the intervening 19 years. The additions are mainly nitrophytes of the Xanthorion community of lichens –characterised by *Xanthoria* and *Physcia* spp. together with *Candelariella reflexa*—and is a community that indicates that nitrogen enrichment is a feature of this site. The source of hypertrophication is open to debate but the intensive grazing out to the south west undoubtedly contributes a significant amount. There is also localised dunging by cattle and sheep within this area of the NNR which also adds to the nitrogen impact.

The lichen *Lecanora conizaeoides* was not re-found, and has probably been lost from the trees—with a reduction in acid rain, it is also being lost throughout the UK. As indicated above, several additional species were recorded from the trees.

Management: The present grazing level should continue—most of the ammonia probably originates from outside the reserve. These are interesting trees and should be retained.

Site 19: SO 36075 98604. Duration of survey 1 hour.
Old walls forming the northern boundary of compartment 61c

Stone and earth banks are a feature of the enclosures adjacent to this site, some are intact, but most are simply lines of heaped stones that do not appear to have been completed into banks. They are of considerable age and at this stage the lichen flora is too important to disturb. This is particularly true of this wall—the diameters of the thalli of *Rhizocarpon geographicum* growing on this line of stones indicate the surface has probably been exposed for close to 100 years. It is an important site for *Schaereria cinerorufa.*
Management: The walls should not be disturbed and the present grazing regime retained to prevent the wall becoming overwhelmed by bracken and scrub.

Site 20: SO 36353 98757
This site (a peaty bank in the SW corner of compartment 25a) no longer exists—it appears to have been eroded away.

Site 21: SO 36455 98977 Duration 30 minutes
An area of managed heather.
This is an area with patches of heather of different ages—recently burnt on the lower western slopes and leggy, mature sward, higher up on the hillside. It exhibits an interesting sequence of recolonisation by species of *Cladonia* after the fire. *Cladonia portentosa* is particularly noticeable as small primordial patches sheltered below bilberry and heather tufts.
Management: No recommendations are necessary.

Site 22: Duration of survey 2 hours
An area of mature heather running up from site 21 to Manstone Rock.

This site is mentioned as having suffered a serious fire in 1976. As a result the occasional rocks found below the heather sward have little lichen cover. The heather is too close-growing to encourage a notable lichen flora—those species recorded being found in breaks in the sward where the peat is exposed.

The quartzite rocks reveal how little growth has taken place in the saxicolous communities over the last 33 years since the fire of 1976 effectively wiped them clean.
Management: No recommendations are considered necessary.

Site 23: No location is given for this site in the 1990 report. There is a comment on the compartment map of that report which indicates that "there is no site 11&23"

Site 24: SJ 36922 00034. Duration of survey 2 hours.
The trees along the path by compartments 53b and 53d, together with other trees in the general area.
This is an important corticolous site, supporting the most diverse epiphytic lichen community within the NNR boundary and the Hollies compartments. Several additions to the site were added, including a new county record, *Flavoparmelia soredians* on a mature *Acer* at **SO 36996 99970**. Other notable records included *Ramalina fastigiata, Graphis scripta* (on a holly above the mine spoil site, at the start of the gully eroded by the path to the ridge—(**SJ 36922 00034** see photograph 2) and *Usnea subfloridana.*

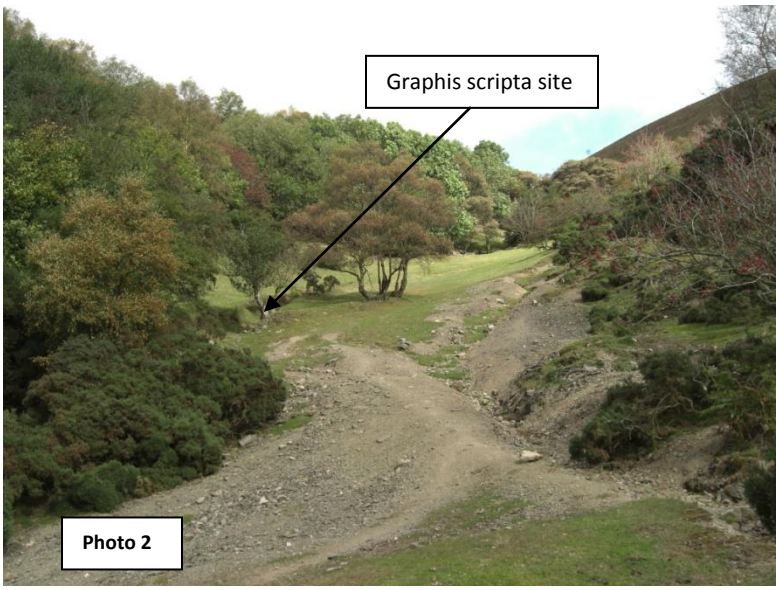

Photo 2

The additional interest of the site is that it indicates the dramatic change that the effect of nitrogen has produced since Gosling surveyed this area in 1990. He did not record any nitrophytes—*Xanthoria, Physcia,* and *Phaeophyscia*—from the trees; now they are the dominant component of the community.

These trees are important; they are in an open situation with adequate light and moisture. The mature sycamores in particular must be conserved, it has long been realised that sycamore is a good tree for lichens as its bark is neutral to high in pH.

Management: Retain all the mature trees at the site; if any become moribund, plant more—suitably protected from sheep grazing. This particularly applies to the sycamores. Retain the "open" habitat.

Site 25: SO 36910 99976. Duration of survey 1 hour
Mine spoil at the end of Perkin's Beach.

The sides of this tip are too mobile to support anything other than a weak assemblage of lichens, and these are confined to the large, more stable, blocks (Mytton Flags geology). The top is more established and, now that the gorse has been cleared, is developing some interest. Crustose lichens are confined to the stones eroding out of the loose surface, and *Cladonia* spp. are associated with patches of developing turf. The flora is vulnerable; any surface disturbance will tend to tumble the stones and destroy the lichens on their upper surface. Many of these are early colonisers and will grow on fresh surfaces as these present themselves. The parasitic lichen ("lichenicolous") *Rimularia furvella* (new county record) was recorded growing on *Rhizocarpon reductum.*
Management: The top of the waste tip should be kept clear of gorse *Ulex* sp.—this will shade out the developing lichen flora.

Site 26: SJ 37902 00692. Duration 3 hours.
Small quartzite tors at the northern end of the reserve between compartments 44b and 45b
These crags have been damaged by fire and the flora low down on the western faces, has been destroyed. The obvious bird perching site is so toxic with excrement that not even the ornithocoprophilous species, which are normally found at these sites, can survive. A number of lichens not recorded in the last survey were added to the list for this tor—these were common species to the ridge generally.
The green alga *Klebsormidium sp.* is a feature of these outcrops—particularly on the eastern, sheltered face. A rowan, growing out from the base of the last outcrop, also supports a number of nitrophytes on many of its twigs and branches. Both these features indicate that nitrogen enrichment is a feature of this site, but its effects are not noticeably any more severe than at the southern end of the reserve.
The heather moor to the west is regenerating and the first stages of a *Cladonia* heath is forming with small clumps of *Cladonia portentosa* growing between fresh heather and bilberry shoots. It will be interesting to follow this re-generation and succession.

The crag at **SJ 38020 00870** was visited but added little to the overall flora of the ridge.
Management: Heather management by fire should be carried out with caution.

Site 27: SJ 37924 00727. Duration 2 hours
Quartzite screes east of Site 26
This has retained the exceptional saxicolous flora previously reported by Gosling. A number of species were not re-found (*Bryoria fuscescens, Cladonia ciliata* var. *ciliata, Parmeliopsis ambigua* and *Hypocenomyce scalaris*) but several others were recorded for the first time from this site. The diameters of the largest *Rhizocarpon geographicum* thalli indicate that most of the scree has been stable for many years—perhaps in excess of 100—stones that have tumbled have a noticeably weaker flora. The *Cladonia* flora is good—small "rafts" of vegetation within the scree are the refuge to the *Cladina* group (photograph 3); and both the soil in crevices and the exposed peat at the edges support a wide diversity of common moorland species. *Cladonia luteoalba* was a notable find and *Umbilicaria polyphylla* is frequent on the stone tops.

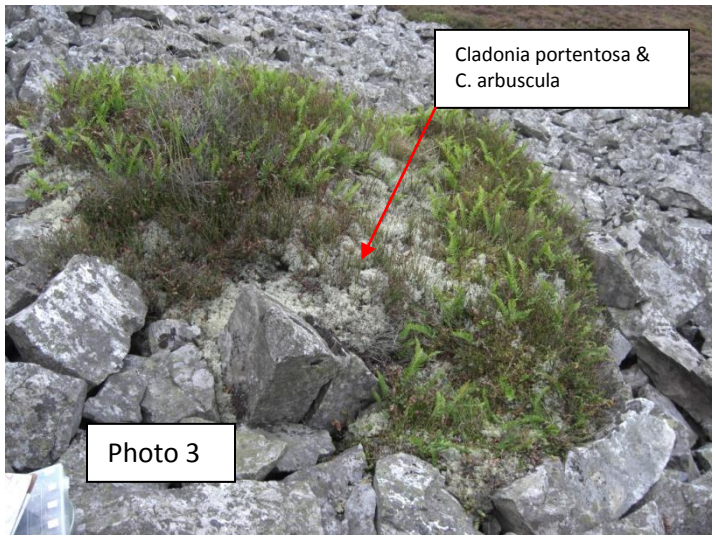

Photo 3

Management: Fire control is essential during heather burning.

Site 28: An old wooden post north east of compartment 45B.
This was not relocated but the two species it originally supported are abundant on a series of Willows running south from site 29. These trees (site A2) are developing an interesting flora.

Site 29: SO 38177 01051. Duration 1 hour.
Dry stone walls of quartzite east of compartment 44c
This is a short section of thick walling that was probably used to dispose of field stones. The stock security has been increased since Gosling's survey by the addition of a post and wire fence running along its western face and this might raise management

difficulties—stock are unable to graze up to the base of the wall and scrub may develop between the fence and wall reducing light and lichen viability. The east face has a good diversity of species. The wall is collapsing into the slope and the "sheets of *Mycoblastus sanguinarius*" (Gosling) are in danger of being lost

Management: If the wall is to be rebuilt, the aspect and height above ground of most of the walling stones will need to be retained. For the present no intervention is recommended.

Site 30: SJ 36962 00466. Duration of survey 4 hours
Mytton Flags Outcrops on the northern slopes of Mytton Dingle.

These outcrops and smaller rocks on the steep northern slopes of Mytton Dingle have a southern aspect. The site was too extensive and the terrain too difficult (mature heather, bilberry on very steep ground) to cover it in its entirety – two days or more would be needed for a complete survey, with rope work essential on the upper faces. The exposures 150 metres above the mine entrance at **SJ 36962 00466** were covered thoroughly. *Candelariella vitellina*, recorded during the 1990 survey was not re-found but is almost certainly present at bird perching spots.
Several other species were added to the site, mostly common members of the Mytton Flags community. *Lepraria membranacea* was frequently found in the cracks and crevices, this is a scarce species in the county.
Management: "Wild-fires" are a threat to this site, particularly to those communities growing on the smaller exposures surrounded by heather.

Site 31: SJ 36962 00466. Duration of survey 1 hour
A mine spoil tip below the entrance to the mine mentioned in the above site (Site 30) and one further up the Dingle.

A small Cladonia community is developing on the platform of the lower tip but most of the interest lies with the saxicolous community growing on the larger, more stable, rocks which are eroding out of the waste. Animal excrement is a noticeable feature of the grassy sward about the tips, one which will add to the nitrogen load already experienced by this area of the reserve; although, at present, hypertrophication appears to be slight, with only a few nitrophytes growing on the sycamore, hawthorn, and birch which scatter the slopes about the tip. It is possible that Buxton Hill with its wood, out

to the west, is both screening the Dingle from ammonia produced by stock outside the reserve and is also providing an area of reducing grazing, and hence ammonia emission.
Management: This site should be monitored by NE staff over the next few years for increasing signs of hypertrophication (specifically, by learning the Xanthorion community of nitrophyte lichens and noting any change in its abundance on the trees)

Additional Sites
A1: SO 36738 97940. Duration of survey 30 minutes.
Hawthorns on the hillside NW of the car park. These trees form a small developing strip of woodland running down the east facing heather moor, north east of the southern car park. It supports a developing Xanthorion community of nitrophytes, indicating nitrogen enrichment, but also a good number of acidophytes, e.g. *Evernia prunastri, Hypogymnia* spp. and *Parmelia* spp. The presence of *Parmotrema perlatum* also indicates that air quality, in terms of SO2 level, is very good. These two communities growing together at the same site indicate that environmental change is occurring and the trees offer a future indicator of what might be increasing hypertrophication—the nitrophytes increasing and the acidophytes decreasing.
Management: The wood should be protected from fire and the grazing regime continued to retain an open scattered corticolous habitat.

A2: SJ 38171 00975. Duration of survey 15 minutes.
A line of Salix adjacent to the dry-stone wall at Site 29.
Site 28, a wooden post recorded during the1990 survey, could not be found, but this line of trees has more than taken over in importance. They support a developing community, which includes *Usnea hirta*—the only site in the NNR
Management: Opening up the area at the base of these trees will increase light and hence further lichen colonisation.

A3: SJ 373 015 Duration of survey, 1 day, as part of the woodland floor quadrat survey.
Resting Hill Woodland.
This is secondary oak woodland forming the northern limit of the NNR and situated on steep west and south facing slopes. It is an interesting site, and in terms of the debate about the effects of nitrogen enrichment across the area and its possible source, it is also an important one. Resting Hill Wood was not surveyed by Gosling in 1990 but, as hypertrophication was not a noticeable feature of any of the sites visited at that time (other than a bird perching spot on Manstone Rock), one may assume that it also applied to this wood. The present survey found minor effects of excess nitrogen on the

woodland epiphytes in the form of *Klebsormidium* sp., a green alga, covering many of the trees; and the orange coloured alga *Trentapolia* sp. rising up the boles of a significant number of oaks. The *Xanthorion* lichen community, so common on trees at many other sites visited during the present survey and indicative of hypertrophication, was not found on any of the fallen twigs and branches, or observed in the canopy. Furthermore the acidophyte lichen community *Evernia* sp., *Hypogymnia* sp., etc –usually lost when nitrogen from ammonia is a factor—is healthy and abundant. A pleasing terricolous *Cladonia* community on the woodland floor about **SJ 3734 0160** is a further indication of a site not experiencing significant hypertrophication. This community is situated high up on the southern slopes, where winds are a factor; the trees are stunted and the canopy more open.

The branches of ash trees that had been cut down at the top of Crowsnest Dingle did support the Xanthorion community but, significantly, this valley faces the intensive sheep and cattle pasture to the west, and also the prevailing winds.

Psilolechia lucida, a lime yellow coloured lichen, was noticeable on several of the small rock exposures in the wood and also on the mine "Compressor House". *Cyrtidula quercus,* occasionally found on young oak branches, was a new county record.

Management: The Xanthorion community of lichens is easy to recognise by a non-specialist, and this should enable NE staff to do regular "visits" to check up on the ecological continuity of this important wood—specifically to record any obvious increase in the orange coloured *Xanthoria parietina* and the grey species of the genus *Physcia* on the twigs and upper branches.

A4 & A5 The Hollies: Duration of survey, 5 hours.

This large area of predominantly rough grazing was not surveyed in 1990.

For convenience, recording was carried out as two separate units:

1. **Site A5. The valley woodland** situated on either side of the road leading to Upper Vessons Farm from the chapel. The valley is aligned east west and, because the wood grows on the north facing slope, light is reduced and is too low to encourage lichen colonisation. Nevertheless there is some interest in more open areas. The bole of a large ash tree 50 metres before the farm, on the south side of the access road that rises to The Hollies pasture, is covered in a remarkable crust of *Phlyctis argena,* (a new record for the SSSI) forming a white coloured 3 metre high crust that is aggressively growing over the other lichens on the bark which were present prior to its arrival.

Higher up the path *Pertusaria amara* f. *amara* and *Ochrolechia subviridis* were recorded on ash, the later a second county record.

The trees about a ruined mine building (*Prunus* sp., hazel, willow and ash) support a developing assemblage that includes *Lecanora compallens* (new county record) growing on an ash bole.

Management: Efforts to open up this valley by clearing saplings and scrub will increase the light levels experienced by the tree boles and hence encourage lichen development

2. Site A4 The Hollies South—a large compartment of rough grazing running up towards the northern end of the Stiperstones ridge. The area of grazing on both sides of a dividing wire fence is the most important for lichens and contains number of remarkable holly trees scattered about [reputed to be several hundred years old] . The lichen community is mainly of common species although a rowan, just above the dividing fence and to the east of the track, supports *Candelaria concolor*, a new county record. *Opegrapha varia* and *Cliostomum griffithii* were also interesting records and new to the SSSI.

There is noticeable localised hypertrophication due to sheep and cattle grazing and this is encouraging a vigorous growth of nitrophytes.

Management No recommendations are suggested at this time.

A6: Ruins west of Site 17. Duration of survey, 15 minutes.

The importance of these anthropogenic structures should not be minimised—they should be retained for as long as they stand. They are structurally sound and present no health and safety issues. Lime mortar is still present between the stones and base run off from this has encouraged *Tephromela atra* and *Rhizocarpon petraeum* to colonise the acid stones below. Both species are new records for the NNR. A concrete base to two troughs within the buildings is the site for several saxicolous lichens that are adapted to this substrate—this is the only site for *Aspicilia calcarea, Caloplaca flavescens* and *Verrucaria viridula.*

Management: No recommendations are considered necessary other than conserving the walls as they are at present

A7: SJ 38149 02053. Duration of survey 15 minutes.

Mine Chimney.

Although not strictly part of The Reserve this structure was surveyed and supports enough interesting taxa to be included in this report. This is the only site within the SSSI

for a species of *Porina* (not identified), *Verrucaria fuscella*, *Verrucaria macrostoma* form *furfuracea*, and *Verrucaria elaeina*—the latter perhaps a new county record.
Management: If re-pointing is needed in the future, it should be done to only those sections in immediate need, to allow lichens to spread on to the new mortar from the old.

Sites A8, A9 and A10: Duration of survey: 30 minutes
Worked timber structures across the Reserve **For map references see Appendix 5**
The gate posts, fence rails and posts at these sites are developing very interesting and vigorous communities of lignicolous lichens. *Lecanora conizaeoides* is present on two of the posts and is fertile. This species increased spectacularly throughout the UK during the industrial pollution of the 19th and 20th centuries because of its resistance to atmospheric acidification. Now it is being lost at an equally rapid rate and in many places is confined to sites such as these—pine posts with a low pH.
Two wooden benches on the "all-ability" track from the main car park were also looked at. They support similar communities and these were not recorded.
Management: The posts are all sound at the moment but when they need replacing they should be retained on site, attached to the fence adjacent to the new structure. The original aspect of the old wooden structures should be retained, and ideally stainless steel wire used to support them in position.

Site A11: Single isolated wooden post. SJ 37523 00748. Duration of survey: 10minutes.
This is a particularly important post. It is unstable and will be lost soon if not conserved. It is the only remaining substrate for *Hypocenomyce scalaris* and *Cyphelium inquinans* in the reserve and also carries healthy populations of *Mycoblastus sanguinarius* and *Parmeliopsis ambigua.*
Management: It should be lifted as soon as is practicable and attached to the wire fence a few metres to the west [ideally with stainless steel wire, but plastic ties would also serve for a few years]. It needs positioning away from shading trees, not tied to an existing post, and the aspects of its four sides retained

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I would like to thank The Senior Reserve Manager, Mr Tom Wall, together with all his staff, for the help and courtesy, generously given, during the survey.