



Red Data Books of Britain and Ireland:

lichens

Volume 1: Britain

by

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Red Data Book of Britain and Ireland

Lichens

**Dedicated to the memory of Frank H. Brightman (1921-1996),
founder chairman of the British Lichen Society Conservation Committee.**

Volume 1: Britain

Edited by G. M. Smith, G. S. Long, and M. R. Heald

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Foreword

It was just over a century ago that the Rev. James M. Crombie wrote his monograph of lichens found in Britain (Crombie 1894). Since then, our understanding of the systematics of lichens as well as their distribution in the United Kingdom has improved enormously. The recent publication of *The lichen Flora of Great Britain and Ireland* by the Natural History Museum and the British Lichen Society (Purvis *et al.* 1992) has highlighted our increased knowledge of the British lichens and has brought together for the first time detailed descriptions of both the common and the rarer species and their assumed distribution in the United Kingdom. Since this publication, the British Lichen Society has started a continuing series of publications showing the distribution and status of all the British species of lichen. Maps for the genus *Parmelia* have already been published, in collaboration with the University of Bradford, and several other genera are well on their way. The recognition of many new species in the British flora will create a renewed effort in the coming years to establish the real status of many of the rarer and less conspicuous species.

It is our continuing duty to try to understand how our rapidly changing human activities affect the other living organisms in the environment. The purpose and contribution to the living world of most species is not yet known so, using the precautionary principal, biodiversity should be preserved. The cost of not doing so may be incalculable. This is particularly vital for the rarer species. Although some of these may be destined to become extinct anyway, in the natural course of events, we cannot afford to assume that this will be so. We should ask whether human impact has contributed to the impending disappearance of a species. If it has, we must do our utmost to prevent such a loss.

Before we can even start to think about conservation measures for lichens, we need to find out the current status of our rarer species. The present Red Data Book provides a starting point for enabling us to do this. It is of especial pleasure to the British Lichen Society, as well as to the many members of the Society and of Plantlife who have used their expertise and experience to provide the raw data for this work, that this book is being published by the Joint Nature Conservation Committee. It will be regarded as an important baseline work for future surveys, which will now inevitably follow.

All contributors are to be congratulated on this very notable achievement.

Brian W. Fox
British Lichen Society President 1993-5

Acknowledgements

This Red Data Book is the second of a series covering lower plants of Britain and Ireland. The first book dealt with stoneworts and the third will cover mosses and liverworts. These books have been produced through contracts funded by the former Nature Conservancy Council, the Republic of Ireland's National Parks and Wildlife Service, the Department of the Environment for Northern Ireland and, since 1991, the Joint Nature Conservation Committee (JNCC). Data collation began in 1988 and was initially carried out by the Conservation Association of Botanical Societies (CABS), a voluntary organisation set up by the main botanical societies to deal with conservation issues. In 1990 CABS amalgamated with Plantlife, which was contracted to continue work on the British species. The final text is the product of a combined effort by five Plantlife and British Lichen Society members.

The production of this book has benefited greatly from inputs by the British Lichen Society and numerous individual lichenologists. The authors would like to thank Alan Fryday, Sandy O'Dare, Alan Orange, William Purvis, Francis Rose, Neil Sanderson, Mark Seaward and Ray Woods. We are grateful to the Natural History Museum, the National Museum of Wales and the Royal Botanic Garden, Edinburgh, for allowing access to herbarium material. Staff of the Countryside Council for Wales, English Nature, Scottish Natural Heritage, the National Trust and the Wildlife Trusts provided site information. Andrew Farmer of English Nature provided useful information on pollution. Gavin Stark of JNCC helped with the preparation of Appendix A, while Margaret Palmer and Nick Hodgetts, also of JNCC, steered the project through to its successful conclusion.

The cover illustration is by Claire Dalby and is based on material loaned by the Natural History Museum.

Introduction

Lichens are among the most remarkable of living things, being composite organisms, part fungus and part alga. Modern lichenologists generally prefer to think of them as 'lichenised fungi', and the Latin name of each species is actually the name of the fungal partner. Generally speaking, the fungal component is incapable of living independently, whereas the algal component can often be found leading an independent existence as a species in its own right. Dobson (1992) gave a useful introduction to lichens for those unfamiliar with them.

It has been known intuitively for a long time that many species of lichen are rare and threatened, but it is only recently that knowledge of the ecology and distribution of British lichens has progressed to the stage where a Red Data Book can be written. A result of this growing awareness is that lichens are now regularly included in environmental assessments, so a book such as this is essential to the evaluation of survey data and the formulation of conservation policies. An important factor in raising the profile of lichens has been the publication of well illustrated intermediate level and advanced level Floras (Dobson 1992; Purvis *et al.* 1992) which have resolved most problems of identification. At the same time ecological studies have shown that lichens are powerful indicators of environmental conditions. This was demonstrated first in connection with regional and point source air pollution (Hawksworth & Rose 1976) and is now being extended to cover a variety of agrochemicals. In an important series of papers Rose (1976, 1992) has also developed their use as indicators of environmental continuity in woodland.

This book covers the threatened lichens of Britain. Each species is placed in a threat category reflecting the likelihood of it disappearing from the British flora. These categories are defined using internationally recognised 'Red List' designations, so that the status of lichens in Britain can be compared with that throughout the world and with other groups of plants and animals which have been evaluated using identical criteria. This book is the first of two companion volumes, the second of which will cover the Republic of Ireland and Northern Ireland.

One hundred and seventy-seven species, representing about 11% of the current checklist for Britain and Ireland (Purvis *et al.* 1992), have been selected for the British Red List. In addition, a further 187 rare species are mentioned. These are either very localised but not sufficiently threatened to be included in the Red List, or there is insufficient information for them to be allocated a threat category.

There are several ways the information in this book can be used. It provides a standard reference for assessing species lists and evaluating sites, so can assist in establishing the importance of individual localities. It also helps to identify where and how positive management for our rarest lichens should be carried out. If conservation is approached simply on a species by species basis, organisations will quickly become overwhelmed just attempting to safeguard the 168 plant species scheduled for special protection under the Wildlife and Countryside Act 1981 (26 lichens, 33 bryophytes, 2 stoneworts, 107 vascular plants), to say nothing of the scheduled animals. Among plant groups so far studied, a staggering 14% of all British species have recently been accorded Red List status. The information in this book will probably be of most use in focusing on habitat conservation and the identification of key sites where lichen conservation measures are vital. The rationale of this approach has been set out by Ratcliffe (1977), but lichens played only a minor role in this influential Nature Conservation Review and only a fraction of important lichen habitat is covered by the list of key sites it contains. Britain and Ireland have an international responsibility for preserving oceanic communities of epiphytic, heathland and coastal lichens. Conservation of these communities would be a major contribution to global biodiversity.

At the species level, attention should be paid to endemics and near endemics, but as our islands have been subjected to recent glaciation, these are few. It is not certain that any lichen is endemic to Britain and Ireland, although *Arthothelium dictyosporum*, *Aspicilia tuberculosa*, *Bacidia*

subturgidula, *Catillaria subviridis*, *Chromatochlamys larbalestieri*, *Enterographa soredata*, *Graphina pauciloculata*, *Graphis alboscripta* and *Halecania rhypodiza* have not yet been found elsewhere.

This first edition of the Lichen Red Data Book is a foundation on which to build. Allocation to threat categories will undergo review as more data are collected. Greater understanding of lichen ecology will come as more evidence is collected on dispersal, establishment and the dynamics of populations. This will lead to a greater insight into the causes of rarity and the place of the British lichen flora in the world context.

For further information on lichen conservation readers are directed to *Lichen conservation in Britain* (Gilbert 1977). Advice on the use of lichens as indicators of ecological continuity can be found in Rose (1992). Harding & Rose (1986) provide guidance on the management of pasture woodlands which are an important habitat for Red List species. Further information on conservation matters can be found in the publications of the British Lichen Society* (*The Lichenologist*, *British Lichen Society Bulletin*).

Production of the Red Data Book

Area covered

This volume covers the lichens of Great Britain (i.e. England, Scotland and Wales but not the Isle of Man or the Channel Islands). For comparative purposes each species account includes an indication of the known distribution in Ireland and, where relevant, the Isle of Man and the Channel Islands.

The database and species selection

Selection of the short-list of possible Red List species relied heavily on the British Lichen Society's computerised 10 km x 10 km grid square records held at the University of Bradford. For initial selection lichens had to fulfil at least one of the following criteria:

- well recorded species found in fifteen or fewer 10 km x 10 km squares of the Ordnance Survey National Grid;
- species with slightly more records, but with populations known to be small at all or nearly all sites;
- species with more records, but which have shown a marked decline in abundance;
- species thought to be under-recorded, but which are known to be sufficiently habitat-confined that they are likely to fit one of the above criteria, even when better recorded.

This method produced a list of about 400 lichens, which were candidates for inclusion in the Red List. Further detailed information was collected for each species, particularly regarding their British and international distributions, ecology, threats, site protection and conservation needs. The extensive collections in the national herbaria at the Natural History Museum, London, the Royal Botanic Garden, Edinburgh, and the National Museum of Wales, Cardiff, were searched, while literature sources, including county Floras, *The Lichenologist* and the *British Lichen Society Bulletin*, yielded further information. Experts with field knowledge of the species were also consulted. Records of all these lichens are now on a computer database held by the Joint Nature Conservation Committee (JNCC).

At the end of 1994, the criteria used to draw up Red Lists for the last thirty years were revised by the IUCN and replaced by a new system that provides a more objective and quantitative framework for

* The society can be contacted c/o Department of Botany, The Natural History Museum, Cromwell Road, South Kensington, London, SW7 5BD.

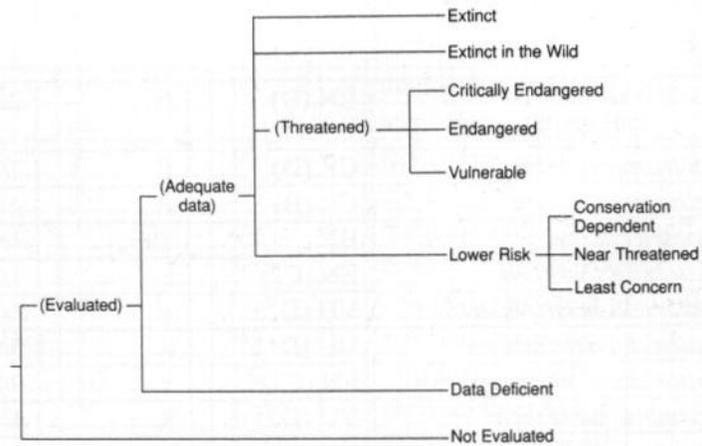


Figure 1.
The revised IUCN threat categories

the classification of species according to their extinction risk (World Conservation Union 1994). The structure of the new categories is shown in Figure 1. The revised system is applicable across a wide range of taxonomic groups and has been recommended by the IUCN for use at regional or national levels as well as at the global level. It was endorsed in 1995 by the JNCC as the new standard for Britain and was used for selecting the Red List lichens from the short-list of about 400 species.

Table 1 is an alphabetical list of lichens considered to qualify for the British Red List, using the revised IUCN system. Appendix A gives the Red List species arranged by threat category.

Threat categories derived by applying the previous IUCN system are also given in Table 1, for reference purposes. These are defined in Appendix B.

Table 1. Inventory of British Red List lichens.

Red List status:

1. Categories according to the revised IUCN system (World Conservation Union 1994)

EX = Extinct; CR = Critically Endangered; EN = Endangered; VU = Vulnerable. The criteria satisfied under the revised IUCN system are given in parenthesis beside the status.

2. Categories according to the previous IUCN system

Ex = Extinct; E = Endangered; V = Vulnerable; R = Rare; K = Insufficiently Known.

No. of records:

No. of 10 km x 10 km squares with records, total/post-1960.

Species	Red List status		No. of records	Ecological preference*
	1	2		
<i>Acarospora rhizobola</i>	VU (D2)	V	2/2	montane calcicole
<i>Acarospora subrufula</i>	VU (D2)	V	3/3	coastal acidic saxicolous
<i>Alectoria ochroleuca</i>	VU (B)	V	13/8	montane acidic
<i>Arthonia anglica</i>	EN (B)	E	4/2	deciduous woodland
<i>Arthonia galactites</i>	EX	Ex	5/0	deciduous woodland
<i>Arthothelium macounii</i>	VU (D2)	R	6/6	deciduous woodland
<i>Arthothelium spectabile</i>	EX	Ex	2/0	deciduous woodland
<i>Aspicilia melanaspis</i>	EN (D)	E	1/1	aquatic/water margin
<i>Aspicilia tuberculosa</i>	EX	Ex	2/0	saxicolous acidic (flints)
<i>Bacidia auerswaldii</i>	EX	Ex	1/0	artificial: parkland
<i>Bacidia incompta</i>	VU (A)	V	232/142	deciduous woodland
<i>Bacidia polychroa</i>	EX	Ex	4/0	deciduous woodland
<i>Bacidia subturgidula</i>	EX	Ex	1/0	deciduous woodland

* See Glossary for definitions of terms.

<i>Bacidia vermifera</i>	EN (D)	E	2/2	Caledonian pinewoods & birchwoods
<i>Bactrospora dryina</i>	CR (D)	E	2/1	deciduous woodland
<i>Bellemeria alpina</i>	CR (B)	E	2/1	montane acidic (late snow)
<i>Biatora cuprea</i>	EX	Ex	1/0	montane calcicole
<i>Biatorella fossarum</i>	EN (C2)	E	1/1	terricolous calcicole
<i>Biatorella hemisphaerica</i>	VU (D2)	V	2/1	montane calcicole
<i>Biatoridium delitescens</i>	VU (D1)	R	5/5	deciduous woodland
<i>Biatoridium monasteriense</i>	EN (C2)	V	9/8	deciduous woodland
<i>Bryonora curvescens</i>	VU (D2)	R	4/4	montane acidic
<i>Bryoria furcellata</i>	VU (D1)	V	4/4	Caledonian pinewoods
<i>Bryoria implexa</i>	EX	Ex	4/0	Caledonian pinewoods
<i>Bryoria nadvornikiana</i>	VU (D2)	R	1/1	saxicolous acidic
<i>Bryoria nitidula</i>	EX	Ex	1/0	montane acidic
<i>Bryoria smithii</i>	CR (B)	E	11/3	deciduous woodland
<i>Buellia asterella</i>	CR (A, C2, D)	E	7/4	terricolous calcicole
<i>Buellia insignis</i>	VU (D2)	V	1/1	montane calcicole
<i>Calicium adpersum</i>	CR (D)	V	4/2	deciduous woodland
<i>Calicium corynellum</i>	CR (A, B, D)	E	1/1	artificial: churchyard
<i>Calicium quercinum</i>	EX	Ex	18/0	artificial: lignicolous
<i>Calicium trabinellum</i>	EX	Ex	1/0	artificial: fence posts
<i>Caloplaca aractina</i>	CR (B)	E	7/1	coastal acidic saxicolous
<i>Caloplaca cinnamomea</i>	EN (D)	V	1/1	montane calcicole
<i>Caloplaca flavorubescens</i>	EN (A)	E	71/26	artificial: wayside trees
<i>Caloplaca haematites</i>	EX	Ex	4/0	artificial: wayside trees
<i>Caloplaca irrubescens</i>	EX	Ex	1/0	saxicolous acidic
<i>Caloplaca luteoalba</i>	VU (C1)	V	247/112	artificial: wayside trees
<i>Caloplaca nivalis</i>	CR (B, D)	E	1/1	montane acidic
<i>Caloplaca pollinii</i>	EX	Ex	2/0	deciduous woodland (?)
<i>Caloplaca virescens</i>	VU (D1)	R	15/14	artificial: wayside trees
<i>Catapyrenium daedaleum</i>	VU (D1)	R	5/5	montane calcicole
<i>Catapyrenium michelii</i>	VU (D2)	V	1/1	artificial: pathside
<i>Catapyrenium psoromoides</i>	CR (D)	E	3/1	deciduous woodland
<i>Catillaria laureri</i>	VU (D1)	V	4/4	deciduous woodland
<i>Catillaria modesta</i>	VU (D2)	V	2/2	montane calcicole
<i>Catillaria neuschildii</i>	VU (D2)	V	4/4	woodland
<i>Catillaria picila</i>	EX	Ex	1/0	montane calcicole
<i>Catillaria subviridis</i>	VU (D2)	V	1/1	coastal acidic saxicolous
<i>Catolechia wahlenbergii</i>	VU (D1)	R	6/6	montane acidic
<i>Cetraria juniperina</i>	EX	Ex	5/0	Caledonian pinewoods
<i>Chaenotheca gracilentia</i>	EN (D)	E	3/3	deciduous woodland
<i>Chaenotheca laevigata</i>	EN (D)	E	3/3	deciduous woodland
<i>Chaenotheca phaeocephala</i>	CR (B)	E	6/2	corticolous & lignicolous
<i>Chaenotheca xyloxena</i>	VU (D2)	R	5/5	deciduous woodland; Caledonian pinewoods
<i>Chromatochlamys larbalestieri</i>	VU (D2)	V	2/2	aquatic/water margin
<i>Cladonia botrytes</i>	CR (A)	E	12/12	Caledonian pinewoods; submontane acidic
<i>Cladonia convoluta</i>	VU (B)	R	10/8	terricolous calcicole

<i>Cladonia maxima</i>	VU (D2)	V	3/3	montane acidic (late snow)
<i>Cladonia mediterranea</i>	CR (D)	E	1/1	terricolous (serpentine)
<i>Cladonia peziziformis</i>	CR (A)	E	7/5	terricolous acidic
<i>Cladonia stellaris</i>	EX	Ex	3/0	upland acidic
<i>Cladonia stricta</i>	VU (D2)	V	2/2	montane acidic (late snow)
<i>Cladonia uncialis uncialis</i>	VU (D2)	V	5/5	coastal terricolous acidic
<i>Cliostomum corrugatum</i>	VU (B)	V	15/5	coastal lignicolous
<i>Collema ceraniscum</i>	VU (D1, D2)	V	4/4	montane calcicole
<i>Collema conglomeratum</i>	EX	Ex	2/0	artificial: wayside trees
<i>Collema dichotomum</i>	VU (B)	V	22/17	aquatic/water margin
<i>Collema fragile</i>	VU (B)	V	17/10	saxicolous calcicole
<i>Collema fragrans</i>	VU (A)	V	60/30	artificial: wayside trees
<i>Collema latzelii</i>	VU (D2)	V	1/1	saxicolous (serpentine)
<i>Collema parvum</i>	VU (D1, D2)	V	4/4	montane calcicole
<i>Cryptolechia carneolutea</i>	VU (A)	V	49/24	deciduous woodland
<i>Degelia ligulata</i>	VU (D2)	V	3/3	coastal
<i>Dictyonema interruptum</i>	EN (B, C2)	E	7/1	deciduous woodland
<i>Endocarpon adscendens</i>	EN (D)	E	3/3	aquatic/water margin
<i>Endocarpon pusillum</i>	EN (B, D)	E	8/1	artificial: mortared walls
<i>Enterographa elaborata</i>	CR (D)	E	1/1	deciduous woodland
<i>Fulgensia bracteata</i>	VU (D2)	V	1/1	montane calcicole
<i>Graphina pauciloculata</i>	VU (D2)	V	4/4	deciduous woodland
<i>Gyalecta ulmi</i>	EN (C2)	E	18/10	saxicolous calcicole
<i>Gyalidea roseola</i>	CR (B, D)	E	1/1	saxicolous (heavy metal)
<i>Halecania alpivaga</i>	VU (D2)	V	4/4	montane calcicole
<i>Halecania rhypodiza</i>	VU (D2)	V	2/2	montane calcicole
<i>Heterodermia isidiophora</i>	CR (D)	E	1/1	terricolous (serpentine)
<i>Heterodermia leucomelos</i>	EN (C2)	E	29/13	coastal terricolous
<i>Heterodermia propagulifera</i>	EN (D)	E	1/1	coastal terricolous
<i>Hypocenomyce anthracophila</i>	EN (D)	E	2/2	Caledonian pinewoods
<i>Hypocenomyce xanthococca</i>	VU (D2)	V	3/2	Caledonian pinewoods
<i>Hypogymnia intestiniformis</i>	CR (B, D)	E	7/1	montane acidic
<i>Ionaspis heteromorpha</i>	VU (D2)	V	4/4	montane calcicole
<i>Ionaspis melanocarpa</i>	VU (D2)	V	3/3	montane calcicole
<i>Japewia tornöensis</i>	VU (D2)	V	2/2	montane calcicole
<i>Lecanactis amylicia</i>	VU (C2)	R	31/28	deciduous woodland
<i>Lecania coeruleorubella</i>	EX	Ex	1/0	artificial: mortar
<i>Lecania fuscella</i>	EX	Ex	3/0	artificial: wayside trees
<i>Lecania olivacella</i>	EX	Ex	1/0	coastal
<i>Lecanora achariana</i>	CR (B, C2)	E	3/2	aquatic/water margin
<i>Lecanora atromarginata</i>	VU (D2)	V	3/3	montane calcicole
<i>Lecanora chlorophaeodes</i>	VU (D2)	V	1/1	montane acidic
<i>Lecanora epibryon</i>	VU (D2)	V	4/3	montane calcicole
<i>Lecanora frustulosa</i>	VU (D2)	V	6/4	montane calcicole
<i>Lecanora fuscescens</i>	EX	Ex	1/0	deciduous woodland
<i>Lecanora populicola</i>	EX	Ex	1/0	artificial: wayside trees
<i>Lecanora strobilina</i>	VU (D2)	V	4/3	corticulous and lignicolous
<i>Lecidea antiloga</i>	VU (D2)	V	4/3	lignicolous
<i>Lecidea erythrophaea</i>	VU (B)	V	13/6	deciduous woodland

<i>Lecidea inops</i>	EN (B)	E	2/2	saxicolous (heavy metal)
<i>Lecidea sarcogynoides</i>	VU (D2)	V	5/3	saxicolous acidic
<i>Lecidella wulfenii</i>	VU (D2)	V	2/2	montane calcicole
<i>Leptogium hildenbrandii</i>	EX	Ex	2/0	deciduous woodland
<i>Leptogium saturninum</i>	VU (C2)	R	33/28	deciduous woodland
<i>Micarea assimilata</i>	VU (D2)	V	2/1	montane acidic
<i>Micarea crassipes</i>	VU (D2)	V	1/1	montane acidic
<i>Micarea elachista</i>	EN (D)	E	1/1	Caledonian pinewoods
<i>Miriquidica garovaglii</i>	VU (D2)	V	1/1	saxicolous acidic
<i>Nephroma arcticum</i>	EN (D)	E	3/2	montane acidic
<i>Nephroma helveticum</i>	EX	Ex	1/0	deciduous woodland
<i>Nephroma resupinatum</i>	EX	Ex	1/0	deciduous woodland
<i>Opegrapha subelevata</i>	EN (D)	E	2/2	coastal saxicolous
<i>Pannaria ignobilis</i>	VU (D1)	R	15/14	artificial: wayside trees
<i>Parmelia minarum</i>	VU (B)	V	6/5	deciduous woodland; coastal saxicolous
<i>Parmelia quercina</i>	VU (A, C1)	V	38/21	deciduous woodland
<i>Parmelia robusta</i>	CR (D)	E	1/1	deciduous woodland
<i>Parmelia tinctoria</i>	VU (D2)	V	3/3	saxicolous acidic
<i>Parmentaria chilensis</i>	VU (D2)	V	1/1	deciduous woodland
<i>Peltigera lepidophora</i>	CR (B)	E	1/1	aquatic/water margin
<i>Peltigera malacea</i>	EN (B)	E	11/5	coastal acidic dunes
<i>Peltigera scabrosa</i>	VU (D2)	V	2/2	montane acidic
<i>Peltigera venosa</i>	VU (C1)	V	31/14	upland calcicole
<i>Pertusaria bryonantha</i>	CR (D)	E	1/1	montane calcicole
<i>Pertusaria glomerata</i>	VU (D2)	V	6/4	montane calcicole
<i>Pertusaria melanochlora</i>	EN (B)	E	3/1	saxicolous acidic
<i>Pertusaria pustulata</i>	VU (B)	V	15/10	deciduous woodland
<i>Phaeophyscia endococcinea</i>	VU (D2)	V	7/7	aquatic/water margin
<i>Physcia tribacioides</i>	EN (A)	E	20/15	artificial: wayside trees
<i>Poeltinula cerebrina</i>	VU (B)	V	20/10	saxicolous calcicole
<i>Polyblastia sendtneri</i>	VU (D2)	V	2/2	montane calcicole
<i>Polychidium dendriscum</i>	VU (D2)	V	3/3	deciduous woodland
<i>Porina guaranitica</i>	CR (D)	E	1/1	deciduous woodland
<i>Porina sudetica</i>	VU (D2)	V	2/2	terricolous (heavy metal)
<i>Protoparmelia atriseda</i>	VU (D2)	V	6/3	upland acidic
<i>Pseudocyphellaria aurata</i>	CR (C2)	E	8/2	coastal terricolous
<i>Pseudocyphellaria lacerata</i>	VU (D1)	V	4/4	deciduous woodland
<i>Psora globifera</i>	CR (D)	E	1/1	montane calcicole
<i>Psora rubiformis</i>	VU (D2)	V	2/1	montane calcicole
<i>Pyrenula coryli</i>	VU (D2)	V	3/2	deciduous woodland
<i>Pyrenula dermatodes</i>	CR (D)	E	1/1	deciduous woodland
<i>Pyrenula nitida</i>	VU (D2)	R	6/5	deciduous woodland
<i>Pyrenula nitidella</i>	EX	Ex	2/0	deciduous woodland
<i>Ramalina chondrina</i>	VU (D2)	V	2/2	coastal acidic saxicolous
<i>Rinodina mniaraea</i>	EN (D)	E	1/1	montane calcicole
<i>Schadonia fecunda</i>	VU (D2)	V	3/2	montane calcicole
<i>Schismatomma graphidioides</i>	VU (B, D1)	R	12/10	deciduous woodland
<i>Sclerophora nivea</i>	VU (C2, D1)	R	21/16	deciduous woodland

<i>Solenopsora liparina</i>	VU (D2)	V	1/1	saxicolous (serpentine)
<i>Squamarina lentigera</i>	EN (B, C2)	E	12/5	terricolous calcicole
<i>Staurothele areolata</i>	VU (D2)	V	2/2	saxicolous calcicole
<i>Staurothele rufa</i>	EN (D)	E	1/1	saxicolous calcicole
<i>Stereocaulon symphycheilum</i>	EN (D)	E	1/1	saxicolous (heavy metal)
<i>Sticta canariensis</i> s.str. independent thalli	VU (D2)	R	36/36 4/4	deciduous woodland mossy rocks
<i>Strigula stigmatella</i>	EN (D)	E	2/1	deciduous woodland
<i>Synalissa symphorea</i>	VU (B)	V	14/5	saxicolous calcicole
<i>Teloschistes chrysophthalmus</i>	CR (B, C2, D)	E	5/1	artificial: epiphytic
<i>Teloschistes flavicans</i>	VU (A)	V	131/68	saxicolous acidic
<i>Thelenella modesta</i>	CR (B)	E	3/1	deciduous woodland
<i>Toninia coelestina</i>	VU (D1, D2)	V	2/2	montane calcicole
<i>Toninia cumulata</i>	VU (D2)	V	3/1	montane calcicole
<i>Toninia physaroides</i>	EX	Ex	2/0	terricolous calcicole
<i>Toninia rosulata</i>	EN (D)	E	2/1	montane calcicole
<i>Tornabea scutellifera</i>	EX	Ex	6/0	coastal
<i>Umbilicaria crustulosa</i>	VU (D2)	R	4/4	montane acidic
<i>Umbilicaria spodothroa</i>	EN (D)	E	1/1	saxicolous acidic
<i>Usnea madeirensis</i>	VU (D2)	V	4/3	deciduous woodland
<i>Usnea subscabrosa</i>	VU (D2)	V	3/3	saxicolous acidic
<i>Vestergrenopsis elaeina</i>	VU (D2)	R	3/3	montane calcicole

Summary of revised threat categories and criteria

A summary is given below of the new IUCN threat categories and qualifying criteria appropriate for lichens and used to draw up the Red List (see also Figure 1). This system is complex and offers a range of alternatives for identifying the status of threatened species. A species is required to fulfil a minimum of one criterion (of criteria A to D) to qualify for the Red List. Species are tested against all criteria, working 'downwards' through the threat categories (starting with *Extinct*) until the appropriate category for that species is found. The species is allocated to the 'highest' category that it fits. In other words, if a species is determined as *Critically Endangered* using criterion B but only *Endangered* using criterion C, its status is *Critically Endangered*. Decline may be measured as a reduction in the number of 'individuals' observed or, in the absence of this information, inferred from distribution data.

Extinct (EX)

Interpreted as not having been seen in the wild in Britain during the last 50 years, despite searches having been made, and not maintained in cultivation.

Critically Endangered (CR), Endangered (EN), Vulnerable (VU) (IUCN criteria A to D are described. Criterion E was not used.)

A. Large decline

Major population decline observed in the last 10 years:

80% decline = CR

50% decline = EN

20% decline = VU

B. Restricted area of occupancy, few localities, decline

To qualify under this criterion, a species must occupy a restricted area **and** have few localities **and** have a continuing decline observed, inferred or projected. For lichens, the area of occupancy has been interpreted as the number of grid squares in which a species has been recorded. Extreme fluctuations,

used in the IUCN criteria, have not been used here, as there is seldom any information available on the dynamics of lichen populations.

Recently recorded in fewer than ten 1 km x 1 km squares **and** found in only one locality **and** in decline = CR

Recently recorded in five or fewer 10 km x 10 km squares **and** found in two to five localities **and** in decline = EN

Recently recorded in six to twenty 10 km x 10 km squares **and** found in six to ten localities **and** in decline = VU

Although there *could* be species occurring in, for example, three 10 km x 10 km squares and six localities, thus falling between two threat categories, this situation was not encountered in any of the Red List lichens. If it did arise, such a species would fall into the 'lower' category (i.e. *Vulnerable*).

C. Small population and decline

Small population:

fewer than 250 mature individuals = CR

fewer than 2,500 mature individuals = EN

fewer than 10,000 mature individuals = VU

together with **either**:

C1. Large decline:

at least 25% in 3 years = CR

at least 20% in 5 years = EN

at least 10% in 10 years = VU

or:

C2. Continuing decline and restricted to a single population **or** continuing decline and subpopulations small:

no subpopulation estimated to contain more than 50 mature individuals = CR

no subpopulation estimated to contain more than 250 mature individuals = EN

no subpopulation estimated to contain more than 1,000 mature individuals = VU

D. Very small or restricted populations

Fewer than 50 mature individuals = CR

Fewer than 250 mature individuals = EN

Fewer than 1,000 mature individuals (sub-criterion D1) **or** 4 or fewer localities (sub-criterion D2) = VU

Data Deficient (DD)

Species with insufficient data to categorise them but which are thought likely to qualify as *Extinct*, *Critically Endangered*, *Endangered* or *Vulnerable* when they are better known. The *Data Deficient* category includes recently discovered taxa and those which can be identified only by experts or by using complex techniques. It also includes species which have occurred apparently as 'chance' ephemerals and several species which have not been seen for over 50 years but which cannot be regarded as extinct because insufficient attempts have been made to refind them. *Data Deficient* species are listed in Appendix C.

Lower Risk (near threatened) (LR(nt))

Species which are 'close to qualifying for *Vulnerable*'. As applied in Britain, this category includes species which occur in 15 or fewer 10 km x 10 km squares but which do not qualify as *Critically Endangered*, *Endangered* or *Vulnerable*. These species are listed in Appendix D. This category does not include species thought to be significantly under-recorded.

Examples of applying threat criteria

The examples below give the reasons why species do or do not qualify for their status under each of the criteria A to D.

Hypogymnia intestiniformis. Status: CR.

- A. Not applicable. Last recorded in 1964, so no major population decline in last 10 years.
- B. Applicable. Declined from seven localities in seven 10 km x 10 km squares to a single locality in a single 10 km x 10 km square (and a single 1 km x 1 km square): *Critically Endangered*.
- C. Not applicable. No detailed information available on population size.
- D. Applicable. Anecdotal evidence suggests that the single locality supported only a very small number of individuals (< 50): *Critically Endangered*.

Lecidea erythrophaea. Status: VU.

- A. Not applicable. Insufficient information exists to determine the percentage decline in the last 10 years.
- B. Applicable. Declined from 13 localities in 13 10 km x 10 km squares to six localities in six 10 km x 10 km squares: *Vulnerable*.
- C. Not applicable. No detailed information available on population size.
- D. Not applicable. Number of individuals cannot be estimated with sufficient accuracy to assign it to a category on this basis (D1). Occurs in more than four localities (D2).

Parmelia quercina. Status: VU.

- A. Applicable. Although recorded in 21 10 km x 10 km squares since 1960, survey work suggests a serious decline more recently: *Vulnerable*.
- B. Not applicable. Occurs in more than ten localities.
- C. Applicable. The total population certainly comprises fewer than 10,000 individuals, and there has been a recent serious decline (C1): *Vulnerable*.
- D. Not applicable. Number of individuals cannot be estimated with sufficient accuracy to assign it to a category on this basis (D1). Occurs in more than four localities (D2).

Peltigera malacea. Status: EN.

- A. Not applicable. Insufficient information exists to determine the percentage decline in the last 10 years.
- B. Applicable. Declined from nine localities in eleven 10 km x 10 km squares to three localities in five 10 km x 10 km squares: *Endangered*.
- C. Not applicable. No detailed information available on population size.
- D. Not applicable. No information on number of individuals (D1). Occurs in fewer than four localities (D2) but this would only be relevant in assigning the species to the category *Vulnerable*, if it had not already been determined as *Endangered* under criterion B.

Usnea subscabrosa. Status: VU.

- A. Not applicable. No decline observed.
- B. Not applicable. No decline observed.
- C. Not applicable. No decline observed.
- D. Applicable. No information on number of individuals (D1), but occurs in fewer than four localities (D2): *Vulnerable*.

The number of species assigned to each threat category is shown in Table 2. As the system used to arrive at these designations is new, it is anticipated that in future there will be some movement between categories. Also, the application of the IUCN criteria is not always straightforward because of the special character of lichens and the quality of the data available for evaluation. For example, what comprises an individual lichen is not always clear, frequently there is only scant information available on population size, and declines are difficult to prove unless a species is being monitored. Lichen taxonomy has been so dynamic over the last century that for many species the historical records are unreliable unless they are backed up by specimens. The massive increase in recording effort in recent years also distorts the picture. As a result of factors such as these, which are common

to many groups of plant and animal, the IUCN guidelines favour an element of informed opinion unless there are clearly insufficient data, when the species is placed in the *Data Deficient* category.

Table 2. Numbers of species in the British Red List and the *Data Deficient* and *Near Threatened* categories

<i>Extinct</i> (EX)	29
<i>Critically Endangered</i> (CR)	27
<i>Endangered</i> (EN)	30
<i>Vulnerable</i> (VU)	91
<i>Data Deficient</i> (DD)	96
<i>Lower Risk (near threatened)</i> (LR (nt))	91
Total	364

Newly recorded species do not automatically qualify for inclusion in the Red List; a period of at least five years is normally required before an accurate assessment of the threat category can be made. For example, after their initial discovery, species such as *Macentina stigonemoides*, *Micarea viridiatra* and *Psilolechia leprosa* proved to be widespread.

The species accounts

Full accounts are provided for all *Extinct*, *Critically Endangered*, *Endangered* and *Vulnerable* species. Each account is headed by the currently-accepted Latin name, which, except where there has been recent taxonomic revision, follows Purvis, Coppins & James (1994), together with a synonym if this is thought to be useful. The English name is added, if it exists, together with the threat category. Each species account contains the following information.

Description. All species are well described in the recent *Lichen Flora of Great Britain and Ireland* (Purvis *et al.* 1992). Consequently, this section merely gives a brief indication of the appearance of each species.

Distribution. This section indicates the distribution of the species in Britain, principally using Watsonian vice-counties (Dandy 1969). Any evidence of a decline is noted here. Names of vice-counties have sometimes been amended slightly where they are thought to be obscure (e.g. 'Skye' might be cited rather than 'North Ebuades'). More 'user-friendly' county names are also often used instead of vice-counties, (e.g. 'Yorkshire' might be cited rather than 'South-west Yorkshire'). Distribution in Ireland, in mainland Europe and on a world scale is also indicated, as far as is known. 'Fennoscandia' is used as a collective name for the countries of Denmark, Finland, Norway and Sweden.

Ecology. Detailed information is provided on the ecology of the species in Britain as this is fundamental to conservation.

Threats and conservation. Where the knowledge exists, events and activities which have affected the species in the past, and those that may do so in the future, are mentioned, together with conservation measures which have been taken or are proposed. For the rarest species details of site protection are given. If the species is included in any current conservation programmes, these are mentioned. Our knowledge about very many, if not most, of the Red List lichens would benefit from new surveys and regular monitoring of the populations, so this point is not laboured in the individual species accounts.

Number of records. The total number of 10 km x 10 km grid square records in Britain and the number of records since 1960 are given. These figures are as accurate as possible, but it should be appreciated that in a few cases there may be a small percentage error.

References. Further sources of information are listed where appropriate. Purvis *et al.* (1992) provides additional references.

Legislation

Section 13.1(a) of the Wildlife and Countryside Act 1981 states that anyone who "intentionally picks, uproots, or destroys any wild plant listed on Schedule 8 is guilty of an offence". This Schedule contains many of the most threatened plants in Britain and, in 1992, 26 lichens were added. These species are listed in Appendix E. In the future, others may be added and some may be removed, as the Schedule is open to revision at least every five years. Protection for all plant species is provided under Section 13.1(b) which stipulates that anyone "not being an authorised person" (i.e. without the permission of the landowner or occupier) who intentionally uproots any wild plant is committing an offence. The term "uproot" is defined in the Act as meaning "dig up or otherwise remove" and therefore covers lichens, despite the fact that they have no roots. Section 13.2 makes it an offence to trade in the species listed on Schedule 8. Sometimes lichens may gain protection indirectly, through Tree Preservation Orders.

The UK, being within the European Union, is now obliged to comply with the EC Habitats and Species Directive. This does not currently list any lichens that must receive special protection. However, all species of *Cladonia* in the subgenus *Cladina* (reindeer lichens) are included in the list of plants (Annex Vb) whose exploitation must be subject to management in member states, if they deem it necessary in order to maintain "favourable conservation status" for these species.

Lichens are also afforded some protection in the UK through the network of protected sites. The principal site designations are: Sites of Special Scientific Interest (SSSIs), in which the appropriate statutory conservation agency can negotiate management agreements for the benefit of the wildlife; National Nature Reserves (NNRs), which may be owned by one of the statutory agencies, and which are managed specifically for nature conservation; Local Nature Reserves, managed by local authorities; National Parks; and Special Areas of Conservation (SACs). The last is a new designation soon to be brought into operation under the EC Habitats and Species Directive.

This Directive lists a number of habitat types that are considered to be of European importance and for which a series of SACs must be designated. Eighty-three of these habitats occur in Britain, of which 22 are regarded as rare enough to deserve special consideration as "priority habitats". Of these, the following are particularly important for lichens: fixed (grey) dunes; eu-Atlantic decalcified fixed dunes with *Calluna vulgaris*; dry calcareous grassland (*Festuco-Brometalia*) important for orchids; species-rich *Nardus* grassland; alpine pioneer formations with *Carex atrofusca*; limestone pavement; Caledonian pine forest. The system of statutory protection for sites is backed up by non-statutory designations, including Wildlife Trust reserves and National Trust ownership.

The international context

The lichen flora of Britain is of international importance because of its high proportion of oceanic species. Of particular significance is sheltered valley woodland along the west coast where the combination of a high rainfall, cool summers and mild winters favours the development of communities rich in genera containing blue-green algae (cyanobacteria), such as *Leptogium*, *Lobaria*, *Pannaria* and *Sticta*. Many oceanic species, although they may not be threatened in Britain, have a very restricted world distribution; some are listed in a preliminary European Community Red List (Sérusiaux 1989) (see Appendix F).

The prevailing wind carries much of the country's air pollution eastwards, leaving the west coast of Britain with some of the purest air in Europe. This is a further factor favouring the lichen communities in the west, although acid inputs associated with the high rainfall are causing concern. Other distinctive and internationally important communities well represented in Britain are associated

with lowland heaths, coastal rocks and montane areas which experience less snow-lie than their continental counterparts.

The British lichen flora consists of some 1700 species, compared with approximately 5000 species in Europe as a whole. Our lichen flora, with 34% of the European species, thus compares favourably with our vascular plant flora, which includes only about 20% of the European species. Published Red Lists or Red Data Books exist for the lichens of Austria (Türk & Wittmann 1986), Denmark (Alstrup & Søchting 1988; Miljøministeriet, Skov-Og Naturstyrelsen 1991), Estonia (Trass & Randlane 1986), Finland (Lommi 1995; Vänska 1987), Luxembourg (Diederich 1987), The Netherlands (Siebel *et al.* 1992), Poland (Cieslinski & Czyzewska 1990; Cieslinski, Czyzewska & Fabiszewski 1986, 1992), Russia (Borodin, Bannikov & Sokolov 1984), Saarland (John 1986, 1988), Slovakia (Pišút 1985, 1990; Pišút, Lackovicová & Lisická 1993), Sweden (Aronsson, Hallingbäck & Mattson 1995; Databanken för Hotade Arter & Naturvårdsverket 1991; Moberg 1987), Switzerland (Clerc, Scheidegger & Ammann 1992), Ukraine (Anon. 1995) and the former West Germany (Wirth 1977, 1984). These show a similar picture to Britain with, in each case, around 20% to 30% of the flora (using pre-1994 IUCN threat categories) considered threatened. Sérusiaux (1989) regarded 196 macrolichens to be threatened within the European Community (using the pre-1994 IUCN threat categories). Fifty-seven of these (29%) occur in Britain, of which 19 are either on our Red List or in the Data Deficient category. This means that, encouragingly, Britain has 38 species of macrolichen which are considered threatened in the European Community but are still relatively well established here. These are listed in Appendix F.

Outside Europe information on lichens is fragmentary, with a few exceptions, such as the United States of America and Australasia, although even there the coverage is uneven.

Habitats of the Red List lichens

Red List lichens are very unevenly distributed through Britain because concentrations of threatened species occur at certain sites where the habitat is particularly suitable. The habitat preferences of all extinct and threatened lichens are given in Table 1. The numbers of species associated with each major habitat type are shown in Table 3.

Table 3. Main habitat preferences of Red List species

	Extinct	Critically Endangered	Endangered	Vulnerable	Total	% of Red List
Woodland	12	11	9	27	59	33
Montane	4	5	6	37	52	29
Coastal	0	2	4	7	15	8
Aquatic/marginal	0	2	2	3	7	4
Lowland rock	2	3	5	16	26	15
Lowland soil	1	5	4	3	13	7
Artificial habitats	8	3	3	5	19	11

N.B. A few species are included in more than one category, so the total percentage adds up to more than 100.

Woodland

A third of the Red List lichens are found in woodland or parkland. Lichen-rich woodland occurs in many parts of Britain but historical, geographical and ecological factors make certain types of woodland more important than others. Factors which influence lichen diversity in woodland include the range of tree species and their age structure, long-term continuity, the abundance of standing and

lying dead wood, the occurrence of rocks and banks free of leaf litter and the presence of glades and rides which increase light levels.

Particularly important is ancient woodland where there has been a long ecological continuity of pasture woodland or forest conditions, especially with high humidity, old trees and persistently low levels of pollution. Red List species of ancient woodland include *Catillaria laureri*, *Parmelia minarum*, *Pertusaria pustulata* and *Pyrenula nitida*. An exceptionally fine example is the New Forest in Hampshire. Some counties have examples preserved in medieval deer parks, such as Melbury Park in Dorset and Boconnoc Park in Cornwall. Parkland is a peculiarly British and Irish landscape feature, rare on the mainland of Europe.

Oceanic woods of oak, ash and hazel in the sheltered, frost-free valleys of the west of Britain from Cornwall to northern Scotland are especially rich in Lobarion communities, including pollution-sensitive genera containing blue-green algae. These woodlands are recognised internationally for their lichen flora. The richest areas tend to be where humidity is highest, in sheltered valleys, ravines and along riversides. These conditions are best developed in the western Highlands of Scotland and the Loch Sunart (Inverness-shire) and Glasdrum (Argyll) woodlands are among the richest for oceanic lichens. Red List species found in this habitat include *Arthothelium macounii*, *Parmentaria chilensis*, *Pyrenula coryli*, *P. dermatodes* and *Pseudocyphellaria lacerata*. In the east of Britain, a more continental type of woodland is present, which supports rare species of the order Caliciales, such as *Chaenotheca gracilentia* and *C. xyloxena*.

Caledonian pinewood is a type of woodland that is singular, scarce in Britain and internationally rare, but holds 5% of the British Red List species. These pinewoods were intensively studied in the 1980s and found to support rare species of the genera *Bryoria*, *Cladonia* and *Hypocenomyce*, as well as of the Caliciales. Many of these are present on stumps and dead standing timber. There is a distinct gradation in the flora from west to east, associated with a decrease in rainfall; the lichen flora of pinewoods in the eastern Grampians has similarities with that of the boreal forests of Scandinavia.

Montane habitats

Nearly a third of the Red List lichens are montane species found chiefly above 800 m and confined mainly to the Scottish Highlands. Of particular importance are rock outcrops and cliffs, which provide a range of niches from acid to basic, wet to dry, sheltered to exposed and stable to eroding.

Many montane Red List species (e.g. *Acarospora rhizobola*, *Halecania rhypodiza*, *Psora rubiformis*) are limited by a requirement for calcareous conditions, so the few sites where there is a combination of strongly basic rock at high altitude, such as Caenlochan (Angus), Ben Alder (Inverness-shire) and especially Ben Lawers (Perthshire), feature regularly in the species descriptions.

However, acidic habitats are also significant. The summit heaths and plateau of the Cairngorms are the nearest equivalent in Britain to tundra and are of international importance. Around late-thawing snow patches there is a vegetation zonation in which lower plants become progressively more prominent towards the centre. Although snow-bed lichens do not figure to a large extent on the Red List, a number of acidophilous species (e.g. *Alectoria ochroleuca*, *Cladonia stricta*) are confined to the Cairngorm plateau.

Coastal habitats

Lichens are a notable feature of the seashore and there is usually a well-marked zonation reflecting the degree of exposure and the frequency of inundation by sea water and spray. Britain and Ireland have the greatest length of shingle beach in northern Europe and, in south-east England, stabilised shingle provides a rare coastal habitat for saxicolous lichens.

A surprisingly small number of coastal lichens are represented in the Red List (15 species, 8% of the total). Some of these are plants of windy cliff tops (e.g. *Heterodermia leucomelos*) or sand dunes (e.g. *Peltigera malacea*), rather than species dependent on an environment that includes salt spray. The threatened *Cladonia uncialis* subsp. *uncialis* occurs on shingle ridges and dune heath. Most maritime lichens tend to be widely distributed on the extensive rocky shores of western and northern Britain but several species are restricted by climatic conditions. For example, *Acarospora subrufula* and *Ramalina chondrina* occur only in the extreme south-west of England. The Isles of Scilly, parts of mainland Cornwall and the Pembrokeshire coast all support particularly rich examples of coastal lichen communities.

Aquatic and water-margin habitats

Fresh water and water-margin habitats contribute 4% of the Red List. Many of these species grow on periodically submerged rocks or tree bases at the edges of rivers and lakes. The prime sites are mostly in the uplands, where outcropping rock is frequent and there are few problems of nutrient enrichment (eutrophication) or excessive silting. They include the margins of tarns, swift mountain torrents and the strandline of lowland rivers running through limestone or sandstone gorges. The Isla (Perthshire and Angus), Wharfe (Yorkshire) and Teifi (Cardiganshire) are examples of rivers which support important communities. The most prominent genera represented are *Aspicilia*, *Dermatocarpon* and *Staurothele*.

Lowland rock and soil

Lichens growing on rock in the lowlands away from the seashore form 12% of the Red List. Basic rock outcrops, chiefly Carboniferous limestone cliffs at altitudes below 400 m, support the majority of these. *Caloplaca granulosa*, *Collema fragile*, *Poeltinula cerebrina* and *Synalissa symphorea* are examples. There is a concentration of markedly southern species on the basic serpentine rocks of the Lizard Peninsula, Cornwall (e.g. *Collema latzelii*, *Solenopsora liparina* and *Heterodermia isidiophora* at its only European locality). Other calcicoles are just as likely to occur on the pre-Cambrian and Cambrian limestones of Scottish glens as along the south coast.

Acid rock outcrops below 400 m support several more Red List species. This habitat type is most common in the north and is typical of the fringes of upland areas. Examples of Red List species characteristic of this habitat are *Bryoria nadvornikiana*, *Fuscidea mollis*, *Lecidea promixta* and *Protoparmelia atriseda*.

Because they are weak competitors, terricolous (ground-living) lichens tend to be restricted to poorly vegetated sites (e.g. landslips, roadside banks, railway cuttings), very dry or nutrient-deficient places, open areas in heathland and heavily-grazed grassland. *Cladonia* species may be dominant in some lowland heathlands.

Some sites in the lowlands include fragments of terricolous lichen-rich vegetation which have continental or Mediterranean affinities. The most famous of these are the Brecklands of East Anglia, where *Buellia asterella*, *Squamarina lentigera* and *Verrucaria xyloxena* are found. Elsewhere, chalk downs and limestone grassland contribute a few Red List species (e.g. *Cladonia convoluta* in the Mendips and elsewhere) and coastal heathlands support several rare species of *Cladonia* such as *C. peziziformis*. In total, lowland terricolous lichens form 7% of the Red List.

Artificial habitats

A number of Red List lichens (11% of the total) are now closely associated with the cultural landscape, being found on artefacts such as buildings, tombstones, worked timber, tracksides or mine spoil heaps.

Many of these habitats are under threat. For example, a reduction in the use of untreated worked timber in barns, which are now constructed of artificial materials, is responsible for the demise of

several species. *Calicium trabinellum*, now extinct, was restricted to fence posts. Churchyards form an important habitat for lichens, providing a range of rock types where there may be little naturally-occurring rock, usually set in grassland with a low level of management. *Calicium corynellum* is a Critically Endangered species known in Britain only from churchyards. Also included in this group are certain lichens (e.g. *Caloplaca virescens*) that are largely confined to the bases of wayside and parkland trees with nutrient-enriched bark. Several rare lichens are associated with mines and mine spoil containing deposits of heavy metals such as copper, lead and iron. These species include *Gyalidea roseola*, *Lecidea inops*, *Porina sudetica* and *Stereocaulon symphycheilum*.

Threats and conservation

Reasons for the decline of Red List lichens are not always known, although in some cases subtle climate change may be suspected, for which there is no hard evidence. Many lichens are rare because of their specialised habitat requirements. For these naturally rare species it is difficult to recommend positive conservation measures. Examples are montane and many coastal species which occur only in remote areas where the land use intensity is low. Occasionally part of a site may be affected by recreational activities which threaten rare species (e.g. *Alectoria ochroleuca*, *Bellemeria alpina*), but this is unusual.

At the opposite extreme, epiphytic lichens in the lowlands are increasingly affected by air and water pollution, inappropriate woodland management or the death of trees which are not being replaced, for instance in parkland. The sensitivity of many species of lichen to air pollution has been well documented (Gilbert 1986, Looney & James 1988, Farmer, Bates & Bell 1992, Gauslaa 1995). Particularly vulnerable are the lichens with a blue-green algal partner (e.g. species of *Lobaria*, *Sticta*, *Leptogium* and *Collema*). Many of the most vulnerable species are epiphytes of tree bark, but species growing on rock may also be affected. In areas subject to acid deposition many epiphytes that once grew on a wide variety of tree species are now restricted to trees with base-rich bark such as ash, elm and sycamore because this counteracts, or buffers, the acid. Asbestos roofs also often have abundant lichen growth for the same reason.

Many lichens which declined up until the 1970s as a result of sulphur dioxide pollution are now beginning to recover, following legislation limiting industrial and domestic emissions (Gilbert 1992). Levels of pollutants resulting largely from vehicle emissions and agricultural pollution are now of greater concern, especially high levels of nitrogen, which encourage the growth of rank vascular plants and algae at the expense of less nutrient-demanding organisms such as many lichens (Bakker 1989). An example of this can often be seen on trees adjacent to farmland, where enrichment from fertilisers has led to a coating of green algae on the trunks but few, if any, lichens. There is a suggestion that the intense pollution of the cities has been replaced by low level pollution over a much wider area and that despite the fact that some lichens have returned to the cities, others are being lost in previously little-polluted areas in the countryside (Benfield 1994).

Recommendations that will enhance the chances of survival of lichens sensitive to pollution often have huge political and financial implications. Cutting harmful emissions from industry is a costly procedure, although the Government has committed itself to reducing the 1980 levels of sulphur dioxide by 80% by 2010 (Critical Loads Advisory Group 1995). The challenge of cutting emissions from vehicle exhausts is even more daunting, but it is an issue that is gradually becoming recognised as crucial for the health of the environment, though usually for reasons other than the well-being of lichens!

Management agreements with landowners, for instance to stop or modify the use of fertilisers in part of a deer park or to restrict the removal of timber from a wood to safeguard the canopy continuity, can be very effective. Some success has been achieved in transplanting rare epiphytes from trees that

had to be felled for safety purposes (Gilbert 1990, Hallingbäck 1990) but there is still much to learn in this area. Such action is not as satisfactory as protecting the host trees themselves, so is a measure of last resort. Other threats difficult to counter include Dutch elm disease, which drastically reduced populations of many lichens, including *Bacidia incompta*, *Caloplaca luteoalba*, *Collema fragrans* and *Cryptolechia carneolutea* (Watson, Hawksworth & Rose 1988), and the spread of *Rhododendron ponticum*, self-seeded conifers and, locally, holly in western deciduous woods, as these species can shade out epiphytic lichen communities on the trunks of trees.

Most existing areas of ancient Caledonian pine forest significant for lichens are now protected. However, many of these are small, and are only tiny fragments of the original pine forest. Fire is a potential threat, particularly to the smaller stands of pine. Although fire is a natural component of the ecology of boreal pine forest, and a hazard lichens are presumably adapted to survive, it may cause extinctions among the lichen flora because of the fragmented nature of the remaining forest.

Water-margin habitats have been seriously disturbed through the artificial alteration of water levels in lakes, tarns and rivers used for water supply or in connection with hydro-electric power schemes. This also affects the water course below the dam because flow is controlled. As freshwater habitats have not been well surveyed for lichens, the effects have largely gone unrecorded, but one of the only two British sites for *Lecanora achariana* was destroyed when the level of Llyn Bodlyn, Merioneth, was raised. Water eutrophication and increased siltation, sometimes caused by afforestation, are additional threats to lichens associated with water. River jelly lichen *Collema dichotomum* is one of those most at risk. Fortunately, most aquatic and semi-aquatic Red List lichens are characteristic of headwaters, so escape many of these adverse influences.

The habitats of lowland ground-living (terricolous) lichens are at great risk. Permanent grasslands and heathlands have a history of progressive fragmentation but today losses to intensive agriculture, forestry and urbanisation are no longer the only threats. Additional threats are reduced grazing, which allows the succession of open, lichen-rich communities to scrub; and aerial nitrogen inputs, which increase the growth of the surrounding vegetation.

In most circumstances, despite the often slow growth rate of lichens, neither collecting for commercial purposes nor botanical collecting is a threat to Red List species. Although close examination is sometimes necessary for identification purposes, lichenologists are normally sufficiently aware to collect responsibly or to record rare species photographically. However, in a few cases, where populations are tiny (e.g. *Catapyrenium psoromoides* and *Pertusaria bryontha*), collecting could seriously damage a colony. Commercial or private collecting of species of *Cladonia* subgenus *Cladina* for use in dried flower arrangements, ornaments or model railways may take place in some areas, but most of the material used at present is continental in origin. This subgenus is now afforded some protection by inclusion on Annex Vb of the EC Habitats and Species Directive.

Because knowledge about individual species is incomplete it is often difficult to recommend positive and effective conservation measures for Red List lichens. However, with the increasing emphasis on the conservation of biodiversity and the recognition that Britain's lichen flora is of international importance, more action is now being taken which will benefit lichens. For example, since 1992, when SSSI site selection guidelines for lower plants were published (Hodgetts 1992), it has been possible to designate SSSIs purely for their lichen interest. Several SSSIs now exist where the primary interest is the lichen flora.

There are several current conservation programmes which include lichens. Survey underpins these activities and monitoring is essential to indicate the success or otherwise of any recovery programme. Under the Scottish Cryptogamic Conservation Project, a partnership between Scottish Natural Heritage and the Royal Botanic Garden, Edinburgh, known sites of selected threatened species are surveyed and conservation recommendations are drawn up. Proposals have been made for the

conservation of the Scottish lichens listed on Schedule 8 of the Wildlife and Countryside Act 1981 and it is intended that other Red List species should be covered in the future. An example of recent action under this programme is for *Catapyrenium psoromoides*, which was confined to a single ash tree in a wood in Perthshire, but has now been transplanted to two nearby trees, with further transplants proposed. Management recommendations for this species include maintaining similar habitats for young ash trees nearby and ensuring that invading vegetation does not shade the site excessively.

English Nature's Species Recovery Programme is a programme of action for bringing threatened species back from the brink of extinction. A recovery programme for the Breckland lichens *Buellia asterella* and *Squamarina lentigera* is in progress, with several transplants made from existing healthy populations to appropriate sites nearby. Work is beginning on *Teloschistes flavicans* in the south-west, with a full survey of its known sites. The latter species has also been the subject of a recent survey in Wales.

Thirty-seven habitats of conservation importance are listed in *Biodiversity: the UK Action Plan* (HMSO 1994), a document produced by the UK Government in response to the United Nations Convention on Biological Diversity, which the UK ratified in 1994. Habitats mentioned in this document which are of particular importance for lichens include broadleaved and yew woodland, native pine woodland, lowland wood pastures and parkland, calcareous grasslands, lowland heathland, rivers and streams, montane habitats, upland heath, maritime cliff and slope, shingle above high tide mark, boulders and rock above the high tide, machair, sand dunes and limestone pavement.

In response to the publication of *Biodiversity: the UK Action Plan* a report (HMSO 1995) has been presented to Government from the Biodiversity Steering Group, a consortium of representatives from statutory conservation agencies, the voluntary conservation sector, Government Departments, industry and other bodies. This report contains costed action plans for 14 habitats, including lowland heathland, upland oak woodland, native pine wood and limestone pavement, and also action plans for the conservation of seven species of lichen: *Buellia asterella*, *Caloplaca luteoalba*, *Collema dichotomum*, *Gyalecta ulmi*, *Pseudocyphellaria aurata*, *P. norvegica* and *Schismatomma graphidioides*. The action plan for *S. graphidioides* includes recommendations to discourage the use of agrochemical sprays near colonies and, if feasible, to restore populations at sites where it formerly occurred. Lichens are also taken into account in several of the habitat action plans. For example, the action plan for upland oakwoods emphasises the importance of this habitat for lichens and recommends a number of conservation measures, including strengthening planning legislation to include a presumption against building roads within upland oakwoods.

It is therefore clear that lichens are now firmly on the conservation agenda and that their protection is likely to be addressed with increasing effectiveness as our knowledge about these enigmatic organisms increases.

Accounts of Critically Endangered, Endangered, Vulnerable and Extinct taxa

Acarospora rhizobola (Nyl.) Alstrup

Vulnerable

The thallus of this lichen consists of large scales, brown when dry, bright green when wet, attached to the substrate by distinctive white strands. It is known from the Ben Lawers range, Perthshire, where several small populations occur on high ground. Elsewhere it is found in Greenland, Norway and Sweden. In Scotland, *A. rhizobola* grows over thin layers of moss and organic detritus on damp, calcareous, mica-schist cliff faces, at altitudes above c. 750 m. At two sites it occurs in a community with *Psora rubiformis*, a lichen with a similarly restricted distribution. All sites lie within the Ben Lawers NNR.

Total no. of 10 km x 10 km squares: 2.

1960 onwards: 2.

Gilbert, Coppins & Fox (1988): habitat details and species list.

Acarospora subrufula (Nyl.) H. Olivier

Vulnerable

This is a reddish-brown crustose species with the thallus divided into segments by interlocking cracks. Each segment usually contains a single dark red-brown apothecium. In Britain, *A. subrufula* is so far known from seven sites, on Tresco, St Mary's and Bryher, in the Isles of Scilly, and near Land's End, Cornwall. It is also found in the Channel Islands and on the coasts of France, Spain, Portugal, Sardinia and Algeria. It grows on sunny, exposed, hard, crystalline granite near the sea. A new survey to ascertain the extent of the populations is desirable.

Total no. of 10 km x 10 km squares: 3.

1960 onwards: 3.

Alectoria ochroleuca (Hoffm.) Massal.

Vulnerable

This striking, sulphur yellow, shrubby lichen forms tufts or straggles among other vegetation. *A. ochroleuca* is now confined to high ground in the Cairngorm Mountains but was formerly known also from Ben Loyal in Sutherland and from Clova, Angus. The populations are small and scattered. Elsewhere this species is widely distributed in the colder regions of both hemispheres. In Scotland it occurs in *Racomitrium-Empetrum* communities mainly between 780 and 910 m. Soils are acidic, the sites exposed, and the vegetation wind-clipped. There is a minor risk to this species from trampling as some of its localities are on ridges used by walkers. Most recent records are from outside NNRs and SSSIs.

Total no. of 10 km x 10 km squares: 13.

1960 onwards: 8.

Hawksworth (1972): full details of distribution and ecology.

Arthonia anglica Coppins

Endangered

This crustose lichen forms a thin grey-white to pale fawn stain, often delimited by a dark brown line, with scattered, irregularly star-shaped, reddish-brown apothecia. Restricted to southern England, this species is now known from only two sites on the north coast of Devon and Cornwall, but was previously known from the New Forest, Hampshire, and St. Leonard's Forest, Sussex. Elsewhere, it has recently been discovered on Madeira. This is one of several species of similar appearance found on the smooth bark of ash, beech and holly in ancient coastal or valley woodland. On Madeira it was collected from sycamore. No immediate threats to this species are known, but owing to its rarity it could be affected by tree felling or invasion of its habitats by rhododendron. The Devon site is an SSSI owned by the National Trust; the Cornish site is not protected.

Total no. of 10 km x 10 km squares: 4.

1960 onwards: 2.

Coppins (1989): taxonomy and records.

Arthonia galactites* (DC.) Dufour*Extinct**

This crustose lichen forms thin, chalky-white, more or less circular patches on bark, with flat, black, fleck-like apothecia. This species was formerly known from five sites in England, in South Hampshire, East Sussex, North Essex and North-east Yorkshire, but has not been seen for over a century. It is a southern European species with a sub-Mediterranean to suboceanic distribution. It grows on smooth, rather nutrient-rich bark, with all the British material being recorded from poplars. However, it is also found on oaks in northern Spain and on ash (*Fraxinus ornus*) in Italy.

Total no. of 10 km x 10 km squares: 5.

1960 onwards: 0.

***Arthothelium macounii* (G. Merr.) W.J. Noble**
(*Arthothelium reagens* (Coppins & P. James) Coppins & P. James)**Vulnerable**

The thin, pale grey-green thallus of this crustose species is often delimited by a blackish line, and bears purplish-black apothecia. It is known from six sites, in Kintyre, Argyll, Inverness-shire (Lochaber) and Skye (Sleat Peninsula), and elsewhere only from western Canada. *A. macounii* is confined to extremely oceanic woodlands, mainly growing on hazel, but once found on ash. In Britain, it is host to the apparently endemic lichenicolous fungus *Arthonia cohabitans* Coppins. One of the sites is a Scottish Wildlife Trust reserve, while the remainder have NNR or SSSI status.

Total no. of 10 km x 10 km squares: 6.

1960 onwards: 6.

Arthothelium spectabile* Flotow ex Massal.*Extinct**

This crustose lichen has a creamy to grey-white thallus, usually delimited by a brown line, and flat, black, irregular apothecia. This species is known in Britain only from two 19th century collections, near Dolgellau in Merioneth and from Dartmoor, Devon. It was also collected in Killarney in south-western Ireland in 1860. Its overall distribution in Europe is unclear, but it is certainly known from southern Germany, Austria and mountain regions of the Mediterranean. It also occurs in eastern Asia and North and South America. Unfortunately the British and Irish collections offer little ecological information, except that the species grew on smooth bark. It is probable, however, that all are from ancient, oceanic or suboceanic woodlands.

Total no. of 10 km x 10 km squares: 2.

1960 onwards: 0.

***Aspicilia melanaspis* (Ach.) Poelt & Leuckert**
(*Lobothallia melanaspis* (Ach.) Hafellner)**Endangered**

The thallus of this species is composed of elongate, silvery-grey, loosely attached lobes, with red- to brown-black apothecia at the centre of the thallus. Apart from an unconfirmed record from Argyll, this species is known only from a single site near Inchnadamph in Sutherland. It is widely distributed in Fennoscandia, and is also known from other mountainous areas of Europe and North America. At its Sutherland locality, it grows on acidic rocks in a periodically inundated zone at the margin of a small upland lochan. This site, and other similar ones in the vicinity, should be surveyed to establish the extent of the population(s) of this species. It is within an SSSI.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 1.

Aspicilia tuberculosa* (Ach.) Laundon*Extinct**

This crustose lichen has a thallus composed of separate brownish-grey hemispherical granules. It is often sterile but occasionally has black apothecia with a white powdery coating. It is an endemic species and was confined to the south of England, from where nine specimens are known from two localities: the beach at Ryde, Isle of Wight, and the Sussex Downs. It has not been recorded since c. 1830 and so is assumed to be extinct. However,

being poorly known, and easily confused with two other related species, there is a possibility that it still survives. It occurred on flint nodules. The habitat at Ryde has been destroyed by development.

Total no. of 10 km x 10 km squares: 2.

1960 onwards: 0.

Laundon (1986): taxonomy and details of records.

***Bacidia auerswaldii* (Hepp ex Stizenb.) Mig.**

Extinct

This crustose lichen has a finely granular green-grey to grey-brown thallus with black apothecia. Microscopic examination is required to distinguish it from *B. biatorina*. In Britain, *B. auerswaldii* was known only from Norton Manor, South Somerset, from where specimens were collected between 1927 and 1937. Elsewhere, it is a rare and apparently declining species in southern Fennoscandia and western Europe. *B. auerswaldii* grows on rather nutrient-rich bark of mature trees in well-lit situations; in Somerset it was found on an old parkland elm, associated with *B. phacodes* and *B. rubella*. In 1989, when a visit was paid to Norton Manor, it was found that the former parkland had been an army camp since 1939, and that no trees suitable for *B. auerswaldii* survived.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 0.

O'Dare (1990): visit to site and further references.

***Bacidia incompta* (Borrer ex Hooker) Anzi**

Vulnerable

This crustose species has a whitish-fawn to grey-green or dull green, mealy-granular thallus and mostly rather flat, purplish-brown to black apothecia. *B. incompta* was formerly widely distributed in Britain, being especially common in south-east England, but very rare in western oceanic districts, and extending north to North Aberdeenshire in Scotland. The decline up until 1960 mainly reflects the effects of air pollution and changes in the rural landscape, including the felling and non-replacement of parkland and wayside trees. Since 1960, this species has suffered a further drastic decline owing to the impact of Dutch elm disease (Watson, Hawksworth & Rose 1988), and the post-1960 figure of 142 grid squares is a vast over-representation of the current situation. Visits to some of its former sites in southern England have shown it to have disappeared from about 30 squares, and the same is likely for most of the others not yet checked. However, it probably persists in a few localities, such as the New Forest, South Hampshire, where it occurs on beech, and some pockets of surviving elms in Scotland. It is a rare species in southern Ireland, where its current status needs to be investigated. Although widely distributed in temperate Europe and southern Fennoscandia, it has severely declined in many countries. It is also reported from Madeira and North America. In Britain, this species is almost entirely confined to the bark of mature elms, usually in rain-tracks or below old wounds, often associated with *Caloplaca luteoalba* (q. v.). However, it has been found on other trees, including ash, beech, holly, hornbeam and sycamore, usually on the exposed wood or bark in and around old wounds. Any sites where viable populations are known to persist, especially on trees other than elm, should be afforded protection. Tree Preservation Orders could be placed on individual trees.

Total no. of 10 km x 10 km squares: 232.

1960 onwards: 142.

***Bacidia polychroa* (Th. Fr.) Körber**

Extinct

A corticolous, crustose lichen, this species has an irregularly warted, whitish to pale green-grey thallus and pale reddish to dark red-brown apothecia. This species is known in Britain from four 19th century records, two from the New Forest in Hampshire and Malvern in Worcestershire, and two based on specimens of doubtful provenance from Anglesey and Argyll. It is an apparently rare or much declined species in Europe, recorded from suboceanic areas from southern Sweden to the Mediterranean mountains. It is also known from North America. There is little information associated with the British material, but it apparently favours rather nutrient-rich bark on the trunks of mature deciduous trees. The New Forest specimens were collected on elm.

Total no. of 10 km x 10 km squares: 4.

1960 onwards: 0.

Bacidia suburgidula* (Nyl.) Zahlbr.*Extinct**

This crustose lichen has an inconspicuous, whitish thallus and small bluish-grey, or grey-brown to brown-black, apothecia. It is apparently endemic to Britain, being known only from its type locality, the New Forest in Hampshire, where it was found on wood in the hollows of an old holly in 1868 and 1873. In recent years, several concerted efforts to re-find it have failed.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 0.

***Bacidia vermifera* (Nyl.) Th. Fr.
(*Bacidia hegetschweileri* (Hepp) Vainio)****Endangered**

An inconspicuous white to white-grey crustose lichen, this species has a thin to irregularly warted thallus and small black apothecia. Originally discovered in Britain in 1968, it is now known from three populations, all in sites of old pine or birch forest in Strathspey, Inverness-shire. Elsewhere, it is found in scattered localities in central Europe and Fennoscandia, as far north as Torne Lappmark in Sweden. It is also known from North America. In Scotland it has been recorded on the bark of birch, wych elm and juniper in humid situations, and in Europe it is additionally known from alder, oak and sycamore. The population on wych elm may now be lost owing to Dutch elm disease. All localities are within SSSIs.

Total no. of 10 km x 10 km squares: 2.

1960 onwards: 2.

Bactrospora dryina* (Ach.) Massal.*Critically Endangered**

The grey-white thallus of this inconspicuous, crustose species is thin and scurfy with small, black and irregularly rounded apothecia. Apart from a 19th century specimen supposedly from Argyll, but of doubtful provenance, *B. dryina* is known only from a single site on the north side of Loch Sunart in Inverness-shire. Elsewhere, it is found in northern and central Europe, extending eastwards to Georgia. All European collections of this species are from oak. At Loch Sunart, it was found growing in bark crevices on the trunk of a mature, vertically standing oak. The site at Loch Sunart is an SSSI and an RSPB reserve. There has been a recent extensive clearance of rhododendron from the site, which may have been beneficial to this species. A visit to the site to assess the size of the population is recommended.

Total no. of 10 km x 10 km squares: 2.

1960 onwards: 1.

Egea & Torrente (1993): taxonomy, illustration, distribution map.

Bellemeria alpina* (Sommerf.) Clauz. & Roux*Critically Endangered**

A white, crustose lichen, this species has sunken fawn-coloured apothecia (red-brown when wet). A single population is known in the Cairngorm Mountains where it is restricted to a limited area. It was recorded last century from Ben Lawers, Perthshire. In Europe this species is known from Norway, Sweden and the Alps; it also occurs in North America. The specimen from Ben Lawers is on schist. On Cairn Gorm this species is locally abundant at 1100 m on quartz pebbles in wet ground associated with a late snow patch. This small population is adjacent to the most accessible late snow bed in the Cairngorms. A sharp increase in recreation pressure could cause damage from trampling, especially as the soils are fragile; the area is used for snowboarding throughout the summer and for bivouacking in snow holes which could produce a local problem of eutrophication. The site lies within an NNR, in an area owned by the RSPB.

Total no. of 10 km x 10 km squares: 2.

1960 onwards: 1.

being poorly known, and easily confused with two other related species, there is a possibility that it still survives. It occurred on flint nodules. The habitat at Ryde has been destroyed by development.

Total no. of 10 km x 10 km squares: 2.

1960 onwards: 0.

Laundon (1986): taxonomy and details of records.

***Bacidia auerswaldii* (Hepp ex Stizenb.) Mig.**

Extinct

This crustose lichen has a finely granular green-grey to grey-brown thallus with black apothecia. Microscopic examination is required to distinguish it from *B. biatorina*. In Britain, *B. auerswaldii* was known only from Norton Manor, South Somerset, from where specimens were collected between 1927 and 1937. Elsewhere, it is a rare and apparently declining species in southern Fennoscandia and western Europe. *B. auerswaldii* grows on rather nutrient-rich bark of mature trees in well-lit situations; in Somerset it was found on an old parkland elm, associated with *B. phacodes* and *B. rubella*. In 1989, when a visit was paid to Norton Manor, it was found that the former parkland had been an army camp since 1939, and that no trees suitable for *B. auerswaldii* survived.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 0.

O'Dare (1990): visit to site and further references.

***Bacidia incompta* (Borrer ex Hooker) Anzi**

Vulnerable

This crustose species has a whitish-fawn to grey-green or dull green, mealy-granular thallus and mostly rather flat, purplish-brown to black apothecia. *B. incompta* was formerly widely distributed in Britain, being especially common in south-east England, but very rare in western oceanic districts, and extending north to North Aberdeenshire in Scotland. The decline up until 1960 mainly reflects the effects of air pollution and changes in the rural landscape, including the felling and non-replacement of parkland and wayside trees. Since 1960, this species has suffered a further drastic decline owing to the impact of Dutch elm disease (Watson, Hawksworth & Rose 1988), and the post-1960 figure of 142 grid squares is a vast over-representation of the current situation. Visits to some of its former sites in southern England have shown it to have disappeared from about 30 squares, and the same is likely for most of the others not yet checked. However, it probably persists in a few localities, such as the New Forest, South Hampshire, where it occurs on beech, and some pockets of surviving elms in Scotland. It is a rare species in southern Ireland, where its current status needs to be investigated. Although widely distributed in temperate Europe and southern Fennoscandia, it has severely declined in many countries. It is also reported from Madeira and North America. In Britain, this species is almost entirely confined to the bark of mature elms, usually in rain-tracks or below old wounds, often associated with *Caloplaca luteoalba* (q. v.). However, it has been found on other trees, including ash, beech, holly, hornbeam and sycamore, usually on the exposed wood or bark in and around old wounds. Any sites where viable populations are known to persist, especially on trees other than elm, should be afforded protection. Tree Preservation Orders could be placed on individual trees.

Total no. of 10 km x 10 km squares: 232.

1960 onwards: 142.

***Bacidia polychroa* (Th. Fr.) Körber**

Extinct

A corticolous, crustose lichen, this species has an irregularly warted, whitish to pale green-grey thallus and pale reddish to dark red-brown apothecia. This species is known in Britain from four 19th century records, two from the New Forest in Hampshire and Malvern in Worcestershire, and two based on specimens of doubtful provenance from Anglesey and Argyll. It is an apparently rare or much declined species in Europe, recorded from suboceanic areas from southern Sweden to the Mediterranean mountains. It is also known from North America. There is little information associated with the British material, but it apparently favours rather nutrient-rich bark on the trunks of mature deciduous trees. The New Forest specimens were collected on elm.

Total no. of 10 km x 10 km squares: 4.

1960 onwards: 0.

Bacidia subturgidula* (Nyl.) Zahlbr.*Extinct**

This crustose lichen has an inconspicuous, whitish thallus and small bluish-grey, or grey-brown to brown-black, apothecia. It is apparently endemic to Britain, being known only from its type locality, the New Forest in Hampshire, where it was found on wood in the hollows of an old holly in 1868 and 1873. In recent years, several concerted efforts to rekindle it have failed.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 0.

Bacidia vermifera* (Nyl.) Th. Fr.*Endangered****(*Bacidia hegetschweileri* (Hepp) Vainio)**

An inconspicuous white to white-grey crustose lichen, this species has a thin to irregularly warted thallus and small black apothecia. Originally discovered in Britain in 1968, it is now known from three populations, all in sites of old pine or birch forest in Strathspey, Inverness-shire. Elsewhere, it is found in scattered localities in central Europe and Fennoscandia, as far north as Torne Lappmark in Sweden. It is also known from North America. In Scotland it has been recorded on the bark of birch, wych elm and juniper in humid situations, and in Europe it is additionally known from alder, oak and sycamore. The population on wych elm may now be lost owing to Dutch elm disease. All localities are within SSSIs.

Total no. of 10 km x 10 km squares: 2.

1960 onwards: 2.

Bactrospora dryina* (Ach.) Massal.*Critically Endangered**

The grey-white thallus of this inconspicuous, crustose species is thin and scurfy with small, black and irregularly rounded apothecia. Apart from a 19th century specimen supposedly from Argyll, but of doubtful provenance, *B. dryina* is known only from a single site on the north side of Loch Sunart in Inverness-shire. Elsewhere, it is found in northern and central Europe, extending eastwards to Georgia. All European collections of this species are from oak. At Loch Sunart, it was found growing in bark crevices on the trunk of a mature, vertically standing oak. The site at Loch Sunart is an SSSI and an RSPB reserve. There has been a recent extensive clearance of rhododendron from the site, which may have been beneficial to this species. A visit to the site to assess the size of the population is recommended.

Total no. of 10 km x 10 km squares: 2.

1960 onwards: 1.

Egea & Torrente (1993): taxonomy, illustration, distribution map.

Bellemeria alpina* (Sommerf.) Clauz. & Roux*Critically Endangered**

A white, crustose lichen, this species has sunken fawn-coloured apothecia (red-brown when wet). A single population is known in the Cairngorm Mountains where it is restricted to a limited area. It was recorded last century from Ben Lawers, Perthshire. In Europe this species is known from Norway, Sweden and the Alps; it also occurs in North America. The specimen from Ben Lawers is on schist. On Cairn Gorm this species is locally abundant at 1100 m on quartz pebbles in wet ground associated with a late snow patch. This small population is adjacent to the most accessible late snow bed in the Cairngorms. A sharp increase in recreation pressure could cause damage from trampling, especially as the soils are fragile; the area is used for snowboarding throughout the summer and for bivouacking in snow holes which could produce a local problem of eutrophication. The site lies within an NNR, in an area owned by the RSPB.

Total no. of 10 km x 10 km squares: 2.

1960 onwards: 1.

***Biatora cuprea* (Sommerf.) Fr.**

Extinct

The thallus of this crustose species is composed of smooth, whitish warts, contrasting with the rather large convex to spherical red-brown apothecia. In Britain *B. cuprea* is correctly known only from two collections made near the summit of Ben Lawers, Perthshire, in the 1860s. It has an arctic distribution in the mountains of Fennoscandia and North America. On Ben Lawers it was found on soil at an altitude of c. 1000 m.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 0.

***Biatorella fossarum* (Dufour) Th. Fr.**

Endangered

This ephemeral, terricolous, crustose species has an indistinct, pale grey thallus with orange-red, convex apothecia that burst through the soil. In Britain, it is known only from Ham Hill in South Somerset. It is a southern European species, known from a few localities in the Mediterranean region. In Somerset, it grows on the floor of an old quarry, on sunny, compacted, calcareous, sandy soil. When discovered, in November 1989, it was locally frequent, but a visit in April 1994 failed to re-find it. However, as its apothecia are short-lived it is quite likely still to be present. The site is an SSSI and managed as a Country Park by South Somerset District Council.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 1.

***Biatorella hemisphaerica* Anzi**

Vulnerable

This lichen has a thin, pale green, crustose thallus bearing conspicuous, orange-red, hemispherical apothecia. It is restricted to the Ben Lawers range in Perthshire, where several populations are known on the highest ground. There is also a 19th century record from an unknown location, possibly in the Stirling area. Abroad it is known from the mountains of northern and central Europe, including the Alps and Carpathians. It grows on base-rich soil derived from soft layers within the mica-schist and on associated mosses, usually in shady rock crevices. Although no immediate threats have been identified, this species is vulnerable because the populations all occur within a single, restricted area. The sites lie within an NNR.

Total no. of 10 km x 10 km squares: 2.

1960 onwards: 1.

***Biatoridium delitescens* (Arnold) Hafellner
(*Strangospora delitescens* (Arnold) Coppins)**

Vulnerable

This inconspicuous species has a thin thallus and small, flat to convex, whitish to pale yellowish apothecia. It is known from four sites in Scotland (Seil in Argyll, Skye, West Ross and near Aviemore in Inverness-shire), and has recently been found in Wales (Cardiganshire). It is confined to Europe, being reported from Fennoscandia, Germany and the Spanish Pyrenees. It occurs in sheltered habitats, mostly on the basic bark of hazel, but also occasionally on ash and elm. The site on Seil is a Scottish Wildlife Trust reserve, and that near Aviemore an SSSI; the remaining sites have no protected status.

Total no. of 10 km x 10 km squares: 5.

1960 onwards: 5.

Hafellner (1994): description, distribution map.

***Biatoridium monasteriense* J. Lahm
(*Biatorella monasteriensis* (J. Lahm) J. Lahm)**

Endangered

This is a crustose lichen with a thin, scurfy-granular, grey-green thallus and small pale yellowish to dull brownish apothecia. *B. monasteriense* is scattered throughout upland areas of Britain, being known from eight sites in Merioneth, Cumberland, South Northumberland, Kirkcudbrightshire, Mid and East Perthshire, Morvern in Inverness-shire, and the Island of Mull, plus two 19th century records from North-east Yorkshire. It is confined to Europe, with scattered records from southern Sweden to south-east France, and eastwards to the Ukraine. It occurs in ancient, sheltered woodland, mostly in valleys, growing on the shaded, base-rich bark of the trunks of deciduous trees, especially wych elm and ash, but also elder. Half of the sites have some statutory

protection. However, at each site it was recorded on single trees and several of these are likely to have fallen or died; the elms at at least four of the sites have succumbed to Dutch elm disease.

Total no. of 10 km x 10 km squares: 9.

1960 onwards: 8.

Hafellner (1994): description and distribution map.

***Bryonora curvescens* (Mudd) Poelt**
(*Lecanora curvescens* (Mudd) Nyl.)

Vulnerable

The indistinct thallus of this lichen is mostly encrusting and growing within moss cushions, so the lichen is perceived as small, dark brown apothecia, which may occur singly or in clusters. This lichen is known from four scattered sites in the Scottish Highlands: Ben Lawers in Perthshire, Caenlochan in Angus, Bidean nam Bian within Glen Coe in Argyll, and the Ben Nevis range, Inverness-shire. The populations are very small but due to its inconspicuous nature the species may be more widespread than the records indicate. In Europe it has an arctic-alpine distribution. There are also records from Greenland and Nepal. *B. curvescens* is found overgrowing mosses, particularly cushions of *Andreaea* and *Grimmia* on damp, inclined, north-facing rock surfaces. It has been recorded from both acidic and more or less calcareous sites and from summit heath. At two of the sites it occurs on the sides of boulders. All its sites enjoy some level of protection and most are within NNRs.

Total no. of 10 km x 10 km squares: 4.

1960 onwards: 4.

***Bryoria furcellata* (Fr.) Brodo & D. Hawksw.**

Vulnerable

Dark brown and shrubby, this lichen has a tufted, spiky, rather shiny appearance. This species is known from four sites in the ancient Caledonian pine forests of Glen Affric, Glen Guisachan and Abernethy, all in Inverness-shire. It is widely distributed in the northern hemisphere in central and eastern Europe, Fennoscandia, Madeira, North and Central America, the Himalayas and Japan. In Scotland it occurs mainly as scattered individuals on the standing decorticated trunks of pine, the bark of old pine trunks and birch twigs. Where it is well established, it also colonises old fence-posts and the stems of 'leggy' heather. It is restricted to rather humid situations in areas of ancient forest with a long continuity of tree cover. Apart from extensive forest fires, there are no apparent threats to this species, and all sites are within nature reserves or SSSIs. Populations of this species are enhanced by allowing old decorticated pines and old fence posts to remain *in situ*. This species is listed on Schedule 8 of the Wildlife and Countryside Act 1981, and recent surveys have taken place as part of the Scottish Cryptogamic Conservation Project. Further survey work is recommended in order to reach a full understanding of its distribution.

Total no. of 10 km x 10 km squares: 4.

1960 onwards: 4.

***Bryoria implexa* (Hoffm.) Brodo & D. Hawksw.**

Extinct

This fruticose 'beard lichen' has slender, hanging, pale brown or greyish to dark brown branches with numerous minute white flecks or spots (pseudocypbellae) but no soralia. It is known from four 19th century collections, made in Angus, Inverness-shire and Mid Perthshire. Its overall distribution encompasses northern and central Europe and North America. This species predominantly grows on coniferous trees, although the British specimens have little accompanying information.

Total no. of 10 km x 10 km squares: 4.

1960 onwards: 0.

Hawksworth (1972): description and distribution map.

***Bryoria nadvornikiana* (Gyelnik) Brodo & D. Hawksw.**

Vulnerable

The shrubby, hanging thallus of this species has the appearance of tresses of brown hair plastering the rock. This species is locally very abundant on two sandstone crags 3 km apart on the Northumberland-Cumberland border. Elsewhere it has a widespread distribution throughout northern and central Europe, North America, Hawaii, Africa, the Himalayas and Japan. *B. nadvornikiana* shows a preference for slightly sheltered north-facing aspects on exposed sandstone cliffs at 330 m. High atmospheric humidity, frequent low cloud and a persistent breeze

favour a lush community dominated by fruticose lichens. One of the sites, Muckle Samuel's Crag, is threatened by encroaching conifer plantations which are altering the special microclimate. One site is an SSSI, the other lies within the Borders Forest Park.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 1.

Gilbert (1980): site description, lists, photographs of habitat.

***Bryoria nitidula* (Th. Fr.) Brodo & D. Hawksw.**

Extinct

The thallus of this fruticose species has shiny, dark brown to blackish branches that are more or less circular in cross section. They have small lateral spines but lack soralia or white spots (pseudocyphellae). In Britain, this species was collected twice from Cairn Gorm in the 19th century. There have been several unsuccessful attempts to refine the species there, its most southern outpost in Europe. It has a circumpolar distribution in the northern hemisphere. This is a characteristic species of arctic and subarctic heaths, especially 'snow-patch' communities.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 0.

Hawksworth (1972): world distribution map.

***Bryoria smithii* (Du Rietz) Brodo & D. Hawksw.**

Critically Endangered

This fruticose species dark brown to black branches that are a paler brown or olive at their apices and more or less circular in cross section. The branches have numerous small lateral spines and also soralia from which arise tufts of short spines. Since 1960, *B. smithii* has been seen at only two sites on Dartmoor in Devon. Although known from six sites in North Wales, it has not been seen there since 1958. There are also two records from Scotland (Mid Perthshire and Stirlingshire) where it has not been seen for over 150 years. Elsewhere it is found in north-west and central Europe, the Himalayas, southern China, Malaysia and Hawaii. It grows on the acid bark of old oaks and on mossy boulders in sheltered, but fairly well-lit, upland situations, mainly in areas experiencing an annual precipitation in excess of 1500 mm. One of the Dartmoor sites has been extensively damaged by fire, and *B. smithii* is not thought to have survived. At its remaining Dartmoor site, which is within an SSSI, it is vulnerable to grazing, trampling and perhaps also to collecting.

Total no. of 10 km x 10 km squares: 11.

1960 onwards: 3.

Hawksworth (1972): European distribution map.

***Buellia asterella* Poelt & Sulzer**

Critically Endangered

Starry Breck-lichen.

This lichen grows on calcareous soil where it forms small, irregular, rosettes of thick, chalky-white scales; black fruits are usually present. Since 1960 this species has been seen at four sites in the Brecklands of East Anglia (Norfolk and Suffolk) but a recent survey (1991) located it only at Lakenheath Warren. It is a central and northern European species known from France, Germany, Norway and Sweden. *B. asterella* is a terricolous species of dry, strongly calcareous soil that occurs in an open, lichen-dominated community. The substrate in the Brecklands is chalky boulder-clay containing abundant chalk-flint rubble. A combination of grazing, drought and past disturbance prevent the sward from closing. The rapid and synchronised decline of this species, since the mid-1980s, suggests that some, as yet unidentified, type of pollution may be involved. There is also a threat from invasion by Scots pine. This species is listed on Schedule 8 of the Wildlife and Countryside Act 1981. It is being monitored in its only remaining site, which lies within an SSSI and, since 1992, has been included in English Nature's Species Recovery Programme. This has involved transplanting material from Lakenheath Warren to other sites nearby and monitoring subsequent progress.

Total no. of 10 km x 10 km squares: 7.

1960 onwards: 4.

Gilbert (1993): habitat description, species lists, discussion of decline.

Buellia insignis* (Naeg. ex Hepp) Th. Fr.*Vulnerable**

The thallus forms a white to grey-green, lumpy crust over moss and other lichens; abundant black apothecia are usually present. This lichen has been collected twice from near the summit of Ben Lawers, Perthshire. In Europe it has an arctic-alpine distribution and it is also present in North America. In Britain *B. insignis* grows over mosses and other lichens on calcareous soils at altitudes above 900 m. There is some evidence that it prefers sheltered crevices on the leeward side of boulders and rock outcrops. The site lies within an NNR.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 1.

Calicium adpersum* Pers.*Critically Endangered**

This 'pin-head' lichen has a granular, grey thallus and stalked black apothecia, the cups of which have a yellow powdery coating. *C. adpersum* is currently known from two sites, in Montgomeryshire and Oxfordshire, with additional old records extending its former range northwards to Lowther Park in Westmorland and Ingleby, North-east Yorkshire. Elsewhere it is found in southern Fennoscandia, central Europe, North America and, as a distinct subspecies, in New Zealand. It grows on the dry, rough bark of old oaks in areas of ancient woodland or wood-pasture; at each site it has been recorded on only one or two trees. The main threat to this species is the accidental or natural demise of its host trees. Both sites have SSSI protected status.

Total no. of 10 km x 10 km squares: 4.

1960 onwards: 2.

Calicium corynellum* (Ach.) Ach.*Critically Endangered**

A black 'pin-head' lichen with a distinctive, powdery, bright yellow-green thallus, this species is known from a single site in the lower Tyne valley, Northumberland. It has a scattered distribution in Europe and Canada. Its habitat in England is the sheltered, slightly damp, north-facing wall of a church tower where it grows on both sandstone and mortar. In Europe it is typical of siliceous rock below overhangs in very humid habitats. Since its discovery in 1972, this small population has been monitored and has decreased in area by 90%. It is currently on only four stones, and apothecia, once abundant, are now scarce. Church officials have been made aware of its presence. The decline appears to be the result of replacing a stone slab at the base of the tower with gravel, so that rain water cascading from a pipe no longer splashes high up the wall, which is becoming dryer. The site has no legal protection.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 1.

Calicium quercinum* Pers.*Extinct**

This crustose lichen has a thick, greyish-green, granular thallus and small black 'pin-head' apothecia with a white powdery coating. Although many records are misidentifications of other species, it is evident from the available specimens that this species was once widely distributed in the lowlands of southern England, with outlying localities in mid-Wales and southern Scotland. It is otherwise known from Fennoscandia, as far north as Medelpad in Sweden, central Europe and possibly North America. In Britain, this species grew on the wood of decorticated, ancient oaks and boarded buildings. Its demise can be attributed to a combination of pollution from sulphur dioxide, agricultural activities and the increased use of timber preservatives and substitutes.

Total no. of 10 km x 10 km squares: 18.

1960 onwards: 0.

Calicium trabinellum* (Ach.) Ach.*Extinct**

Calicium trabinellum is a crustose lichen with an indistinct thallus but with stalked black 'pin-head' apothecia up to c. 1 mm tall with a greenish-yellow powdery coating on the side of the head. This species has been recorded only once, in 1858, from a site near Perth, growing on "palings" and "rotten fabricated wood". This is puzzling, as it is a common species in Fennoscandia, and its distribution extends widely throughout much of Europe into Asia and North Africa, and also to North America and Australasia. Throughout its range it grows on the wood of decorticated trees and stumps, as well as on worked timber.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 0.

Caloplaca aractina* (Fr.) Häyrén*Critically Endangered**

The dark crustose thallus of this species is crowded with brownish-orange to blood-red fruits with persistent dark grey margins. This lichen has recently been recorded only from the Lizard Peninsula, Cornwall, but over fifty years ago it was known from five other scattered sites in Cumberland, Argyll, Lochaber (Inverness-shire) and North Yorkshire. Most records are from the west coast. There is also a 19th century record from the Isle of Man. This species is found along the coast of western Europe north to the Arctic circle and also inland in southern Europe. The habitat on the Lizard, where *C. aractina* occurs in extensive patches, is sunny, vertical to sloping, serpentine rocks up to 100 m above high water mark. Elsewhere it was on siliceous coastal rocks, often near bird perches. The reasons for the decline of this species are unknown. Its single remaining locality is in an NNR.

Total no. of 10 km x 10 km squares: 7.

1960 onwards: 1.

Gilbert & James (1987): site description.

Caloplaca cinnamomea* (Th. Fr.) H. Olivier*Endangered**

The white to grey, crustose thallus, overgrowing moss, bears crowded rust-red, irregular apothecia. This lichen is known from near the summit of Ben Lawers, Perthshire, where single thalli have been found at three sites. Abroad it has a circumpolar distribution. It encrusts mosses and general plant debris in exposed sites on calcareous mica-schist cliffs. It is part of a community that is rich in rare montane lichens. It is considered Endangered because of the very small population occurring in a very restricted area. All sites lie within the NNR.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 1.

Gilbert, Coppins & Fox (1988): site description, lists, photograph of habitat.

Caloplaca flavorubescens* (Huds.) Laundon*Endangered**

The thallus of this species forms a grey or greenish, yellow-tinged crust on bark; conspicuous bright orange fruits are usually present. This species was once widespread and probably fairly frequent throughout Britain, as far north as the southern Highlands of Scotland. However, there has been a substantial decline; it has been seen in only 26 10 km x 10 km squares since 1960 and there have been considerable further reductions in its range since then. For example, it appears to have virtually disappeared from eastern England, where the last verified record was from a sweet chestnut tree in Melford Hall Park, Suffolk, in 1985. There are three modern records from Ireland. Elsewhere its range includes most of Europe, North America and Australia. *C. flavorubescens* grows on the trunks and roots of isolated, old deciduous trees and also rarely on wood. It displays some preference for wayside and parkland trees, especially ash. It frequently occurs where the bark is enriched by dust and manure from grazing animals. The decline of this species can be attributed primarily to air pollution, with the loss of large, isolated trees and heavy enrichment from agricultural chemicals being secondary causes. The majority of sites, being waysides and parklands, lie outside protected areas. Tree Preservation Orders could be placed on individual trees.

Total no. of 10 km x 10 km squares: 71.

1960 onwards: 26.

Caloplaca haematites* (Chaub. ex St-Amans) Zwackh*Extinct**

This crustose lichen has a thin to granular, grey thallus and brownish-red apothecia. It was known from four sites, in Cambridgeshire, South Devon and Worcestershire, but has not been seen this century. It has a predominantly Mediterranean distribution in southern Europe, North Africa and Israel, and is further reported from South America. In Britain, this species occurred in open habitats on the smooth bark of the branches and twigs of broad-leaved trees and shrubs. The British collections were from poplar and fruit trees.

Total no. of 10 km x 10 km squares: 4.

1960 onwards: 0.



1. Prawle Point, South Devon. *Roccella fitziformis*, an example of a Lower Risk (near threatened) species, growing on a sheltered, overhanging maritime cliff. (Photo by F.S. Dobson)



2. Giant ash pollard at Whiddon Deer Park, South Devon. Relics of the wood pasture system are often the last refuge of ancient woodland indicator lichens in lowland England. (Photo by Mrs A.M. Coppins)



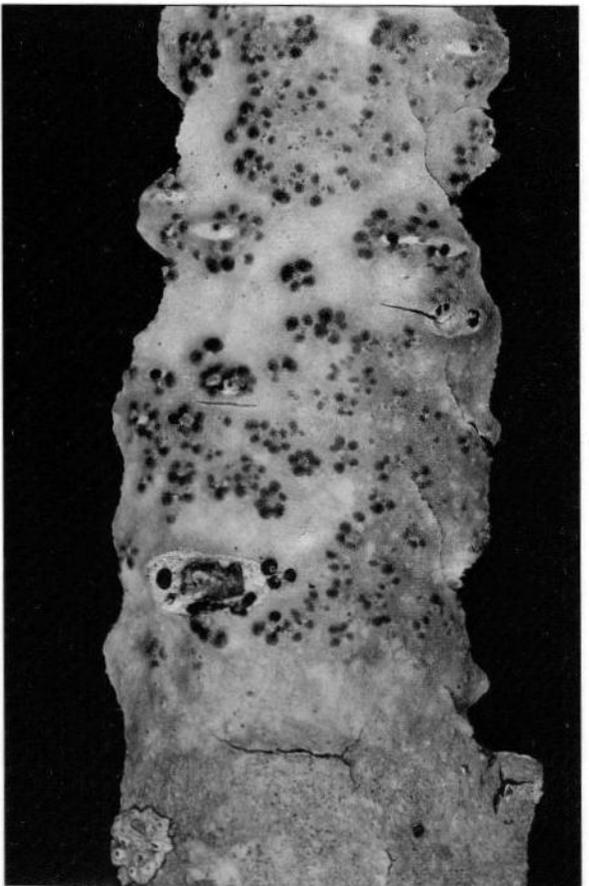
3. Torrinch, Loch Lomond. Lake margins support a complex zonation related to degree of submergence and wave splash. They are vulnerable to changes in water level associated with hydro-electric schemes and water abstraction. (Photo by J. Mitchell)



4. Ben Lawers, Perthshire. *Gyalecta foveolata*, an example of a Lower Risk (near threatened) species, a rare montane lichen. (Photo by O.L. Gilbert)



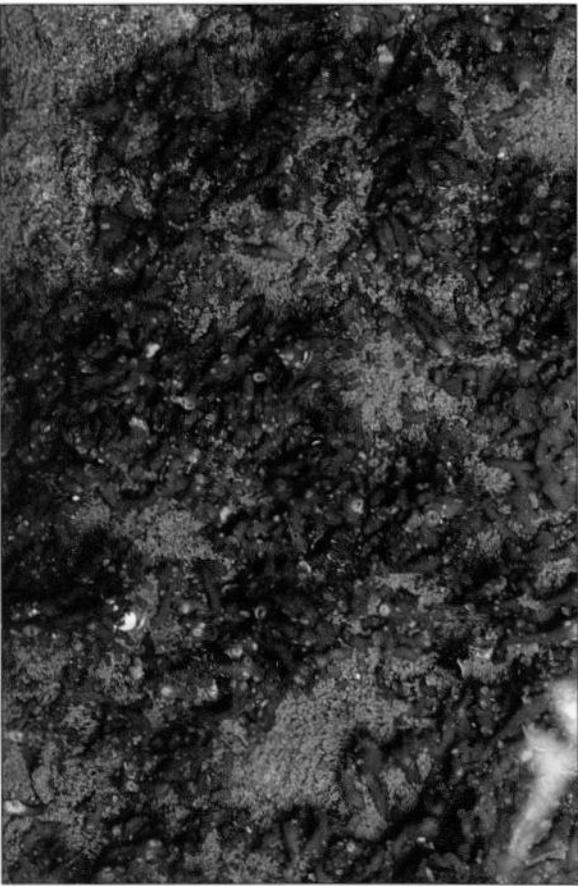
5. Ben Lawers, Perthshire. *Perisartia glomerata*, a rare arctic-alpine lichen. Four tiny populations are known in the Scottish Highlands. (Photo by I.C. Munro)



6. Ben Resipole, Westness. *Parmenaria chilensis*, a strongly oceanic species known in Britain from a single hazel wood. (Photo by Mrs A.M. Coppins)



7. Balnabraid, Kintyre. The green algal form of *Sictia canariensis* occurs as independent thalli at very few sites. (Photo by B.J. Coppins)



8. River Isla, Angus. *Callena dichotomum*. This rare lichen of acid streams is threatened by water pollution and alterations to natural flow. (Photo by B.J. Coppins)

Caloplaca irrubescens* (Nyl.) Zahlbr.*Extinct**

The thallus of this crustose species grows in small patches and consists of orange segments, with small, brownish-orange apothecia, over a black background (prothallus) that is often associated with blue-green algae. In Britain this species is known only from a single 19th century collection from near Barmouth in Merioneth. In Europe it is a southern, Mediterranean species extending northwards into the dry valleys of the Alps and central Europe. It is also reported from Saudi Arabia and North America. No habitat data accompany the British material, but in southern Europe it grows on the steeply inclined, sunny surfaces of more or less basic siliceous rocks.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 0.

Caloplaca luteoalba* (Turner) Th. Fr.*Vulnerable**

Orange-fruited elm-lichen

This crustose species has bright orange, closely grouped apothecia that tend to obscure the thin, grey-white thallus. It was formerly relatively frequent in lowland southern, central and eastern England and eastern Scotland, with scattered populations in eastern Wales, but has declined catastrophically in the present century in a similar manner to *Bacidia incompta* (q. v.), firstly due to a combination of air pollution and changes in the rural landscape, and latterly (since 1960) due to the death of elm trees through Dutch elm disease. Hence the 1960 onwards figure of 112 grid squares is a gross over-representation of the true status of this species today. There are several old records from central and southern Ireland, and its current status there is in need of investigation. It has a wide distribution in western Europe, but has suffered a marked decline, and is apparently extinct in Denmark, The Netherlands and northern Germany. It is also reported from North America. *C. luteoalba* is mainly restricted to parkland and wayside situations in areas with an annual rainfall below 750 mm. It is predominantly an epiphyte of elm, often associated with *Bacidia incompta* in nutrient-enriched rain- or wound-tracks, but has rare occurrences on ash, field maple, poplar, horse chestnut and sycamore and also soft calcareous rocks of natural outcrops, walls and gravestones. Few, if any, of its extant populations appear to be within protected sites. This species is listed on Schedule 8 of the Wildlife and Countryside Act 1981. The current status of *C. luteoalba* should be reviewed, and protection afforded to trees supporting viable populations.

Total no. of 10 km x 10 km squares: 247.

1960 onwards: 112.

Watson, Hawksworth & Rose (1988): decline related to Dutch elm disease.

Caloplaca nivalis* (Körber) Th. Fr.*Critically Endangered**

Snow caloplaca

This lichen has a whitish to dark grey granular thallus, usually crowded with small orange to rust-coloured fruits. It is always found in association with the moss *Racomitrium heterostichum*. The thallus of *C. nivalis* has been reliably recorded only from near the summit of Ben Lawers, Perthshire where it was described as "not rare" in the middle of the 19th century. Currently only two very small populations are known. A 19th century record from Ben Cruachan, Argyll, is generally discounted. This arctic-alpine species occurs in northern and central Europe, and North America. This species is apparently parasitic on mosses overgrowing acidic rock at an altitude of over 1000 m. When last seen, in 1986, the largest extant population comprised half a dozen thalli on a flat-topped boulder. The decline of *C. nivalis* is not fully understood. It may be due to over-collecting in the past: there has been no general decrease elsewhere in its range. A search was made in 1994 as part of the Scottish Cryptogamic Conservation Project, but it was not found. This species is listed on Schedule 8 of the Wildlife and Countryside Act 1981. Ben Lawers is an NNR.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 1.

Carroll (1865): occurrence on Ben Lawers.

***Caloplaca pollinii* (Massal.) Jatta**
(*Caloplaca phaeocarpella* (Nyl.) Zahlbr.)

Extinct

This is a crustose species with a thin whitish grey to dark grey thallus and reddish brown to black apothecia. There are two 19th century collections of some taxonomic uncertainty. One collection is from Craig Cluny near Braemar in South Aberdeenshire, and has dark brown apothecia that correspond with the northern European *C. phaeocarpella*. The other, from Yorkshire, has black apothecia corresponding to *C. pollinii*, which has a mainly Mediterranean distribution. The distinction between *C. phaeocarpella* and *C. pollinii*, together with the status of the British collections, requires further study. The British collections are on bark, but no further ecological information is available. In Fennoscandia, specimens referred to *C. phaeocarpella* are found also on wood and plant debris.

Total no. of 10 km x 10 km squares: 2.

1960 onwards: 0.

***Caloplaca virescens* (Sm.) Coppins**

Vulnerable

The thallus of this species forms a thick, coarsely granular, bluish green to dark grey crust, with orange apothecia produced rarely. It is known from several sites in southern England and the English Midlands, and there is an unconfirmed report from eastern Scotland. It is otherwise known only from Belgium. This lichen grows on the nutrient-enriched trunks of large parkland and wayside trees, especially elm, but also ash and sycamore, usually forming large patches around the tree base. It is able to persist for several years on stumps after its host tree is felled. Very few of its sites have a protected status. The 10 km square records suggest little change. However, many of the modern records are from elm, often on the surviving stumps of trees killed by Dutch elm disease - a habitat that cannot be considered secure.

Total no. of 10 km x 10 km squares: 15.

1960 onwards: 14.

***Catapyrenium daedaleum* (Krempelh.) B. Stein**

Vulnerable

The thallus of *C. daedaleum* consists of dispersed to crowded brown scales with dark strands on their lower surface. It is fairly frequent on Ben Lawers, Perthshire, and there are records from two other mountains in the Breadalbanes. Abroad it is present in central and northern Europe and Fennoscandia. *C. daedaleum* is found on soil, plant debris and growing over mosses on calcareous mica-schist. The majority of sites lie within NNRs.

Total no. of 10 km x 10 km squares: 5.

1960 onwards: 5.

Bruss (1990): ecology and distribution in Europe.

***Catapyrenium michelii* (Massal.) R. Sant.**

Vulnerable

The thallus of this species resembles small, scattered, brown, leather-like buttons, with black dots (which are the emerging tops of the sunken perithecia) on the upper surface. Microscopic examination is required to distinguish it from *C. squamulosum*. This species is known in Britain from a single site in Surrey, where, in 1970, it was said to be abundant. However, a poorly developed specimen from Breckland in Suffolk may belong to this species. Elsewhere, it is found in southern Sweden and central Europe, east to the Caucasus mountains, as well as in western Greenland. It has possibly been under-recorded owing to its superficial similarity to the common *C. squamulosum*. At the Surrey site it was found on the compacted calcareous sandy soil of a path. The Surrey site is probably within an SSSI. The current status of the species at the site needs to be re-assessed and any necessary management action taken. The species is vulnerable to changes in the habitat from such factors as scrub encroachment and excessive trampling, although it probably benefits from moderate disturbance.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 1.

Bruss (1990): European distribution map.

***Catapyrenium psoromoides* (Borrer) R. Sant.**
Tree catapyrenium

Critically Endangered

This species has a thallus of small, dull, greyish or greenish-brown to fawn scales and sunken perithecia that open onto the surface as minute, blackish pores. This species is currently known only from Milton Wood in East Perthshire, but was found in the early 19th century at two sites in West Sussex and later (1923) at Harlech Castle in Merioneth. World-wide it is a rare species with a wide range, occurring in western and central Europe, Morocco and East Africa; also in North America, Japan and New Zealand. It is mainly a species of mossy, basic bark, but occasionally, as at Harlech, it has been found on mossy, calcareous rocks. In Sussex it occurred on ash and elm, and in Perthshire it grows associated with the mosses *Homalothecium sericeum* and *Leucodon sciuroides* on a single ash on a west-facing slope overlooking rough pasture. This species is listed on Schedule 8 of the Wildlife and Countryside Act 1981, and its remaining site is an NNR. Successful tree surgery has been carried out on the host tree to improve its stability. Transplantation of material to two nearby trees has been carried out, and is currently being monitored as part of the Scottish Cryptogamic Conservation Project, 1993-95.

O'Dare & Coppins (1994): habitat details, photographs.

Total no. of 10 km x 10 km squares: 3.

1960 onwards: 1.

***Catillaria laureri* Hepp ex Th. Fr.**
(*Catinaria laureri* (Hepp ex Th. Fr.) Degel.)
Laurer's catillaria

Vulnerable

Catillaria laureri is a whitish to grey-green crustose lichen with the thallus often delimited by a blackish line, and small black apothecia with a paler, brownish margin. This species is confined to the New Forest, Hampshire, where it is known from seven woods; a recent survey found it on 26 trees in six of the woods. There is also an early 19th century record from Killarney in south-west Ireland. Elsewhere it occurs in western Europe from southern Sweden to Portugal, extending eastwards to humid montane woods in the Alps. It is also present in eastern North America. Although there is an earlier report of it on oak, *C. laureri* in the New Forest appears today to be strictly confined to the trunks of past-damaged or pollarded old beeches, occurring in sheltered and well-lit glades. It grows in or near raintracks below burrs, knot-holes or forks. All the sites of this species are protected within SSSIs. The populations of this species are limited by the number and density of suitable trees, and in some sites are threatened by the dense shade cast by thickly regenerating holly. This species is listed on Schedule 8 of the Wildlife and Countryside Act 1981.

Total no. of 10 km x 10 km squares: 4.

1960 onwards: 4

Sanderson (1994a, 1994b, 1994c): habitat details.

***Catillaria modesta* (Müll. Arg.) Coppins**

Vulnerable

This crustose species has a thin, pale fawn to ochre-tinted thallus and black apothecia. Microscopic examination is required to distinguish it from similar species, especially *Clauzadea monticola*. *C. modesta* is known in Britain from Meall na Samhna in Mid Perthshire and a hillside overlooking Loch Maree in West Ross. Earlier British records are misidentifications of unrelated species. It is otherwise known in Ireland, from two sites in West Donegal, and from its type locality in Switzerland. Although certainly not a common species, it has probably been under-recorded. It is a species of upland limestone, growing on more or less vertical, freely draining surfaces. In Perthshire it grows on crystalline limestone at 350 m, and in West Ross on a small limestone outcrop (fucoid beds). One site is an NNR, the other an SSSI.

Total no. of 10 km x 10 km squares: 2.

1960 onwards: 2.

***Catillaria neuschildii* (Körber) Th. Fr.**
(*Catinaria neuschildii* (Körber) P. James)

Vulnerable

The thin thallus of this inconspicuous crustose species has small dark brown apothecia. It is known from three sites in the vicinity of the Cairngorm Mountains, in Dinnet Oakwood (South Aberdeenshire), Ben Avon, Banffshire and Abernethy Forest, Inverness-shire, and also from Glen Lochay in Mid Perthshire. Its European

distribution is poorly known, but it ranges from Swedish Lapland in the north to central Italy in the south. In Britain it has been found on the bark of old juniper in Caledonian pinewood, on oak in old oak-woodlands and on an isolated willow in a mountain valley at an altitude of c. 450 m. The four sites are all protected as nature reserves and/or SSSIs.

Total no. of 10 km x 10 km squares: 4.

1960 onwards: 4.

***Catillaria picila* (Massal.) Coppins**

Extinct

This crustose species has a thin, pale fawn to ochre-tinted thallus and black apothecia that are constricted or shortly stalked below. It was recorded last century from Tulach Hill in Mid Perthshire, but searches in recent years have failed to re-find it there. There is an old record from western Ireland and it occurs across central and southern Europe. It grows underneath damp overhangs of calcareous schist and limestone.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 0.

***Catillaria subviridis* (Nyl.) Zahlbr.**

Vulnerable

This crustose species has a thin, slightly cracked, beige to green-grey or grey-brown thallus with small black apothecia. It requires microscopic examination to distinguish it from several, superficially similar, species. *C. subviridis* is known only from two sites in the Isles of Scilly, one of which is an SSSI, the other unprotected, and the Channel Islands. There is also a doubtful record from Denbighshire. It grows on nutrient-enriched rocks, especially those used regularly as bird perches. There are no known immediate threats to this species apart from its occurrence in small and restricted populations, but its sites should be surveyed to evaluate its current status.

Total no. of 10 km x 10 km squares: 1

1960 onwards: 1.

***Catolechia wahlenbergii* (Ach.) Körber**

Vulnerable

This elegant lichen has a rosette-shaped thallus composed of thick, ridged scales that are lobed at the margins and vivid yellow-green. The distribution of this species is centred on high ground in the Ben Nevis range with outlying localities on Ben Alder, Inverness-shire, Ben Avon, Banffshire, and the Black Cuillin of Skye. It has an arctic-alpine distribution in Europe and is also present in North America. It usually grows on acidic solifluction soils, in rock crevices and occasionally overgrowing bryophytes. The records from Skye are of isolated thalli on the gabbro of the main ridge. The sites where this lichen occurs are mostly very isolated and are not threatened. They all lie within SSSIs.

Total no. of 10 km x 10 km squares: 6.

1960 onwards: 6.

Gilbert, Fryday, Giavarini & Coppins (1992): description of the Ben Nevis habitat.

***Cetraria juniperina* (L.) Ach.**

Extinct

(*Vulpicida juniperinus* (L.) J.E. Mattsson & M.J. Lai)

A foliose lichen forming small, irregular, pale-yellow rosettes, *C. juniperina* is frequently fertile. It was formerly known from Upper Teesdale in County Durham and four sites in the Scottish Highlands including the Breadalbane Mountains and the Rothiemurchus pine woods. It has not been seen this century so is presumed extinct. It is otherwise known from Europe, North America and Japan. Details of the habitat have not always been recorded, but it appears to be a species of the ancient Caledonian pine forest, occurring as an epiphyte both on the trunks of pine trees and particularly the understorey of juniper. The Teesdale record was from open, hillside juniper scrub. Reasons for the extinction of this species probably include habitat destruction.

Total no. of 10 km x 10 km squares: 5.

1960 onwards: 0.

***Chaenotheca gracilenta* (Ach.) Mattsson & Middelborg**
(*Cybebe gracilenta* (Ach.) Tibell)

Endangered

This 'pin-head' lichen has a greyish-green thallus of powdery granules and pale brown-beige, spherical apothecia each borne on a slender, elegant stalk, which is black but covered in a grey powdery coating. This species has an eastern distribution, occurring at three sites, in Mid-west and North Yorkshire and Angus. Elsewhere it is found in northern and central Europe, Macaronesia and North America. This is a very shade-tolerant species, growing on dry bark and associated soil in hollows at the bases of elm and sycamore. Only the Scottish site has SSSI status. This species is threatened by the small size of populations, being known only from single trees at each site.

Total no. of 10 km x 10 km squares: 3.

1960 onwards: 3.

***Chaenotheca laevigata* Nád.v.**

Endangered

This 'pin-head' lichen has a thin olive-yellow thallus. The apothecia have a club-shaped to golf tee-shaped cup and both cup and stalk are covered in a yellow-green powdery coating. Microscopic examination is required to distinguish it from similar species, especially *C. chlorella*. It is known in Britain from only three sites, in Banffshire, West Perthshire and Roxburghshire, and elsewhere from Fennoscandia, Russia, central Europe and North America. In Britain this lichen occurs in valley woodlands, in dry bark crevices of mature ash, elm and oak in moderately well-lit situations. The three sites do not have SSSI status, but one is owned by the National Trust for Scotland. In all cases it was found on single trees, and is thus threatened by virtue of the small size of its populations.

Total no. of 10 km x 10 km squares: 3.

1960 onwards: 3.

***Chaenotheca phaeocephala* (Turner) Th. Fr.**

Critically Endangered

The usually thickish, dark grey to greenish-brown thallus of this species bears short-stalked and goblet-like 'pin-heads' (apothecia), which have a pale to dark brown stalk and a yellowish-green powdery coating on the sides of the cup. In the late 18th and early 19th centuries, this species was recorded from several lowland localities in England (Norfolk, Suffolk, Sussex, Shropshire), but since then it has only been seen in West Sussex and mid-Wales. It is widely distributed in the northern hemisphere: in Europe from northern Italy north to Swedish Lapland; also Nepal, Japan, USA (Oregon) and Canada. In Britain, *C. phaeocephala* is known from the worked timber of old boarded buildings and fencing that has not been treated with creosote or other preservatives; the recent find in Sussex was from the side of an ancient oak-clad barn, where the species has no statutory protection. The mid-Wales population (Montgomeryshire) is on a single oak in parkland. The decline of this species in Britain is probably due to the extensive use of timber preservatives on farm buildings and the substitution of timber for other materials. An additional factor is eutrophication from inorganic fertilisers. It has recently (1996) been reported that the barn in Sussex has collapsed, so this species may now occur at only one site.

Total no. of 10 km x 10 km squares: 6

1960 onwards: 2

Gilbert (1992): notes on habitat

***Chaenotheca xyloxena* Nád.v.**

Vulnerable

This crustose species has a thin thallus that imparts a faint greenish-grey tinge to the wood on which it grows. The small 'pin-head' apothecia each have a delicate, black, wiry stalk and are often covered in a white powdery coating. This species is known from five sites in the central and eastern Scottish Highlands, in Inverness-shire, Mid Perthshire and South Aberdeenshire. It is widely distributed in the northern boreal and temperate zones of the northern hemisphere, and also in New Zealand. In Scotland, it is confined to ancient woodlands, where it grows on the wood of split and damaged deciduous trees, such as alder, birch and oak, as well as on decorticated pines. At least four of the five sites have SSSI or NNR status.

Total no. of 10 km x 10 km squares: 5.

1960 onwards: 5.

***Chromatochlamys larbalestieri* (A.L. Sm.) Mayrhofer & Poelt**

Vulnerable

This inconspicuous, crustose lichen has a thin, pale olive-brown to brown thallus and small black perithecia that are partly covered by the thallus. This species is apparently endemic to Scotland and Ireland. It is known from two sites in western Scotland, the north shore of Loch Moidart in Inverness-shire, and near Tobermory on the Island of Mull. In Ireland it was collected in 1876 and again in 1962 from two sites in Connemara in western Ireland. Owing to its inconspicuous habit, this species may be somewhat overlooked. It grows, usually in deep shade, over the thalli of *Verrucaria* species on periodically inundated mica-schist, quartzite or doleritic rocks, either in streams or on damp stones in woodland. This species is vulnerable to water pollution. Both sites are within SSSIs.

Total no. of 10 km x 10 km squares: 2.

1960 onwards: 2.

Morgan-Jones & Swinscow (1965): description and habitat details.

***Cladonia botrytes* (Hagen) Willd.**

Critically Endangered

This species has small erect basal scales and short, erect, yellow-green stalks (podetia), unbranched or sparingly branched above, which terminate in cushion-shaped, pale brown apothecia. Since 1960, *C. botrytes* has been found at twelve sites in eastern Scotland (South Aberdeenshire, Angus, Inverness-shire and Mid and East Perthshire), but was last recorded in 1978. It has a circumboreal distribution in northern and central Europe, Asia and North America. The main habitat of this species in Scotland is around the circumference of the cut surface of pine stumps, especially in areas of native pine woodland. However, it has also been recorded on decaying pine bark, and on old heather stems and peaty ground on an open hillside at an altitude of 350 m. The reasons for the apparent recent rapid decline of this species are unclear, and require urgent investigation. Many of the sites have statutory protection.

Total no. of 10 km x 10 km squares: 12.

1960 onwards: 12.

***Cladonia convoluta* (Lam.) Cout.**

Vulnerable

This attractive pale primrose-yellow lichen forms clumps of straggling, elongated lobes in calcareous grassland. It occurs in scattered localities along the south coast, with outlying colonies in the Mendip Hills. Records from East Anglia, the lower Thames Valley and Wales are generally discounted. Abroad it is widespread in southern Europe, North Africa and south-western Asia. *C. convoluta* is found in sunny, open, stony, calcareous grassland. Sites are almost equally divided between the chalk, older limestones and fixed coastal shingle areas. In the Mendips it is associated with block scree. This lichen is sensitive to changes in grazing pressure. If grazing is too heavy the colonies are fragmented by heavy trampling; too light and the sites become threatened by scrub invasion. All its localities lie within SSSIs.

Total no. of 10 km x 10 km squares: 10.

1960 onwards: 8.

***Cladonia maxima* (Asah.) Ahti**

Vulnerable

This lichen forms patches of robust greyish-brown stalks (podetia) that are unbranched or forked towards the apex. *C. maxima* is reasonably widespread on the Cairngorm plateau and there is an outlying record from high ground in the Ben Nevis range. It has a circumpolar distribution. It appears to be confined to patches of dense, wet, *Nardus* grassland associated with areas of prolonged snow lie. It occurs deep down among the grass tussocks so is unlikely to be found unless a special search is made. The majority of sites lie within NNRs.

Total no. of 10 km x 10 km squares: 3.

1960 onwards: 3.

Gilbert & Fox (1985): ecology.

Cladonia mediterranea* Duvign. & des Abb.*Critically Endangered**

This bushy lichen has a richly branched, grey-white thallus which forms low straggling clumps among open vegetation. It is restricted to sites on the Lizard Peninsula, Cornwall, Carn Ingli in Pembrokeshire and Lundy Island. It is widespread in the Mediterranean, western France, Turkey, North Africa and the Canary Isles. The Cornish population grows on a bank in serpentine heath. The site is a mosaic of rock, red fescue *Festuca rubra* and heather *Calluna vulgaris*. The soil pH is 7.0–7.3. There is evidence that the colonies were more fragmented and in poorer condition in 1986 when compared with gatherings made 35 years earlier. At the Pembrokeshire site, *C. mediterranea* grows with *Calluna* in coarse boulder scree and on Lundy it was found in small damp declivities between stands of *Calluna*. The species is particularly vulnerable because of the small size of the populations. It could be threatened by fires and trampling by cattle and the public. The Cornish site lies within an NNR and the sites in Wales and Lundy are SSSIs. A reassessment of the Lizard population is required.

Total no. of 10 km x 10 km squares: 3.

1960 onwards: 3.

Ahti (1961): world distribution map.

Gilbert & James (1987): site description, ecology and species list.

Cladonia peziziformis* (With.) Laundon*Critically Endangered**

The thallus of this lichen consists of basal scales covered in conspicuous black dots (pycnidia) and short, unbranched, longitudinally fissured stalks (podetia) with a granular surface, bearing at their tip a single, large, dark brown apothecium. The species has a widely scattered distribution, from West Sussex, Devon and Pembrokeshire to south-west Scotland and Mull. Abroad it has been recorded from Europe (including Ireland) and North and South America. This lichen grows on damp peaty soil in coastal and montane heathland up to 400 m. There are very few recent records and only three during the last 30 years, from within SSSIs in Pembrokeshire and Mull and an unprotected site in Devon. Disturbance by burning may favour it: it grows in Pembrokeshire on an area of heath burned in the recent past. On the other hand, disturbance associated with heather burning and habitat disturbance may be responsible for its sharp decline: unfortunately there is little hard information available.

Total no. of 10 km x 10 km squares: 7.

1960 onwards: 5.

Cladonia stellaris* (Opiz) Pouzar & Vězda*Extinct**

The richly branched, pale grey thallus of this lichen forms compact, rounded tufts up to several centimetres in diameter. It has been collected from Glen Lochay, Mid Perthshire; Hill of Ardo, near Aberdeen; and Glen Nevis, Lochaber (Inverness-shire). None of the specimens is dated but all are from the 19th century. The provenance of some of them is doubtful. Old records from Ireland are now generally discounted. On a world scale this species is widespread with a circumpolar distribution. The only information known about the Scottish sites is that the lichen was growing with the moss *Racomitrium lanuginosum*. Abroad, it is a lichen of open pine forest, where it can dominate the ground flora. It prefers sheltered sites and avoids highly oceanic districts, so should be sought in the foothills of the eastern Grampians. It is sometimes harvested for use in ornamental wreaths and model-making.

Total no. of 10 km x 10 km squares: 3.

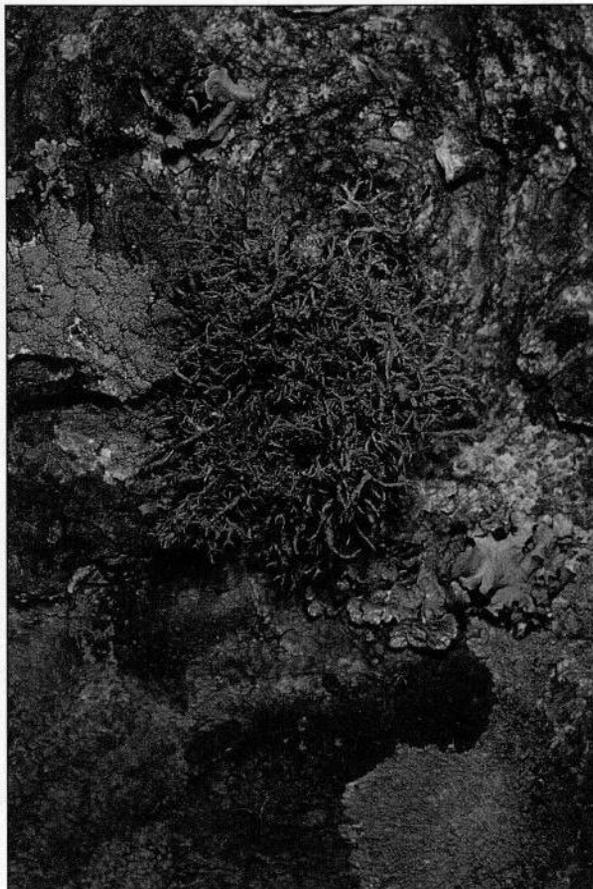
1960 onwards: 0.

Ahti (1961): map of world distribution. Ahti (1965): discussion of British records.

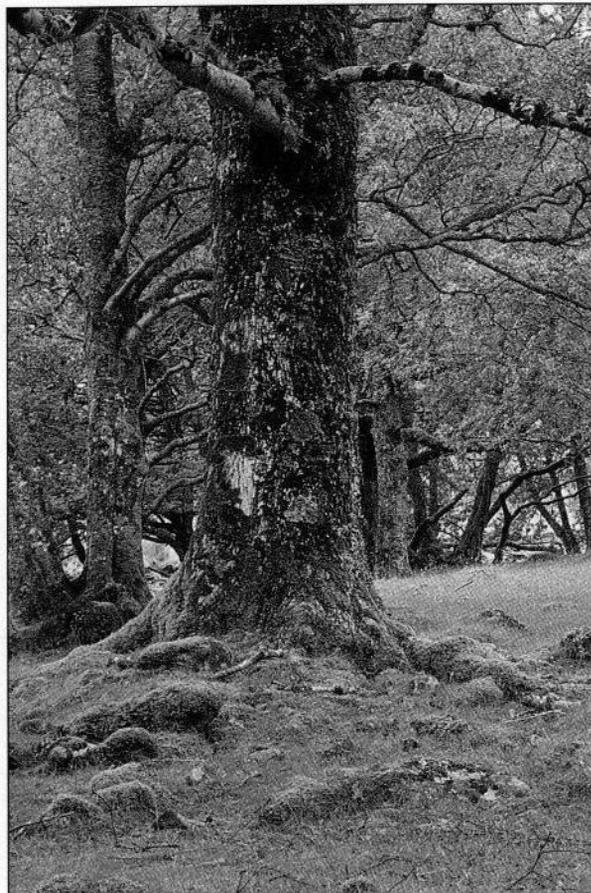
Cladonia stricta* (Nyl.) Nyl.*Vulnerable**

Upright mountain cladonia

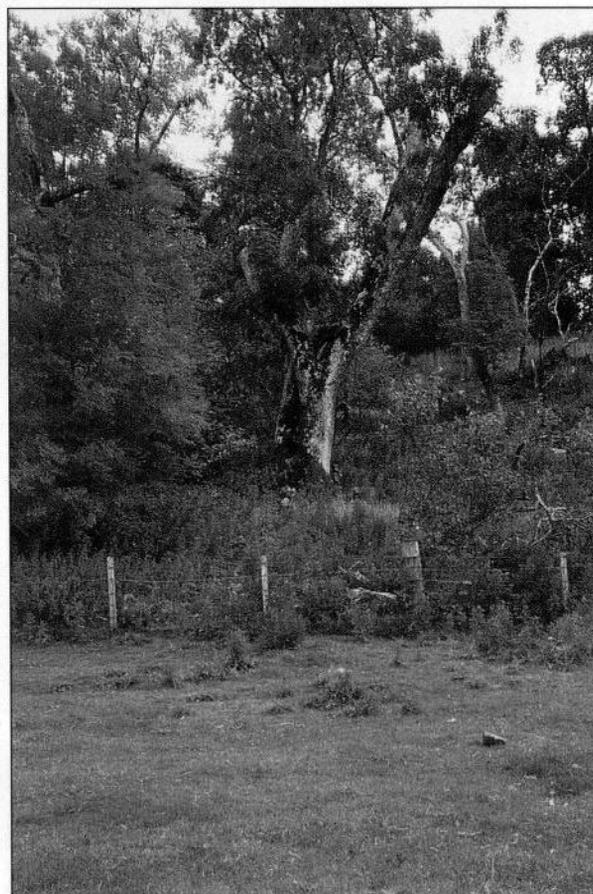
The grey, sparingly branched stalks (podetia) of this species have a distinctively blackened base and terminate in narrow irregular cups. In Britain, it has been recorded only from the Cairngorm plateau, where five small populations are known. It has a circumpolar, arctic-alpine distribution. Most records are from areas of dense, wet, *Nardus* grassland associated with areas of prolonged snow lie. It occurs deep down among the grass tussocks, so is easily overlooked. In Scotland it has also been found growing in pockets of soil in boulder fields adjacent to late snow patches. This species is listed on Schedule 8 of the Wildlife and Countryside Act 1981. All



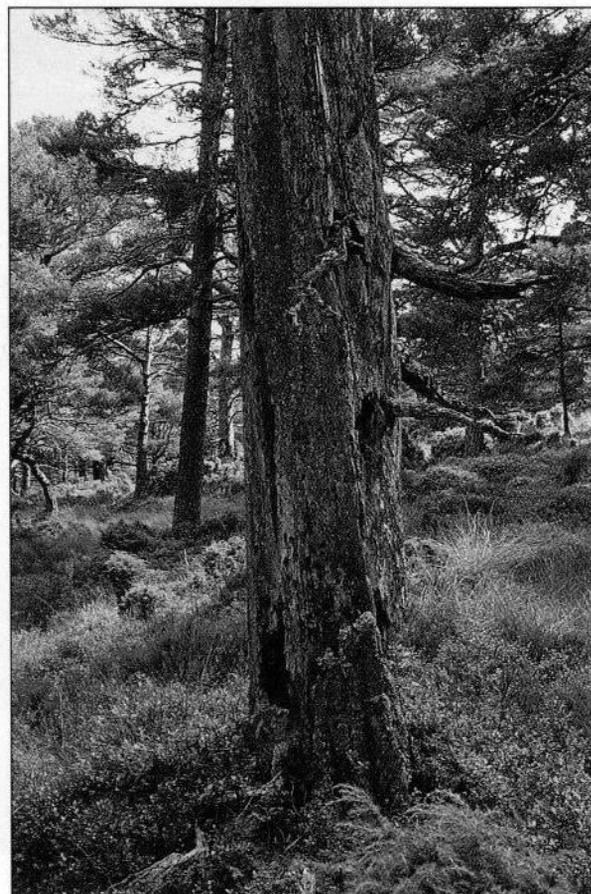
13. Golden hair-lichen *Teloschistes flavicans* growing on coastal rocks in western Britain. This declining species is listed on Schedule 8 of the Wildlife & Countryside Act 1981. (Photo by F.S. Dobson)



14. Strath Crowe, Easterness. *Pannaria ignobilis* on a large, mossy ash. This species is predominantly found on roadside trees and is therefore potentially threatened by road improvement schemes. (Photo by Mrs A.M. Coppins)



15. Milton Wood, East Perthshire. This large mossy ash tree is the sole British locality for *Catapyrenium psoromoides*. (Photo by Mrs A.M. Coppins)



16. Rothiemurchus Forest, Cairngorms. Dead, standing pine trees form one of the richest lichen habitats in the Caledonian pine forests. Though scarce, they support a wide range of the rarest and most characteristic species and should be preserved at all costs. (Photo by B.J. Coppins)

***Collema conglomeratum* Hoffm.**

Extinct

This is a small, foliose, gelatinous lichen with short olive-black lobes; it forms small cushions which bear numerous, crowded red-brown apothecia. This species was collected twice in the 19th century, from Aberfeldy in Mid Perthshire and from near Beeding in West Sussex. It is widely distributed in southern Europe and is recorded also from the eastern USA. It grows on the bark of trees, such as ash and elm, in nutrient-enriched wayside situations.

Total no. of 10 km x 10 km squares: 2.

1960 onwards: 0.

***Collema dichotomum* (With.) Coppins & Laundon**

Vulnerable

River jelly lichen

This gelatinous foliose lichen forms distinctive olive-green, often circular, patches, resembling a small brown seaweed. Each thallus is composed of regularly branched, strap-like lobes that splay out at their tips. Apothecia are produced occasionally. In Scotland this species is abundant in stretches of the River Isla in Angus, and is also locally present in West Water in Angus, the River Ericht in East Perthshire and River Whiteadder in Berwickshire, but has almost certainly disappeared from its former sites in Fife and Lanarkshire. In the north of England it has been recorded in recent years in rivers, including the Tweed and Coquet in Northumberland and River Eden in Cumberland, and in a high tarn on the slopes of Helvellyn in Westmorland. It has not been refound in Snowdonia, where it was collected in the 18th century, but is still present in the Rivers Usk, Irfon and Wye in South Wales. Old records from south-west England and from the limestone country of North Yorkshire are here discounted as being probable errors, probably misidentifications of *Leptogium plicatile*. *C. dichotomum* grows, often permanently inundated, in freshwater rivers (rarely inland lakes) on more or less basic siliceous rocks, especially where the latter form slabs. It requires some water movement, but is usually absent from rapids and areas of fast flow, and is tolerant of some degree of silt deposition. The potential threats are water pollution or alterations of the natural flow of the rivers by hydro-electric or water extraction schemes. Several sites are within SSSIs, and most are in rivers with highly commercial angling interests, which on the whole are sympathetic to the requirements of this lichen. This species is given as 'endangered' in the Red List for macrolichens in the EC (Sérusiaux 1989). It is included in Schedule 8 of the Wildlife and Countryside Act 1981. Recent surveys of several populations and clarification of its habitat requirements have taken place as part of the Scottish Cryptogamic Conservation Project.

Total no. of 10 km x 10 km squares: 22

1960 onwards: 17.

***Collema fragile* Taylor**

Vulnerable

This is a small foliose, gelatinous lichen with short, knobbly, olive-black lobes that forms small cushions, rosettes or crust-like patches. The young parts of the lobes have soft white hairs, whereas the older parts bear numerous spherical outgrowths (isidia). *C. fragile* is known from the Isle of Raasay, its northernmost limit in Europe, Lismore in Argyll, North-west Yorkshire, the Great Orme in Caernarvonshire, the Gower in Glamorgan, Stackpole Warren in Pembrokeshire, the Mendip Hills of North Somerset and Portland in Dorset. There are early records from Derbyshire, Denbighshire and Devon. It is also recorded from several localities in western Ireland, but recently only from Co. Clare. It has a southern European distribution, from the coast of Portugal, along the Mediterranean coast east to Greece. It grows on hard limestone or limestone walls, usually on lightly shaded, steeply inclined surfaces. Several of its sites have SSSI status, and the species is not threatened with immediate extinction. However, at some localities it may be vulnerable to shading out by scrub encroachment or to quarrying developments.

Total no. of 10 km x 10 km squares: 17.

1960 onwards: 10.

***Collema fragrans* (Sm.) Ach.**

Vulnerable

This is a small foliose, gelatinous lichen with short, olive-black lobes, sometimes bearing small spine- or lobe-like outgrowths, that forms small rosettes or cushions. Apothecia are usually numerous and crowded in the centre of the thallus. This species has been widely reported from southern England and southern and mid-Wales, with scattered localities extending northwards to Inverness-shire. There are several early records from the

Channel Islands, and one from south-west Ireland. In Europe it is widely distributed, especially in western, central and southern parts, but has an outlying northern locality in Lule Lappmark, Sweden. It is also known from Morocco and the eastern USA. It grows on the nutrient-enriched bark, often in rain- or wound-tracks, of parkland and wayside trees, especially elm, and has once been found on rocks. Even before 1960, *C. fragrans* had suffered more than a 50% decline, being lost from all its sites in Perthshire, Westmorland, Yorkshire, Lincolnshire, Shropshire, Worcestershire, Gloucestershire and East Anglia. This was probably as a result of a combination of air pollution from sulphur dioxide and changes in the structure of, and practices in, the agricultural landscape. The decline has since continued, accelerated by the demise of elm from Dutch elm disease, and the species is certain to have been lost from many post-1960 localities, including those in Sussex. In the New Forest it is still to be found on wounded beeches. A re-assessment of the distribution and state of the current populations of this species are urgently required, so that adequate protective or recovery measures can be formulated. About half of the sites where it has been recorded recently appear to have SSSI status.

Total no. of 10 km x 10 km squares: 60.

1960 onwards: 30.

Watson, Hawksworth & Rose (1988): decline related to Dutch elm disease.

***Collema latzelii* Zahlbr.**

Vulnerable

The thalli of this lichen appear as small, contorted, rounded or irregular, deeply lobed, dark cushions firmly attached to the rock surface. This species is confined to two sites on the Lizard Peninsula in Cornwall; the populations, which lie within 1 km of each other, are extremely restricted. Elsewhere it is known from the Mediterranean countries of Portugal, Spain, Italy, the former Yugoslavia and Morocco. On the Lizard *C. latzelii* is found on hot, vertical, sunny, coastal serpentine rock faces a little inland, so sea spray is not a strong influence. It favours minor seepage tracks. Both its sites are within an NNR.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 1.

Gilbert & James (1987): site description, species list.

***Collema parvum* Degel.**

Vulnerable

A foliose lichen, forming small blackish rosettes on hard limestone, this species is known from Caenlochan in Angus, from near Blair Atholl in East Perthshire, and beside two rivers in the Yorkshire Dales. It is very restricted at all these sites. It occurs throughout western Europe from the arctic to the Mediterranean. The Scottish sites are bare, exposed, metamorphosed limestone in the mountains. By contrast, the Yorkshire localities are both on Carboniferous limestone in the inundation zone of river gorges. The common factor is damp limestone in the uplands. No immediate threats to this species are apparent, although it is vulnerable due to there being only one or two thalli at each site. Caenlochan is an NNR and at least two of the other sites are within SSSIs.

Total no. of 10 km x 10 km squares: 4.

1960 onwards: 4.

***Cryptolechia carneolutes* (Turner) Massal.**

Vulnerable

The extensive, smooth, white thallus of this epiphytic lichen bears pinkish apothecia. It is confined to the extreme south of England. Most records are from near the coast, between East Sussex and the Isles of Scilly. Formerly it also occurred in Kent and Gloucestershire with an outlying colony at Silverdale, Lancashire. There is a single record from Co. Clare in the west of Ireland and it has also been recorded in the Isle of Man. Elsewhere, it is confined to, but not common in, southern oceanic parts of Europe, Madeira and the Azores. *C. carneolutes* grows on the shaded trunks of old trees with nutrient-rich bark, in sheltered, warm localities, usually close to the sea. It shows a distinct preference for elm, but is also found on ash, beech, elder, ivy, poplar and occasionally on calcareous rock. This species is rare and decreasing. The initial decline, associated with the spread of air pollution, was continued by the removal of trees and eutrophication linked to the use of inorganic fertilisers. A further dramatic decline accompanied Dutch elm disease. The current status of this species is not really known

so the threat category is only tentative. The majority of sites, being waysides and parklands, lie outside protected areas. Tree Preservation Orders could be placed on individual trees.

Total no. of 10 km x 10 km squares: 49.

1960 onwards: 24.

James, Hawksworth & Rose (1977): community description. Seaward & Hitch (1982): map with extended legend. Watson, Hawksworth & Rose (1988): map and discussion of the effects of Dutch elm disease.

***Degelia ligulata* P.M. Jørg. & P. James**

Vulnerable

This foliose lichen has a round blue-grey thallus with radiating lobes that have prominent longitudinal ridges and numerous small, more or less erect, flattened projections above, with blue-black, fluffy strands below. This recently described species is known from four localities in the west of Scotland: near Portpatrick in Wigtownshire, the Treshnish Isles off the coast of Mull, the Ardnamurchan Peninsula, Argyll, and Torridon in West Ross. Elsewhere it is found on the west coast of Ireland, Madeira and the Azores. In Scotland, *D. ligulata* is confined to rocky coastal habitats, being found on sheltered, more or less vertical, rock faces, by seepage tracks or in gullies. Elsewhere it has also been recorded on the bases of coastal trees and shrubs. It is possibly dependent on onshore mists. Although there are no obvious immediate threats to this species, and the Treshnish Isles and the Ardnamurchan site both have SSSI status, it is vulnerable because of the small size of its populations.

Total no. of 10 km x 10 km squares: 4.

1960 onwards: 4.

***Dictyonema interruptum* (Carmich. ex Hook.) Parmasto**

Endangered

This is the only lichen known from Europe that has a 'bracket-like' basidiomycete fungus. Its branches form a bluish to grey-green weft that later produces small lobes with a creamy white spore-producing underside. During the 19th century, this species was widely distributed along the west coast, in Scotland from Appin in Argyll and the Island of Mull, south to Denbighshire and Montgomeryshire in Wales, and further south to near Bristol and eastwards to Wareham in Dorset. It was long thought to be extinct until recently discovered at Abergwysyn in Breconshire. Elsewhere it is known only in south-western Ireland (North Kerry), Madeira and the Azores, where there are modern collections from several of the islands. Old records in Britain are from amongst bryophytes on humid sheltered tree trunks and rocks in areas of relict woodland, mainly near the coast. The single modern record is from the liverwort *Diplophyllum albicans* in a sheltered recess on an acid cliff of Silurian shale. The site is within an SSSI. Reasons for the decline of this species are not properly understood.

Total no. of 10 km x 10 km squares: 7.

1960 onwards: 1.

***Endocarpon adscendens* (Anzi) Müll. Arg.**

Endangered

This species is composed of a compact mat of small, overlapping, beige coloured scales, the tips of which turn up slightly at the ends. Tiny dark pimples on the surface of the lobes are the tops of the sunken perithecia. The separation of this species from *E. pusillum* can be difficult, and the genus is much in need of a taxonomic revision. In Britain this species is found in the River Usk in Breconshire, and a specimen from the River Wharfe in Mid-west Yorkshire, previously identified as *E. pusillum*, is apparently poorly developed *E. adscendens*. In the River Usk, *E. adscendens* grows among mosses on periodically submerged Old Red Sandstone rocks, but elsewhere it has been found on lake shores and on granite, mica-schist and porphyry. This species is especially susceptible to declines in water quality and alterations to the natural flow of the rivers. The sites are not currently protected.

Total no. of 10 km x 10 km squares: 3.

1960 onwards: 3.

***Endocarpon pusillum* Hedwig**

Endangered

The thallus of *E. pusillum* consists of reddish-brown scales closely attached to the substrate. Tiny dark pimples on the surface of the lobes are the tops of the sunken perithecia. The taxonomic distinction between this species and *E. adscendens* requires clarification; they are distinguished here largely on habitat. This species is known from several 19th century records from southern and south-eastern England including Rottingdean in East

Sussex, Alum Bay on the Isle of Wight, and Thetford in West Norfolk. Some further old records, including two from Derbyshire, are included here, but should be checked when the taxonomic problems are resolved. The only confirmed, modern record is from the Afon Alun valley in Glamorgan. *E. pusillum* is widely reported from large parts of Europe, as well as Macaronesia, Asia, North America and Australia (McCarthy 1991). *E. pusillum* is essentially a species of compacted, calcareous soil overlying limestone or chalk, although some of the more questionable records are from mossy limestone rocks, or calcareous rocks by ponds or streams. At the Glamorgan site it grows on soil over limestone in a railway cutting (Orange 1994). The site, which is not protected, should be visited to assess the status of the population and identify any potential threats.

Total no. of 10 km x 10 km squares: 8.

1960 onwards: 1.

***Enterographa elaborata* (Leighton) Coppins & P. James**

Critically Endangered

This is a crustose lichen with a finely cracked, pinkish-brown, mosaic-forming thallus and sunken, dark brown, elongated and branched apothecia. It is easily mistaken in the field for some forms of the common *E. crassa*. In Britain, this species is only known from a single site in the New Forest, Hampshire, where it was rediscovered in 1993 after more than 140 years. In Ireland it was first found in 1990 at Hanging Rock NNR, Co. Fermanagh. Elsewhere it is known from southern Sweden and Denmark, the Pyrénées, Portugal, the Azores and Madeira. It occurs in the New Forest in raintracks on the trunk of a hollow senescent beech in old pasture woodland. This tree lost its top several decades ago, and thus resembles a pollard. At its Irish locality it was found on a mature ash in woodland on a north-facing, limestone scarp face. This species may have been more widespread in the New Forest when the pollarding of beech was still carried out, a practice which ceased 150 years ago. The site is protected by an SSSI designation and under no immediate external threat. Further investigation in the New Forest is desirable in order to attempt to locate further populations and make management recommendations.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 1.

***Fulgensia bracteata* (Hoffm.) Räsänen**

Vulnerable

The thallus of this elegant lichen consists of extensive, golden-yellow rosettes and irregular patches of scales growing over moss and soil. This species is known from a single buttress of metamorphosed limestone high in the Ben Alder range of the Scottish Highlands. It is the dominant lichen on the lower part of the cliff. *F. bracteata* has an arctic-alpine distribution in Europe and is widespread in North America. The lichen grows on the soft crumbling surface of metamorphosed 'sugar limestone', on moss cushions, and on pockets of immature soil that have collected on ledges and in crevices on the cliff. It is part of a community that is rich in rare montane lichens. The site lies within an SSSI.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 1.

Gilbert (1978): full site description, taxonomic discussion. Gilbert, Fox & Purvis (1982): full site description with photograph and lists.

***Graphina pauciloculata* Coppins & P. James**

Vulnerable

This crustose species has a thin, pale grey to grey-green thallus and black, elongated, slit-like apothecia, which are often tightly clustered. It is so far known from three sites on Dartmoor in South Devon and one on Bodmin Moor in East Cornwall, but may be somewhat overlooked. It is apparently endemic to Britain and Ireland, being otherwise known in southern Ireland from East Cork. It grows on the smooth bark of hazel, holly and young oak in moist open woodland or willow carr. Its sites should be visited to establish the size and state of the populations and to assess any management requirements. The three Devon sites lie within an SSSI.

Total no. of 10 km x 10 km squares: 4.

1960 onwards: 4

Gyalecta ulmi* (Swartz) Zahlbr.*Endangered**Elm *gyalecta*

The crustose, grey-white thallus of this species is largely obscured by the abundant, often clustered, pink to pinkish-brown apothecia with a thick margin, which are often coated with a white frosting. This species has not been seen this century at its former sites in West Sussex, Shropshire and North-east and Mid-west Yorkshire. Although seen since 1960 in North-west Yorkshire and North Northumberland, it is probably now extinct there, the records being from elm that are likely to have died from Dutch elm disease. However, there is still an extant, saxicolous population in a limestone gorge in South Northumberland. Since 1990, it has been found at six sites (five 10 km x 10 km squares) in Scotland, in South Aberdeenshire, Angus and Mid Perthshire, all on rock faces. It has a wide European distribution, ranging from Iceland and Fennoscandia south to the Mediterranean mountains and east to the Caucasus, although it has suffered a marked decline in many regions. *G. ulmi* grows on trees with a high bark pH, especially elm, or on Carboniferous limestone, calcareous mica-schist or dolomitic conglomerate rocks. At its Scottish sites it grows on more or less vertical rock faces, at altitudes of c. 100–550 m, with a northerly to easterly aspect, beneath overhangs or in dry niches protected above from run-off by small rocky projections or turf-capping. In most cases it largely overgrows mosses, especially *Neckera* spp. Owing to the devastating effects of Dutch elm disease, *G. ulmi* is probably extinct in Britain as an epiphyte. However, at the remaining saxicolous sites there are no immediate apparent threats, although the populations are mostly small and shading over of the rock faces by invading trees or shrubs could become a problem at some of them. All but one of the sites have NNR or SSSI status. This species has been included in the Scottish Cryptogamic Conservation Project, which has recommended further survey and monitoring work.

Total no. of 10 km x 10 km squares: 18.

1960 onwards: 10.

Gyalidea roseola* (Arnold) Lettau ex Vězda*Critically Endangered**

A crustose species with a thin white thallus bearing small flesh-coloured fruiting bodies, this lichen has only been recorded on one occasion from a single site near Strontian, Inverness-shire. It is otherwise known from Austria, Norway and Sweden. At its British site this species grew on damp, shaded limestone at the entrance to a disused lead mine. Despite several subsequent searches, *G. roseola* has not been seen since its discovery in 1962. The site, which has become considerably overgrown with brambles, is an SSSI.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 1.

Halecania alpivaga* (Th. Fr.) M. Mayrh.*Vulnerable**

The thallus of *H. alpivaga* consists of brown-grey, granular warts bearing sunken, dark apothecia that are at first pore-like but later expand into a disc. This species was first collected in the Ben Alder range, Inverness-shire, and was subsequently found on Ben Lawers and near Blair Atholl, both in Perthshire. All the populations are small. It has an arctic-alpine distribution in Europe. Its habitat is calcareous rock, such as limestone and mica-schist, where it is a member of a distinctive community which develops on prominent boulders that are occasionally used as bird perches or sheep rubbing places. The sites, which all receive statutory protection, range from intermediate to high altitude.

Total no. of 10 km x 10 km squares: 4.

1960 onwards: 4.

Purvis, Gilbert & Coppins (1994): species list.

Halecania rhypodiza* (Nyl.) Coppins*Vulnerable**

An inconspicuous lichen with a black, granular thallus and flat, black apothecia, *H. rhypodiza* resembles a *Placynthium*. This lichen, which is endemic to Scotland, is known only from its type locality, Creag na Caillich in the Ben Lawers range, Perthshire, and Caenlochan in Angus. Both modern records are from minor outcrops of calcareous mica-schist at around 610 m. The sites lie within NNRs.

Total no. of 10 km x 10 km squares: 2.

1960 onwards: 2.

Heterodermia isidiophora* (Vainio) Awasthi*Critically Endangered**

This foliose lichen forms small rosettes of pale, narrow, radiating lobes that are almost entirely covered with tiny outgrowths (isidia). A widespread species in the tropics from South America to Africa and Asia, it is confined in Britain to a single locality on the Lizard Peninsula, Cornwall. This is its only known site in Europe. It grows over bryophytes on serpentine block scree, in a sheltered sunny valley near the sea, where humidity appears to be fairly high. The locality has not been revisited since its discovery in 1986. This species did not, at that time, appear to be under immediate threat, though a path used by tourists runs nearby. Potential risks include scrub invasion and fires. The site lies in an NNR.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 1.

Gilbert & James (1987): site description, ecology, species list.

Heterodermia leucomelos* (L.) Poelt*Endangered**

Ciliate strap-lichen

The distinctive, narrow, flat, ribbon-like white lobes, loosely scrambling over mosses and small plants, distinguish this species. This lichen has a south-western distribution, and is now restricted to Cornwall, including the Isles of Scilly, with an outlying colony in Anglesey, which represents its northern limit in Europe. It was previously far more widespread in southern England with a range that included Devon, Dorset, Wiltshire and West Sussex. This species is well established in the extreme south-western tip of Ireland. *H. leucomelos* is widely distributed through most temperate and tropical parts of the world, but is chiefly oceanic and western in Europe. It is a species of sunny, exposed, mainly coastal cliff-tops, moss-lichen turf or mossy rocks where it scrambles on and among other vegetation. Its range included both acid and alkaline sites. It formerly grew on mossy beeches in St Leonard's Forest, West Sussex. Reasons for the marked decline of this species include past over-collecting, burning, the spread of air pollution and perhaps trampling where it occurred in proximity to cliff-top paths. This species is listed on Schedule 8 of the Wildlife and Countryside Act 1981. The largest populations lie within NNRs.

Total no. of 10 km x 10 km squares: 29.

1960 onwards: 13.

Seaward & Hitch (1982): map with extended legend.

Heterodermia propagulifera* (Vainio) Dey*Endangered**

Coralloid rosette-lichen

This lichen has a thallus of radiating, ivory-white lobes which form neat rosettes, the centre of which are covered with tiny lobe-like projections. *H. propagulifera* is known from only a single locality on Tresco, Isles of Scilly, where it covers an area of c. 0.2 ha. This is its only known European site. Elsewhere it is widely distributed throughout most of the warmer parts of the world. On Tresco, this species grows beside a coastal path, on peaty soil amongst short heather between low, exposed, scattered rocks. The main threats to this species are from burning and trampling by walkers. It is listed on Schedule 8 of the Wildlife and Countryside Act 1981. The site is within an SSSI.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 1.

Hypocenomyce anthracophila* (Nyl.) P. James & G. Schneider*Endangered**

The thallus of this species is composed of raised, downwardly directed, glossy, green-brown scales, which are edged with grey soralia. Convex, red-brown apothecia are sometimes produced. This species is known in Britain from only two sites in Inverness-shire: Glen Strathfarrar and Glen Guisachan. It is a predominantly boreal species, being frequent in Fennoscandia, but it has also been collected in the southern European mountains, as well as in Japan and North America. In Britain, it is confined to the Caledonian pinewoods, where it grows on the more or less vertical sides of large pine stumps or standing decorticated trunks. Both sites have NNR or SSSI status. *H. anthracophila* appears to be present as small populations, being recorded only from a single stump or tree at both localities. At one site it is in danger of being shaded-out by underplanted conifers which are,

however, due to be removed in the near future. This species requires a continuity of plentiful, standing, dead trees.

Total no. of 10 km x 10 km squares: 2.

1960 onwards: 2.

***Hypocenomyce xanthococca* (Sommerf.) P. James & G. Schneider**

Vulnerable

This species has a cracked, crustose thallus composed of pale grey to yellowish-brown segments with flat, black apothecia and numerous minute black dots (pycnidia). It was originally discovered in Britain in the 19th century, in Ballochbuie Forest, South Aberdeenshire, but has not been seen recently in that or any other Deeside site. It is currently known from the Speyside forests of Inverness-shire: Abernethy and Rothiemurchus. It is otherwise confined to Fennoscandia. In Scotland, it is found only on the wood of standing decorticated pines in areas of Caledonian pine forest. Both sites have NNR or SSSI status, and Abernethy Forest is also an RSPB reserve. As with *H. anthracophila* and other lignicolous lichens of the native pine forest, this species requires a continuity of plentiful, standing dead trees for its long-term survival.

Total no. of 10 km x 10 km squares: 3.

1960 onwards: 2.

***Hypogymnia intestiniformis* (Vill.) Räsänen**

Critically Endangered

(*Brodoa intestiniformis* (Vill.) Goward)

The loosely attached thallus of this species forms small rosettes of shiny, narrow, convex, uneven, pale grey-brown lobes. This species had a scattered distribution in the Cairngorm mountains with an outlying site on Ben Lawers, Perthshire, but has not been seen recently. The last record was from Ben Avon, Banffshire, in 1964. It is widely distributed in Europe from northern Fennoscandia to the Mediterranean region but is not found on the Atlantic coast. *H. intestiniformis* grows on exposed acidic boulders above 900 m. The reason for the apparent decline of this species is not known. In the past, there has been some confusion with *Allantoparmelia alpicola* but several correctly determined herbarium specimens exist. Ben Avon lies within the Cairngorm NNR.

Total no. of 10 km x 10 km squares: 7.

1960 onwards: 1.

***Ionaspis heteromorpha* (Krempelh.) Arnold**

Vulnerable

The white to yellow-grey thallus of this lichen has sunken, dark bluish or blackish apothecia. It is known from Orton Scar and Cross Fell in the northern Pennines, Creag Mhor in the Breadalbane mountains, Perthshire, and the Ben Alder sugar limestone outcrop, Inverness-shire. It has an arctic-alpine distribution in Europe and is also known from Siberia and Alaska. *I. heteromorpha* is an upland calcicolous species found on Carboniferous limestone in the Pennines, mica-schist in the Breadalbanes and sugar limestone in the Ben Alder range. The Scottish sites are SSSIs.

Total no. of 10 km x 10 km squares: 4.

1960 onwards: 4.

***Ionaspis melanocarpa* (Krempelh.) Arnold**

Vulnerable

The inconspicuous thallus of this species has small, sunken, scattered, blackish apothecia. This lichen is known only from Inchnadamph, Sutherland, where it is quite widespread, and a site in Upper Teesdale, County Durham. It has an arctic-alpine distribution in Europe and is also present in Siberia and Canada. A species of calcareous rocks, it occurs at Inchnadamph at a low altitude beside the Traligill River and also on high limestone outcrops, while in Upper Teesdale it is on damp limestone pavement at 750 m. The sites are within SSSIs.

Total no. of 10 km x 10 km squares: 3.

1960 onwards: 3.

***Japewia tornöensis* (Nyl.) Tønsberg**

Vulnerable

This is a crustose species with an uneven, sometimes ephemeral, thallus and strongly convex, dark red-brown apothecia. It is known from two localities in the Breadalbane mountains of Mid Perthshire, Ben Lawers and Càrn Gorm. It has a circumpolar distribution in the northern hemisphere, being in Europe concentrated in

Fennoscandia and the central European mountains. In Scotland it grows over low-growing hepatics and mosses in sheltered rock crevices in calcareous mica-schist at altitudes above 800 m. However, in Fennoscandia it is more commonly found on acidic bark or wood. Both sites have NNR or SSSI status.

Total no. of 10 km x 10 km squares: 2.

1960 onwards: 2.

***Lecanactis amylacea* (Ehrh. ex Pers.) Arnold**
(*Opegrapha illecebrosa* Dufour)

Vulnerable

This crustose species has a chalky white thallus with a rather powdery surface dotted with tiny pale brown to dark brown flecks. It rarely produces apothecia, which are irregularly rounded black discs, usually partly veiled with a thick white powdery coating. In Britain, it is mostly found in south-west England, from the New Forest westwards, and in south and mid-Wales, although there are scattered localities northwards to Skye and Moray and Nairnshire (Inverness-shire). In Ireland it is very rare, being found at two sites in Fermanagh and Londonderry. It has a suboceanic distribution in Europe, ranging from southern Sweden south to the hills of the Tyrrhenian coast of Italy, and is also present in North America. *L. amylacea* grows on the dry bark of old trees, and in Britain appears to be confined to oak. It occurs in sheltered situations from open parkland and pasture woodland to closed forest. Although widely distributed, this species is usually present at a site as small populations on only one or two trees. Its long-term survival is dependent on the continuous availability of large oaks, and at some sites it is threatened by dense shade cast by the uncontrolled growth of ivy or understorey shrubs such as holly and rhododendron. In its parkland habitats, it is also susceptible to eutrophication or smothering by slurry, the application of which should be avoided. Most of its sites are within SSSIs or have other forms of protection.

Total no. of 10 km x 10 km squares: 31.

1960 onwards: 28.

***Lecania coeruleorubella* (Mudd) H. Mayrhofer**

Extinct

This crustose species has a thick, coarsely cracked and granular yellow-brown to blue- or brown-grey thallus and rather sunken red-brown to black apothecia that usually have a grey powdery coating and an irregularly swollen margin. In Britain it is known only from the type collection from Ayton in North-east Yorkshire, made c. 1860. It is a rarely recorded European species, known from Norway, Sweden, France, Germany (Bavaria), Czech Republic, Slovakia and Austria. At Ayton it grew on the crumbling mortar of an old wall, although at some of its European localities it is found beneath overhangs of schistose or dolomitic rocks.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 0.

***Lecania fuscella* (Schaerer) Körber**

Extinct

This is a crustose lichen with a thin, grey-white thallus and numerous brown apothecia that sometimes have a white powdery coating and a persistent thalline margin. *L. fuscella* was collected in the 19th century from Stoney Cross and near Brockenhurst in the New Forest, Hampshire, and at Glynde in East Sussex. The numerous other records of this species are misidentifications, mostly referable to *Bacidia naegelii*. It is widely distributed in Fennoscandia and central and southern Europe, occurring also in Arabia (Yemen) and North America. It grows on the nutrient-rich bark of deciduous trees, especially poplars.

Total no. of 10 km x 10 km squares: 3.

1960 onwards: 0.

***Lecania olivacella* (Nyl.) Zahlbr.**

Extinct

This is a crustose species with a dirty white to yellow-brown, scaly or cracked thallus and orange-red to dark brown apothecia with a thin, whitish thalline margin. In Britain, *L. olivacella* is known from a single 19th century collection from 'Tor Point' in South Devon. Its scattered European distribution includes Oppland in Norway, south-east France, northern Spain, Sardinia, the Austrian Tyrol and Greece, and its range extends to Tunisia in North Africa. It grows on calcareous or base-rich siliceous rocks.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 0.

Lecanora achariana* A.L. Sm.*Critically Endangered**Tarn lecanora

Lecanora achariana forms conspicuous, loosely attached, pale yellow-green rosettes or irregular patches on horizontal rock surfaces. This species is locally abundant around the margins of a single mountain tarn in the Lake District and several small lochans and pools on the north side of Beinn Dearg in West Ross. It was formerly present in a similar habitat in Snowdonia, Merionethshire, but became extinct when the water level was artificially raised. This species has recently been discovered beside a high-level tarn in south-western Ireland. Elsewhere it is known in central Europe and north to Norway and Sweden. *L. achariana* grows on the tops of prominent boulders at the margins of tarns or pools. This niche is kept moist by spray and mildly eutrophicated by birds which come to drink and bathe. In both the Lake District and Irish sites the boulders are mildly calcareous. The populations are well established and appear to be stable. The main threat to this species is alterations to the water level of the tarn at the Lake District site, which has an old unfinished dam just below the outflow. This species is listed on Schedule 8 of the Wildlife and Countryside Act 1981. The Lake District site lies within an SSSI.

Total no. of 10 km x 10 km squares: 3.

1960 onwards: 2.

Gilbert & Giavarini (1993): description of habitat and community.

Lecanora atromarginata* (Magnusson) Hertel & Rambold*Vulnerable***(L. marginata* auct. brit.)

The crustose thallus of this species is well developed, pale lemon-yellow, with a white or bluish-grey background (prothallus) and sunken black apothecia. This species is locally abundant in a restricted area high up on the south-western cliffs of Ben Lawers, Perthshire. It has also been recorded from Inchnadamph in West Sutherland where it is less frequent. On Ben Lawers *L. atromarginata* grows on sloping, hard slabs of mica-schist, which are intermittently flushed by seepage water, while at Inchnadamph it is on high-level impure limestone. Both sites are within NNRs.

Total no. of 10 km x 10 km squares: 3.

1960 onwards: 3.

Lecanora chlorophaeodes* Nyl.*Vulnerable**

This lichen has a wide-spreading, pale yellow-green thallus, with prominent, convex, black, shiny apothecia. There is a single, small population near the summit of Ben Loyal in West Sutherland. The species is otherwise known throughout Sweden and from southern Norway. At its Scottish site it grows on the vertical side of an exposed base-rich igneous (syenite) tor. The site lies within an SSSI.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 1.

Gilbert & Fox (1986): ecology and photograph of habitat.

Lecanora epibryon* (Ach.) Ach.*Vulnerable**

This crustose lichen has a thallus of whitish, wart-like granules and shortly stalked, brown apothecia with a persistent thalline margin. This species has been recorded from three mountains in the Scottish Highlands: Ben Alder, Inverness-shire, Ben Lawers, Perthshire, and one near Blair Atholl. There is also a record from North Yorkshire. It is only well established at the Ben Alder site. Abroad, the species has a circumpolar distribution. *L. epibryon* grows on mosses, soil and decaying vegetation associated with limestone or occasionally calcareous mica-schist cliffs. It has a wide altitudinal range. The Yorkshire locality, which is not protected, is a drystone wall, which may therefore be subject to periodic maintenance work. The Scottish localities are within SSSIs.

Total no. of 10 km x 10 km squares: 4.

1960 onwards: 3.

***Lecanora frustulosa* (Dickson) Ach.**

Vulnerable

The thallus of this elegant lichen is composed of strongly convex, pale yellow segments on a black background (prothallus); the apothecia are red-brown, large and irregular. This lichen occurs on a number of cliffs and crags in the Ben Lawers range, Perthshire, and at similar sites in Glen Coe and on the Isle of Skye. It has an arctic-alpine distribution in Europe and is circumpolar. In the Breadalbanes the lichen shows a preference for vertical, freely draining faces of mica-schist and epidiorite on cliffs and boulders above 700 m. On Skye it is on a vertical basalt rock face at 500 m. The sites all have NNR or SSSI status.

Total no. of 10 km x 10 km squares: 6.

1960 onwards: 4.

***Lecanora fuscescens* (Sommerf.) Nyl.**

Extinct

This crustose lichen has a white to greyish granular thallus with brown apothecia with a thin thalline margin that disappears with age. *L. fuscescens* was collected in the 19th century, apparently from Morrone Birchwood, near Braemar in South Aberdeenshire. However, there is some doubt as to the British provenance of the specimen and recent attempts have failed to rediscover it. Elsewhere, it is common in Fennoscandia and its range extends to Poland and the Alps. It is also present in North America. It grows on the acidic bark and wood of trees and shrubs, and the Morrone specimen is on birch bark.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 0.

***Lecanora populicola* (DC.) Duby**

Extinct

This is a crustose species with a thin grey thallus surrounded by a broad greyish-white zone and clustered apothecia, which have a white powdery coating. The only British record was in the early 19th century from Coltishall in East Norfolk. It is widely distributed in Europe, Siberia and North America. At Coltishall, as throughout most of its range, *L. populicola* grew on the nutrient-rich bark of poplar.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 0.

Laundon (1970): description, general discussion.

***Lecanora strobilina* (Sprengel) Kieffer**

Vulnerable

This crustose lichen has a light green thallus bearing small, crowded apothecia with pale brown discs which slowly become convex. In Britain, it has recently been recorded from St Mary's in the Isles of Scilly and two localities in Caernarvonshire and Merioneth. There is also a modern record from Co. Kerry in south-western Ireland, and an old one, on wood, from the Channel Islands. However, it may be somewhat under-recorded owing to confusion with fertile specimens of the common *L. expallens*. Its overall range encompasses southern Europe, eastern North America and Mexico. Its British occurrences are on the bark of conifers, including larch, and on wood. On St Mary's the site is a coastal conifer plantation. The Merioneth site is within Rhinog SSSI.

Total no. of 10 km x 10 km squares: 4.

1960 onwards: 3.

Laundon (1976): description, general discussion.

***Lecidea antiloga* Stirton**

Vulnerable

This is an inconspicuous crustose species with small, more or less flat, black apothecia. It is known from Culbin in Moray and Nairnshire (Inverness-shire), and from near Cannich in Inverness-shire, but has not been recently seen in the vicinity of its type locality near Aviemore. Elsewhere it occurs in Fennoscandia, Provence in France and Calabria in Italy. At Culbin, *L. antiloga* is locally abundant in the pine plantations on the former dunes, growing on the loose bark and old cones of pine, but in Inverness-shire it has been found on the wood of conifer fencing. The sites at Culbin are within an SSSI.

Total no. of 10 km x 10 km squares: 4.

1960 onwards: 3.

Lecidea erythrophaea* Flörke*Vulnerable**

This crustose species has a thin whitish thallus and dark reddish-brown to brown-black apothecia. It has a wide overall distribution in Britain, but is currently known in England only from a single site, in South Somerset. It has not been refound in its former localities elsewhere in southern England or in North-east Yorkshire. In Scotland it is known from five localities, in Berwickshire, Inverness-shire, East Ross and West Sutherland. Several additional records from south-western and north-western England require verification, and are here discounted as being probable misidentifications of *Japewia carrollii*. It has recently been discovered in Ireland, in Co. Fermanagh. It is a mainly boreal species, being frequent in Fennoscandia but also occurring in the central European mountains. In Britain,

L. erythrophaea grows on more or less smooth bark of deciduous trees, especially ash but also aspen and hazel, in sheltered woodlands. Its known sites, at least three of which are SSSIs, need to be revisited to assess the size and viability of the populations, and to make management suggestions where appropriate.

Total no. of 10 km x 10 km squares: 13

1960 onwards: 6.

Coppins & James (1979): discussion and distribution map.

Lecidea inops* Th. Fr.*Endangered****Copper lecidea**

A whitish-grey, crustose lichen with black apothecia, *L. inops* requires examination under the microscope to confirm its identity. This species is confined to copper-rich rocks around disused upland mines at Coniston and Dalehead in the Lake District. Elsewhere it is restricted to substrata containing copper minerals in France, the former Czechoslovakia, Norway and Sweden. The lichen is abundant on rock fragments containing copper over a restricted area of the old workings. The main copper minerals involved are carbonates such as azurite and malachite, which weather to produce much less acid conditions than most copper deposits. Both sites are frequently visited by geologists who cause disturbance. Reworking of the old spoil heaps is also a potential threat, as is recent suggested clearance of the mine spoil followed by landscaping. This species is listed on Schedule 8 of the Wildlife and Countryside Act 1981. Access to the sites, which support other rare lichens, should be controlled. Neither site has any statutory protection.

Purvis & James (1985): description of Coniston site.

Total no. of 10 km x 10 km squares: 2.

1960 onwards: 2.

Lecidea sarcogynoides* Körber*Vulnerable**

The indistinct thallus of this crustose species consists of no more than a few dispersed grey-white fragments bearing black apothecia, which are often clustered and have a powdery white coating. In Britain this species is confined to West Cornwall, including the Isles of Scilly, and also occurs in the Channel Islands. Elsewhere in Europe it occurs from southern Sweden south to Portugal and the mountains of the Mediterranean region. Further afield it is found in North Africa, and is widespread in the southern hemisphere. At its British sites it grows on exposed granitic rocks and stones on the coast. Although no immediate threats to this species are apparent, its sites should be visited to ascertain any potential problems and to determine the size of the populations. Two of its seven sites in the Isles of Scilly are within SSSIs.

Total no. of 10 km x 10 km squares: 5.

1960 onwards: 3.

Lecidella wulfenii* (Hepp) Körber*Vulnerable**

The rather thick, white-grey to pale ochre, coarsely granular and often strongly rough-textured thallus of *L. wulfenii* bears black apothecia. This montane species is known from small populations on Ben Lawers in Perthshire and at Caenlochan in Angus. It has an arctic-alpine distribution in Europe and also occurs in North America. The lichen overgrows mosses on exposed parts of calcareous mica-schist cliffs and boulders. Both sites lie within NNRs.

Total no. of 10 km x 10 km squares: 2.

1960 onwards: 2.

***Leptogium hildenbrandii* (Garov.) Nyl.**

Extinct

This large, gelatinous lichen, with rounded, partly overlapping, deep blue- to blackish-grey, wrinkled lobes and numerous apothecia, was found during the 19th century at two sites, one in Teesdale, County Durham, the other in East Perthshire. Elsewhere, it occurs in central and southern Europe, China and Japan. The British specimens were from the bark of ash, but have no further habitat details. In southern Europe it is found on nutrient-rich bark in wayside situations.

Total no. of 10 km x 10 km squares: 2.

1960 onwards: 0.

***Leptogium saturninum* (Dickson) Nyl.**

Vulnerable

This is a large, olive-black, gelatinous foliose lichen with numerous spherical or cylindrical outgrowths (isidia) on the upper surface and short grey-white hairs on the lower surface. It is currently confined to the Scottish Highlands, especially the central and eastern parts, with an isolated occurrence in Roxburghshire. In the 19th century it was also known from a few sites in Northumberland, County Durham and North Yorkshire, but is almost certainly now extinct in England. In Europe it occurs from the arctic zone south to the Mediterranean mountains. It also occurs in northern Asia and northern North America. This species grows on the mossy trunks of old trees with a base-rich bark, especially ash and sycamore, but also aspen, elm and hazel. In woodlands it occurs by roadsides or in glades, or on trunks around the top of the understorey zone. On wayside trees it occurs in sheltered, well-illuminated situations. At one site in Deeside it has also been found on mossy calcareous rocks. Most of its woodland sites are protected in SSSIs, but this species is most vulnerable in wayside situations due to the lack of replacement trees and road improvement schemes. Even in some protected sites a decline in populations has been noted owing to the natural loss of suitable old trees. Tree Preservation Orders may be an effective means of protection at some sites.

Total no. of 10 km x 10 km squares: 33.

1960 onwards: 28.

***Micarea assimilata* (Nyl.) Coppins**

Vulnerable

Forming a thick crust of confluent, white to brownish-white, convex segments, the thallus of this species bears scattered brown structures (cephalodia) and prominent black apothecia. There are only two confirmed records of this species, an old one from Ben Lawers, Perthshire, (1856) and a recent one from Beinn Dearg in East Ross, although it may be somewhat overlooked. Abroad, this lichen is known from Fennoscandia, North America and Australia. *M. assimilata* grows on acid soil among stones on wind-swept mountain summits. The site, which is an SSSI, is not threatened but the species is considered vulnerable because of its occurrence in a single population.

Total no. of 10 km x 10 km squares: 2.

1960 onwards: 1

***Micarea crassipes* (Th. Fr.) Coppins**

Vulnerable

The pale grey, finely granular thallus of this species bears black apothecia. This lichen is known only from a single rock near the summit of Ben Lawers, Perthshire. It has an arctic-alpine distribution in Europe and is also known from North America, so it may be circumboreal. *M. crassipes* grows over bryophytes and plant debris on a moderately sheltered acidic rock at 1100 m. It lies within an NNR.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 1.

***Micarea elachista* (Körber) Coppins & R. Sant.**

Endangered

The thallus of this crustose species consists of more or less spherical, greenish-white to grey-brown segments with more or less spherical, dark brown to black apothecia. Although for long expected to occur in Britain, this species has only recently been discovered, at Glen Guisachan in Inverness-shire. Its distribution avoids strongly oceanic areas and its range extends from mid-Fennoscandia southwards, in upland or montane regions, to France, Germany, Austria and Italy. It grows on the wood (rarely bark) of partially or wholly decorticated trunks or large stumps of old trees, especially sweet chestnut, oak and pine. At Guisachan, it was found growing near

the base of a very large, standing, decorticated pine. The site, which is not protected, is in danger of being shaded-out by underplanted conifers which, however, it is planned to remove in the near future.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 1.

***Miriquidica garovaglii* (Schaerer) Hertel & Rambold**

Vulnerable

The thallus of this species is dark brown, glossy and strongly fragmented and bears black apothecia that are strongly constricted below. This species is known from a single site near Loch Maree in West Ross. It is a circumpolar, arctic-alpine species of Europe, North America and Asia. In West Ross, *M. garovaglii* occurs on an acidic, schistose, south-west-facing cliff, within an SSSI. The population is well-established but, as the only known British occurrence of this species, it is considered vulnerable.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 1.

***Nephroma arcticum* (L.) Torss.**

Endangered

Arctic kidney lichen

A conspicuous, yellow-green, foliose lichen with rounded lobes, *N. arcticum* is found in alpine moss heath. This lichen is present as two colonies in the Beinn Eighe range, West Ross, and on a further mountain in Inverness-shire. It has been seen recently at only one of the localities, where it is well established. This species has a circumpolar distribution, being widespread in low sub-arctic and mid-boreal alpine regions. In Europe it is restricted to the high arctic islands, Iceland, Fennoscandia and the Tatra Mountains. In Scotland *N. arcticum* occurs as a component of species-rich *Racomitrium* heath, overlying leached base-rich soils derived from dolomitic shales or mica-schist, at altitudes above 900 m. The sites are preferentially grazed by deer and mountain hare. Moderate grazing may be necessary to prevent encroachment of vascular plant growth, but heavy grazing can cause thalli to become detached. *N. arcticum* is otherwise threatened only by the small size of the populations. This species is listed on Schedule 8 of the Wildlife and Countryside Act 1981, and has been surveyed as part of the Scottish Cryptogamic Conservation Project. The main Beinn Eighe site lies within an NNR. Since 1991 this population has been monitored using permanent quadrats.

Total no. of 10 km x 10 km squares: 3.

1960 onwards: 2.

McVean & Ratcliffe (1962): species lists. Fryday (1991a): details of the monitoring.

***Nephroma helveticum* Ach.**

Extinct

This foliose lichen forms loosely attached, compact rosettes of brown lobes that have a densely hairy lower surface. This species has been recorded only once in Britain, in 1904 from Achmore Woods, near Killin in Perthshire. It is also extinct in Fennoscandia and rare elsewhere in Europe. Elsewhere in the world it is more-or-less cosmopolitan. The Perthshire collection was from mossy rocks or trees. In the rest of its range it is a species of cool, moist, oceanic woodland. Reasons for the loss of this species are not known. Achmore Woods still exist.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 0.

James & White (1987): account of the species in Europe.

***Nephroma resupinatum* (L.) Ach.**

Extinct

This is a foliose lichen, forming loosely attached rosettes of brown lobes that have distinctly hairy undersides with scattered pale warts (papillae). *N. resupinatum* has been collected twice, possibly from the same site, on Deeside, Aberdeenshire. The records date from 1792 and 1863. This circumpolar, boreal to low-alpine species is widespread in Fennoscandia. It occurred on mossy rocks or trees in a cool, moist, shady habitat. Reasons for the loss of this species are unknown.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 0.

James & White (1987): account of the species in Europe.

Opegrapha subelevata* (Nyl.) Nyl.*Endangered**

This crustose lichen has a smooth to finely cracked and granular, ash- to yellow-grey thallus and elongate, black apothecia with a mauve-grey powdery coating. In Britain it is known from two sites in North Devon and Dorset. It is a southern, coastal species, occurring also in the Channel Islands, the Atlantic coasts of Spain, Portugal and Morocco, Madeira, and along the Mediterranean coast from Spain to Italy and Algeria. In Devon it grew on sheltered, moist, basic slate in a small road cutting. It has now been destroyed there by a recent road-widening scheme. In Dorset it was found on soft limestone among chert in a rock-face that was probably quarried in the past. This species is endangered because of the restricted nature of the remaining population, which occurs within an SSSI.

Total no. of 10 km x 10 km squares: 2.

1960 onwards: 2.

Pannaria ignobilis* Anzi*Vulnerable***(Fuscopannaria ignobilis* (Anzi) P.M. Jørg.)

Caledonian pannaria

This species has a thallus of tiny, pale grey or blue-grey to olive-brown scales arising from an inky, blue-black background (prothallus) that usually forms a conspicuous border around the thallus. Numerous red-brown apothecia are usually present. Apart from a 19th century record from Cumberland, *P. ignobilis* is confined to the Scottish Highlands, being best represented in the glens and straths of Inverness-shire, but also present near the head of Loch Duich in West Ross, near Loch Arkaig in Inverness-shire, and near Loch Earn and Kinloch Rannoch in Mid Perthshire. In Europe it has a Mediterranean-Atlantic distribution. It grows in sheltered but well-illuminated sites in river or stream valleys, mostly by the side of roads or tracks, frequently in narrow strips of woodland between the road and the watercourse. It grows on the base-rich bark of ash, occasionally elm, oak or willow, on small to medium-sized trees with a girth rarely exceeding 2.5 m. Only two of the sites have SSSI status. This species is especially vulnerable to loss and damage to trees during the widening or resurfacing of roads and tracks and several such losses have been noted in recent years. At some locations, its long-term survival is further threatened by the lack of suitable young trees which could act as future hosts. Tree Preservation Orders and tree-planting may be good mechanisms for the protection of this species. *P. ignobilis* is listed on Schedule 8 of the Wildlife and Countryside Act 1981, and recent surveys and conservation recommendations have been included in the Scottish Cryptogamic Conservation Project.

Total no. of 10 km x 10 km squares: 15.

1960 onwards: 14.

Jørgensen (1978): European distribution map.

Parmelia minarum* Vainio*Vulnerable***(Parmelinopsis minarum* (Vainio) Elix & Hale)

New Forest parmelia

This is a small foliose species whose lobes have a grey-white, rather glossy upper surface with a dense mat of tiny, cylindrical, often brown-tipped outgrowths (isidia). Originally found in Britain inhabiting crevices in a wall at Bolt Head, South Devon, *P. minarum* is restricted to southern England, where it is currently known from 54 trees in ten woods in the New Forest, Hampshire, and in two sites in West Cornwall. It has been much confused with the related *P. horrescens*, but it is apparently distributed elsewhere in south-west Europe and Macaronesia, south-east USA, Central America and Brazil, eastern and southern Africa, the Indian subcontinent, south-west Asia and Japan. In the New Forest this species is found on rather acid bark of the trunks of old beeches in areas of ancient forest. It grows best in well-lit, sheltered situations, usually at the edge of glades. In one of the Cornish sites it occurs on a turkey oak in a landscaped park in a sheltered valley, whilst in the second it grows on coastal trees and rocks. This species is listed on Schedule 8 of the Wildlife and Countryside Act 1981. Most of its sites are SSSIs and the overall habitats are not immediately threatened. However, in the New Forest, where its populations have recently been assessed and monitored, shading from excessive holly regeneration has been

identified as a serious threat. An investigation of the status of the Cornish populations should be considered a priority.

Total no. of 10 km x 10 km squares: 6.

1960 onwards: 5.

Rose (1994); Sanderson (1994a, 1994b, 1994c): habitat and population studies.

***Parmelia quercina* (Willd.) Vainio**
(*Parmelina quercina* (Willd.) Hale)

Vulnerable

This foliose lichen usually forms neat rosettes, with shiny-satiny, pale, blue- to beige-grey lobes. When mature, it has cup-shaped chestnut-brown apothecia with a grey margin and black strands below. The distribution of this species falls mainly south of a line between the estuaries of the Thames and Severn, with outlying localities along the coast of mid-Wales. However, it is now apparently extinct in counties east of Dorset (Hampshire, Isle of Wight, Surrey, Sussex and Kent), and today is mainly confined to sites close to the sea, several of which are SSSIs or NNRs. It is a southern species in Europe, being especially frequent in the Mediterranean zone. Further afield it is reported from Pakistan, Nepal, eastern Asia, California and Australia. *P. quercina* grows on well-lit, slightly nutrient-rich branches and twigs of trees such as ash, elm, oak and sycamore, in parkland or wayside situations, in hedgerows, or in the canopies of trees in coastal woodland. The decline of this species may be partly due to climatic factors, but sulphur dioxide air pollution has probably been a significant factor in eastern England. A recent rapid decline has been noted in some areas of its current stronghold, in south-west England, where increased levels of nitrogen compounds from agricultural fertilisers and slurry are likely to be a causal factor.

Total no. of 10 km x 10 km squares: 38.

1960 onwards: 21.

***Parmelia robusta* Degel.**
(*Parmotrema robustum* (Degel.) Hale)

Critically Endangered

This is a large foliose species with rounded pale grey lobes that have rounded soralia borne on small extensions of the lobe margin. It differs from the common *P. perlata* in its larger size and in having very few and short marginal hairs and a different thallus chemistry. It has recently been discovered at its northernmost European locality, in Cardiganshire. It is also found in south-western Ireland, where it is very rare, and further south in western France, Portugal and Macaronesia. Elsewhere, it occurs in North and South America and Australia. In Cardiganshire, it occurs in humid, old woodland, at an altitude of 80 m, on a large, more or less vertical, east-facing, acidic rock-face. Five plants were recorded in 1994, the largest being 30 x 20 cm. In south-west Ireland it grows on blackthorn and on mossy rocks on heathland near the coast. This species is endangered owing to the restricted size of its single population. The site is just outside an SSSI boundary, which should be reviewed.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 1.

***Parmelia tinctoria* Maheu & A. Gillet**
(*Xanthoparmelia tinctoria* (Maheu & A. Gillet) Hale)

Vulnerable

This foliose lichen has yellow-grey lobes with inflated, more or less spherical outgrowths (isidia). Care in identification is needed to avoid confusion with the common and variable *P. conspersa*. In Britain this species has been collected from three localities: the Lizard Peninsula in Cornwall, the island of Skomer off the coast of Pembrokeshire, and in South Somerset. It is also found on Jersey in the Channel Islands, and elsewhere in southern and western Europe, north to southern Norway, and in the Canary Islands and Madeira. At its British sites, it grows on sunny coastal boulders or on slate roofs. Two of the sites have SSSI status.

Total no. of 10 km x 10 km squares: 3.

1960 onwards: 3.

***Parmentaria chilensis* Fée**
(*Pyrenula chilensis* (Fée) R.C. Harris)
Oil-stain parmentaria

Vulnerable

The clustered black perithecia on the yellowish crustose thallus, which tends to swell the girth of the branches on which it grows, gives *P. chilensis* a characteristic appearance of blackberries floating in custard! This very strongly oceanic species is known in Britain from a single locality in Inverness-shire, but is present in several woodlands in south-western Ireland. Elsewhere it is known from Macaronesia, USA (Florida), the West Indies, Colombia and Chile (Juan Fernandez). In Scotland, it is found in local abundance on the branches of hazels on the steep sides of a wooded ravine, at an altitude of c. 100 m. In Ireland it is also found on holly. The Scottish site is an SSSI. *P. chilensis* is listed on Schedule 8 of the Wildlife and Countryside Act 1981, and has been surveyed as part of the Scottish Cryptogamic Conservation Project.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 1.

Coppins & O'Dare (1992): site description, species list.

***Peltigera lepidophora* (Vainio) Bitter**
Ear-lobed dog-lichen

Critically Endangered

This is a foliose lichen with concave to ear-shaped lobes, the upper surfaces of which are thinly hairy and bear numerous button-like outgrowths (isidia). This species is known in Britain from a single locality in East Perthshire, where it was last seen in 1976. It is frequent in Fennoscandia, local in central and eastern Europe, but very rare in the west. It has a circumpolar distribution with outlying occurrences in Hawaii, South America and New Zealand. It is a terricolous species of slightly calcareous substrata. At its British site it occurred on a flat mossy ledge of Old Red Sandstone conglomerate in a wooded river gorge. This species is listed on Schedule 8 of the Wildlife and Countryside Act 1981, and its site is an SSSI. It has been included in the Scottish Cryptogamic Conservation Project but was not refound in 1994. However, as *Peltigera* species are sometimes ephemeral and demonstrate a rapid turnover of thalli, it should be looked for again within a few years.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 1.

Vitikainen (1994): monograph with distribution map.

***Peltigera malacea* (Ach.) Funk**
Matt felt lichen

Endangered

P. malacea is a large foliose species with smooth, grey, 'boat-shaped' lobes, which have patches of minute colourless hairs near the lobe-ends and blackish felty hairs on the underside, but no distinct veins. In recent years this species has been found at three coastal sites: Culbin Sands in Moray, Cuthill Links in West Ross and Tentsmuir in Fife. There are six 19th century records, some of which require verification, from South Aberdeenshire, Inverness-shire and Mid Perthshire. It has a circumpolar, temperate to arctic distribution in Europe, Asia and North America. It is rare or absent in oceanic areas of western Europe and in the Mediterranean area. The extant populations occur in pine plantations established on old dune systems. Locally abundant and fertile colonies grow on acidic sandy soil, often among mosses, on the sides of tracks and paths. This species appears to benefit from the combination of well-drained, oligotrophic soil conditions with localised disturbance that together suppress competition from grasses. The sites of recent records have NNR and/or SSSI status.

Total no. of 10 km x 10 km squares: 11.

1960 onwards: 5.

Vitikainen (1994): monograph with distribution map.

***Peltigera scabrosa* Th. Fr.**

Vulnerable

This large foliose species has grey or partly browned lobes, which have a roughened, but not hairy, upper surface and a distinctly veined lower surface. In Britain it is known from two northern localities: Seana Bhraigh in East Ross, and Mid Hill near Loch of Swannay on Mainland, Orkney. It is a circumpolar, boreal to arctic species,

which in Europe is common in Fennoscandia with outlying localities further south in Poland, Slovakia and Ukraine. At its British localities it grows on acidic, wind-swept, mossy soil. In East Ross it was found on a summit ridge at an altitude of c. 820 m. The sites, of which the one on Orkney is a nature reserve, the other unprotected, should be re-visited to assess the populations and to identify any potential threats, such as excessive trampling by walkers.

Total no. of 10 km x 10 km squares: 2.

1960 onwards: 2.

Vitikainen (1994): monograph with distribution map.

***Peltigera venosa* (L.) Hoffm.**

Vulnerable

This conspicuous foliose lichen has rounded, often fan-shaped, green lobes, with a conspicuously dark veined underside, the veins bearing wart-like outgrowths (cephalodia). The main centres of distribution of this species, which has declined, are the Breadalbane and Grampian Mountains. There are, however, a fair number of outlying localities stretching from Ben Hope in West Sutherland down to the northern Pennines and Snowdonia and there are also records from northern and western Ireland. This species is widespread throughout the northern hemisphere. It grows on basic soil, usually in moist habitats. A number of sites are beside waterfalls. It is also found on cliff ledges, turf-capped walls and on heavy-metal mine spoil. The majority of sites are at moderate to high altitudes, but it occasionally occurs on low ground. Reasons for the decline of this species are not clear. In lowland sites, where it has decreased most, the spread of air pollution seems to be the most likely cause. Many of the sites are within NNRs or SSSIs.

Total no. of 10 km x 10 km squares: 31.

1960 onwards: 14.

Vitikainen (1994): monograph with distribution map.

***Pertusaria bryontha* (Ach.) Nyl.**

Critically Endangered

Alpine moss pertusaria

The warty grey thallus of this species is covered with abundant brown apothecia. This lichen is known only from a single locality, at 1030 m., on Aonach Beag in the Ben Alder range, Inverness-shire. Two 19th century specimens, supposedly from the Cairngorm mountains, almost certainly do not originate from Britain. It has an arctic-alpine distribution in Europe, occurring in the Alps and the tundra. In Scotland, *P. bryontha* was present (in 1981) as one or two thalli encrusting mosses and low alpine vegetation on a limestone cliff. A recent search (1994), as part of the Scottish Cryptogamic Conservation Project, failed to relocate it. The collection of material could seriously weaken the tiny population, if it still exists. The site lies within an SSSI. *P. bryontha* is listed on Schedule 8 of the Wildlife and Countryside Act 1981.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 1.

***Pertusaria glomerata* (Ach.) Schaerer**

Vulnerable

The thick, white-grey, smooth, often shining thallus bears crowded, spherical, fertile warts with dot-like apothecia. This rare lichen is known from the Ben Lawers range, Perthshire (two sites), Ben Hope, Sutherland, and from Coire Cheap, Ben Alder, Inverness-shire. All populations are tiny. This species has an arctic-alpine distribution in Europe. *P. glomerata* overgrows mosses, decaying plant remains and soil in calcareous habitats over 900 m. It is known from mica-schist, epidiorite and metamorphosed 'sugar limestone'. The sites lie within an NNR and SSSIs.

Total no. of 10 km x 10 km squares: 6.

1960 onwards: 4.

***Pertusaria melanochlora* (DC.) Nyl.**

Endangered

This species has a thick, dark grey, crustose thallus covered with coarse, blunt-tipped, cylindrical warts. Currently this lichen is known from Cox Tor and White Tor in western Dartmoor, South Devon. Last century it was also recorded from Herefordshire and Merioneth. It has recently been found in Co. Kerry, Ireland. Elsewhere it occurs in south-western Europe, the Mediterranean region and southern Norway. *P. melanochlora*

favours acidic saxicolous substrates and is locally abundant on shattered boulders of dolerite on Dartmoor; the Merioneth record was on schist. Both of the Dartmoor sites are within the National Park but have no other statutory protection.

Total no. of 10 km x 10 km squares: 3.

1960 onwards: 1.

Giavarini (1990): description of habitat, species lists.

***Pertusaria pustulata* (Ach.) Duby**

Vulnerable

This crustose lichen has a thin, smooth to slightly cracked, pale grey to greenish-grey thallus with apothecia borne mostly singly within thalline warts. Microscopic examination is essential to distinguish it from superficially similar species, especially *P. leioplaca* and *P. hymenea*. Old records are confused, and several await verification. However, *P. pustulata* is mainly distributed in southern England, with an old, confirmed record from near Dolgellau in Merioneth. Today, it is known with certainty from two sites in West Sussex, one in North Hampshire, several in the New Forest, South Hampshire, and Dorset. It has a suboceanic-Mediterranean distribution in Europe and is widely distributed in eastern North America. It grows on the bark of trees, especially beech, in ancient woodlands. The sites, several of which are protected within SSSIs, need to be visited to assess the size and condition of the populations, and make appropriate management recommendations.

Total no. of 10 km x 10 km squares: 15.

1960 onwards: 10.

***Phaeophyscia endococcinea* (Körber) Moberg**

Vulnerable

This foliose lichen has narrow dark grey lobes, with internal tissues developing an orange-red pigment with age, and numerous black apothecia. This lichen is restricted to the Scottish Highlands where it has been recorded from Ben Lawers in Perthshire, Caenlochan in Angus, Torridon in West Ross, and Sutherland. It is widespread from central Europe to Fennoscandia and also occurs in North America and Nepal. *P. endococcinea* is confined to the nutrient-enriched, flat tops of boulders used as bird-perches, in and around upland streams and lake shores. Two of its sites are NNRs and the rest are within SSSIs.

Total no. of 10 km x 10 km squares: 7.

1960 onwards: 7.

***Physcia tribacioides* Nyl.**

Endangered

Southern grey physcia

This foliose species has crowded, narrow, grey-white lobes which are partly obscured towards the centre of the thallus by numerous, white, powdery soralia. This is a very southern species, with scattered localities along the coast, from the Isle of Wight to Cornwall and with one site in Pembrokeshire. In the 19th century its range extended further east into West Sussex. In Ireland its distribution is mainly coastal. It has a Mediterranean-Atlantic distribution in southern and western Europe, from the British Isles to the Iberian Peninsula, eastwards to the Tyrrhenian coast of Italy. Overall, it is a subtropical species, occurring also in Macaronesia, East Africa, Brazil, Japan and Australasia. In Britain, it favours open parkland, old orchards and wayside situations, especially near the sea, growing on the nutrient-rich bark of deciduous trees such as elm, oak, holm oak, sycamore, willow, elder and fruit trees. It has also been found on coastal boulders enriched by bird droppings. This species is listed on Schedule 8 of the Wildlife and Countryside Act 1981. Very few of its sites appear to be within protected areas. It has probably suffered a marked decline since 1960, due to the loss of elms from Dutch elm disease, habitat destruction (Hawksworth 1987) and excessive eutrophication from fertiliser and slurry application. It appears to have suffered a comparable decline in Ireland.

Total no. of 10 km x 10 km squares: 20.

1960 onwards: 15.

Hawksworth (1987): examples of decline.

Poeltinula cerebrina* (DC.) Hafellner*Vulnerable**

The thick, chalky white thallus of this species, which is often eroded and undulating, bears shortly elongate, contorted apothecia. The main concentration of this species is on the limestones of northern England, particularly in Cumberland, County Durham and North Yorkshire. It is also known from outlying sites in Dorset and Stirlingshire. It has apparently disappeared from several sites within the main area and has not been seen for over 60 years at three Welsh localities. There is a recent record from Co. Sligo in the west of Ireland. Abroad this species is rare in the mountainous regions of Europe but does not occur in Fennoscandia. *P. cerebrina* usually grows on the exposed surfaces of hard Carboniferous limestone cliffs and boulders, though it is also present on shelving limestone in the inundation zone of the River Ure, in Wensleydale, Yorkshire. In Dorset it is found on Jurassic limestone and at the Scottish site it is associated with mica-schist. The reasons for the decline of this lichen are unclear. Most of its sites are SSSIs and one is an NNR.

Total no. of 10 km x 10 km squares: 20.

1960 onwards: 10.

Polyblastia sendtneri* Krempelh.*Vulnerable**

P. sendtneri has an irregular, pale grey-brown, uneven thallus of coarse, convex granules, bearing scattered black perithecia. This lichen is known from high ground on Ben Lawers, Perthshire, and Aonach Beag in the Ben Alder range, Inverness-shire. It is reasonably well established at both localities. Elsewhere it is known from the Alps, Fennoscandia and North America. *P. sendtneri* grows on solifluction soils, mosses and decaying vegetation, on mica-schist and limestone ledges, at altitudes above 1000 m. It is a member of a community that is rich in rare montane lichens. The sites are all NNRs or SSSIs.

Total no. of 10 km x 10 km squares: 2.

1960 onwards: 2.

Polychidium dendriscum* (Nyl.) Henssen*Vulnerable**

The delicate thallus of this species is composed of short, slender, intricately branched filaments which form shining blue-grey to pale brown cushions. *P. dendriscum* is restricted to a few woods on the west coast of Scotland. It also occurs in the Killarney district of south-western Ireland. Elsewhere it is widely distributed in warm humid parts of the world, including Macaronesia, Brazil, Hawaii and New Caledonia. It grows over bryophytes, particularly *Frullania tamarisci*, on the trunks of a variety of deciduous trees, such as hazel, ash, oak, birch and willow, in humid, undisturbed, oceanic woodland. It is usually found in very boggy situations and is vulnerable to any form of disturbance that opens up the tree or shrub canopy, thereby reducing the constantly high humidity level that this species requires. At least two of its sites are SSSIs.

Total no. of 10 km x 10 km squares: 3.

1960 onwards: 3.

***Porina guaranitica* Malme
(*Porina heterospora* (Fink) R.C. Harris)****Critically Endangered**

This crustose lichen has a thin, pale grey- to yellow-brown thallus and yellow- to orange-brown perithecia sunken in warts on the thallus surface. Although known for many years from several sites in North Kerry in south-west Ireland, this subtropical species has recently been discovered at a site near the North Devon coast. Elsewhere it is known from Madeira, south-eastern USA, Cuba, the Caribbean, Brazil, Paraguay, Uruguay and South Africa. In Devon it grows on bark and moss near the base of a large oak trunk by a woodland track. It grows in similar situations in Ireland, but also on mosses over rocks and in South America it occasionally grows directly on rock. At the Devon site, *P. guaranitica* is endangered owing to the small size of the population and the possibility of accidental damage associated with the adjacent track. A further threat from the encroachment of rhododendron will hopefully be averted by the current management plans for the site, which is an SSSI.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 1.

McCarthy (1993): map of world distribution.

Porina sudetica* (Körber) Lettau*Vulnerable**

This crustose species has a green-grey to blackish-grey, rather granular or warted thallus and prominent, spherical black apothecia. In Britain, it is known from two sites on the Land's End Peninsula in Cornwall. Elsewhere, it has a scattered distribution in central Europe. At its Cornish sites, one of which is an SSSI, *P. sudetica* grows on soil, mosses and plant debris on metal-rich spoil from old mine-workings. The main threat to this species is the landscaping of derelict mine sites.

Total no. of 10 km x 10 km squares: 2.

1960 onwards: 2.

Protoparmelia atriseda* (Fr.) R. Sant. & V. Wirth*Vulnerable**

This crustose lichen forms small patches of shiny, more or less spherical red-brown fragments, with similarly coloured apothecia. It is always associated with the bright yellow-green thallus of *Rhizocarpon geographicum*. It has recently been recorded at one site in Scotland and two in Wales. There are further, 19th century, records from near Braemar in South Aberdeenshire and from Merioneth. Elsewhere it is found in Fennoscandia and in the central European mountains. It grows, apparently parasitically, on the thallus of *Rhizocarpon geographicum* on exposed, hard, acidic rocks at low altitudes in upland areas. Its Scottish site, Old Struan in Mid Perthshire, is on the roadside and thus is vulnerable to any road improvement schemes. One of the Welsh sites is an SSSI.

Total no. of 10 km x 10 km squares: 6.

1960 onwards: 3.

Pseudocyphellaria aurata* (Ach.) Vainio*Critically Endangered**

Gilt-edged lichen

The lobes of this large foliose lichen are pale grey with a striking golden-yellow colour on the margin (soralia), in pores on the hairy underside and wherever the thallus is damaged. It formerly occurred in southern England, in the New Forest in Hampshire, the Isle of Wight and Dorset, but is recently (1972) known only from Wingletang Down on St Agnes in the Isles of Scilly. However, it was not refound there during a survey in 1989. It is also present on Sark in the Channel Islands and on the Blasket Islands in south-western Ireland. Elsewhere, this oceanic species is found in western France, Portugal and Macaronesia, and is widespread in the tropics and temperate southern hemisphere. It can grow on trees, as it did in the New Forest, or on rocks and heather stems, as on the Isles of Scilly. A systematic search on the Isles of Scilly should be made for this species and, if successful, appropriate management should be undertaken. Burning and cattle grazing on the St Agnes site, which is an SSSI, are thought to be responsible for its disappearance there.

Total no. of 10 km x 10 km squares: 8.

1960 onwards: 2.

Pseudocyphellaria lacerata* Degel.*Vulnerable**

Ragged pseudocyphellaria

The dark ochre to greenish lobes of this foliose species are concave with undulating or crisped margins, and are often obscured by a dense mass of dark grey-blue outgrowths (isidia), which become whitish where abraded. In Britain, this species is known from a single site in the Nant Gwynant Pass in Snowdonia, where it was last seen in 1961, and in three sites in western Scotland, two on the Kintyre Peninsula and one near Tobermory on the Island of Mull. Elsewhere, it is known from several sites near Killarney in south-west Ireland, the Faeroe Islands, the Azores and Madeira. In North Wales, *P. lacerata* was found on a wet rock face in a woodland, and in Kintyre it occurs on sheltered rock faces overlooking the sea-shore. On Mull it was collected on the ground, having apparently fallen from the crown of an oak in coastal woodland. In Ireland it has been recorded on the trunks and branches of oaks, as well as on mossy boulders. *P. lacerata* is listed on Schedule 8 of the Wildlife and Countryside Act 1981, and has been included in the Scottish Cryptogamic Conservation Project. During surveys for this project in 1994, it was not refound at its site on Mull but was seen at its two localities in Kintyre. It is apparently under no immediate threat at these latter sites, which are SSSIs, but is considered vulnerable because the populations are small and localised.

Total no. of 10 km x 10 km squares: 4.

1960 onwards: 4.

Galloway (1994): map of world distribution.

Psora globifera* (Ach.) Massal.*Critically Endangered**

The thallus of this lichen is composed of elongated, overlapping, red-brown to dark brown scales bearing black hemispherical apothecia. This species has recently been rediscovered at its only known site, above Lochan nan Cat on Ben Lawers, Perthshire. The previous record dated from 1863. A 19th century record from the coast of North Wales is generally discounted. It is arctic-alpine in Europe ranging from Fennoscandia to the Alps and is also known from Greenland and North America. In 1989, the single small patch of *P. globifera* was growing over bryophytes on a mica-schist crag. It particularly favours rock crevices at high altitude. The small size of the population makes it susceptible to chance events such as becoming detached. It occurs within an NNR.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 1.

Psora rubiformis* (Ach.) Hook.*Vulnerable**

Rusty alpine psora

The thallus of *P. rubiformis* consists of elongated, ascending, white to yellowish-green, white-edged, overlapping scales, with dark apothecia often present. This species is restricted to high ground in the Ben Lawers range, Perthshire, where there are three small populations. It has an arctic-alpine distribution in Europe and is also known from Greenland and North America. *P. rubiformis* grows on damp calcareous mica-schist crags above 750 m. It is normally associated with *Acarospora rhizobola*. This species is listed on Schedule 8 of the Wildlife and Countryside Act 1981. All the sites lie within the Ben Lawers NNR and have recently been visited as part of the Scottish Cryptogamic Conservation Project.

Total no. of 10 km x 10 km squares: 2.

1960 onwards: 1.

Gilbert, Coppins & Fox (1988): ecology and species list.

Pyrenula coryli* Massal.*Vulnerable**

Pyrenula coryli is a crustose species with an inconspicuous, possibly non-lichenised, thallus and small black perithecia. It requires microscopic examination to distinguish it from several species of *Arthopyrenia* and *Eopyrenula*. With one early record, from Merioneth in 1877, *P. coryli* is currently known only from two Scottish sites: Morvern in Inverness-shire, and Invernaver in West Sutherland. It has a scattered distribution throughout central and northern Europe, although it has rarely been recorded during this century. In Britain it apparently grows only on the smooth bark of hazel, although elsewhere in Europe it also occurs on rowan. One site is an NNR, the other an SSSI. Assessing the size of populations is hampered by the difficulties of accurate identification in the field.

Total no. of 10 km x 10 km squares: 3.

1960 onwards: 2.

Pyrenula dermatodes* (Borrer) Schaerer*Critically Endangered**

This crustose species has a thick, rather glossy, yellowish-green to rusty-orange thallus and numerous sunken perithecia, visible only as minute black pores on the thallus surface. Although known only from a single site in Britain (Knoydart, Inverness-shire, where it was recorded in 1975), *P. dermatodes* is a strongly oceanic species that is locally frequent in the Killarney Woods of Co. Kerry, with a few outlying localities elsewhere in western Ireland, north to Glenveagh in West Donegal. It is not known elsewhere in Europe, but occurs further afield in Macaronesia, India, China and South America. At Knoydart it was found on rowan in a small wooded ravine. In Ireland it grows mainly on holly, but also on beech, hawthorn and rowan, and rarely on rock. The site, which is within an SSSI, should be visited to assess the current status of the population and make any appropriate management suggestions.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 1.

Pyrenula nitida* (Weigel) Ach.*Vulnerable**

The rather glossy, yellow- to olive-brown or dark brown thallus of this crustose lichen sometimes has a few minute white spots in addition to the numerous sunken black perithecia. Until recently this continental species has been much over-recorded, in error for the oceanic *P. macrospora*, and microscopic examination is required to distinguish the two species. In Britain, *P. nitida* is confined to the New Forest, Hampshire, and south-eastern England. There is an early, unlocalised record from Sussex, and it has recently been confirmed from nine woods in the New Forest, as well as from Burnham Beeches in Buckinghamshire and Eastwell Park in East Kent. Most sites are SSSIs and one is an NNR. Its range apparently includes much of temperate Europe, but excludes areas that are highly oceanic. *P. nitida* occurs in ancient pasture woodland on the thick, smoothish bark of old beech or hornbeam, usually on the drier parts of trees away from rain-tracks. The main threats are loss of suitable trees and, in the New Forest, increasing shade by uncontrolled holly regeneration.

Total no. of 10 km x 10 km squares: 6.

1960 onwards: 5.

Pyrenula nitidella* (Flörke ex Schaerer) Müll. Arg.*Extinct**

This crustose lichen has a rather glossy, olive-brown to fawn thallus that has minute white spots and numerous, small, sunken, black perithecia. Microscopic examination is required to distinguish it from the much more common *P. chlorospila*. *P. nitidella* has been recorded with certainty from Britain on only two occasions: from Kildale in Cleveland, North-east Yorkshire, in 1856, and from Pitlochry in East Perthshire in 1914. In Europe as a whole it appears to be rather continental, but its precise distribution is obscured owing to confusion with the apparently more oceanic *P. chlorospila*. Like other members of the genus, *P. nitidella* grows on the smooth bark of deciduous trees. The host trees were not noted on the British material, but appear to be hazel and oak.

Total no. of 10 km x 10 km squares: 2.

1960 onwards: 0.

Ramalina chondrina* Steiner*Vulnerable**

This fruticose lichen forms untidy straggling patches formed of thin, green-grey, wiry threads that are richly dichotomously branched, often with curled or hook-shaped tips. In Britain *R. chondrina* is known from the Land's End Peninsula in Cornwall and from Gugh and St Agnes in the Isles of Scilly. It has an Atlantic coastal distribution that also includes south-western Ireland, southern France, the Canary Islands and Madeira. At its British sites, *R. chondrina* grows on loose soil or entangled among shrubby lichens (frequently *R. siliquosa*), on steep, siliceous rocks overlooking the sea. On St. Agnes and Gugh, it is mostly found on inaccessible, south- to west-facing bluffs. Its sites on the Isles of Scilly are SSSIs but the Land's End site has no protection.

Total no. of 10 km x 10 km squares: 2.

1960 onwards: 2.

Rinodina mniaraea* (Ach.) Körber*Endangered**

This is a crustose lichen with a coarsely warted, pale to dark grey or brownish thallus and brown apothecia. The British population belongs to var. *cinnamomea* Th. Fr., characterised by the presence of orange pigment in the internal tissues of the thallus. This arctic-alpine species of Europe and North America is known in Britain from a single site on the Beinn Eighe NNR in West Ross. Here, it grows over mosses in species-rich calcareous grassland overlying base-rich soils derived from dolomitic shales or mica-schist, at an altitude of c. 850 m. This species is considered endangered because of the small size of the population.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 1.

Schadonia fecunda* (Th. Fr.) Vězda & Poelt*Vulnerable**

The greyish brown, warty to granular thallus carries black apothecia with prominent margins. This lichen is known only from near the summit of Ben Lawers in Perthshire and from Beinn Eighe in West Ross. There is also an old record from Creag na Caillich in the Ben Lawers range. This species has an arctic-alpine distribution in Europe. On Ben Lawers, *S. fecunda* grows on damp ledges of mica-schist cliffs where it colonises soil, moss

and dead vegetation, while on Beinn Eighe it occurs in a species-rich montane heath. The populations lie within areas protected by NNR or SSSI status.

Total no. of 10 km x 10 km squares: 3.

1960 onwards: 2.

Gilbert, Coppins & Fox (1988): species list.

***Schismatomma graphidioides* (Leighton) Zahlbr.**

Vulnerable

The thin, white to pale grey thallus of this crustose species is often cracked and with numerous irregularly shaped, often elongate, black apothecia. Microscopic examination is required to distinguish it from *Opegrapha rufescens*. Since 1960, *S. graphidioides* has been recorded from ten sites, in Devon, South Somerset, Peeblesshire and Inverness-shire. In the last century it was recorded also from Shropshire and Denbighshire. This species was originally described from Ireland, but has not been found there this century. Elsewhere it is known from southernmost Sweden, Denmark, north-western Germany, Italy (Liguria), Portugal, Mallorca and the former Yugoslavia (Dalmatia), but there are few modern records (Tehler 1993). It grows on the slightly nutrient-enriched bark of old or mature deciduous trees, including ash, beech and oak, at woodland edges, in glades and in sheltered parkland. Except at the two sites in Inverness-shire, where it is locally abundant, *S. graphidioides* is apparently confined to single trees, and its host tree at the Peeblesshire site has since fallen. Most sites have some level of protection, either as SSSIs or under the ownership of the National Trust.

Total no. of 10 km x 10 km squares: 12.

1960 onwards: 10.

Rose, Jarman & O'Dare (1990): site details and photographs. Tehler (1993): monographic treatment.

***Sclerophora nivea* (Hoffm.) Tibell**

Vulnerable

This is a 'pin-head' lichen with an inconspicuous thallus. The young, spherical apothecia are at first unstalked and covered in a yellow powdery coating, but later become elevated on pale brown stalks and have a pinkish-brown spore mass. Although still widely distributed in the central and eastern Scottish Highlands (fifteen 10 km x 10 km squares), *S. nivea* has been recently recorded from only one of its English localities, in South Northumberland. It has apparently disappeared from other parts of that county, as well as from County Durham and North-east Yorkshire. Elsewhere it ranges from southern Fennoscandia to central Europe, and is present in North America. It is found in sheltered habitats, either in parkland and wayside situations or in open, wooded areas, especially by tracks or rivers. Always occurring in small populations, it grows in dry bark crevices or below large boughs and on wood in the split or hollowed trunks of deciduous trees, including alder, ash, birch, elm, oak and rowan. It has once been found on the bark of a parkland pine. Only a few of its sites are NNRs, SSSIs or other reserves and at many sites it is vulnerable to a decline in available trees.

Total no. of 10 km x 10 km squares: 21.

1960 onwards: 16.

***Solenopsora liparina* (Nyl.) Zahlbr.**

Vulnerable

Serpentine solenopsora

The compact rosette of strongly convex, narrow, olive-grey lobes bears abundant dark, greyish-blue apothecia at the centre. This species is present at two sites, 1 km apart, on the Lizard Peninsula, Cornwall. Otherwise this lichen is known only from the Mediterranean. It grows on sunny outcrops of serpentine rock near the coast, showing a preference for vertical cliff faces, and extends into seepage tracks. The sites lie within an NNR. This species is listed under Schedule 8 of the Wildlife and Countryside Act 1981.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 1.

Gilbert & James (1987): site description, species list.

***Squamarina lentigera* (Weber) Poelt**
Scaly breck-lichen

Endangered

The rounded, whitish-green rosettes of white-margined scales have pale brown apothecia crowded in the centre. This species has recently been recorded from six sites in the Brecklands of East Anglia. Previously it was also known from the East Sussex coast and Tennyson Down on the Isle of Wight. There are old, unconfirmed records from Cornwall and Somerset. This continental species is widely distributed in southern and central Europe from Norway to the Mediterranean. It has also been recorded from Russia, North America, North Africa and Asia. *S. lentigera* grows on highly calcareous soils derived directly from the chalk or from chalky boulder clay. Many of its sites have experienced major disturbance within the last 50 years. Such disturbance is important in helping to keep the sward open and to bring subsoil to the surface. Since the mid-1980s this species has declined greatly at all its sites, possibly becoming extinct at two of them. The reasons for this rapid and synchronised decline are not known but it is consistent with some form of pollution. This species is listed on Schedule 8 of the Wildlife and Countryside Act 1981. Most of the sites are protected by SSSI status. The lichen is currently being monitored and, since 1992, has been included in English Nature's Species Recovery Programme. This has involved transplanting material from sites where there are relatively healthy populations to other sites nearby and monitoring subsequent progress.

Total no. of 10 km x 10 km squares: 12.

1960 onwards: 5.

Gilbert (1978): species lists. Gilbert (1993): ecology, discussion of decline.

***Staurothele areolata* (Ach.) Lettau**
(*Staurothele clopima* (Wahlenb.) Th. Fr.)

Vulnerable

The thallus of this species forms a dark brown, fragmented crust bearing black perithecia sunken in almost spherical warts. This lichen is known from two sites, high on Cairn Toul in the Cairngorm mountains and Coire nan Beitheach in Glen Coe. Abroad, this species is montane in central and northern Europe and North America. The habitat is distinctive, being submerged boulders in melt-water streams. On Cairn Toul it occurs immediately below a late snow patch, while in Glen Coe it grows further downstream. In Fennoscandia, *S. areolata* occurs on siliceous and basic rocks. Both Scottish sites are very remote: one lies within an NNR and the other is an SSSI owned by the National Trust for Scotland.

Total no. of 10 km x 10 km squares: 2.

1960 onwards: 2.

Gilbert & Fox (1985): site description.

***Staurothele rufa* (Massal.) Zsch.**

Endangered

This is a crustose species with a thin, cracked to fragmented, pale to dark grey thallus with prominent, partly sunken, black perithecia. In Britain, *S. rufa* is known only from one site, at Porthkerry in Glamorgan, where it was recorded in 1964. Elsewhere it is reported from Belgium, the Pyrénées, the Alps, the Apennines of Italy and the Czech Republic. It is a species of slightly calcareous rocks, and in Glamorgan was collected on Liassic limestone in an old quarry near the coast. The site, and any similar ones nearby, should be visited to assess the current status of this species. It is not known whether the site is within the Cliff Wood SSSI, as the record is not precisely localised.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 1.

***Stereocaulon symphycheilum* Lamb**

Endangered

The fruticose thallus of prostrate, sparingly branched, pale grey stems, covered with flattened scales, is firmly attached to rock. This lichen has been recorded only from the Coniston copper mines in the Lake District where it is restricted to a limited area. Internationally, it has a scattered circumpolar, arctic distribution being found in Fennoscandia, Canada, Alaska and Russia, but seems to be absent from the Alps and central Europe. In the Lake District this species is restricted to copper-rich scree fragments associated with the old workings. In Fennoscandia, however, it occurs more generally on bare or mossy rocks in the uplands. *S. symphycheilum* is vulnerable because of the small size of the population. The site, which has no statutory protection, is frequently

visited by geologists who cause disturbance. Reworking of the spoil heaps is also a potential threat. Access to the site, which supports other rare lichens, should be controlled.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 1.

Purvis & James (1985): site description.

***Sticta canariensis* (Bory) Bory ex Delise s. str.**

Vulnerable

This foliose species can express itself in two ways, depending on its associated alga. The commonest form has a blue-black thallus with a blue-green algal associate (*Nostoc*) and is usually given the separate name *S. dufourii* Delise. Much rarer is the form with a green algal associate, which is the one treated here. This is most frequently seen as tiny rounded lobes, which are bright green when wet, arising from the dark thallus of *S. dufourii*. More rarely, it is free-living, sometimes forming extensive patches of large, forked lobes, bright green when wet, with small white, concave pores (cyphellae) and a more or less uniform, thin felty covering on the underside.

Although the form with the green algal associate is known at many sites along the west coast of Britain from Devon to Sutherland, arising from *S. dufourii*, it is probably present as independent thalli at only four sites: one in North Wales and three in western Scotland. Two of the Scottish sites are within SSSIs. It is also known from western Ireland, especially Co. Kerry, Portugal and Macaronesia. *S. canariensis* grows on moist mossy rocks, and sometimes on trees, in sheltered, shaded situations in wooded ravines, wooded cliffs or in large gullies on rocky coast. The sites with the best populations of this species should be identified, especially where independent thalli are found, and afforded necessary protection.

Total no. of 10 km x 10 km squares: 4 (+ 32 with composite thalli).

1960 onwards: 4 (+ 32 with composite thalli).

***Strigula stigmatella* (Ach.) R.C. Harris**

Endangered

This crustose lichen has an inconspicuous white to pale grey thallus with partly sunken black perithecia. Until 1973, when discovered in the New Forest, Hampshire, this species was known only from an otherwise unlocalised 19th century specimen from Sussex. Although it has a wide European distribution, it appears to be a rare and much declined species. It is also known from Michigan in the USA and from western Canada. In Britain, this species grows on the trunks of old oaks, either directly on the bark or partially overgrowing mosses. A survey is required to determine the current status of this species in the New Forest, where it occurs within an SSSI. The var. *alpestris* (Vězda) Coppins, known from several localities in the Scottish Highlands, grows on mossy rocks and should probably be regarded as a distinct species: it is not included in the Red List.

Total no. of 10 km x 10 km squares: 2.

1960 onwards: 1.

***Synalissa symphorea* (Ach.) Nyl.**

Vulnerable

The thallus of this species forms small, dense, black cushions or tufts of stout branches with swollen ends in which apothecia may develop. This lichen has a scattered distribution in south-western England with outlying localities on the west coast at Llandudno, Caernarvonshire, and in Argyll. A number of records have been discounted due to past confusion with *Lempholemma botryosum*. It is thinly distributed throughout much of Europe, including the west coast of Ireland, and is also known from North Africa and North America. *S. symphorea* grows on soil in the crevices of hard, pure, limestone outcrops where it is often 'epiphytic' on or among squamulose lichens such as species of *Catapyrenium* and *Psora lurida*. Reasons for the loss of this species from several of its former localities are not known. Three of its sites are within SSSIs.

Total no. of 10 km x 10 km squares: c. 14.

1960 onwards: 5.

***Teloschistes chrysophthalmus* (L.) Th. Fr.**

Critically Endangered

This fruticose lichen forms small, compact, almost spherical, orange tufts of narrow, branched lobes on twigs. It has been recorded from five sites along the south coast, from West Sussex through the Isle of Wight to Torquay in South Devon. It was last seen in Devon in 1966. It is extinct in Northern Ireland but still occurs in south-western Ireland and south-western parts of Europe and becomes cosmopolitan in the warmer areas of both hemispheres. It grows on basic, well-lit bark, on twigs, on shrubs and small trees, and occasionally also on

timber in coastal areas, such as fence posts. It prefers sunny, sheltered situations such as are found in orchards or along hedgerows. Disappearance of colonies is thought to be related to air pollution, substrate enrichment from inorganic fertilisers and possibly the destruction of old neglected orchards. A survey of the last recorded site, Start Point, South Devon, an SSSI, should be undertaken to assess whether the plant still occurs there. The hawthorn bush on which it grew was removed as part of a footpath widening scheme.

Total no. of 10 km x 10 km squares: 5.

1960 onwards: 1.

Hawksworth, Coppins & Rose (1974): map of British distribution.

***Teloschistes flavicans* (Swartz) Norman**
Golden-hair lichen

Vulnerable

A strikingly bright orange, shrubby lichen with a richly-branched thallus that forms tufts or straggles among other vegetation, *T. flavicans* is now restricted to south-western England and the Welsh coast. Formerly, it extended along the south coast to Kent, up into central England and had an outpost in the Firth of Clyde. In Ireland, this species is restricted to the south-west, although it was previously more widespread. *T. flavicans* has a Mediterranean-Atlantic distribution in Europe, reaching its northern limit on Anglesey. Overall, it is almost cosmopolitan in warm-temperate and tropical regions of the world. This lichen is now chiefly found on windy cliff-tops along the coast, where it grows on siliceous rock or straggles among grass and heather; a few populations are known on stony ground. Some of the largest remaining colonies are on islands. It is rare inland, where it typically grows on the nutrient-rich boles of old trees in open situations such as orchards, parklands or hedgerows. Some preference is shown for ash and sycamore, and, as it is sometimes confined to the upper trunk or canopy, it has probably been overlooked in some localities. The national decline of this conspicuous species is largely a result of sulphur dioxide air pollution, to which it is extremely sensitive. Its disappearance from individual sites may, in addition, be due to unsuitable management, especially related to the burning and ploughing of heathland, contamination by agrochemicals and slurry, and the felling of wayside trees. In the past, especially the late 19th and early 20th centuries, collecting may have weakened populations. Tree Preservation Orders may be an effective means of conserving this species outside protected areas. This species is listed on Schedule 8 of the Wildlife and Countryside Act 1981 and extensive surveys have been included in English Nature's Species Recovery Programme, and in a project administered by the Countryside Council for Wales. Many localities lie within SSSIs and/or other protected areas.

Total no. of 10 km x 10 km squares: 131.

1960 onwards: 68.

James, Hawksworth & Rose (1977): community description. Purvis & James (1994): ecology in Wales. Seaward & Hitch (1982): map with extended legend.

***Thelenella modesta* (Nyl.) Nyl.**

Critically Endangered

This crustose species has a warty, yellow-grey to pink- or red-brown thallus with a dirty-waxy texture. The warts each have a brown centre, which is the opening of the sunken perithecia. This species is now restricted to one site, Glamis in Angus, but was known in the last century from Gloucestershire and Oxfordshire. Although not recorded recently, there are six records from Ireland made prior to 1916, all of which require verification. It is widely reported from Europe, but has evidently suffered a marked decline (Mayrhofer 1987). It is also known from Morocco and the USA. It grows on the bark of parkland or wayside trees, and at Glamis was on a medium-aged ash by a road. It was last seen at Glamis in 1978. The site, which is not protected, should be revisited to locate the host tree and ensure that it is suitably managed. Tree Preservation Orders may provide a suitable mechanism for the protection of this species.

Total no. of 10 km x 10 km squares: 3.

1960 onwards: 1.

Mayrhofer (1987): monograph.

***Toninia coelestina* (Anzi) Vězda**
(*T. oribata* (Nyl.) P. James)

Vulnerable

The crustose to almost squamulose thallus of this species consists of small, greyish-brown granules that form a thick continuous crust. This lichen is known from near the summit of Ben Lawers in Perthshire and a site on Deeside. Elsewhere it has been recorded from the former Czechoslovakia, Italy and Norway. In Britain, this species is terricolous or epiphytic on mosses or lichens overgrowing calcareous schist at over 900 m. No immediate threats have been identified but this species is considered vulnerable because of its small, restricted populations. One site is within an NNR.

Total no. of 10 km x 10 km squares: 2.

1960 onwards: 2.

Timdal (1992): distribution map and ecology.

***Toninia cumulata* (Sommerf.) Th. Fr.**

Vulnerable

Large clusters of blackberry-like apothecia are found between the greyish-white lobes of the squamulose thallus of this species. It has been correctly reported from three Scottish mountains: there are old records from Ben Lawers in Perthshire and Ben Avon in the eastern Cairngorms and a modern record from Angus. It is otherwise known from Europe and North America. In Scotland, *T. cumulata* has been recorded on mosses on acid boulders and from immature soils at high altitude. No threats to this species are apparent but it is considered vulnerable because of its occurrence in a single, small population at an unprotected site.

Total no. of 10 km x 10 km squares: 3.

1960 onwards: 1.

***Toninia physaroides* (Opiz) Zahlbr.**
(*Toninia lurida* (Arnold) H. Olivier)

Extinct

The thallus of this species is composed of strongly convex to columnar, dark greyish-green to dark brown scales with white spots or flecks (pseudocyphellae), and usually a thin, white powdery coating. The apothecia are black. In Britain this hitherto poorly understood species is known from four late 18th or early 19th century collections, only one of which can be localised accurately, from the Gogmagog Hills in Cambridgeshire. One of the other specimens is probably from Suffolk. It is common in central and southern Europe, but rare elsewhere. Overall, it is widely distributed in the northern hemisphere. It grows in open habitats on calcareous soil and, at least when young, is associated with lichens that have a blue-green algal component.

Total no. of 10 km x 10 km squares: 2.

1960 onwards: 0.

Timdal (1992): distribution map and ecology.

***Toninia rosulata* (Anzi) H. Olivier**

Endangered

The rosette-shaped thallus of this species is composed of large, swelling, white scales, of which the marginal ones are often elongated. This species is known from two collections, one old, one modern, in the Ben Lawers range, Perthshire, where it occurs at an altitude of over 700 m. Elsewhere it is found in central and northern Europe and in Greenland. *T. rosulata* grows on soils derived from calcareous mica-schist; it is apparently always associated with lichens that have, when young, a blue-green algal component. Its single known locality lies within an NNR, where the population is considered endangered because of its very small size.

Total no. of 10 km x 10 km squares: 2.

1960 onwards: 1.

Timdal (1992): distribution map and ecology.

Tornabea scutellifera* (With.) Laundon*Extinct**

This fruticose lichen has a shrubby thallus formed of grey to grey- or reddish-brown, finely hairy, entangled branches that are rounded to angular in section. Until about 1870 this species was known from six localities on the Sussex coast, especially in the vicinities of Chichester and Hastings. Despite extensive searches in recent years, it has not been refound. In Europe its distribution extends south to the Iberian Peninsula and east along the Mediterranean, continuing to the Crimea, Iran and the north-western Himalayas. It is also present in Macaronesia and North Africa, and perhaps down the Atlantic coast to southern Africa. In Sussex, it was found in a range of habitats, including sea-cliffs, sand, the trunks of old trees and the untreated timber of old barns. Air pollution, land-slips and changes to the agricultural landscape are the probable causes of extinction, but given the numerous herbarium specimens, over-collecting may well have been an important contributory factor.

Total no. of 10 km x 10 km squares: 6.

1960 onwards: 0.

Umbilicaria crustulosa* (Ach.) Frey*Vulnerable**

The more or less circular thallus of *U. crustulosa* is grey and smooth on both surfaces, with abundant dark strands on the underside. It is attached to the substrate by a single central holdfast on the undersurface. This species is restricted to the Lake District where a large colony was discovered in the Langdale valley in 1889. Since then it has been found at several further localities in the Buttermere, Grasmere, Great Gable and Scafell areas. Elsewhere it is found in the western Alps, the Pyrénées and Fennoscandia. The English sites are mostly below 450 m. on moist, acid, cliff faces of the Borrowdale Volcanic Series. Although the sites are not obviously threatened, rock climbing and scrambling may occasionally dislodge specimens. Its main locality, in Langdale, has no statutory protection.

Total no. of 10 km x 10 km squares: 4.

1960 onwards: 4.

Day (1981): list of Lake District localities. Gilbert & Giavarini (1993): species list.

Umbilicaria spodochoa* (Ehrh. ex Hoffm.) DC.*Endangered**

The thallus of this species, which is more or less circular and attached to the substrate by a single central holdfast on the undersurface, has a smooth, grey, upper surface and a rough, brown-black, lower surface with abundant dark strands. This species is known from a single site in West Sutherland. There is an old record from Co. Wicklow in Ireland. *U. spodochoa* has an oceanic distribution in Europe where it is mainly restricted to lowland coastal regions. In Scotland the small colony grows in seepage tracks on low, acid outcrops, close to a sea loch, within an SSSI. Moorland fires are a potential threat to this species.

Total no. of 10 km x 10 km squares: 1.

1960 onwards: 1.

Usnea madeirensis* Motyka*Vulnerable**

This is a shrubby or hanging yellow-green, fruticose species, whose main branches are often blackened at the base and have ring-like cracks around them. Care is needed to distinguish it from similar species, especially *U. wasmuthii*. In Britain, *U. madeirensis* has been recognised in recent years from only three widely spaced localities, in Cornwall, South Devon and Kintyre. There are also 19th century records from Cornwall and Kent. Elsewhere it is found in south-western Europe and Macaronesia. The recent localities should be visited to assess the size of populations and identify any possible threats. The Cornish site is within an SSSI. The other records are too inexact to determine whether the localities receive statutory protection.

Total no. of 10 km x 10 km squares: 4.

1960 onwards: 3.

Usnea subscabrosa* Nyl. ex Motyka*Vulnerable**

This yellow-green fruticose lichen has a scrambling thallus with conspicuous, shiny, rigid branches that tend to form loose tufts. It bears numerous small, rounded soralia from which short, fragile outgrowths (isidia) often arise. In Britain it is so far known only from St. Agnes in the Isles of Scilly, where it is said to be locally frequent and occurs within an SSSI. Elsewhere it is found in Portugal, Macaronesia and the eastern USA. In the Isles of Scilly, *U. subscabrosa* grows on heather and granitic rocks near the sea.

Total no. of 10 km x 10 km squares: 3.

1960 onwards: 3.

Clerc (1992): description, distribution map.

Vestergrenopsis elaeina* (Wahlenb. ex Ach.) Gyelnik*Vulnerable**

This species forms closely-appressed rosettes of grooved, olive-brown lobes that become coarsely nodulose with age. This recent addition to the British lichen flora is known from the Trotternish ridge on Skye, where it is locally frequent, and from high and low altitudes in Glen Coe. It is otherwise known from Fennoscandia, Iceland, Greenland and arctic North America. In Britain it grows on vertical, mildly basic rocks, such as basalt and andesite, most often on free-draining buttresses. Its sites are within SSSIs.

Total no. of 10 km x 10 km squares: 3.

1960 onwards: 3.

Fryday (1991b): site description.

Glossary

- apothecium, pl. apothecia: disc-shaped (often resembling miniature jam tarts) or elongate spore-producing lichen fruiting body.
- cephalodia: portions of thallus of lichen that normally has a green alga, containing a blue-green alga instead, often forming outgrowths.
- corticolous: growing on bark.
- crustose: crust-like; one of the basic forms of the lichen thallus.
- decorticated: referring to trees where the bark has disappeared.
- epiphytic: growing on other plants.
- foliose: leaf-like, the thalli with a distinct upper and lower surface; one of the basic forms of the lichen thallus.
- fruticose: bushy, tufted or beard-like, with thalli \pm radial or flattened in cross-section; one of the basic forms of the lichen thallus.
- gabbro: a coarsely crystalline igneous rock.
- isidia: small detachable protuberances on the surface of the thallus that act as propagules.
- lignicolous: growing on exposed wood (not bark).
- Lobarion: a community of lichens, usually epiphytic, characterised chiefly by large foliose species of the genera *Lobaria*, *Sticta*, *Peltigera* and *Nephroma*.
- macrolichen: an imprecise term used to distinguish foliose or fruticose species from crustose species.
- oceanic: referring to the damp, mild, western seaboard of Britain and Europe.
- perithecium, pl. perithecia: flask-shaped spore-producing lichen fruiting body, sometimes sunken within the thallus, opening onto the surface by a pore, so usually visible only as a small dot.
- podetia: fruit-bearing stalks arising from the thallus.
- prothallus: thin region that does not contain algal cells, often visible around the edge of a crustose thallus.
- pseudocyphellae: small dot-like areas of the thallus where the surface layer is absent, allowing the pale inner tissue to be seen.
- pycnidia: small dot-like body producing asexual spores.
- saxicolous: growing on rock.
- solifluction: the creep of soil down a slope.
- soralia: structures bearing soredia (small powdery propagules); normally appearing as powdery patches on thallus.
- squamulose: scale-like, composed of scales; one of the basic forms of the lichen thallus.
- suboceanic: referring to distributions that are essentially oceanic but not exclusively so.
- sub-Mediterranean: referring to distributions that are essentially Mediterranean but not exclusively so.
- terricolous: growing on the ground.
- thallus, pl. thalli, adj. thalline: the body of the lichen.

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Appendix A. British Red List lichens arranged under threat categories

Critically Endangered (CR)

IUCN definition: "A taxon is *Critically Endangered* when it is facing an extremely high risk of extinction in the wild in the immediate future", defined (for British lichens) by any of the criteria below:

- A. 80% population decline observed in the last 10 years.
- B. Recently recorded in fewer than ten 1 km x 1 km squares **and** found in only one locality **and** in decline.
- C. Small population (<250 mature individuals) and **either**:
 - C1. large decline (25% in 3 years)
 - or**:
 - C2. either continuing decline and restricted to a single population **or** continuing decline and subpopulations with <50 mature individuals.
- D. Total population <50 mature individuals.

Bactrospora dryina D

Bellemeria alpina B

Bryoria smithii B

Buellia asterella A, C2, D

Calicium adspersum D

Calicium corynellum A, B, D

Caloplaca aractina B

Caloplaca nivalis B, D

Catapyrenium psoroides D

Chaenotheca phaeocephala B

Cladonia botrytes A

Cladonia mediterranea D

Cladonia peziziformis A

Enterographa elaborata D

Gyalidea roseola B, D

Heterodermia isidiophora D

Hypogymnia intestiniformis B, D

Lecanora achariana B, C2

Parmelia robusta D

Peltigera lepidophora B

Pertusaria bryontha D

Porina guaranitica D

Pseudocyphellaria aurata C2

Psora globifera D

Pyrenula dermatodes D

Teloschistes chrysophthalmus B, C2, D

Thelenella modesta B

Endangered (EN)

IUCN definition: "A taxon is *Endangered* when it is not *Critically Endangered* but is facing a very high risk of extinction in the wild in the near future", defined (for British lichens) by any of the criteria below:

- A. 50% population decline observed in the last 10 years.
- B. Recently recorded in five or fewer 10 km x 10 km squares **and** found in two to five localities **and** in decline.
- C. Small population (<2500 mature individuals) and **either**:
 - C1. large decline (20% in 5 years)
 - or**:
 - C2. either continuing decline and restricted to a single population **or** continuing decline and subpopulations with <250 mature individuals.
- D. Total population <250 mature individuals.

Arthonia anglica B, D

Aspicilia melanaspis D

Bacidia vermifera D

Biatorella fossarum C2

Biatoridium monasteriense C2

Caloplaca cinnamomea D

Caloplaca flavorubescens A

Chaenotheca gracilentia D

Chaenotheca laevigata D

Dictyonema interruptum B, C2

Endocarpon adscendens D

Endocarpon pusillum B, D

Gyalecta ulmi C2
Heterodermia leucomelos C2
Heterodermia propagulifera D
Hypocenomyce anthracophila D
Lecidea inops B
Micarea elachista D
Nephroma arcticum D
Opegrapha subelevata D
Peltigera malacea B

Pertusaria melanochlora B
Physcia tribacioides A
Rinodina mniaraea D
Squamarina lentigera B, C2
Staurothele rufa D
Stereocaulon symphycheilum D
Strigula stigmatella D
Toninia rosulata D
Umbilicaria spodochroa D

Vulnerable (VU)

IUCN definition: "A taxon is *Vulnerable* when it is not *Critically Endangered* or *Endangered* but is facing a high risk of extinction in the wild in the medium-term future", defined (for British lichens) by any of the criteria below:

- A. 20% population decline observed in the last 10 years.
- B. Recently recorded in six to twenty 10 km x 10 km squares **and** found in six to ten localities **and** in decline.
- C. Small population (<10,000 mature individuals) and **either**:
 - C1. large decline (10% in 10 years)**or**:
 - C2. either continuing decline and restricted to a single population **or** continuing decline and subpopulations with <1,000 mature individuals.
- D. Total population <1,000 mature individuals (sub-criterion D1) **or** four or fewer localities (sub-criterion D2).

Acarospora rhizobola D2
Acarospora subrufula D2
Alectoria ochroleuca B
Arthothelium macounii D2
Bacidia incompta A
Biatorella hemisphaerica D2
Biatoridium delitescens D1
Bryonora curvescens D2
Bryoria furcellata D1
Bryoria nadvornikiana D2
Buellia insignis D2
Caloplaca luteoalba A, C1
Caloplaca virescens D1
Catapyrenium daedaleum D1
Catapyrenium michelii D2
Catillaria laureri D1
Catillaria modesta D2
Catillaria neuschildii D2
Catillaria subviridis D2
Catolechia wahlenbergii D1
Chaenotheca xyloxena D2
Chromatochlamys larbalestieri D2
Cladonia convoluta B
Cladonia maxima D2
Cladonia stricta D2
Cladonia uncialis ssp. *uncialis* D2
Cliostomum corrugatum B

Collema ceraniscum D1, D2
Collema dichotomum B
Collema fragile B
Collema fragrans A
Collema latzelii D2
Collema parvum D1, D2
Cryptolechia carneolutea A
Degelia ligulata D2
Fulgensia bracteata D2
Graphina pauciloculata D2
Halecania alpivaga D2
Halecania rhypodiza D2
Hypocenomyce xanthococca D2
Ionaspis heteromorpha D2
Ionaspis melanocarpa D2
Japewia tornoënsis D2
Lecanactis amylacea C2
Lecanora atromarginata D2
Lecanora chlorophaeodes D2
Lecanora epibryon D2
Lecanora frustulosa D2
Lecanora strobilina D2
Lecidea antiloga D2
Lecidea erythrophaea B
Lecidea sarcogynoides D2
Lecidella wulfenii D2
Leptogium saturninum C2

<i>Micarea assimilata</i> D2	<i>Psora rubiformis</i> D2
<i>Micarea crassipes</i> D2	<i>Pyrenula coryli</i> D2
<i>Miriacidia garovaglii</i> D2	<i>Pyrenula nitida</i> D2
<i>Pannaria ignobilis</i> D1	<i>Ramalina chondrina</i> D2
<i>Parmelia minarum</i> B	<i>Schadonia fecunda</i> D2
<i>Parmelia quercina</i> A, C1	<i>Schismatomma graphidioides</i> B, D1
<i>Parmelia tinctoria</i> D2	<i>Sclerophora nivea</i> C2, D1
<i>Parmentaria chilensis</i> D2	<i>Solenopsora liparina</i> D2
<i>Peltigera scabrosa</i> D2	<i>Staurothele areolata</i> D2
<i>Peltigera venosa</i> C1	<i>Sticta canariensis</i> s. str.
<i>Pertusaria glomerata</i> D2	(independent thalli) D2
<i>Pertusaria pustulata</i> B	<i>Synalissa symphorea</i> B
<i>Phaeophyscia endococcinea</i> D2	<i>Teloschistes flavicans</i> A
<i>Poeltinula cerebrina</i> B	<i>Toninia coelestina</i> D1, D2
<i>Polyblastia sendtneri</i> D2	<i>Toninia cumulata</i> D2
<i>Polychidium dendriscum</i> D2	<i>Umbilicaria crustulosa</i> D2
<i>Porina sudetica</i> D2	<i>Usnea madeirensis</i> D2
<i>Protoparmelia atriseda</i> D2	<i>Usnea subscabrosa</i> D2
<i>Pseudocyphellaria lacerata</i> D1	<i>Vestergrenopsis elaeina</i> D2

Extinct (EX)

IUCN definition: "A taxon is *Extinct* when there is no reasonable doubt that the last individual has died." Interpreted to include species not seen in the wild in Britain for the last 50 years, despite searches having been made, and not maintained in cultivation.

<i>Arthonia galactites</i>	<i>Cetraria juniperina</i>
<i>Arthothelium spectabile</i>	<i>Cladonia stellaris</i>
<i>Aspicilia tuberculosa</i>	<i>Collema conglomeratum</i>
<i>Bacidia auerswaldii</i>	<i>Lecania coeruleorubella</i>
<i>Bacidia polychroa</i>	<i>Lecania fuscella</i>
<i>Bacidia subturgidula</i>	<i>Lecania olivacella</i>
<i>Biatora cuprea</i>	<i>Lecanora fuscescens</i>
<i>Bryoria implexa</i>	<i>Lecanora populicola</i>
<i>Bryoria nitidula</i>	<i>Leptogium hildenbrandii</i>
<i>Calicium quercinum</i>	<i>Nephroma helveticum</i>
<i>Calicium trabinellum</i>	<i>Nephroma resupinatum</i>
<i>Caloplaca haematites</i>	<i>Pyrenula nitidella</i>
<i>Caloplaca irrubescens</i>	<i>Toninia physaroides</i>
<i>Caloplaca pollinii</i>	<i>Tornabea scutellifera</i>
<i>Catillaria picila</i>	

Appendix B. Threat categories as defined in the original IUCN system

Extinct (Ex)

Taxa that are no longer known to exist in the wild after repeated searches of type localities and other known or likely places.

Endangered (E)

Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included are taxa whose numbers have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.

Vulnerable (V)

Taxa believed likely to move into the Endangered category in the near future if the causal factors continue operating. Included are taxa of which most or all the populations are decreasing because of over-exploitation, extensive destruction of habitat or other environmental disturbance; taxa with populations that have been seriously depleted and whose ultimate security is not yet assured; and taxa with populations that are still abundant but are under threat from serious adverse factors throughout their range.

Rare (R)

Taxa with small world populations that are not at present Endangered or Vulnerable but are at risk. These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range.

Indeterminate (I)

Taxa known to be Extinct, Endangered, Vulnerable or Rare but where there is not enough information to say which of the four categories is appropriate.

Insufficiently Known (K)

Taxa that are suspected but not definitely known to belong to any of the above categories because of the lack of information.

Out of Danger (O)

Taxa formerly included in one of the above categories, but which are now considered relatively secure because effective conservation measures have been taken, or because the previous threat to their survival has been removed.

Not threatened (nt)

Taxa that are not in any of the above categories.

No information (?)

Taxa for which there is no information.

Appendix C. List of *Data Deficient* (DD) lichens in Britain

IUCN definition: "A taxon is *Data Deficient* when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status." Interpreted to include species with insufficient data to categorise but which are thought likely to qualify as *Extinct*, *Critically Endangered*, *Endangered* or *Vulnerable* when they are better known. This category includes many recently discovered taxa and many of the taxa which can be identified only by experts or by using complex techniques. It also includes species that have occurred apparently as 'chance' ephemerals and several species that have not been seen for over 50 years but which cannot be regarded as extinct because insufficient attempts have been made to refind them.

Lichens in the *Data Deficient* category do not currently qualify as Red List species but may move into the Red List when more information becomes available.

In the following list of *Data Deficient* lichens, the status of each species according to the pre-1994 IUCN threat categories is listed in brackets. Numbers refer to total/modern (post-1960) 10 km x 10 km grid square records.

<i>Absconditella sphagnum</i> (K) 1/1	<i>Lecanora cinereofusca</i> (K) 2/2
<i>Acarospora chlorophana</i> (K) 1/1	<i>Lecidea commaculans</i> (K) 4/3
<i>Acrocordia cavata</i> (E) 2/2	<i>Lecidea exigua</i> (K) 1/1
<i>Aphanopsis coenosa</i> (K) 1/1	<i>Lecidea mucosa</i> (K) 1/0
<i>Arctomia delicatula</i> (K) 4/4	<i>Lecidea paraclitica</i> (K) 2/0
<i>Arthonia myriocarpella</i> (K) 1/0	<i>Lecidea promixta</i> (<i>L. pernigra</i>) (K) 4/4
<i>Aspicilia recedens</i> (K) 5/2	<i>Lecidella pulveracea</i> (K) 6/0
<i>Bacidia assulata</i> (K) 5/3	<i>Lecidella viridans</i> (K) 3/0
<i>Belonia calcicola</i> (K) 2/1	<i>Leptogium byssinum</i> (K) 1/1
<i>Biatora tetramera</i> (K) 5/3	<i>Leptogium coralloideum</i> (K) 1/0
<i>Buellia abstracta</i> (K) 1/1	<i>Melaspilea amota</i> (K) 3/3
<i>Buellia papillata</i> (K) 1/1	<i>Melaspilea interjecta</i> (K) 5/2
<i>Byssoloma leucoblepharum</i> (K) 3/3	<i>Mniacea nivea</i> (K) 1/1
<i>Calicium diploellum</i> (K) 1/1	<i>Opegrapha viridis</i> (K) ??/?
<i>Caloplaca atroflava</i> (K) 9/5	<i>Parmelia protomatrae</i> (K) 2/2
<i>Caloplaca concilians</i> (K) 5/4	<i>Parmelia subargentifera</i> (K) 1/1
<i>Caloplaca crenulatella</i> (K) 1/0	<i>Parmelia submontana</i> (K) 3/3
<i>Caloplaca granulosa</i> (K) 4/4	<i>Peltigera ponojensis</i> (K) 3/3
<i>Catapyrenium boccanum</i> (K) 1/1	<i>Pertusaria flavocorallina</i> (K) 2/2
<i>Catapyrenium waltheri</i> (K) 1/1	<i>Pertusaria geminipara</i> (K) 4/4
<i>Catillaria minuta</i> (K) 2/1	<i>Pertusaria lactescens</i> (K) 3/1
<i>Cladonia deformis</i> (K) ??/?	<i>Placidiopsis pseudocinerea</i> (K) 1/1
<i>Cladonia metacorallifera</i> (K) 1/1	<i>Placynthium lismorensense</i> (K) 3/3
<i>Cladonia norvegica</i> (K) 1/1	<i>Placynthium pluriseptatum</i> (K) 4/4
<i>Cladonia pleurota</i> (K) ??/?	<i>Polyblastia gothica</i> (K) 3/2
<i>Collema callopismum</i> (K) 3/3	<i>Polyblastia helvetica</i> (K) 2/2
<i>Collema subnigrescens</i> (K) ??/?	<i>Polyblastia quartzina</i> (K) 2/2
<i>Dermatocarpon arnoldianum</i> (K) 1/1	<i>Polyblastia verrucosa</i> (K) 3/3
<i>Dermatocarpon leptophyllum</i> (K) ??/?	<i>Polysporina cyclocarpa</i> (K) 4/4
<i>Dermatocarpon rivulorum</i> (K) 1/1	<i>Porina grandis</i> (K) 4/4
<i>Fuscidea mollis</i> (K) 7/6	<i>Porocyphus rehmicus</i> (K) 2/2
<i>Gyalidea diaphana</i> (K) 5/5	<i>Pterygiopsis coracodiza</i> (K) 1/1
<i>Gyalidea lecideopsis</i> (K) 4/4	<i>Pyrenopsis furfurea</i> (K) 1/1
<i>Hypocenomyce leucococca</i> (K) 1/1	<i>Rhizocarpon caeruleoalbum</i> (K) 1/1
<i>Hypocenomyce sorophora</i> (K) 2/2	<i>Rhizocarpon chioneum</i> (K) 2/2

Rhizocarpon inarense (K) 1/1
Rhizocarpon intermediellum (K) 2/2
Rhizocarpon plicatile (K) 3/1
Rhizocarpon postumum (K) 1/1
Rhizocarpon simillimum (K) 1/1
Rimularia fuscocolorata (K) 1/1
Rimularia sphacelata (K) 1/1
Rinodina colobina (K) 4/3
Rinodina colobinoides (K) 1/1
Rinodina parasitica (K) 1/1
Rinodina pyrinea (K) 4/4
Schaereria corticola (K) 1/1
Staurothele arctica (K) 1/1

Staurothele guestphalica (K) 3/3
Stereocaulon glareosum (K) 6/4
Stereocaulon tomentosum (K) 9/0
Strangospora deplanata (K) 1/1
Toninia opuntioides (K) 2/2
Toninia tumidula (K) ??/?
Trapeliopsis aeneofusca (K) 1/1
Trapeliopsis viridescens (K) 4/1
Trimmatothele perquisita (K) 1/1
Umbilicaria nylanderiana (K) 2/2
Usnea chaetophora (K) 10/4
Usnea glabrata (K) ??/?
Verrucaria xyloxena (K) 4/4

Appendix D. Lower Risk sub-categories and list of Near Threatened lichens in Britain

Definitions of the Lower Risk sub-categories

IUCN definition of *Lower Risk*: "A taxon is *Lower Risk* when it has been evaluated and does not satisfy the criteria for any of the categories *Critically Endangered*, *Endangered* or *Vulnerable*."

The *Lower Risk* category, as applied in Britain, is separated into four sub-categories, *Conservation Dependent* (cd), *Near Threatened* (nt), *Nationally Scarce* (ns) and *Least Concern* (lc), of which only the second is relevant to this Red Data Book.

IUCN definition of *Least Concern*: "Taxa (in the *Lower Risk* category) which do not qualify for *Conservation Dependent* or *Near Threatened*". This category includes the majority of the British lichen flora.

IUCN definition of *Conservation Dependent*: "Taxa which are the focus of a continuing taxon-specific or habitat-specific conservation programme targeted towards the taxon in question, the cessation of which would result in the taxon qualifying for one of the threatened categories above within a period of five years." No lichens currently fall into this sub-category.

The *Nationally Scarce* category is a non-IUCN category used in Britain to include those species recorded recently (post-1960) in 16-100 10 km x 10 km squares.

IUCN definition of *Near Threatened*: "Taxa which do not qualify for *Conservation Dependent*, but which are close to qualifying for *Vulnerable*." This is interpreted to include species which occur in 15 or fewer 10 km x 10 km squares but do not qualify for higher categories.

Lichens in the *Lower Risk* sub-categories do not currently qualify as Red List species but in time a number may move into the Red List.

In the following list of *Near Threatened* lichens, the status of each species according to the pre-1994 IUCN threat categories is in brackets. Numbers refer to total/modern (post-1960) 10 km x 10 km grid square records.

Acarospora badiofusca (R) 5/4
Acarospora macrospora (R) 23/10
Anaptychia ciliaris ssp. *mamillata* (R) 15/12
Arthonia astroidestra (R) 9/9
Arthonia zwackhii (R) 10/9
Arthopyrenia subcerasi (K) 5/5
Arthothelium dictyosporum (R) 7/7
Bacidia subincompta (R) 16/16*
Blarneya hibernica (R) 5/5
Brigantiaea fuscolutea (R) 16/12
Buellia saxorum (R) 10/9
Calicium parvum (R) 5/5
Caloplaca approximata (R) 6/6
Caloplaca herbidella (R) 14/14
Caloplaca lucifuga (R) 7/7
Catillaria aphana (K) 5/5

Catillaria globulosa (R) 18/15
Cetraria delisei (R) 9/9
Cetraria pinastri (R) 21/11
Chaenothecopsis pusiola (R) 7/7
Chiodecton myrticola (R) 7/6
Cladonia cenotea (R) 15/10
Cladonia mitis (K) 8/7
Cladonia phyllophora (K) 8/5
Collema bachmanianum (R) 14/12
Cyphelium notarisii (R) 22/13
Cyphelium tigillare (R) 9/9
Dirina massiliensis (R) 8/6
Enterographa soreliata (R) 7/7
Fulgensia fulgens (V) 19/14
Graphis alboscripta (R) 6/6
Gyalecta foveolaris (R) 14/10
Gyalidea fritzei (R) 7/7
Gyalidea subscutellaris (R) 5/5
Gyalideopsis scotica (R) 8/8
Hypogymnia farinacea (*H. bitteriana*) (R) 6/6

* Retained in list as populations are very small and certain to have disappeared from some localities because of loss of elms.

Lecanactis hemisphaerica (V) 15/15
Lecania chlorotiza (R) 17/14
Lecanora atrosulphurea (R) 6/6
Lecanora straminea (R) 12/12
Lecidea botryosa (R) 10/10
Lecidella bullata (R) 10/7
Lemmopsis arnoldiana (K) 13/6
Lempholemma cladodes (K) 8/8
Lempholemma intricatum (R) 7/6
Lempholemma radiatum (R) 11/11
Leptogium cochleatum (R) 7/5
Leptogium corniculatum (R) 34/17
Leptogium diffractum (R) 12/10
Leptogium hibernicum (R) 7/6
Leptogium massiliense (R) 7/6
Lopadium pezizoideum (R) 6/5
Nephroma tangeriense (R) 6/6
Opegrapha paraxanthodes (R) 9/7
Pachyphiale fagicola (R) 7/7
Pannaria hookeri (R) 15/15
Pannaria praetermissa (R) 7/7
Peltigera elisabethae (R) 6/6
Pertusaria gallica (R) 8/8
Pertusaria velata (R) 28/15
Phaeophyscia endophoenicea (R) 4/4
Placynthium asperellum (K) 9/8
Polyblastia efflorescens (K) 5/5
Polyblastia terrestris (R) 8/8

Porina mammosa (R) 10/9
Porocyphus kenmorensis (R) 8/7
Protoparmelia oleagina (K) 9/8
Protoparmelia picea (R) 8/7
Protothelenella sphinctrinoides (R) 10/10
Ptychographa flexella (R) 10/10
Ramalina polymorpha (R) 19/15
Ramonia nigra (R) 5/5
Rinodina aspersa (R) 11/8
Rinodina interpolata (R) 10/8
Rocella fuciformis (R) 32/26 (a number of
 these records are likely to be erroneous)
Sagiolechia protuberans (R) 8/8
Sagiolechia rhexoblephara (R) 6/5
Siphula ceratites (R) 5/5
Solorina bispora (R) 11/11
Staurothele bacilligera (K) 15/6
Staurothele rugulosa (K) 7/7
Stereocaulon alpinum (R) 10/6
Stereocaulon spathuliferum (R) 5/5
Strangospora microhaema (R) 8/8
Thelidium fumidum (R) 10/9
Thelopsis melathelia (R) 10/10
Toninia squalida (R) 8/6
Umbilicaria hirsuta (R) 5/5
Wadeana minuta (R) 14/14
Zamenhofia hibernica (R) 11/11
Zamenhofia rosei (R) 9/9

Appendix E. Lichens listed on Schedule 8 of the Wildlife and Countryside Act 1981

<i>Bryoria furcellata</i>	Forked hair-lichen
<i>Buellia asterella</i>	Starry breck-lichen
<i>Caloplaca luteoalba</i>	Orange-fruited elm-lichen
<i>Caloplaca nivalis</i>	Snow caloplaca
<i>Catapyrenium psoromoides</i>	Tree catapyrenium
<i>Catillaria laureri</i>	Laurer's catillaria
<i>Cladonia stricta</i>	Upright mountain cladonia
<i>Collema dichotomum</i>	River jelly-lichen
<i>Gyalecta ulmi</i>	Elm gyalecta
<i>Heterodermia leucomelos</i>	Ciliate strap-lichen
<i>Heterodermia propagulifera</i>	Coralloid rosette-lichen
<i>Lecanactis hemisphaerica</i>	Churchyard lecanactis
<i>Lecanora achariana</i>	Tarn lecanora
<i>Lecidea inops</i>	Copper lecidea
<i>Nephroma arcticum</i>	Arctic kidney-lichen
<i>Pannaria ignobilis</i>	Caledonian pannaria
<i>Parmelia minorum</i>	New Forest parmelia
<i>Parmentaria chilensis</i>	Oil-stain parmentaria
<i>Peltigera lepidophora</i>	Ear-lobed dog-lichen
<i>Pertusaria bryontha</i>	Alpine moss pertusaria
<i>Physcia tribacioides</i>	Southern grey physcia
<i>Pseudocyphellaria lacerata</i>	Ragged pseudocyphellaria
<i>Psora rubiformis</i>	Rusty alpine psora
<i>Solenopsora liparina</i>	Serpentine solenopsora
<i>Squamarina lentigera</i>	Scaly breck-lichen
<i>Teloschistes flavicans</i>	Golden hair-lichen

Appendix F. List of British macrolichens considered threatened in the European Community as a whole and listed on the preliminary EC Red List (Sérusiaux 1989); those not threatened in Britain are indicated

<i>Bryoria furcellata</i>		<i>Stereocaulon spathuliferum</i>	not threatened
<i>Bryoria lanestrus</i>	not threatened	<i>Stereocaulon symphycheilum</i>	
<i>Bryoria implexa</i>		<i>Sticta fuliginosa</i>	not threatened
<i>Bryoria nitidula</i>		<i>Sticta limbata</i>	not threatened
<i>Bryoria smithii</i>		<i>Sticta sylvatica</i>	not threatened
<i>Catapyrenium psoromoides</i>		<i>Teloschistes chrysophthalmus</i>	
<i>Cavernularia hultenii</i>	not threatened	<i>Teloschistes flavicans</i>	
<i>Cetraria delisei</i>	not threatened	<i>Usnea wirthii</i>	not threatened
<i>Cetraria sepincola</i>	not threatened		
<i>Cladonia azorica</i>	not threatened		
<i>Cladonia fragilissima</i>	not threatened		
<i>Cladonia luteoalba</i>	not threatened		
<i>Cladonia maxima</i>			
<i>Cladonia norvegica</i>			
<i>Collema bachmanianum</i>	not threatened		
<i>Collema ceraniscum</i>			
<i>Collema dichotomum</i>			
<i>Collema glebulentum</i>	not threatened		
<i>Dictyonema interruptum</i>			
<i>Leptogium burgessii</i>	not threatened		
<i>Leptogium cochleatum</i>	not threatened		
<i>Leptogium coralloideum</i>			
<i>Leptogium hibernicum</i>	not threatened		
<i>Lobaria amplissima</i>	not threatened		
<i>Lobaria scrobiculata</i>	not threatened		
<i>Lobaria virens</i>	not threatened		
<i>Nephroma arcticum</i>			
<i>Nephroma helveticum</i>			
<i>Pannaria hookeri</i>	not threatened		
<i>Pannaria praetermissa</i>	not threatened		
<i>Pannaria sampaiana</i>	not threatened		
<i>Parmelia arnoldii</i>	not threatened		
<i>Parmelia endochlora</i>	not threatened		
<i>Parmelia sinuosa</i>	not threatened		
<i>Parmelia taylorensis</i>	not threatened		
<i>Parmeliella atlantica</i>	not threatened		
<i>Parmeliella jamesii</i>	not threatened		
<i>Parmeliella testacea</i>	not threatened		
<i>Peltigera britannica</i>	not threatened		
<i>Pilophorus strumaticus</i>	not threatened		
<i>Platismatia norvegica</i>	not threatened		
<i>Pseudocyphellaria crocata</i>	not threatened		
<i>Pseudocyphellaria intricata</i>	not threatened		
<i>Pseudocyphellaria lacerata</i>			
<i>Pseudocyphellaria norvegica</i>	not threatened		
<i>Ramalina chondrina</i>			
<i>Ramalina portuensis</i>	not threatened		
<i>Stereocaulon delisei</i>	not threatened		
<i>Stereocaulon glareosum</i>			