

Lichen Conservation in Scotland

BRIAN J. COPPINS

*Royal Botanic Garden Edinburgh, Inverleith Row,
Edinburgh EH3 5LR*

Summary

The significance of the Scottish lichen flora is outlined within the context of the British Isles and Europe, prompting a cautionary note on an over-reliance of assessing conservation importance using national *Red Data Book* categorisations. The conservation needs of lichens and their habitats, from 'gardening' to landscape management are discussed.

Introduction

Despite its relatively small geographical area, Scotland is enormously diverse with regard to geology, topography and climate, and much of its countryside, although under the influence of man, has been relatively free from the effects of atmospheric pollution. These aspects are reflected in a high biodiversity of some 1500 lichens, about a third of the total European lichen flora.

In a European and global context, Scotland is justifiably renowned for the lichen flora of its oceanic woodlands in the Western Highlands, but internationally important lichen assemblages are also to be found in its mountains, lochs, rivers, rocky seashores, coastal dunes and shingle, native pinewoods, and other woodlands further east.

Scotland has relatively few endemics, owing largely to its glacial past, but the number of supposed endemic lichens (Table 1) markedly exceeds the numbers for bryophytes, vascular plants and vertebrates (Shaw & Shewry, 2002). A cautionary note is required here, as many of these 13 lichens are expected to occur outside the British Isles but are not recorded, either because they are inconspicuous in the field and/or require critical identification. However, some of the species occur in habitats almost unique to Scotland, such as *Graphis alboscripta* (Atlantic hazelwoods), and *Ameliella grisea* Fryday in ed., *Catillaria gilbertii*, *Chromatochlamys geislerioides* Fryday in ed., *Halecania bryophila*, *H. micacea*, and *H. rhypodiza* (hyper-oceanic mountains, above the tree-line; Fryday, 1997).

The Species approach

In the UK, statutory protection for individual lichens began in 1992, with 26 species being listed on Schedule 8 of the Wildlife and Countryside Act 1981, and 17 of the 29 lichens currently on this schedule are to be found in Scotland (Appendix 1). Restrictions were imposed on the numbers of species that could be included, so those selected were among the more conspicuous of our threatened species, from a range of important lichen habitats, thus providing 'flagships' for the cause of lichen conservation. Further 'official' recognition of threatened lichens came in the form of the *Red Data Book* for the lichens of Britain (Church

¹ Except for unpublished ('in ed.') names, lichen nomenclature follows Coppins (2002).

Table 1. Scottish lichens that are currently considered to be endemic to the British Isles.

Ameliella grisea Fryday in ed. (S)	H. rhypodiza (S)
Arthonia atlantica	Lecidea mucosa (S)
A. ilicinella	Melaspilea lentiginosula (S)
Arthopyrenia nitescens	Micarea olivacea (S)
Arthothelium dictyosporum (S)	M. pseudomarginata
Bacidia subcircumscripita (S)	Mycomicrothelia atlantica
Caloplaca britannica	Polyblastia wheldonii
Catillaria gilbertii (S)	Ramonia dictyospora
Chromatochlamys confusa Fryday in ed.	Rimularia globulosa (S)
C. geislerioides in ed. (S)	R. mullensis
C. larbalestieri	Schismatomma quercicola
Graphis alboscipita (S)	Stereocaulon plicatile
Gyalideopsis scotica	Thelocarpon magnussonii
Halecania bryophila (S)	T. opertum
H. micacea (S)	

(S) denotes species so far recorded only from Scotland.

NB: many of these species are inconspicuous in the field, and it is likely that many of them will eventually be found elsewhere in Europe or perhaps even further afield.

et al., 1997). This listed 29 (15) species as Extinct, 27 (16) as Critically Endangered, 30 (17) as Endangered and 91 (66) as Vulnerable, with an additional 96 (72) being regarded as Data Deficient and 91 (75) as Near Threatened (numbers occurring in Scotland are given in brackets). Much new information has come to light since the preparation of the *Red Data Book*, and a conservation evaluation of all British lichens is currently being prepared by members of the British Lichen Society's Conservation Committee (Woods & Coppins, in prep.). Advances to the listing of threatened species have resulted from implementation of *Biodiversity: the UK Action Plan* (Department of the Environment, 1994). For lichens occurring in Scotland, 27 Species Action Plans (SAPs) have been drafted, and individual species dossiers have been prepared through collaborative projects between Scottish Natural Heritage (SNH) and the Royal Botanic Garden Edinburgh (RBGE).

The species approach has greatly heightened the profile of lichens in conservation. However there are dangers in basing our policies for lichen conservation using RDB status as the foremost criterion, and the dangers are even worse if conservation is restricted to species with BAP status (as sadly is the case with many Local Biodiversity Action Plans). A Red List of macrolichens for the then European Community (Sérusiaux, 1989) included 57 species that occur in the UK (54 in Scotland). Only 19 of these occur on the main UK Red List, and only five (*Bryoria smithii*, *Catapyrenium psoromoides*, *Collema dichotomum*, *Pseudocyphellaria norvegica* and *Teloschistes chrysophthalmus*) are BAP species.

The reason for this major discrepancy is the presence in the UK of many relatively unpolluted ancient woodlands, especially the oceanic woodlands of western Scotland.

In the EC list, there are 22 species characteristic of oceanic woodlands, and none of these are on the main UK Red List, although one (*Leptogium coralloideum*) is considered Data Deficient, while only one (*Pseudocyphellaria norvegica*) is a BAP species. An analysis of microlichens (*i.e.* lichens with a crustose habit) would produce a similar result, and of all the 177 lichens on the main British Red List, only eight are denizens of oceanic woodland (Coppins, 2001a). To help overcome such discrepancies, the revised conservation evaluation (Woods & Coppins, in prep.) introduces the category of 'International Responsibility' (IR). Notably, 59 of the 73 IR species listed in Table 2 are prevalent in oceanic woodlands. This 'IR' list is very provisional, and is likely to be extended following a better understanding of overall, modern European distributions. The IR species do not require individual SAPs, but do need to be considered in the preparation of the relevant Habitat Action Plans (HAPs) and Local Biodiversity Action Plans (LBAPs).

Apart from discrepancies at an international level, there are also those much closer to home. There are many lichens that are so abundant and widely occurring in western Scotland, that they occur in too many hectads to justify a main Red List category (*i.e.* Critically Endangered, Endangered or Vulnerable). However, some of these species when present elsewhere, in eastern Scotland or other parts of the UK, may be indicative of quality habitat and/or in danger of local extinction. Examples include *Degelia atlantica*, *Fuscopannaria sampaiana*, *Leptogium burgessii*, *Lobaria amplissima*, *Pannaria rubiginosa*, *Parmeliella testacea*, *Pseudocyphellaria crocata*, *P. intricata*, *P. norvegica* and *Pyrenula occidentalis*. This is mainly a problem for England and Wales, but there are a few examples of southern species of 'quality' habitats that just reach Scotland (*e.g.* *Cresponea premnea*, *Physcia clementei*, *Pleurosticta acetabulum*, *Porina hibernica*, *P. rosei* and *Rinodina roboris*).

As stated above, there are 27 BAP species present in Scotland, and a further 118 species that technically qualify for BAP status and are considered to have 'priority' status (Appendix 1). This is a very conservative selection, allowances being made for the poor understanding of the distribution of many other rare and usually inconspicuous species that may eventually qualify. For 43 of the current 145 'priority' species, individual species dossiers have been prepared. Action Plans and species dossiers usually demand or request some subsequent action, even if this is 'simply' monitoring of existing known populations or searching for hitherto unknown populations in potential sites. Such exercises can be quite costly, especially in terms of travel and expenses, but the limiting factor is not finance, rather it is the size of suitably trained and experienced workforce. Currently residing in Scotland, there are only two lichenologists (both in their mid-50s) who have such knowledge and experience, a decrease of 50% on the situation 18 months ago! There is an urgent need to remedy this deficiency, as it is the major obstacle to lichen conservation in Scotland.

Some valuable information can be gathered on conspicuous, easily identifiable species by non-specialist lichenologists, such as the search for further populations of *Alectoria ochroleuca* (Alpine sulphur-tresses) in the Cairngorms by Dr Andy Amplett (RSPB). Similarly, given initial supervision, students on the annual lichen course at Kindrogan Field Centre, Perthshire have even been able

Table 2. Examples of lichens for which Scotland has international responsibility according to Woods & Coppins (in prep.).

<i>Anisomeridium viridescens</i> ^w	<i>M. paratropa</i>
<i>Arthonia anombrophila</i>	<i>M. stipitata</i> ^w
<i>Arthonia ilicina</i> ^w	<i>M. viridiatra</i>
<i>A. ilicinella</i> ^w	<i>M. xanthonica</i> ^w
<i>Arthopyrenia nitescens</i> ^w	<i>Opegrapha saxigena</i>
<i>Arthothelium lirellans</i> ^w	<i>Nephroma laevigatum</i> ^w
<i>A. orbilliferum</i> ^w	<i>N. tangeriense</i>
<i>Bacidia caesiiovirens</i> ^w	<i>Ochrolechia szatalaensis</i> ^w
<i>Bactrospora homalotropa</i> ^w	<i>Pannaria conoplea</i> ^w
<i>Buellia violaceofusca</i>	<i>P. rubiginosa</i> ^w
<i>Calicium lenticulare</i> ^w	<i>Parmeliella parvula</i> ^w
<i>Caloplaca ferruginea</i> ^w	<i>P. testacea</i> ^w
<i>Cavernularia hultenii</i> ^w	<i>P. triptophylla</i> ^w
<i>Chrysothrix chrysothymala</i> ^w	<i>Peltigera britannica</i>
<i>Collema bachmanianum</i>	<i>P. collina</i> ^w
<i>C. fasciculare</i> ^w	<i>Pertusaria borealis</i>
<i>Degelia atlantica</i> ^w	<i>P. flavocorallina</i>
<i>D. plumbea</i> ^w	<i>P. ophthalmiza</i> ^w
<i>Eopyrenula grandicula</i> ^w	<i>Phyllopsora rosei</i> ^w
<i>E. septemseptata</i> ^w	<i>Platismatia norvegica</i> ^w
<i>Fuscopannaria sampaiana</i> ^w	<i>Polyblastia wheldonii</i>
<i>Gomphillus calycioides</i> ^w	<i>Pseudocyphellaria crocata</i> ^w
<i>Gyalideopsis muscicola</i> ^w	<i>P. intricata</i> ^w
<i>Hypotrachyna endochlora</i> ^w	<i>Ptychographa xylographoides</i>
<i>H. sinuosa</i> ^w	<i>Pyrenula laevigata</i> ^w
<i>H. taylorensis</i> ^w	<i>P. occidentalis</i> ^w
<i>Leptogium brebissonii</i> ^w	<i>Ramalina fraxinea</i>
<i>L. britannicum</i>	<i>Schismatomma umbrinum</i> ^w
<i>L. burgessii</i> ^w	<i>Stereocaulon delisei</i>
<i>L. cyanescens</i> ^w	<i>Sticta fuliginosa</i> ^w
<i>L. hibernicum</i> ^w	<i>S. limbata</i> ^w
<i>Lobaria amplissima</i> ^w	<i>S. sylvatica</i> ^w
<i>L. pulmonaria</i> ^w	<i>Strangospora microhaema</i> ^w
<i>L. scrobiculata</i> ^w	<i>Thelotrema macrosporum</i> ^w
<i>L. virens</i> ^w	<i>T. petractoides</i> ^w
<i>Melaspilea atroides</i> ^w	<i>Wadeana dendrographa</i> ^w
<i>Menegazzia terebrata</i> ^w	<i>Xerotrema megalospora</i>
<i>Micarea alabastrites</i> ^w	

All these species are well represented in Scotland.

NB: this list does not include species that are currently considered as endemic to the British Isles (Table 1) or listed as a 'Priority Species' in Appendix 1 (q.v.). Species suffixed with superscript 'W' are prevalent in oceanic woodlands.

to monitor less easily spotted lichens, such as the diminutive *Cladonia botrytes* (Stump lichen) on cut stumps. Unfortunately, however, candidates (both lichens and personnel) for such studies are few, and even when such opportunities do arise there remains the problem of: 'who is to collate and co-ordinate the information in such away that it can be readily available and of lasting practical value?'

The Habitat approach

Given the dearth of available expertise, it is perhaps fortunate that of the lichen action plans and species dossiers produced to date, few give urgently recommended actions that involve detailed manipulation of the lichen population, its substrata or the immediate surrounds. One exception is for tree surgery of the host tree and experimental transplantation of *Catapyrenium psoromoides* at its only Scottish site (Coppins & Coppins, 1999a).

In the majority of cases the recommendations are to maintain the *status quo* (ecological continuity) at a site, or to enhance the habitat so as to allow for expansion of the lichen populations. Clearly, active involvement by lichenologists in the development of relevant Habitat Action Plans (HAPS) is an efficient way forward in the cause of lichen conservation. For different habitats there are some general principles that can be applied, thus spreading messages to the benefit of lichens over a large part of the country. However, all sites are unique and some lichens have a very restricted range within a site and have very particular habitat requirements (that are unlikely to be well understood). Hence a balance needs to be struck between a species and a habitat approach (Coppins, 2001a).

Lichens by their very nature as composite organisms are rarely amenable to cultivation or transplantation. Active conservation needs to be carried out as part of long-term site or landscape management plans, with perhaps some short term 'gardening' to ensure the survival of existing populations for the planned 'better times' ahead. The efficacy of such plans would be enhanced by a much better autecological understanding of the individual lichens in relation to the dynamics of their habitat. Sadly, such information is rarely known, and calculated guesswork is the best that can currently be achieved.

Conservation fashions

Like the fashion trade the conservation movement has its fads too. Some of these can have disastrous results, as far as lichens are concerned, if carried out without due care and consideration. Four examples are given below for illustration.

'This old woodland is on its last legs, we need regeneration, let's exclude grazing and surround it with a deer fence.' The woodland in question maybe an ancient pasture woodland that has had open-grown trees for centuries, and may in fact form a link with the former 'wildwood'. This long continuity may have allowed for the survival of lichens requiring such relatively stable conditions over several centuries. Total exclusion of grazing can lead to a massive regeneration of trees and shrubs, quickly leading to a period of excessive shade, thus bringing about the demise of the old woodland lichen communities on the trunks of the mature trees within a few years.

The resultant woodland may also be of an entirely different character, both in terms of tree composition and of tree shape. A prime example of this can be seen at Rassal Ashwood NNR, where the 1957 enclosure has resulted not in the regeneration of ash (*Fraxinus*) but of a dense growth of hazel (*Corylus*), rowan (*Sorbus aucuparia*), with some willow (*Salix*). In some places trunks, rocks and the woodland floor are smothered with ivy (*Hedera*). There is also a much impoverished lichen flora compared with the surrounding open wood pasture (Coppins & Coppins, 1999b).

'This old woodland is on its last legs, we can get a WGS for it.' Falling for the temptation to apply for a Woodland Grant Scheme, because it is the only available source of funding to rejuvenate a wood, can have a similar, deleterious end-result to the last example, owing to the excessively dense planting requirements generally prescribed.

'This stand of hazel must be a neglected coppice, it must be re-coppiced otherwise the hazel stools will loose vigour and die.' Both these premises are vigorously refuted by Coppins *et al.* (2002) and Coppins & Coppins (this volume). Clear-cut coppicing of hazel, which has probably never been carried out in Scotland on a large scale, would lead to the instant eradication of any old woodland lichens at the site. If carried out in some Atlantic hazelwoods, it would lead to the local extinction of many 'priority' and other notable lichens.

'This dune/shingle area is looking very disturbed and worn out, we must ban bike- and horse-riding, control visitors and exclude grazing.' It may be that some reduction in disturbance is required, but very radical action has the danger of converting a varied mosaic of microhabitats (*e.g.* with short mossy turf and exposed pebbles) into a uniform sward of tall grasses and herbs, broken by stands of scrub and over-worn footpaths. This is illustrated by Coul Links, on the south side of the Fleet Estuary in East Sutherland, where the rich lichen flora present in the early 1980s has virtually been eliminated by misguided conservation management that has removed the disturbance needed for maintenance of lichens (*pers. observ.*).

Site protection

A large proportion of sites for priority lichens fall within the boundaries of protected areas, such as NNRs, SSSIs, and Local Nature Reserves. However, some notable lichen habitats generally slip the net in this regard, as they do with the HAP process. Most important are wayside trees, principal hosts for lichens such as *Anaptychia ciliaris* subsp. *ciliaris*, *Caloplaca flavorubescens*, *C. luteoalba*, *Collema fragrans*, *Pleurosticta acetabulum*, *Schaereria corticola* and *Thelenella modesta*, and sometimes hosts also for *Bacidia incompta*, *Collema occultatum*, *Fuscopannaria ignobilis*, *Leptogium saturninum* and *Pachyphiale fagicola* (Coppins, 2001b). With fewer 'priority' species, but nevertheless of great importance for lichen biodiversity within the overall landscape, are churchyards (*Calicium corynellum*), megalithic monuments (*Ramalina polymorpha*), dry stone walls (*Umbilicaria nylanderiana*) and old wooden fence posts, rails and other worked timber (*Cyphelium trachylioides*, *Lecidea antiloga* and the

supposedly extinct *L. mucosa*, *L. paracitica*, *Calicium quercinum* and *C. trabinellum*).

An analysis of the British Lichen Society's Mapping Scheme database revealed that among the richest 5% of hectads for lichens, 16 appeared to lack SSSIs designated for their lichen interest (Shaw & Shewry, 2002). However, several of these hectads do encompass SSSIs with nationally or internationally important lichen assemblages, but this interest, even when known, is not included in the SSSI citations. The bureaucratic and legal impediments that prevent the updating of citations according to current information need to be addressed.

Most records from two of these 'hot spot' hectads, NM71 and NN11, come from Ballachuan Hazelwood and Glen Shira respectively. Both these sites have been regarded as of international importance by the British Lichen Society since a UK-wide review of epiphytic lichen sites in the early 1980s (Fletcher *et al.*, 1982), and endorsed by later surveys (Coppins & Coppins, 1996, 2000). Despite their unquestioned international importance, neither site has been designated as a SSSI, although the former is now a Scottish Wildlife Trust Reserve, and part of the latter is managed as a Caledonian Forest Reserve by the Forestry Commission.

Challenges for the future

The following are some challenges pertinent to the furtherance of lichen conservation in Scotland for the attention of lichenologists (British Lichen Society), government agencies and NGOs – however, these are but a conservative selection:

1. Increase the cadre of lichen 'experts' through training and the provision of sustainable job opportunities. Without a continuity of such 'experts', little can be achieved.
2. Collate detailed databased information on lichen distribution and habitat ecology from current sources (*e.g.* published and [especially] unpublished survey reports, herbarium specimens, field notebooks and record cards) and make widely available through the National Biodiversity Network (NBN). Subsequently, this will need to be an on-going process.
3. Continually review the conservation evaluation of individual species in a UK and Scottish perspective, as new information becomes available.
4. Promote bioinventory surveys of sites and areas of potential national and international importance. The analyses of Shaw & Shewry (2002) have identified several 'hot spot' areas for lichen biodiversity, but it is likely that some have been 'missed' owing to under-recording, *e.g.* in West Ross, Sutherland and the Great Glen.
5. Promote collaboration with overseas (especially European) lichenologists with regard to the current status and threats to individual lichens and their key habitats, and develop international initiatives accordingly.
6. Promote taxonomic studies to resolve outstanding problems concerning several 'priority' species (*e.g.* *Opegrapha paraxanthodes*, *Pseudocyphellaria lacerata* and *Schismatomma graphidioides*). These need to take an international perspective and be at PhD or post-doctoral level, and involve 'traditional' and molecular techniques.

7. Review the current designation of protected sites (especially SSSIs) in relation to the conservation needs of the Scottish lichen flora, from a Scottish, UK and international perspective.
8. Review the conservation needs of lichens that are not easily accommodated by site designation (SSSIs etc.), and publicise the outcomes to the relevant agencies, local authorities, and public at large.
9. Promote the study of lichen autecology and population dynamics for a selection of species from key habitats. This will need long-term funding commitments, far in excess of the normal maxima of 3-5 years – many lichens are slow to spread and slow growing, and scarcely ‘dynamic’ from a human perspective. These studies could begin with three-year PhD projects, but they would need to be followed up. The resultant information would be invaluable for long-term site and landscape management and the supporting mathematical modelling. For lichens of ancient old-growth woodlands and long-exposed rock surfaces, time-spans of at least 200-500 years need to be considered.
10. Encourage interdisciplinary dialogues and collaborations. These should be wide-ranging, involving, for example, archaeologists, palaeoecologists, historians and ethnobotanists with regard to past history of important sites (how we came by what we have today). Zoologists must also be involved (especially entomologists and malacologists) with regard to specific interrelationships that may have a bearing on the population dynamics of both the lichens and the animals concerned.

Acknowledgements

This paper is very much a personal overview of the current state of lichen conservation in Scotland, and all the comments, as written, are mine alone, and much has been left unsaid through lack of space. However, I am especially grateful for stimulating discussions from many colleagues, in particular my wife and fellow lichenologist, Sandy Coppins, and also Stephen Ward (SNH), Ray Woods (CCW) and Alan Fryday (Michigan State University). Thanks also to Phil Shaw (SNH) for an advanced sighting of the timely and much cited report by himself and Mike Shewry.

References

- Church, J.M., Coppins, B.J., Gilbert, O.L., James, P.W. & Stewart, N.F. (1997 [‘1996’]). *Red Data Books of Britain and Ireland: Lichens. Vol. 1: Britain*. Peterborough: JNCC.
- Coppins, B.J. (2001a). Species versus habitat management. In *Lichen Habitat Management* (ed. A. Fletcher), 02 pp. 1-7. London: British Lichen Society.
- Coppins, A.M. (2001b). Wayside trees, hedgerows and shrubs. In *Lichen Habitat Management* (ed. A. Fletcher), 07 pp. 1-19. London: British Lichen Society.
- Coppins, B.J. (2002). *Checklist of Lichens of Great Britain and Ireland*. London: British Lichen Society.
- Coppins, A.M. & Coppins, B.J. (1996). *Glen Shira (including Achnatra CFR and Glen Shira CFR): Lichen Survey*. Report to Scottish Natural Heritage (Contract no. 38/F2B/485).
- Coppins, A.M. & Coppins, B.J. (1999a). *Milton Wood SSSI: Experimental trans-*

- plants of Catapyrenium psoromoides*. Report to Scottish Natural Heritage.
- Coppins, A.M. & Coppins, B.J. (1999b). *Rassal Ashwood NNR and Rassal SSSI: Lichen Survey*. Report to Scottish Natural Heritage (Order no. E010070).
- Coppins, A.M. & Coppins, B.J. (2000). *Ballachuan Hazelwood SWT Reserve: Lichen Survey II*. Report to Scottish Wildlife Trust.
- Coppins, B.J., Hawksworth, D.L. & Rose, F. (2001). Lichens. In *The Changing Wildlife of Great Britain and Ireland* (ed. D.L. Hawksworth), pp. 126-147. London: Taylor & Francis.
- Coppins, A.M., Coppins, B.J. & Quelch, P. (2002). Atlantic Hazelwoods: some observations on the ecology of this neglected habitat from a lichenological perspective. *British Wildlife* **14**, 17-26.
- Department of the Environment (1994). *Biodiversity: the UK Action Plan*. London: HMSO.
- Fletcher, A., Coppins, B.J., Hawksworth, D.L., James, P.W. & Rose, F. (1982). *Survey and Assessment of Epiphytic Lichen Habitats*. A report prepared by the Woodland Working Party of the British Lichen Society, for the Nature Conservancy Council (contract HF3/03/208).
- Fryday, A.M. (1997). *Ecology and Taxonomy of Montane Lichen Vegetation in the British Isles*. PhD Thesis, University of Sheffield.
- Sérusiaux, E. (1989). *Liste rouge des macrolichens dans la communauté Européenne*, Liège: Centre de Recherches sur les Lichens.
- Shaw, P. & Shewry, M. (2002). *Hotspots for species richness in Scotland*. Battleby: Scottish Natural Heritage.
- Ward, S. (ed.) (1999). Local Biodiversity Action Plans – Technical Information on Species: 1. Cryptogamic Plants and Fungi. *Scottish Natural Heritage Review* No. 70.
- Woods, R.G. & Coppins, B.J. (in prep.). *Conservation Evaluation of the British Lichen Flora*. London: British Lichen Society.

Note: Bibliographic information on unpublished surveys and other ‘grey’ literature pertaining to the lichens of Great Britain and Ireland can be found under ‘Surveys’ on the British Lichen Society’s web site: <http://www.theBLS.org.uk>

Appendix 1: Priority Lichens in Scotland

These are ‘priority’ lichens that have been afforded main RDB list status or legal protection, have existing or proposed action plans, or have detailed dossiers or reports completed or in preparation. Also included are a few additional species treated in Ward (1999).

Nomenclature – follows Coppins (2002).

RDB – Red Data Book category (Church *et al.*, 1997); those listed are in the main Red List (CR = Critically Endangered; EN = Endangered; VU = Vulnerable) but some Data Deficient (DD) or Near Threatened (NT) species are listed where they qualify under other categories.

CE – Conservation Evaluation (Woods & Coppins, in prep.); abbreviations as for RDB, except for EX = Extinct, LC = Least Concern, and NE = not evaluated. Entries are given only where there is a variance from the RDB of Church *et al.* (1997).

S8 – Listed on Schedule 8 of the Wildlife & Countryside Act 1981.

BAP – Species Action Plan published.

End. – Endemic to the British Isles (E), or to Scotland (S); see also Table 1.

Doss. – Detailed species dossier or report prepared by or for EN or SNH. Use of italic print indicates work in progress in September 2002.

Habitat – A = aquatic, rocks in or beside water bodies; C = coastal rocks; DW = deciduous woodland; HM = heavy metal rich substrata; L = lignicolous; MA = montane acidic; MC = montane calcareous or basic; PW = pinewoods; SA = saxicolous acidic [– CH in churchyards], but not montane; SC = saxicolous calcareous, but not montane; SN = saxicolous nutrient enriched; WT = wayside or parkland trees; TA = terricolous acidic in heathland, moorland or dunes.

	RDB 1997	CE 2002	S8	BAP	End.	Doss.	Habitat
<i>Acarospora rhizobola</i>	VU						MC
<i>Alectoria ochroleuca</i>	VU		+	+		SNH	MA
<i>Ameliella andreaeicola</i> in ed.	–	NE					MA
<i>A. grisea</i> in ed.	–	NE			S		MA
<i>Anaptychia ciliaris</i> ssp. <i>ciliaris</i>	–	VU					WT, DW
<i>A. ciliaris</i> ssp. <i>mamillata</i>	NT						C
<i>Arthothelium dictyosporum</i>	NT			+	S	SNH	DW
<i>A. macounii</i>	VU			+		SNH	DW
<i>Aspicilia melanaspis</i>	EN					SNH	A
<i>Bacidia circumspecta</i>	–	VU					DW
<i>B. incompta</i>	VU			+		EN, SNH	DW, WT
<i>B. subincompta</i>	NT	VU					DW
<i>B. vermifera</i>	EN						DW, PW
<i>Bactrospora dryina</i>	CR						DW
<i>Bellemerea alpina</i>	CR			+		SNH	MA
<i>Biatora tetramera</i>	DD	VU					MC
<i>Biatorella hemisphaerica</i>	VU						MC
<i>Biatoridium delitescens</i>	VU						DW
<i>B. monasteriense</i>	EN			+		SNH	DW
<i>Brodoa intestiniformis</i>	CR			+		SNH	MA
<i>Bryonora curvescens</i>	VU						MA
<i>Bryoria furcellata</i>	VU		+			SNH	PW
<i>B. smithii</i>	CR			+		EN	?SA
<i>Buellia arnoldii</i>	–	VU					PW
<i>B. insignis</i>	VU	CR					MC
<i>B. papillata</i>	DD	CR					MC
<i>B. sanguinolenta</i>	–	VU					PW
<i>Calicium corynellum</i>	CR			+		EN	SA-CH
<i>C. diploellum</i>	DD	CR			E		DW
<i>Caloplaca caesiorufella</i>	–	VU					L
<i>C. cinnamomea</i>	EN						MC
<i>C. flavorubescens</i>	EN					SNH	WT
<i>C. lucifuga</i>	NT	VU					DW, WT
<i>C. luteoalba</i>	VU		+	+		EN, SNH	WT
<i>C. nivalis</i>	CR		+	+		SNH	MA
<i>C. virescens</i>	VU	EN					WT
<i>Catapyrenium daedaleum</i>	VU						MC
<i>C. psoromoides</i>	CR		+	+		SNH	DW
<i>C. waltheri</i>	DD	CR					MC
<i>Catillaria alba</i>	–	VU					DW
<i>C. aphana</i>	NT			+		SNH	SC
<i>C. modesta</i>	VU						MC
<i>Catnaria neuschildii</i>	VU						DW, PW
<i>Catolechia wahlenbergii</i>	VU		+			SNH	MA
<i>Chaenotheca gracilentata</i>	EN						DW
<i>C. laevigata</i>	EN						DW
<i>C. xyloxena</i>	VU						DW, PW

Appendix 1 cont.	RDB	CE	S8	BAP	End.	Doss.	Habitat
	1997	2002					
Chromatochlamys larbalestieri	VU						A
Cladonia botrytes	CR			+		SNH	PW
C. maxima	VU					SNH	MA
C. peziziformis	CR			+		EN, SNH	TA
C. trassii ('stricta')	VU		+			SNH	MA
C. uncialis ssp. uncialis	VU						TA
Collema ceraniscum	VU						MC
C. dichotomum	VU		+	+		SNH	A
C. fragile	VU						SC
C. fragrans	VU	EN					WT
C. occultatum	-	VU					DW, WT
C. parvum	VU						MC
Cyphelium trachylioides	-	CR					L
Degelia ligulata	VU						C
Dermatocarpon rivulorum	DD	VU					A
Dictyonema interruptum	EN	DD					DW
Eopyrenula leucoplaca	-	VU					DW
Fulgensia bracteata	VU						MC
Fuscopannaria ignobilis	VU		+			SNH	DW, WT
Graphis alboscripta	NT				S	SNH	DW
Gyalecta biformis	-	VU					SC
G. ulmi	EN		+	+		EN, SNH	SC, DW
Gyalidea roseola	CR						HM
Gyalideopsis scotica	NT			+	E	SNH	MC
Halecania alpivaga	VU						MC
H. rhypodiza	VU			+	S	SNH	MC
Hypocenomyce anthracophila	EN						PW
Hypogymnia vittata	-	VU					TA
Hymenelia heteromorpha	VU						MC
H. melanocarpa	VU						MC
Japewia tornensis	VU						MC
Lecanographa amylicata	VU						DW
Lecanora achariana	CR		+			SNH	A
L. atromarginata	VU						MC
L. chlorophaeodes	VU						MA
L. cinereofusca	DD	VU					DW
L. epibryon	VU						MC
L. frustulosa	VU						MC
L. marginata	-	VU					MC
Lecidea antiloga	VU						L
L. erythrophaea	VU						DW
Lecidella wulfenii	VU						MC
Lempholemma intricatum	NT						MC
Leptogium cochleatum	NT	VU					DW
L. saturninum	VU					SNH	DW, WT
Lopadium coralloideum	-	VU					MC
Melanelia subargentifera	DD	CR				SNH	WT
Melaspilea interjecta	DD						SA
Micarea assimilata	VU						MA
M. crassipes	VU						MA
M. elachista	EN						PW
Miriqidica garovaglii	VU						SA
M. lulensis	-	VU					MA

Appendix 1 cont.	RDB 1997	CE 2002	S8	BAP	End.	Doss.	Habitat
<i>Nephroma arcticum</i>	EN		+			SNH	MA
<i>Opegrapha fumosa</i>	-	LC		+		SNH	DW
<i>O. paraxanthodes</i>	NT			+		SNH	SC
<i>Pachyphiale fagicola</i>	NT						DW, WT
<i>Parmentaria chilensis</i>	VU		+			SNH	DW
<i>Peltigera lepidophora</i>	CR		+	+		SNH	A
<i>P. malacea</i>	EN					SNH	TA
<i>P. scabrosa</i>	VU						MA
<i>P. venosa</i>	VU						MC, HM
<i>Pertusaria bryontha</i>	CR		+	+		SNH	MC
<i>P. glomerata</i>	VU						MC
<i>P. melanochlora</i>	EN						SA
<i>Phaeophyscia endococcinea</i>	VU						A
<i>Phylliscum demangeonii</i>	DD						A
<i>Pleurosticta acetabulum</i>	-	LC					WT
<i>Poeltinula cerebrina</i>	VU						SC
<i>Polyblastia sendtneri</i>	VU						MC
<i>Polychidium dendriscum</i>	VU						DW
<i>Porina rosei</i>	NT			+			DW
<i>Protoparmelia atriseda</i>	VU						SA
<i>Pseudocyphellaria lacerata</i>	VU		+			SNH	C, DW
<i>P. norvegica</i>	-	LC		+		SNH	DW
<i>Pseudephebe minuscula</i>	-	DD					MA
<i>Psora globifera</i>	CR						MC
<i>P. rubiformis</i>	VU		+			SNH	MC
<i>Pycnora xanthococca</i>	VU						PW
<i>Pyrenula coryli</i>	VU						DW
<i>P. dermatodes</i>	CR					SNH	DW
<i>Ramalina polymorpha</i>	NT					SNH	SN
<i>Rimularia sphacelata</i>	DD	CR					MC
<i>Rinodina mniaraea</i> var. <i>cinnamomea</i>	EN						MC
<i>Schadonia fecunda</i>	VU						MC
<i>Schaereria corticola</i>	DD						WT
<i>Schismatomma graphidioides</i>	VU			+		EN, SNH	DW
<i>Sclerophora pallida</i>	VU						DW, WT
<i>Staurothele areolata</i>	VU						SC
<i>Stereocaulon cumulatum</i>	VU	EX				SNH	MA
<i>Sticta canariensis</i> s.str.	VU						C-DW
<i>Thelenella modesta</i>	CR			+		SNH	WT
<i>Toninia coelestina</i>	VU						MC
<i>T. rosulata</i>	EN						MC
<i>Umbilicaria nylanderiana</i>	DD						SA
<i>U. spodochroa</i>	EN						SA
<i>Usnea madeirensis</i>	VU						DW
<i>Vestergrenopsis elaeina</i>	VU						MC