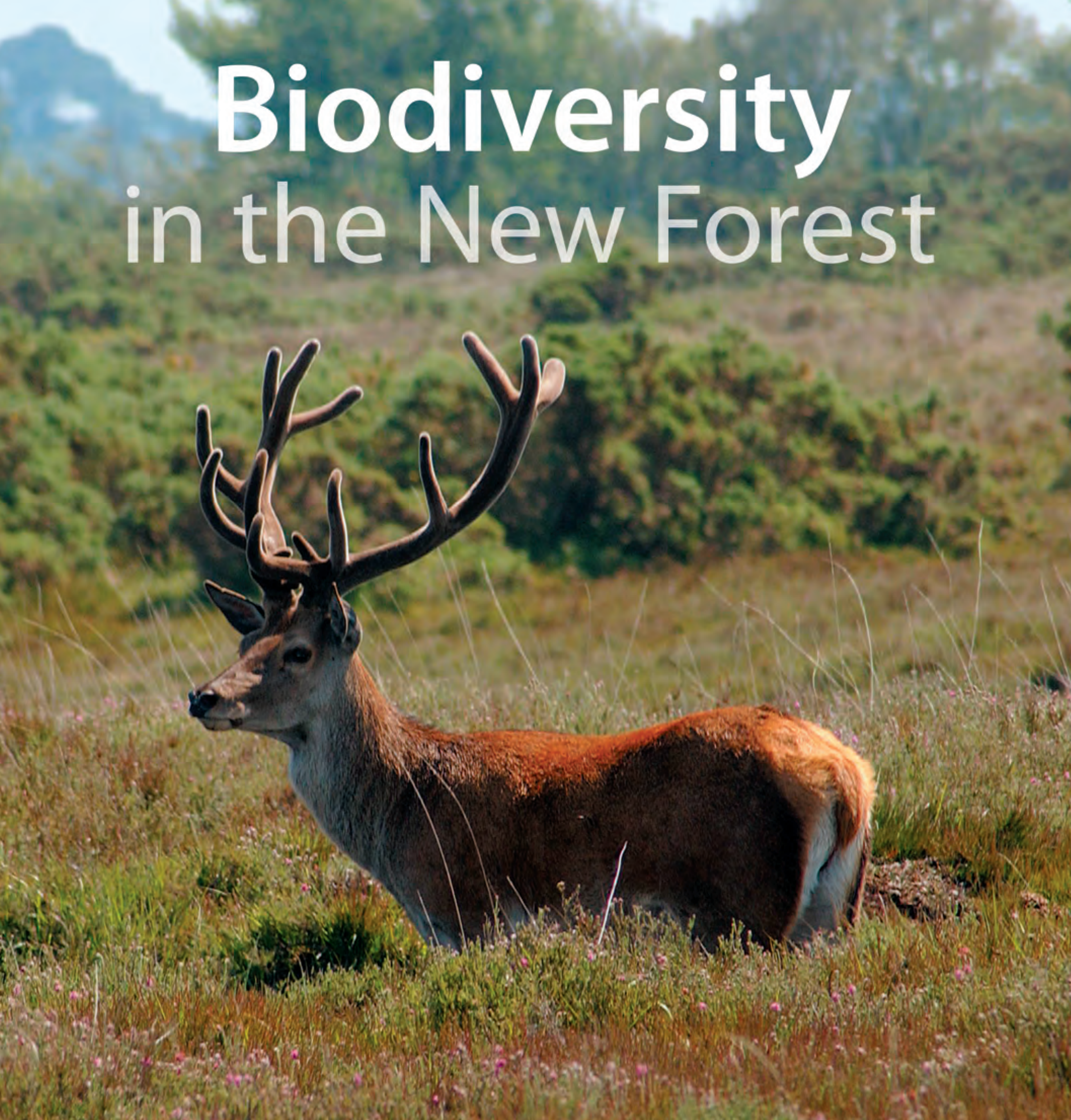

Biodiversity in the New Forest

Edited by Adrian C. Newton

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piscespublications

Newbury, Berkshire

Dedicated to the memory of
Muriel Eliza Newton (1929–2009),
who loved the New Forest,
especially the donkeys.

First published 2010.

British-Library-in-Publication Data
A catalogue record for this book is available from the British Library.

ISBN 978-1-874357-42-1

Designed and published for Bournemouth University by Pisces Publications

Pisces Publications is the imprint of NatureBureau, 36 Kingfisher Court, Hambridge Road, Newbury, Berkshire RG14 5SJ
www.naturebureau.co.uk

Printed by Information Press, Oxford

Cover photographs
Front cover: Red deer *Cervus elaphus* (Isobel Cameron / Forest Life picture library, Forestry Commission); noble chafer *Gnorimus nobilis* (Matt Smith); Dartford warbler *Sylvia undata* (David Kjaer); wild gladiolus *Gladiolus illyricus* (Adrian Newton)
Back cover: Wood Crates (Adrian Newton)

The maps in this book are for illustrative purposes only, and do not represent the legal definition of National Park boundaries or any other feature

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9 Lichens

Neil A. Sanderson

This chapter is decicated to the memory of Dr Francis Rose, who loved these woods and their lichens, and without whom this work would not have been possible.

Introduction

The New Forest is famed as one the foremost sites for lichens in Europe. The most prominent lichen-rich habitats are found within the old growth pasture woodlands on open Forest common lands, locally known as the "Ancient and Ornamental Woods". They are described by Rose (1992a) as having, in lowland temperate Europe, the "largest epiphytic lichen flora known from any comparable area" and were assessed by Fletcher *et al*. (1982) as being the best example in Europe of a lichen-rich pasture woodland in a moderately oceanic climate. Rose (1992a) has argued that the epiphytic flora of the New Forest is likely to be closer to that of the original 'wildwood' than both the floras of more disturbed woodlands and those of less heavily grazed non-intervention woods. As such, the woods are not just important for biodiversity conservation, but as a possible model for wildwood epiphytic lichen ecology.

This chapter concentrates on reviewing the survey and research carried out on the internationally important epiphytic lichen floras. The progress in the survey of the lichen flora of the woods is described. The conservation value of the Forest, individual woods and habitats are also assessed, and the landscape ecology of the lichen recolonisation response to gross disturbance is described with reference to chronosequences. This latter work has important implications on the timescale and practicality of habitat restoration for lichen-rich old-growth woodland. The ecology of the lichen communities in relation to woodland structure, history, grazing and holly invasion is explored, and the implications for conserving the lichen floras are examined. The current state of knowledge on the impact of air pollution and of recreation are also briefly described.

Other lichen-rich habitats are less well known but are described for completeness. The heathlands are far less rich in terms of overall numbers of species than the old-growth woodlands, but have been assessed as the best example in Europe of lichen-rich heath of the heather *Calluna vulgaris* – dwarf gorse *Ulex minor* type (Fletcher *et al.* 1984). The lichen flora and impacts of management are described. Other habitats of interest for lichens within the National Park are also covered as far as current knowledge allows. These included woodland streams, coastal habitats, churchyards and young-growth woodlands.

Epiphytic lichen survey

Review of survey history

Lichenologists have recorded lichens from the New Forest since the 19th century, but with a long hiatus in the early 20th century. In the 19th century important collections were made by pioneer lichenologists especially Sir J. Lyell, who collected extensively between 1808 and 1818, and Rev. J. M. Crombie, who was responsible for the discovery of many of the rarer species in the area during the second half of the 19th century (Rose and James 1974).

Modern recording of the lichen flora of the New Forest started in 1967 led by Dr F. Rose (Rose and James 1974). Since 1967 a large mass of site-based records have been made for the New Forest woods, along with more generalised recording of the heathlands. A summary of the progress since 1974 in compiling a database and on research in the lichen ecology was made by Sanderson (1998) and heathland lichen ecology was summarised by Sanderson (1996a). Since then, further work has been carried out, and this chapter summarises the situation at present.

Between 1967 and 1974 Rose and James (1974) recorded 256 taxa from 40 woods on recording cards maintained by Dr Francis Rose. This survey was continued by Dr Rose, with 312 taxa recorded by 1992 (Rose 1992a). In the 1990s the recording card based system was converted into a computer database maintained by the author (Sanderson 1998) and called the New Forest Epiphytic Lichen Database. This is now held on a File Maker Pro database on an Apple Mac computer and holds records from 109 woods from which 12,164 individual records have been made of 430 taxa. The database is not a conventional biodiversity recording database, as it is based on site recording cards, not individual records; i.e. there is only one entry for one taxon per wood, even if the taxon has been recorded more than once. This is because the database was primarily intended to easily elucidate site factors in the conservation interest and ecology of the New Forest epiphytic lichen flora. Conventional species based records are sent on to the British Lichen Society databases, from where they will eventually be made available to the NBN.

Sites in database

A key feature of the database is strict definition of the sites recorded by land use history. There is a careful separation between little-managed woods on the Open Forest and areas modified by either 18th century or 19th century silvicultural practices (Sanderson 1998). The defined areas are intended to cover no more than 100 ha (1 km^2) of woodland. The 109 sites on the database are listed in Appendix 2. The coverage is based on the core of the woodland of the Open Forest along with adjacent sites such as parklands with frequent old trees, and more disturbed woodlands within statutory Inclosures (areas of common land enclosed under the New Forest Acts for the sole purpose of growing timber). Also included within the database are three woods in the Langley Wood area, a separate smaller group of woodlands, which lie beyond the New Forest core but are included as they are within the New Forest SAC and the National Park. The database is intended to cover all old-growth stands (little-disturbed native woodlands with a stand age of over 200 years; Alexander *et al*. 2002) within the core woodlands (Figure 51) and a selection of more disturbed stands.

Three stand age categories are distinguished for sites on the database:

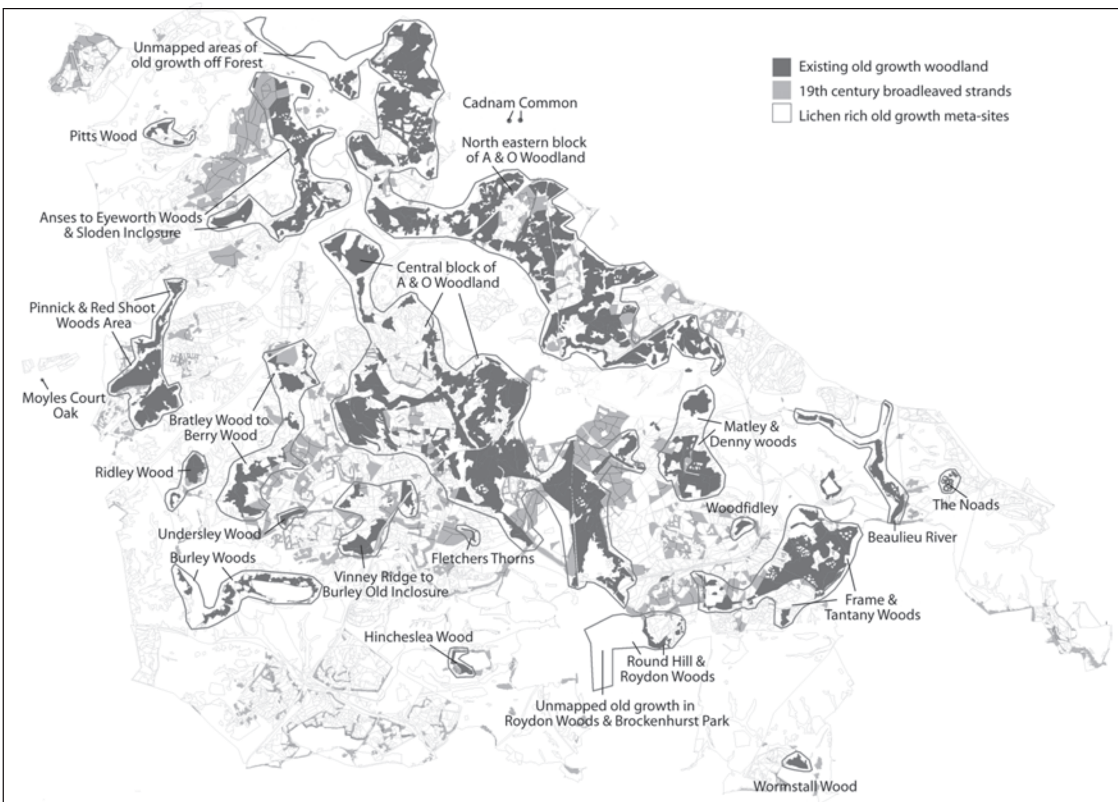
- *Ancient old-growth*: little-disturbed Ancient and Ornamental Woods or Parklands with abundant veteran trees, with no significant break in the continuity of old trees during the last 300 years. These include the typical pasture woodlands of the Open Forest and all known sites are included. Seventy sites on database.
- *Recent old-growth*: mainly covers woodlands that were clear-felled in the 18th century but since started reverting to little-disturbed woodlands with a stand age of between 200–300 years old. Classic examples are the 18th century statutory Inclosures now open to forest grazing such as Ocknell Inclosure, which have became structurally almost indistinguishable from the undisturbed Ancient and Ornamental Woods. All such sites are included. Also included are some rather disturbed woods that still have a few veteran trees, which may be older than 300 years old. Fifteen sites on database.
- *Young-growth*: sites clear-felled in the 19th century, with dominant stand ages of between 100 to 200 years old. This mainly includes a sample of 19th century oak plantations within the statutory Inclosures. Twenty-four sites on database.

The 85 old-growth sites are clustered in 17 separate meta-sites (Figure 51).

Species recorded on database

All epiphytic (growing on trees) lichen and related fungi recorded from the defined sites have been entered into the database. A few young-growth sites have only been surveyed for species of interest but all other sites have been the focus of full surveys. Species growing on the soil of windblown root plates are included but terricolous unconnected with trees are not.

Figure 51
Distribution of old-growth stands in the New Forest showing meta-sites, including sites within the New Forest Epiphytic Lichen Database. Adapted from Sanderson (2007a).



Lichens and related fungi are defined as whatever lichenologists can identify, and include classic lichens (fungi with symbiotic algae), some non-lichenised species that grow with, and resemble lichens and fungal parasites of lichens (lichenicolous fungi). In addition epiphytic fungi not normally recorded by lichenologists, but identified on passing, are added to the database, so the records are not lost. Since 1967 a total of 430 taxa have been added to the database, of which 11 are of epiphytic fungi not normally recorded by lichenologists. Of the remaining 419 taxa, 370 are lichens, 20 ecologically or taxonomically related fungi growing in lichen communities and 29 are parasitic fungi of lichens.

Species conservation status

In the database, data attached to the species records include Red Data Book (RDB) status, rarity (Nationally Rare (NR) and Nationally Scarce (NS)) and International Responsibility (IR) species status (Woods and Coppins 2003). Also indicated are those lichens that are used as old-growth woodland indicator lichens in the New Index of Ecological Continuity (NIEC) (Rose 1992a, Coppins and Coppins 2002). This index reflects high conservation quality in epiphytic lichen floras. High scores of over 20 or more species characteristic of undisturbed old-growth woodlands of nationally significance (Hodgetts 1992) and exceptional sites of international importance can be expected to score over 30 (the maximum score is 70). Also added were custom-made indices of species associated with ancient oaks, old beech stands and clean air.

Appendix 1 lists all species recorded with a national conservation status (RDB, NR, NS and IR). For convenience all NR, NS or IR species not listed in the RDB are referred to as Notable (Nb) species in this paper. Also listed in Appendix 1 are the NIEC indicator species that are not RDB or Notable species. The new Priority Biodiversity Action Plan (BAP) species (Biodiversity Reporting and Information Group 2007) are also given in Appendix 1.

Survey effort

The bulk of the survey effort that has produced this database has been carried out on a voluntary basis. This survey work was carried out by Francis Rose, Neil Sanderson and many other members of the British Lichen Society. As new species are constantly being described, no site can ever be completely surveyed, and an informal rota of revisits is made to all the old-growth sites. In addition to voluntary survey, the Hampshire Wildlife Trust funded a project to organise and report of the results of the database (Sanderson 1998).

Some funded site surveys have been also carried out on the sites covered by the New Forest Epiphytic Lichen Database:

- A lichen survey of Langley Wood NNR, Wiltshire for English Nature (Sanderson 1994c).
- A lichen survey of Brockenhurst Park for the Countryside Commission Sanderson *et al*. (1994).
- A survey of epiphytic lichens in surviving and developing old-growth stands and a sample of 19th century oak plantations within the New Forest Inclosures for Hampshire Wildlife Trust (Sanderson 1996b).
- Lichen surveys of several woods in or near Forest campsites as part of the preparation for a planning application for Terrence O'Rourke (Edwards 2001).
- A survey of epiphytic lichens of Whiteparish Common for English Nature (Sanderson 2003a).
- A survey of epiphytic lichens at Round Hill, close to Round Hill Campsite as part of the preparation for a planning application for Terrence O'Rourke (Sanderson 2003b).
- A survey of epiphytic lichens at Hollands Wood Campsite as part of the preparation for a planning application for Terrence O'Rourke (Sanderson 2004b).
- A survey of epiphytic lichens of Loosehanger Copse for English Nature (Sanderson 2004a).

Epiphytic lichen monitoring

Several monitoring schemes have been carried out on lichens within the Forest. In the 1980s, several small fixed quadrats were located over *Lobaria* species as part of a national project to monitor the effect of acid rain on lichens (Looney and James 1990). There has been no re-monitoring since then. Similar small fixed quadrats were located on some trees in Langley Wood NNR (Sanderson 1994c), for reserve monitoring purposes, but have never been re-examined. Monitoring with small fixed quadrats has proved problematic; losses from quadrats often appear the result of natural dynamics and colonisation is not measured, so the information derived does not give a comprehensive picture of population dynamics.

Other monitoring has tried to be more extensive but less detailed so that an indication of population dynamics can be gained. Single species monitoring has occurred for the Schedule 8 species *Megalaria laureri* (*Catillaria laureri*) and *Parmelinopsis minarum* (*Parmelia minarum*) in 1994, with re-monitoring in 1999 (Sanderson 1994a, 1994b and 1999), which recorded all known trees, and photographed parts of each colony. Species dossiers, consisting of all known data plus field surveys, compiled for the BAP species *Bacidia incompta* (Edwards 2002) and *Enterographa sorediata* (Sanderson 2002) provide baseline data for possible future monitoring of these species.

Detailed baseline monitoring plots covering all species of interest have also been set up in several areas of the Forest. In 1996 Cox and Rose (1996) recorded epiphytic lichens within plots in some areas of New Forest woodland heavily used for recreation, including Hollands Wood campsite. In 1997 within South Bentley Inclosure, in a recent old-growth stand of oak sown in 1700, all trees with species of interest were tagged and the lichen species of conservation interest recorded (Sanderson 1997a).

In 2000 five fixed plots of about 15 ha were set up and randomly sampled to produce data on the numbers of trees occupied per ha by lichen species of conservation interest (Sanderson 2001). The baseline plots were made in three 19th century oak plantations, two intended to be left to develop into pasture woodland, one which is to remain managed for timber production. Two others were made in Ancient and Ornamental woods, both ancient old-growth stands. One has remained densely wooded for centuries, while the second had been opened up by selective felling in the 18th century but had subsequently largely infilled in the 19th century.

Research on conservation, ecology and management of lichens

In addition to simple survey and baseline data, several reports and papers have described the conservation value of the New Forest epiphytic lichen flora and drawn conclusions on the ecology and management requirements of this flora. These include Rose (1993), Rose and James (1974), Sanderson (1991, 1994a, 1994b, 1994c, 1996b, 1997a, 1997b, 1998, 1999, 2001, 2002, 2007a, 2007b and in prep). More general papers on pasture woodland management have also drawn heavily on research results and observations resulting the ongoing survey of the New Forest epiphytic lichen flora (Chatters and Sanderson 1994, Sanderson 1996c, Sanderson and Wolseley 2001). The results of this work are summarised below.

Conservation value

Flora

Since 1967 a total of 421 taxa have been added to the New Forest Epiphytic Database, of which two species *Caloplaca flavorubescens* (EN) and *Lecania chlorotiza* (NT) have only been recorded from the Langley Wood area north of the New Forest woods and not from the core woods of the New Forest. The total has increased from 256 taxa in 1974 (Rose and James 1974), 312 taxa in 1992 (Rose 1992a) and 345 taxa in 1998 (Sanderson 1998). The species added since 1974 have included species not seen since the 19th century in the New Forest or Britain e.g. *Arthonia zwackhii*, *Bacidia subturgidula* and *Enterographa elaborata*, new species to Britain e.g. *Calicium hyperelloides* or new to science e.g. *Enterographa sorediata* and *Ramonia nigra*.

Numbers of taxa recorded from individual sites range from over 200 in the richest pasture woodlands in areas of about 1 km^2, with a maximum of 254 from Mark Ash Wood, to less than 100 from disturbed or small sites. Twenty-one other woods have species densities of higher than 150 species km^{-2} and the flora is variably rich throughout the pasture woodlands. The richest woods in the New Forest are among the richest woods in Europe for epiphytic lichens. No woods in the lowlands of continental western Europe approach this diversity and woods with over 150 species km^{-2} are virtually unknown elsewhere (Rose 1988, 1990, 1992a).

The flora of the New Forest is noted for numerous species that have a significant proportion of their known populations in Britain or Europe. These are listed in Appendix 1. Some Red Data Book species such as *Agonimia octospora*, *Pertusaria velata* and *Porina hibernica* are locally frequent within the Forest but very rare beyond. Others such as *Ramonia nigra* and *Bacidia subturgidula* are rare within the Forest but are very rare beyond. *Bacidia subturgidula* is an extreme example, only four records have ever been made; it was collected twice in the 19th century and is currently known from dry lignum on two hollies at Queen's Bower and Mark Ash Wood.

Biogeography

The lichen flora of the New Forest is essentially southern oceanic and there are few continental species. Many oceanic species reach their eastern limits in the Forest, however it lacks species of hyperoceanic woodland. Many of the latter are large leafy species, which are commoner in the west of Britain, but the flora of crust-forming lichens includes numerous southern oceanic and veteran tree specialist species that are less frequent in the west. In the west competition from mosses is more severe, reducing the diversity of niches available to crust-forming species.

Rare species

The epiphytic lichen flora of the New Forest is of outstanding international importance. The recent publication of a full conservation evaluation of lichens (Wood and Coppins 2003) now allows the rare and threatened species recorded from the Forest since 1967 to be listed (Appendix 1). This assessment excluded less well-known genera of parasitic fungi of lichens.

A total of 64 Red Data Book (RDB) species have been recorded from the main New Forest woodlands since 1967. These are broken down by threat categories below (Table 19).

Many of the Near Threatened species are only accorded this status as they have strong populations within the New Forest. Without these populations they would have been classified as threatened. Two additional RDB species have been recorded from the separate woodland complex at Langley Woods.

In addition, simple definitions of geographic rarity are covered by the National Rare and National Scarce categories, with 34 and 89 species recorded respectively (two additional National Scarce have only been

Table 19
Red Data Book lichen species recorded from the New Forest Woodlands.

Red Data Book category	Number of species
Critically Endangered	3
Endangered	3
Vulnerable	11
Near Threatened	39
Data Deficient	7

recorded from the Langley Wood area). Finally a category of International Responsibility was introduced by Wood and Coppins (2003) for species thought to have 10% or more of their European or World population in Britain. A total of 55 of these species have been recorded with the New Forest woods, with one more recorded from Langley Wood. These totals are among the highest recorded from any woodland complex in Britain, including the richest woods in the west of Scotland.

As well as all the RDB species, the Nationally Rare, Nationally Scarce and International Responsibility species include 78 species of conservation interest, which are not included within the RDB (Notable species). The new list of BAP species includes 30 New Forest lichen species (Biodiversity Reporting and Information Group 2007).

New Index of Ecological Continuity

The NIEC index of old growth woodland indicator lichens (Rose 1992a, Coppins and Coppins 2002) is intended to reflect habitat quality associated with old-growth conditions within ancient woodland. This is a separate concept from vascular plant ancient woodland indicators, which are species associated with continuity of woodland sites, rather than continuity of old trees. A site of national (SSSI) quality for woodland lichens would be expected to score at least 20 on the index (Hodgetts 1992). Since 1967 the whole New Forest complex has had 67 species on the index recorded and scores 61. Within the New Forest woods, the New Forest Epiphytic Lichen Database includes 67 individual woods scoring over 20 in the index (Appendix 2). The highest score currently, is for Frame Wood, scoring 50, with Busketts Wood 48, Bramshaw Wood 48, Mark Ash Wood 47 and Hollands Wood 47 close behind. These are woods are among the most important individual woods in lowland Europe for epiphytic lichens. The break down of numbers of woods by NIEC score above 20 is given on Table 20.

The total of 48 woods scoring 30 or more in the NIEC indicator list is likely to represent more than half of such woods in England. In Appendix 2, the woods on the New Forest Epiphytic Lichen Database are listed in order of their NIEC index scores added to the number of non-index bonus species (i.e. all other species of conservation interest).

Forest-level trends and extinctions

The richness of the New Forest epiphytic lichen flora, and the extent of lichen rich habitat, means that detailed monitoring is not easy; after 40 years investigation of the lichen flora is still at the exploration stage. The majority of uncommon species appear to be holding their own. A few species, however, are clearly declining and some extinctions appear to have occurred. Several species have not been refound since the 19th century, although since 1997 two species then thought extinct (Sanderson 1998) have been refound, showing extinction can never be certain. A total of 13 species were recorded from the New Forest woods in the 19th century and have not yet been refound (Appendix 1). Of these, most are crust-forming species that could still be overlooked but five are more obvious leafy species. The latter are much easier to locate, and observed loses are much more likely to be real than for small crust-forming species. In addition, four leafy species recorded since 1967 appear to have been lost and a further four are declining and rare (Table 21).

All of these species are known to be highly pollution sensitive. Of the 13 leafy species lost or threatened since the 19th century, 10 (i.e. 77%) have blue-green algae (*Cyanobacteria*) symbiotic partners present. This is a far higher proportion than the proportion (4.6%) of blue-green-algae-containing lichens (20) in the total recorded New Forest flora, and probably reflects the exceptionally high sensitivity of blue green algae partners to low level SO_2 pollution or acid rain (Richardson and Cameron 2004). It must be noted, however, that the main observed recent cause of loss of individual colonies is the death of trees and not simply the death of the lichen colonies, and there is no indication of acidification from the composition of the associated species. The current threat appears to be associated with difficulties in colonising rather than direct poisoning of the mature thalli. These could

Table 20
Number of woods scoring 20 or over with the New Index of Ecological Continuity.

Range	Number of woods
40–50	16
30–39	32
20–29	21

Table 21
Apparent losses of lichen species from the New Forest.

Large leafy species recorded in the 19th century and not seen since
Collema fasiculata *
Lobaria scrobiculata *
Meneggazzia terebrata
Pannaria rubiginosa *
Pseudocyphellaria aurata
Large leafy species probably lost since 1967
Degelia plumbea *
Nephroma laevigata *
Pannaria sampaiana *
Parmeliella testacea *
Large highly threatened species 1967–2007
Lobaria amplissima +
Pannaria conoplea *
Pannaria mediterranea *
Sticta limbata

* Alga partner blue-green algae
+ Blue-green algae in secondary structures

either be related to continuing effects of low-level pollution or to reduced viability of the small surviving populations. This trend can also be seen for the same species in Dorset and Wiltshire and, for the most sensitive species, further west into Devon and Cornwall. Further work would be required to identify exactly what is causing these declines but it appears that a small proportion of the flora, which includes some of the most spectacular species, require pristine air conditions to survive.

Habitats and communities

Nature of the flora

The flora is essentially a woodland one and is rich in species that thrive in partial shade and low nutrient conditions and which are rare or absent in more open and nutrient-enriched parkland-like habitat. Conversely, species of old trees in sunny nutrient-rich conditions, as found in typical old parklands, are not prominent.

Tree species

The dominant oak and beech provide the main substrates for the majority of the uncommon species recorded within the woodlands. Some specialist species are completely confined to the dry bark of ancient oaks and others to the smooth bark of beech, often where flushed by rain tracks. Most species are found on both oak and beech, although some show preferences for one or the other tree species.

There appear to be slight differences between the lichen assemblages on the two oak species, with base-rich bark often more frequent on sessile oak than on pedunculate oak, but more work is needed to confirm this suggestion. Collectively the two oak species are certainly the richest tree species within the New Forest woodlands. The specialists of ancient dry oak bark show a distribution pattern, which is related the presence of large populations of veteran oaks and hence to continuity of oak generations. This may reflect the felling intensity of oak during the 17th and 18th centuries (Sanderson 1998). Some very rich woods, such as Mark Ash Wood, are poor in these species, and may have been over-exploited for oak in the early modern period.

The richness of the beech trees in the New Forest is a unique feature in Britain. Other old growth beech forests within the native range of beech are all badly polluted and now have impoverished epiphyte floras. Beech has been widely introduced to north and west of Britain, where it thrives, suggesting its native range was not constrained by climatic factors (Peterken 1993). Here, however, even where veteran trees now occur, they never support the diversity of lichens of the New Forest beech (F. Rose, pers. comm.). As well as lacking the specialist species, many more generalist old woodland species often do not colonise readily even when present on native trees. The beech specialists include a group of species that were once common on old elm trees but have been lost owing to elm disease in the rest of Britain (including *Collema fragrans* and *Bacidia incompta*), and a group that are confined to beech in Britain ('beech specialist species') (*Catillaria laureri*, *Enterographa elaborata* and *Pyrenula nitida*). The latter are confined to two distinct areas west of Lyndhurst (Mark Ash Wood to Lyndhurst Hill and Highland Water Inclosure to Gritnam) and east and north of Lyndhurst (Mallard Wood to Sunny Bushes). The distributions of these species are believed to correspond to the ancient core of beech colonisation in the Forest before the expansion of this tree species in the last 400 years (Sanderson 1999, Richard Reeves, pers. comm.).

Ash trees can be locally important, especially where old pollards are frequent, as by the Highland Water south of the A31 (SU2410), supporting a flora similar to that of oak but with a few specialists, including *Collema subflaccidum* and *Wadeana dendrographa*. Holly supports a specialist flora unique in England, including species with disjunct distributions (e.g. *Mycoporum lacteum*) mainly recorded from Ireland and Scotland beyond the New Forest. Old hazel, were it occurs, also supports a number of specialist smooth bark species. Although hazel is now scarce in the Forest, where it occurs the bushes are often old and uncoppiced, and are far richer in specialist species than the abundant coppiced hazel in enclosed coppices. The specialist species are generally rare in the lowlands and the hazel flora of the New Forest pasture woodlands is of regional significance.

Other species of tree and shrub are much less important for lichens but sheltered old birch in glades, base-rich maple and old blackthorn scrub can be of high interest locally. Minor species such as wild service trees (Chatters *et al*. 1999) are rarely of note but are generally richer in lichens than the same species beyond the Forest. Exotic trees such as sweet chestnut, sycamore, Turkey oak and pine are generally very species poor.

Pine occasionally has been colonised by species such as *Imshaugia aleurites*, which are typical northern pinewood species. They, however, have survived on lignum or on acid bark of native species in southern woods with a high continuity of dead wood, and then colonised the introduced pine. An unusual exception is the recent discovery of *Calicium parvum* on a pine in Wood Crates. This is the first record for England for a species of sheltered well-lit pine previously only known from north-east Scotland.

Epiphytic communities

Lichens of conservation interest are concentrated in distinctive habitats that are summarised below, while the main habitat preferences of each species are indicated in Appendix 1. Lichen species typically have very tight niches, more resembling invertebrates than plants, and often occur at very low densities. A single species-rich tree can have up to 30 to 40 species in the first 2 m of the trunk arranged in several very different communities. The variety of communities on one trunk can be equivalent to entire landscapes if compared to terrestrial plant communities.

Significant factors determining the species composition of epiphytic communities are:

- *Water supply*; ranges from overhanging areas receiving water only as dew, through shedding sites that readily wet in rain then dry out rapidly, to rain tracks that remain wet long after rain.
- *Acidity*; ranges from strongly acidic (about 4.5 pH) through intermediate bark to base rich condition (up to 6.0 pH). Very variable, even on the same species of tree, although birch and alder are rarely anything but acid, maple and ash are rarely acid, while old oak and beech can span the whole range.
- *Exposure to sunshine*; many species of conservation interest are woodland species that avoid long exposure to strong summer sunlight.
- *Shelter from drying winds*; more sheltered sites maintain humid conditions for longer.
- *Rate of tree growth*; old trees expand slowly producing a more stable bark habitat, encouraging the colonisation of slow growing species, as opposed to fast growing pioneer species found on fast growing young trees.
- *Nutrient availability*; generally low in the New Forest but wound tracks can have elevated nutrient availabilities, which can also be somewhat higher in areas with heavy grazing or exposure to external pollution.

The main habitats of conservation interest are summarised below, with the phytosociological classification following James *et al.* (1977). Characteristic species are listed in Appendix 1. The publication of the full conservation evaluation of lichens (Woods and Coppins 2003) allows the comparison of the conservation significance of the main habitats.

- *Base Rich Bark* (*Lobarion*): found on old trees in places weakly flushed by base-rich water. Ancient woodland lichens are a constant feature and the community is confined to veteran trees. Most frequent on oak and beech but also found on ash and maple. It is the richest community in the New Forest for species of conservation interest. The leafy lichen component is not as rich as in hyperoceanic stands of the community in western areas, but the diversity of crust-forming species is exceptionally high, with species such as *Porina hibernica* and *Porina rosei* more abundant than in any other British site.
- *Mature Mesic Bark* (*Pertusarietum amarae and Parmelietum revolutae*): found on mature less acidic bark on wet but shedding bark of mature and veteran trees. In sheltered woodland conditions, crust-forming species dominate (*Pertusarietum amarae*), whereas in more open conditions leafy species become abundant (*Parmelietum revolutae*). The basic communities are composed of widespread lichen species, especially *Pertusaria* and *Parmelia sensu lato* in shaded and well-lit situations respectively. In old-growth stands, ancient woodland species can occur and be locally prominent. The community is richest on beech but good examples are also found on oak and ash. Individual stands of this community are rarely as rich as the Base Rich or Acid Bark habitats but collectively the Mature Mesic Bark habitat is the second richest in lichens of conservation interest. Characteristic species include most of Britain's population of *Pertusaria velata* and significant occurrences of the parasites *Arthonia zwackhii* and *Melaspilea lentiginosa*.
- *Acid Bark* (*Parmelion laevigatae*): found on mature strongly acidic bark on wet but shedding bark of mature and veteran trees. Mainly on oak, beech, holly and alder. The examples in the New Forest represent a mildly oceanic version of the described hyperoceanic association *Parmelietum laevigatae*. A provisional description as the *Cladonia-Thelotrema* community is given by Sanderson (1994a). Ancient woodland species and species rare in the lowlands are always present. Individual stands are usually richer than the Mesic Bark community, but overall the flora is not quite as rich in species of interest. Significant species include *Parmelinopsis minarum*, *Arthonia invadens*, *Micarea pycnidiophora* and *Parmelinopsis horrescens*.
- *Dry Lignum* (*Calicietum abietini*): a very specialised habitat of dry wood on vertical surfaces of exposed lignum on live trees, standing dead trees or rapidly rain-shedding sections of very large fallen logs. Characterised by pinhead lichens and fungi in genera such as *Calicium*, *Chaenotheca* and *Chaenothecopsis*. The habitat is best developed in more continental conditions, but the New Forest assemblage is still among the best in lowland England and the habitat contributes significantly to the diversity of lichens in the New Forest.
- *Ancient Dry Bark* (*Lecanactidetum premneae and Calicietum abietini*): this community is largely confined to the dry craggy bark of ancient oaks and well developed examples are restricted to woods with stand continuity predating the 18th century (ancient old-growth woodland). Leaning trees and deformed trunks are the main habitat and although it does occur on pollards too, this is a minority habitat (Sanderson 2002). The lichens mainly receive their water from dew and the community is southern oceanic in distribution. It supports several very specialist species (*Lecanographa amylacea*, *Blarneya hibernica*, *Enterographa sorediata*, *Opegrapha prosodea* and *Lecanographa lyncea*) and is exceptionally rare in Europe outside of southern Britain and Ireland. The Forest contains a significant proportion of the world resource of this community. In very dry bark the community passes into the more continental *Calicietum abietini*, which is also found on dry lignum.
- *Smooth Bark* (*Graphidion*: *Graphidetum scriptae and Arthpyrenietum punctiformis*): found on the smooth bark of thin barked shrubs within woodlands. The basic community is composed of widespread species, especially on young vigorous trees or bushes. However on ancient hazels and holly, and

slow growing suppressed young trees, ancient woodland and uncommon species can occur. Well-developed examples occur widely on holly in woodland with a stand continuity predating the 19th century (old-growth woodland) support several rare specialists, including *Arthonia astroidestera*, over 90% of the British population of *Mycoporum lacteum* and most of the lowland English population of *Arthonia ilicina*. These holly communities are scarcely developed in southern Britain outside the New Forest. Rich hazel communities with specialist species (including *Arthothelium ruanum* and *Eopyrenula grandicula*) are rare in southern England owing to coppicing, but do occur in sites such as Ivy Wood where long uncut hazel occurs, unlike rich hollies. These are not restricted to old growth woodlands, but appear to require about 75–100 years to colonise. The rarest non-holly species is *Phaeographis lyellii* recorded from hawthorn, beech, hazel and hornbeam in the Forest.

- *Wound Tracks* (*Gyalectinetum carneoluteae*): wound tracks occur where sap or exudates from rot holes flows down trunks. Lichens typically colonise wound tracks when the flow is reducing. Lichen-rich wound tracks occur mainly on beech but also occur on holly, ash and maple, including inside hollow trees. The habitat is nutrient rich and extreme, with only a limited number of specialist lichens occurring. These include some widespread ruderal species but they also include a number of now very rare and threatened species. Often these threatened species were once widespread on old hedgerow and parkland elms, but these trees have now been lost to disease. Important species include five threatened species: *Ramonia nigra*, *Collema fragrans*, *Bacidia circumspecta*, *Bacidia incompta* and *Cryptolechia carneolutea*. The habitat supports more Threatened species than any other habitat analysed.
- *Parkland Trees* (*Pertusarietum amarae*, *Parmelietum revolutae and Physcietum ascendentis*): a small group of species are characteristic of old mesic to base-rich well-lit trees in pasture and woodland edge situations. Nutrient availabilities are typically higher than within the woodlands. The uncommon species present include *Rinodina colobinoides*, *Anaptychia ciliaris*, *Lecanora quercicola* and *Lecanora sublivescens*. This is a rather rare element in the New Forest lichen flora, and is better developed in parklands in other areas of lowland England and Wales.
- *Branch and Sheltered Mid-trunk Habitats* (*Usneetum articulato-floridae var ceratinae*): branches and twigs support mainly common and rapidly colonising species but sheltered areas can support rarer species and especially pollution-sensitive species. Of these *Usnea ceratina* is particularly abundant on sheltered mid-trunks and *Usnea articulata* is very local. *Usnea florida* is a species that appears to be holding its own in the Forest, but is declining in the west country in the face of increased ammonia pollution (Benfield 1994).
- *Rain Tracks* (*Pyrenuletum nitidae*): a local but important community that occurs on strongly flushed areas of bark on old twisted, forked or occasionally pollarded ancient beeches. It includes some of the rarest lichen species in Britain including *Enterographa elaborata* (only in the Forest on three trees), *Megalaria laureri* (only in the Forest on fewer than 30 trees) and *Pyrenula nitida* (locally widespread in the New Forest, but only three known sites beyond the Forest). The community may have a strong relationship with wound tracks, with new colonisation occurring were wound tracks heal and open up new habitat for these species (Sanderson 2007b). Once formed, rain track communities appear to remain as fixed mosaics with no further opportunities for colonisation (Sanderson 1999). This community is still confined to the area occupied by beech in 1565 (Sanderson 1999).
- *Damp Lignum* (*Cladonietum coniocraeae*): a widespread community on damper dead wood and stumps with *Cladonia* species dominant along with crust-forming *Trapeliopsis* species. It occurs on stumps and is frequent well beyond the old-growth stands. This community is not usually of great conservation interests for lichens, presumably because damp lignum is not a rare or declining habitat; there are plenty of stumps in managed woods. The habitat does, however, support a large population ancient woodland species *Cladonia parasitica* in the New Forest. Very rarely *Cladonia incrassata* occurs in this habitat but this is more frequent in the heathlands.
- *Dry Bark* (*Lecanactidetum abietinae and Calicium hyperelli*): dry bark on mature trees is a species-poor habitat, both for overall numbers and for species of conservation interest. An exception is the widespread occurrence of *Schismatomma niveum* on the dry sides of oak and beech, and the very rare occurrence of the threatened northern continental species *Schismatomma graphidoides*.
- *Conifer*: the native gymnosperm yew *Taxus baccata* supports only a limited lichen flora on bark, but exposed lignum can support Dry Lignum habitats (*Calicietum abietini*) of interest and this community can also be found on the introduced Scots pine. These are considered in the Dry Lignum habitat described above. Only two species, however, are confined to introduced conifer species: the under-recorded ephemeral *Absconditella pauxilla* and the pinhead *Calicium parvum*. The latter is an unexpected record of a species otherwise known in the UK only from native pinewoods in NE Scotland. It has however also turned up in the Forêt de Fontainebleau in northern France (Rose 1990), where pine is also introduced, and is likely to be an example of long distance dispersal. It was recorded on pine in a humid glade in beech – oak pasture woodland, a habitat more similar to native pinewood than most occurrence of pine in the New Forest. Finally *Lecidea doliiformis*, which occurs on old acid oaks, has found a widespread secondary habitat on the bark of 19th century Douglas fir and occasionally old Scots pine.

Table 22
Numbers of lichen species of conservation interest recorded from different habitats in the New Forest (for details of habitats and abbreviations, see text).

Habitat	Threatened RDB	NT and DD	Nb	Other NIEC	Total
Base rich bark	2	15	15	15	47
Mesic bark	2	7	10	9	28
Acid bark	2	3	14	5	24
Dry lignum	1	3	11	2	17
Ancient dry bark	1	4	6	4	15
Smooth bark	0	3	8	3	14
Wound tracks	3	1	9	0	13
Park	2	5	1	0	8
Rain tracks	5	0	2	0	7
Branch	0	3	1	2	6
Damp lignum	0	0	3	1	4
Dry bark	1	0	2	0	3
Conifer	0	1	2	0	3

To summarise, the numbers of lichen species of conservation interest recorded from the main habitats of interest are presented on Table 22, in declining order of overall species numbers. Overall, it is clear that the richness of the woodland lichen flora depends on the presence of a wide range of habitats on the trees and dead wood and is not dependent on simply the presence of the base-rich bark community, although this is the richest community. Individual species make use of specific niches on tree bark or wood, many of which (e.g. rain and wound tracks) are scarce or absent in intensively managed woods, because 'poorly grown' (i.e. niche-rich) trees are removed during management operations.

Landscape ecology

Epiphytic lichen data

The extensive, and relatively comprehensive, series of data from defined sites of known stand age permits an analysis of the response of old-growth lichen communities to disturbance. Such analysis is comparatively easier for lichens than for other old-growth-dependant groups.

Stand continuity and lichen diversity

Stand continuity and lichen diversity within the New Forest
A study of a chronosequence of broadleaved stands within the New Forest statutory and freehold Inclosures (Sanderson 1996b and in prep.) of 92 species of lichens that are generally confined to little-disturbed woodlands in England, found the following:

- Six species were found to have widely colonised the 19th century young-growth woods and were common in old-growth woods.
- A further 14 species were present in the 19th century stands but at lower frequencies than found in the old-growth woods.
- Six species were also found to be restricted in the Inclosures to Ivy Wood, where they were associated with old hazel and maple in riparian wood.
- Forty-five species were recorded equally from both the 18th century plantations and in undisturbed pasture woodlands.
- Twenty-one were confined to, or much more frequent in, the pre-enclosure pasture woodlands.

All communities were found to have strongly colonised the 18th century woods, except for assemblages of lichens on ancient dry bark on ancient oaks (*Lecanactidetum premneae*) and wound and rain track assemblages of broken beeches (*Pyrenuletum nitidae* and *Gyalectinetum carneoluteae*). Within the whole flora there are over 100 old-growth dependant species in the New Forest, as opposed to five old-growth dependant epiphytic bryophytes.

In summary it appears that given the relative lack of fragmentation of woodlands that still exists in the New Forest, all but one of the epiphytic lichen communities of the old-growth woodlands can colonise adjacent new stands within 200 to 300 years. The ancient dry barked community, however, requires over 300 years to fully re-establish itself. An old-growth stand at Pigbush, on farmland thought to be abandoned as a result of the Black Death 600 years ago (Richard Reeves, pers. comm.), had a fully developed ancient dry barked community.

Stand continuity and lichen diversity in nearby woods
Sanderson (1998) reviewed the lichen flora of areas adjacent to the core woods of the New Forest, and noted that:

- Isolated woods, situated more than about 1 km from old woods, similar in stand age to the 18th century Inclosures (e.g. Ridley Wood and Langley Wood), are considerably poorer in lichens of conservation interest than 18th century stands close to ancient old-growth stands.
- At Roydon Wood there was widespread colonisation by lichen species characteristic of grazed high forest on to old trees that have been absorbed into in recent pasture woodland with the last 150 years in the south of Brockenhurst Park. Previously these were formerly exposed ex-hedgerow trees in a 18th century park created by removing the hedges. These lichen species were absent from veteran trees in the northern part of the Park that has remained as farmland. The site is adjacent to undisturbed ancient old-growth pasture woodland. This suggests that many old-growth dependant lichens can colonise faster than the trees mature, and that it is the slow development of suitable niches that controls the rate of recovery from clear felling.

These observations suggest that fragmentation of over 1 km had a negative effect on the recovery of the lichen flora. In contrast, in developing stands close to existing lichen-rich woodland, the rate of recovery was governed by the time taken for suitable niches to develop on the trees.

Colonisation of individual trees

Within the woods, the lichen species restricted to old-growth woodland are mainly found on oak and beech of over 2 m in girth, but are not especially restricted to very ancient trees (Sanderson 1994a, 1994b, 1997a). The ancient dry barked community tends to be more frequently found on larger trees than the other communities, but can still be found on trees as small as 1.9 m in girth (e.g. *Lecanactis lyncea* in Frame Wood). The smallest trees colonised tend to be suppressed trees or naturally damaged trees. The invariable presence of ancient trees within lichen-rich stands is a characteristic indicating stand continuity, but is not the result of the restriction of lichens to really ancient trees. This fact means that other than in a few old beech stands and small fragmented woods, there are few obvious problems with tree generation gaps in the New Forest for lichens. Large woods are likely to have little problem with beech and there is no significant generation gap in oak anywhere in the New Forest for lichens.

Historic woodland management

Impacts of early modern woodland management

The existing structure and species composition of the pasture woodlands is largely a product of the past interaction of grazing and tree felling (Tubbs 2001, see also Chapter 13). Although much emphasis is often put on the impact of grazing, the combination of felling and grazing may actually have had more impact on the current species composition than grazing alone. Under current conditions of grazing and no cutting, the sensitive hazel is slowly reinvading from adjacent hedges, as have non-native limes (Sanderson 1996c). Other minor species, such as wild service, have also been recorded as increasing within the Forest pasture woodlands (Chatters *et al*. 1999). Ash is extensively regenerating in some riverine woodlands (Bakker *et al*. 2004). The Forest appears to be recovering tree species diversity under current quite high grazing pressures, but equally appears to have lost diversity in the early modern period when grazing and cutting co-existed (Chatters *et al*. 1999).

The lichen flora of the pasture woodlands appears to have survived this period of high exploitation surprisingly well, although local impacts of over exploitation of oak can be detected (Sanderson 1998), and clearly hazel specialist species have been severely restricted in distribution.

Tree felling and coppicing

Recent documentary research is giving a clearer picture of the degree and type of exploitation that the unenclosed pasture woodlands were subjected to in the early modern period. This exploitation included both cutting timber for the navy (Stagg 1989) and cutting underwood to produce charcoal for export to Cornwall for metal smelting (Roberts 2002). Several unpublished pollen analysis indicate that small-leaved lime appears to have been very locally abundant right into the 18th century (Tubbs 2001 and C. Chatters, pers. comm.), and hazel also steadily declined, to become rare about this time. It is probable that the 17th and 18th century timber and underwood exploitation, especially the charcoaling, compromised the browsing resistance of species such as hazel, which is much more resistant to browsing if left uncut.

Pollarding

In addition to the sale and theft of timber and coppice wood, extensive pollarding was carried out by the Forest keepers to produce fodder for deer and this may have been a key factor in conserving old-growth characteristics and the associated veteran tree flora and fauna. A great deal of documentary information on the keeper's activities has now been published (Stagg 1983, Reeves 2006). Only ash was recorded as being cut in summer and stored as leaf hay. Other species were cut in winter in hard weather to feed directly to deer, either as bark for oak and beech or as bark and leaves in the case of holly, with the resultant left over wood belonging to the keepers as a perk (Reeves 2006). Cutting of species other than ash began at St Andrew's Tide (30 November), with thorn cut in spring. In the 17th century keepers were regularly fined for cutting pollards without regard to feeding the deer (Stagg 1983, Reeves 2006); they appear to have been cutting on a longer cycle than desirable for feeding deer, thus proving themselves with more wood. A 17th century document specifically blames browsing (pollarding) by the keepers for converting thriving and useful trees to spoiled and decayed dotards (senescent ancient trees) (Reeves 2006).

Dead wood

Dead wood was also heavily exploited, with fallen wood apparently rapidly removed. Reeves (2006) gives many 17th century references to the removal of breaknecks (trees with snapped trunks) and morefalls (up rooted trees). The pressure on the fallen wood resource is illustrated by frequent references to morewood (roots) being dug up to get at the firewood. In contrast there were clearly many dotards (senescent ancient trees) and stubs (standing dead trees), even if the references are to the felling of these. Stubs stood long enough to be recorded as whitecoats (dead trees with no bark). In 1677 a stub was reported as stolen from Godshill Wood that had been dead for 30 years or more. The picture is of heavily exploited old-growth woodland that did, however, maintain old-growth characteristics.

Tree regeneration

Reeves (2006) also contains references to 17th century exploitation, damaging 'Vera style' regeneration protected by thorns (Vera 2000; see also Chapter 13), such as:

"*Cutting down thorns and covert by the keepers is a destruction to the preservation of young trees.*"

"*Digging of mores of trees (stump and roots) after trees are felled is destructive to any young trees that grow out of (i.e. coppice growth) and about the roots (i.e. protected saplings) of such mores.*"

"*Pigs without rings root out bushes that would preserve young trees*".

As a result, the early modern woodland may have been more sensitive to grazing pressures influencing regeneration rates than are the modern pasture woodlands. This could explain the difference in view between Peterken and Tubbs (1965) and Morgan (1987a, 1987b, 1991) concerning the regeneration history of the Forest and modern regeneration patterns (see also Chapter 13).

Modern changes

Since the beginning of the 19th century the exploitation of the pasture woodlands has steadily declined, first with the cessation of the felling of timber in between 1800 and 1850 to the present decade, when the removal of dead wood all but came to an end.

Pollarding ceased in 1851, when the deer forest was abolished by the Deer Removal Act and the duties of the keepers to feed the deer were removed. By this time, timber exploitation had ceased within the remaining Open Forest allowing the recovery of near natural woodland structures. Under this act an attempt was made to remove the deer and numbers were reduced to very low numbers. This reduction in grazing pressure and the cessation of holly cutting led to a surge in holly cover within the woods, with many dense holly stands post-dating 1851 (Tubbs 2001). This spread was noticed at the time, and Pasmore (1976) records that the first complaint about the spread of pine on the heaths in 1904 by the Commoner's League and the New Forest Association also contained a complaint about the 'injury done to the old ornamental woods by the dense undergrowth of holly'. This spread of holly is now a significant issue in lichen conservation within the pasture woodlands.

Current factors affecting lichen diversity

Woodland structure and lichens

Structure of the New Forest woodlands

During the monitoring of 19th century oak stands within Inclosures and oak-dominated stands within Ancient and Ornamental woods carried out by Sanderson (2001), structural data were collected along with lichen data. There was a strong contrast between the managed Inclosure oak woods, where structural patterns were very even across stands, and the Ancient and Ornamental woods. In the latter, every sample plot of 20 × 20 m appeared to be unique. There is also strong patterning in tree density within the Ancient and Ornamental woods, with a glade and grove pattern apparently repeating at scales from 20 × 20 m through to 1 km × 1 km. This pattering has every appearance of being fundamental to maintaining lichen diversity, by providing great variation in light availability and in tree architecture, but much more work could be done on this issue.

The existing highly patterned structure has been largely regulated by grazing impacts and appears to at least partly match the theory of Vera (2000) on the functioning of grazed woodlands (see Chapter 13). The reality, however, is probably more complex than this, with areas of core grazed high forest and permanent glades surviving long periods, as well as other areas cycling between high forest and glade as Vera described.

Recent surveys have highlighted a role of extensive canopy collapse within originally dark cores of beech high forest stands in producing very high quality habitats for some very rare lichens (Sanderson 2007b). It appears especially fundamental for wound and rain track specialists of beech trees and is also highly beneficial to dry lignum specialists. The threatened BAP species *Enterographa elaborata*, *Collema fragrans*, *Bacidia circumspecta* and *Bacidia incompta* are all strongly associated with areas of beech canopy collapse.

Although there have been conflicting studies of the Forest regeneration history at a Forest-wide level (Peterken and Tubbs 1965, Morgan, 1987a, 1987b, 1991; see Chapter 13), there appears to have been no detailed analysis of pattern and woodland history at the stand level with the pasture woodlands. This could be a very interesting study in relation to old-growth biodiversity conservation.

Light, shelter, grazing and holly

Several studies of individual species across the Forest (Sanderson 1994a, 1994b and 1999) and of the flora of one stand (Sanderson 1997a) have recorded estimated light and shelter levels. These found a variation in the tolerance of different lichen species but made the following general conclusions for the New Forest:

- Lichen floras tend to be most diverse where the lower trunks of the trees are most sheltered from drying winds, allowing the air to remain more humid for longer.
- Lichen floras were richest on trees with good indirect light but diversity dropped off rapidly with exposure to summer sun, but tailed off more gradually with increased shade.
- Dense shrub layers of holly are a serious threat to rich and diverse lichen communities on old trees.

The consequence of increasing holly cover was demonstrated by Sanderson (1996b) at Woodfidley Inclosure. Here an old-growth beech stand dating from 1700 was partly fenced in the early 1960s, with about 4 ha enclosed and left completely ungrazed while about 3 ha remained open to heavy deer grazing and light pony grazing. Inside the Inclosure, holly and beech had regenerated profusely, producing a nearly impenetrable shrub layer, whereas the grazed stand had remained open and well lit. Within the grazing exclosure, species diversity was much lower, with only 46% the number of species of lichen and bryophyte found in the lowest 2 m of the trunks. The losses were especially severe for more uncommon species with 18 NIEC old-growth indicator lichens recorded within the grazed are, a but none within the grazing exclosure. Similar results have been reported from Exmoor, where rapid expansion of the shrub layer in response to reduced grazing pressure has caused significant declines in epiphytic lichen communities over a short period (Coppins and Coppins 1998). At Woodfidley the removal of grazing also similarly depressed the terricolous vegetation, with 40% fewer species in the grazing exclosure.

Holly has clearly increased greatly in cover since 1851 but shrub holly can also undergo local recession owing to winter browsing of stems. Recession appears much more uncommon than spread at present. Since 1989 holly coppice and pollarding has been extensively revived both to conserve epiphytic and terricolous floras within the woodlands and to provide winter feed to ponies and deer (Sanderson 1991, Sanderson 1997b, Wright and Westerhoff 2001).

External factors affecting lichen diversity

Pollution

Many lichen species are very sensitive to sulphur dioxide (SO_2) pollution (dry deposition), which acts as a direct toxin. Levels of this pollutant have been low over much of the Forest, even during the height of sulphur dioxide pollution in the mid 20th century, but were certainly elevated over pristine conditions and were locally significant. Obviously depressed numbers of slow-colonising sensitive species are present in a few exposed woods in the south-west (and the Bournemouth conurbation), e.g. Ridley Wood and Berry Wood, and in the south-east (close to industrial pollution sources on the Waterside), e.g. the Noads and the east of Denny Wood (Sanderson 1998). The effect, however, is complex; the latter two contain sheltered little-polluted areas rich in lichens and the nearby Frame Wood complex is one of the least affected woodlands in the Forest. A few very sensitive species, especially those with blue green algae partners, have been affected by the low levels of pollution that occur throughout the Forest and species such as *Pannaria conoplea*, *Sticta limbata* and *Nephroma laevigata* are not thriving or have become extinct. Levels of sulphur dioxide have declined nationally and Dr Francis Rose noted that the SO_2 pollution-tolerant lichen *Lecanora conizaeoides*, which was locally prominent on twigs on wood edges in the New Forest in the 1960s, had entirely disappeared from twigs by the late 1990s.

There is no evidence of differential loss of species requiring base-rich bark as opposed to those requiring acidic bark, which would indicate that there is, or has ever been, an acid rain (wet deposition) problem in the Forest sufficient to negatively effect epiphytic lichen floras. Recent examinations of lichen twig floras using the method described by Wolesey *et al*. (2006) indicate that the epiphytic lichen flora shows no signs of a response to nitrogen deposition as ammonia, the main form of nitrogen deposition known to affect epiphytes. Trees very close to busy roads (i.e. less than 4 or 5 m) are affected by road dust and show a loss of sensitive species and the appearance of nitrogen-loving species (Sanderson 1996d), but there is no obvious effect to be seen further from roads, although detailed studies have not been carried out. Trees in a caravan site in an old-growth woodland show signs of acidification, which may result from car exhausts (Edwards 2001, Sanderson 2004b).

Recreation and health and safety

Lichen communities on trees are largely unaffected by recreation within in most woods but there have been very rare instances of illegal fires built against trees with rare species (Francis Rose, pers. comm.). More significant are localised problems with recreation infrastructure built close to veteran trees, in particular car parks and campsites. In the past, heavy-handed tree surgery for health and safety reasons by car parks and roads killed many veteran trees. Now more sensitive safety assessments and tree surgery is generally carried out in such situations (Hayward 1996).

A few caravan sites are placed in or beside Ancient and Ornamental woods. These are clearly problematic; intensive people and vehicle access and veteran trees do not mix well, and this has lead to unfavourable condition assessments for some sites (Wright and Westerhoff 2001). The lichen flora of Hollands Wood campsite has been intensively studied (Cox and Rose 1996, Edwards 2001, Sanderson 2004b). In the most heavily used areas, the safety felling of veteran trees has led to the loss of much of the conservation interest. In areas with surviving veteran trees, internationally important communities survived, but there was a differential loss of dead wood species from the felling of standing dead trees and of species of base rich bark. The latter was a marked effect and could be due to acidification from car exhaust gasses.

Implications for woodland lichen conservation

Lichen conservation in the Ancient and Ornamental Woodlands

The following conclusions are drawn from the above survey and research:

- Direct conservation measures are not practical or significant, the number of rare species and trees of interest is too high for significant individual conservation measures. An added factor is the inability to cultivate many of these lichen species, or to even translocate the majority of the crust-forming species. Actions to conserve lichens will need to be carried out at the habitat level.
- The woods are near-natural: the minimum amount of management required to maintain the biodiversity should be carried out.
- Maintain variable levels of grazing that allow low-level or periodic tree regeneration, thus both maintaining the woods and variable levels of light and exposure.
- The spread of holly, and hence increased shade, in the last 150 years is the most significant internal issue.
- Externally attaining very low levels of sulphur and nitrogen pollution is more significant than all but the more extreme anthropogenic global warming projections. The flora is predominantly a southern Atlantic one and few species are at the southern edge of their distributions.

Specific issues

Holly management

Current holly management for lichen conservation is described by Sanderson (1991, 1997b). Areas where dense holly was potentially threatening lichen diversity within the woods were mapped in a general way by Sanderson (1997b). Forest Enterprise had since directed cutting to these areas. This has proved remarkably effective as cutting has several times revealed unknown trees supporting RDB lichens previously obscured and threatened by dense holly. Directing cutting precisely around known trees would have not achieved this.

The cutting procedure recommended in areas cut to open up dense holly, dominated by small diameter holly, is as follows (Sanderson 1997b): the holly is cut in blocks between 30 to 100 m across within woods, with dense holly left as shelter on the edges. The smallest diameter holly (<10 cm diameter) is coppiced, as is all but the largest holly close to mature trees. A scatter of holly over 10 cm diameter is pollarded and all larger holly (>15 cm diameter) pollarded. Ideally green branches should be left below the cut. Old pollards, especially those over 0.3 m diameter should only be cut if green branches can be left below the cuts.

The condition assessments introduced by English Nature (now Natural England) requires less than 50% of woodland units to have dense holly shrub layers (Wright and Westerhoff 2001; see Chapter 12). Many woods are still in unfavourable condition owing to high holly cover, but because of the introduction of the extensive holly cutting programme, most of these are in Unfavourable Recovering condition (see Chapter 12).

Tree pollarding

Pollarding trees is an important cultural tradition within the New Forest woodlands. In biodiversity conservation terms, however, natural damage to trees and partial competition with other trees in unevenly stocked grazed woodlands seems to generate specialist niches just as well as pollarding. No rare species of lichen is restricted to pollards. For this reason, although cutting new pollards is considered important to maintain the cultural tradition, it is not considered important for biodiversity conservation (Wright and Westerhoff 2001). Most Forest woods lack large generation gaps that could justify attempting to revive lapsed pollards to extend their lives, especially as out of cycle re-cutting of pollards often results in a high percentage of tree death.

Fragmentation

The low density of occurrence of many of the most threatened lichens in the New Forest indicates that they require very large areas of old-growth woodland for long-term survival. Although there are large areas of surviving old-growth woodland within the New Forest, there has been substantial fragmentation of the old-growth woods that existed at the beginning of the 18th century. This fragmentation has been assessed by Sanderson (2007a).

The earliest fragmentation caused by 18th fellings is now being healed by the old-growth stands developing from abandoned 18th century plantations. The demonstrated ability of old growth lichen floras to recolonise such woodlands, suggests that there is the potential to counteract fragmentation, especially if 18th or 19th century oak plantations are available for reversion to pasture woodland. The presence of these older plantations makes counteracting fragmentation within 100 to 200 years a practical proposition.

Forest Enterprise is committed, through its Forest Design Plan, to reverting large areas of 18th and 19th century plantations to old-growth woodlands, mainly as unenclosed pasture woodlands. These will increase the connectivity between many formerly fragmented pasture woodlands. Sanderson (2007a) found, however, that there were still significant important stands of surviving old-growth woodland, which will still be left isolated on existing plans. This is especially so west of Mark Ash Wood. The New Forest Association has suggested that a radical rewilding project is required in the block of Inclosures between Mark Ash Wood and Burley (Reeves *et al.* 2006). If carried out, this would convert the current solid mass of enclosed woodland dominated by plantation to a mosaic of smaller enclosed ungrazed broadleaved woodland set in a matrix of heathland, ancient relic old-growth and old-growth developing from former 19th century oak plantations.

Relationship with browsing and grazing pressure

The New Forest pasture woodlands are now very unusual in a lowland context in having extensive stock and deer grazing within unenclosed woodlands. A common response from commentators is concern that the woodland habitats are being "overgrazed" (e.g. see Chapter 7). The features for which these woods are being overgrazed is often not explicitly stated (Chatter and Sanderson 1994). In the case of the internationally important epiphytic lichen flora it is difficult to substantiate the suggestion that the woods are currently being overgrazed, or ever have been. The converse is the case; the lichen flora of the New Forest appears to be thriving under current conditions, while under-grazing is a frequently cited problem for lichen conservation in other lowland, and increasingly upland old-growth woodlands (Rose 1992a, Coppins and Coppins 1998, Sanderson and Wolseley 2001). Were woods being lost to total regeneration failure, this certainly would be an issue for lichen conservation, but this has not happened to any significant scale to date. Localised temporary regeneration failure in fact appears essential to maintain high lichen diversity.

Epiphytic lichen floras clearly cannot be used to set the upper levels of grazing pressure as they are highly grazing tolerant. They probably do need to be accounted for in setting lower limits to gazing pressure, as rich epiphytic lichen floras are strongly grazing dependent. As grazed woodland is an integral part of the internationally important cultural landscape of the New Forest commons, low stocking levels are not a pressing short-term issue. They may become significant if the socio-economic system of commoning fails in the longer term. Beyond the Forest there are critical lessons to be learned for conserving old-growth and pasture woodland biodiversity, which do not appear to be widely appreciated. Essentially, for rich epiphytic floras to survive within woodlands, free regeneration of trees must be partly suppressed to prevent dense growth shading out rich sheltered lower trunk communities.

Other forest habitats

Heathland

Lichen flora

The other significant habitat for lichens within the New Forest National Park is the heathlands. This habitat includes both *Calluna*-dominated dwarf shrub heath and associated acid grasslands. These habitats have not been systematically surveyed, but to date at least 82 lichen taxa have been recorded recently from the Open Forest's heaths and grasslands, of which 45 have not been recorded from the woodlands. The ecology and conservation management of heathland lichen habitats in the New Forest has been summarised by Sanderson (1996e). Within the heathlands there are two habitats with significant lichen floras: open patches of compact humus within low productivity heather heaths with little grass component, and short open dry acid grassland. Flints within both habitats add to the species diversity. The flora includes 30 taxa of *Cladonia*. Compared to the woods, the heathlands are not nearly as rich in rare species, but include a few rare species such as the nationally scarce *Cladonia incrassata* on sandy banks in the heaths and *Cladonia cariosa*, *Peltigera neckeri* and *Leptogium palmatum* in the grasslands. This reflects the main significance of the New Forest heathland lichen flora; it supports populations of species that are still widespread in the uplands but are in decline outside of the New Forest in the lowlands (Rose 1992b, Sanderson 1995). Especially significant are species such as *Cladonia arbuscula*, now extinct in the heaths of West Sussex (Rose 1992b), and *Cladonia strepsilis* and *Pycnothelia papillaria*, which are now rare and declining in most lowland heathland areas.

The lichen rich heaths have *Cladonia* species prominent, with more than 10 species typically present in the best sites. *Cladonia portentosa* is ubiquitous but species characteristic of richer sites include *Cladonia arbuscula*, *Cladonia ciliata*, *Cladonia gracilis*, *Cladonia uncialis* ssp. *biuncialis*, *Cetraria aculeata*, *Cetraria muricata*, *Dibaeis baeomyces*, *Micarea lignaria* var. *lignaria* and *Pycnothelia papillaria* on soil and *Micarea erratica*, *Porpidia crustulata* and *Porpidia soredizodes* on flints.

In contrast, grasslands with a high lichen cover normally only have a few *Cladonia* species and a small number of associated species including *Peltigera canina*. Exceptions are the heathland "brown field" sites where acid grassland has developed on the sites of ripped up World War II military installations. These grade towards calcicolous grasslands and have distinctive assemblages including species characteristic of less acid conditions, such as *Agonimia gelatinosa* (NS), *Agonimia tristicula*, *Bacidia bagliettoana*, *Cladonia cariosa* (NS), *Cladonia foliacea*, *Diploschistes muscorum*, *Leptogium intermedium* (NS), *Leptogium schraderi*, *Leptogium tenuissimum* (NS), *Peltigera neckeri* (NS) and *Peltigera rufescens*.

A significant rediscovery made in 2007 is the Near Threatened *Leptogium palmatum* (NS). A single collection was made of this species in the 1930s (Rose and James 1974), which is otherwise a specialist species of winter damp sandy tracks in the upland fringes, with its headquarters in mid-Wales and Dartmoor. It was found in two sites in the Open Forest, growing in gaps in mats of robust mosses on the edges of trampled areas within parched acid grasslands. These and a third site, just outside of the National Park, are the only know extant lowland sites for this species.

Only two rare species with old records have not been refound: *Cladonia zopfii* (NS), a northern species, and the Near Threatened *Rinodina aspersa* (NR), a species of flints in the south.

Ecology

Lichen-rich acid grassland sites appear mainly to depend on heavy grazing to maintain open conditions, but the richest sites show an obvious association with past soil disruption. The latter sites are also rich in uncommon vascular plants (see Chapter 8). The future conservation of such habitats raises interesting questions of how to maintain the periodic large scale disruption characteristic of heathland cultural landscapes in the past, in a controlled and protected future.

The rich heaths are more complex and observations on their ecology have been summarised by Sanderson (1996e). Diverse lichen communities are found in two situations:

- Heather stands so heavily grazed that the heather is reduced to a prostrate creeping growth form. Pony and cattle grazing does not kill heather and it can survive in this condition for decades. Most large areas of prostrate heather in the Forest have been in this condition for living memory. Such heaths are kept permanently in the pioneer stage and are very important for species that depend on this stage of heather regrowth such as woodlark. These stands also have much bare ground that remains open for decades; ideal conditions for lichens. The richest and largest lichen rich heaths of the New Forest are all in this type of habitat.
- Small areas of lichen-rich heath do occur locally in less heavily grazed heaths that develop through the normal cycle from pioneer to senescent heather stands. These are managed by grazing and a controlled burning on a roughly 25-year cycle.

Two factors appear to link most lichen-rich heaths:

- low soil productivity, which prevents a significant grass sward forming;
- long-lasting gaps in the heather canopies that allow light demanding lichens to survive.

In more lightly grazed stands, rich lichen floras develop where gaps are maintained in the heather canopies in spite of normal heather regrowth. The use of cool controlled burns appears very important; lichen regeneration is rapid, presumably from surviving propagules. The thalli of most species do not survive burns, but abundant regrowth of new squamules from bare humus occurs in the second spring after a burn. *Cladonia strepsilis* thalli can actually directly survive and regrow. The burns also clear away competing late-succession mosses, which mowing does not. In contrast, after hot wild fires lichen regeneration appears to occur by colonisation from beyond the burnt area and has been shown to take about 13 years (Coppins and Shimwell 1971).

In the first summer after a spring fire both *Calluna* and *Erica* species regenerate, the *Calluna*, at least, mostly as coppice regrowth from existing root stocks. Any grass and the *Calluna* are grazed heavily in the first few years but the *Erica* species are not. Heather regeneration is patchy, with many small bare patches that are the locus of the lichen regeneration. The lichens appear to take about five seasons to fully develop and achieve high ground cover. During this period, however, the gaps can be lost to heather seedlings. *Calluna* flowers in the second summer after the burn, and in the third spring masses of *Calluna* seedlings can be found. Mostly, these will die off, but in a wet summer the gaps could be lost to regeneration from seed. New gaps in the heather cover are also created in the pioneer phase by the parasitic plant dodder *Cuscuta epithymum*. This frequently kills off patches of *Calluna* at this stage.

If the gaps remain open until the *Cladonia* dominates, then further seedling establishment does not occur, possibly owing to an the allelopathic effect on *Calluna* seeds from chemicals produced by the *Cladonia* (Hobbs 1985). From this stage on, only the shade of the growing heather bushes can destroy the lichen-dominated patches. If the ageing of the heather is slowed by grazing, then the gaps will survive longer and the lichen flora become better developed, but all such lichen-rich stands will eventually be shaded out. The occurrence of lichen rich heathland beyond the heavily grazed prostrate heaths is therefore a relatively temporary phenomenon. Lichen-rich patches develop where the effects of burning, grazing and weather combine to allow the survival of canopy gaps in the heather for a decade or more, but most patches are probably lost after about twenty years or so. Recent observations suggest that controlled burns on overgrown impoverished formerly rich lichen heaths can rejuvenate new lichen-rich stands in the same site. Most of the above observations have been confirmed by more detailed experimental observations in eastern America (Johansson and Reich 2005). Lichen-rich heaths are best regarded as late-succession fire-dependent features. They even reappear in time after hot wildfires, recovery just takes longer. For example, the sites of 1976 wild fires were the main lichen-rich areas in the unmanaged Dorset Heath in the 1990s (Davey 1994, B. Edwards, pers. comm.). The common misapprehension that lichen-rich heaths are fire-sensitive features is a serious threat to their continued survival in heathlands outside of the New Forest.

The long length of the burning rotation in comparison to upland gorse moors is probably significant; these are burned on a roughly 10 year or so cycle and here the regular fire impoverishes the lichen flora (B. Coppins, pers. comm.). Colonisation similar to that occurring after hot fires can be seen in old mineral sites on acidic substrates. Gravel pits abandoned back to heathland can also be colonised by rich lichen floras within about 10 years. This has occurred at Fields Heath, near Fawley, within the National Park. Currently the richest such site locally is in the Blashford gravel pit complex, just outside of the National Park, where 63 lichen taxa have been recorded (including 18 concrete weeds and normally epiphytic species), of which 23 were *Cladonia* species, in an area abandoned in 1992.

Woodland streams

Aquatic lichen communities

Acid watercourses with abundant stable rock outcrops support rich lichen assemblages, including uncommon specialist species (Gilbert and Giavarini 1997). Rich examples of this habitat are confined to the uplands in Britain, but the New Forest does support outlying examples of this habitat, which is otherwise very rare in the lowlands. The New Forest examples, however, are very attenuated and consist of a handful of species that are widespread in the uplands but rare in the lowlands, with *Verrucaria hydrela* common, *Verrucaria aquatilis* and *Porina chlorotica* frequent and *Micarea bauschiana*, *Verrucaria rheitrophila* (NS) and *Verrucaria margacea* rare (Gilbert and Giavarini 1997, Sandell and Rose 1996). However, Gilbert and Giavarini (1997) encountered two taxa that they were unable to name, so there may be rare specialist species present.

Aquatic lichen habitats

Aquatic lichens require stable rock surfaces, free of silt deposits, which remain moist or humid through out the year. These conditions are not common in New Forest streams (see Chapter 15). They can be found in shoals of flint pebbles in the beds of small head woodland water streams, where flows of sufficient force to move the flints are rare. Further downstream, the habitat is confined to flints embedded in the banks of the wooded middle reaches of Forest rivers. An extension of the former habitat is found where flints occur in shaded flushes along spring lines, although only *Verrucaria hydrela* occurs in this habitat. Lower reaches of rivers are too silty, even if fixed flints occur in the banks. Tree cover is a common factor of all sites; flints of open heathland streams dry out too much in summer and this lichen habitat is strongly associated with ancient woodland in the New Forest. The richest sites recorded by Gilbert and Giavarini (1997), on the Dockens Water, Shepherds Gutter and the Highland Water headwaters, were all associated with ancient pasture woodlands. Wooded flushes with flints supporting only *Verrucaria hydrela*, however, have been noted in Roydon Wood in overstood coppice.

Woodland terricolous habitats

The ground flora of the woodlands is very poor in lichen species but two obscure crust-forming species have been recorded on disturbed ground of tracks and boundary banks: the nationally scarce *Thelocarpon lichenicola* and one of the few lowland records of the common upland lichen *Trapeliopsis gelatinosa*. Also the nationally scarce fungal parasite of liverworts *Mniacea jungermanniae* (recorded by lichenologists but not strictly a lichenicolous species) is local but widespread.

Lichen habitats beyond the forest core

Introduction

Beyond pasture woodlands and heaths the National Park the countryside and villages contain typical lowland lichen habitats and, as a result, ordinary and unexceptional lichen floras, but with some rare or threatened species occurring occasionally. The lichen-rich habitats that do occur, however, have been rather neglected for survey, owing to the attractions of the New Forest.

Coastal habitats

At a county level the most significant habitats outside of the Forest core are coastal, where rich lichen communities are associated with undisturbed shingle beeches. Hurst Spit uniquely includes stable intertidal pebbles on the lee side of the spit. This provides a habitat for maritime rock-growing species that are common on the west coast but are rare in the south-east, with *Lecanora actophila*, *Verrucaria maura* and *Verrucaria mucosa* recorded along with the coastal *Lecania hutchinsiae* (NS) (Sandell and Rose 1996). Other shingle beeches support non-maritime flint and acid grassland floras that require greater study, but include some local species, such as the only natural stone occurrence in Hampshire of the county-rare *Aspicilia caesiocinerea* on flint at Keyhaven. Marine sediment at Tom Tidlers Ground at Fawley power station, dumped in the 1960s, also supports a lichen rich acid grassland on shingle, with the county-rare *Cladonia scrabriuscula*, which is not yet recorded from the Open Forest.

The built environment

Stone buildings have introduced a wide range of rock types, in an area where there is no natural rock other than flint pebbles. These provide niches for several hundred lichen species that would otherwise be absent. The richest sites for this anthropogenic lichen flora are medieval churches and churchyards in rural settings. These have a long continuity of habitat, the greatest variety of rock type and are in the clean environments. Much informal survey work of churchyard lichens has been carried by members of the BLS, especially by Dr Francis Rose but also by Ken Sandell. The results are unpublished and the following was extracted from the papers of the late Dr Francis Rose.

Many churches within the National Park are of 19th century buildings, which are of no particular interest, but the few medieval buildings are much richer. Old Brockenhurst Church is among the richest churchyards in Hampshire, with 103 species recorded. This is partly because of the presence of numerous veteran oak and an ancient yew. These support a significant assemblage of Ancient Dry Bark community species, including the Near Threatened *Opegrapha prosodea*. Dr Rose considered that this was probably the richest churchyard for epiphytic lichen interest in Britain. The trees are contiguous with Brockenhurst Park, itself part of the New Forest meta-site. The rock flora of the churchyard is also rich and with 80 species recorded, it is the richest churchyard in the National Park, but has no rare species. (The richest churches in the county have over 90 lichen species recorded from rock). The other significant old building complex is the remains of Beaulieu Abbey from which 75 species have been recorded. The old precinct walls are especially rich and include *Caloplaca cirrochroa*, a widespread species on natural hard limestone outcrops in the north and west, which is rare in the lowlands and confined to stonework of medieval date. Also recorded from here is the Nationally Scarce parasitic fungus *Toninia episema* on *Aspicilia calcarea*. Both of these species have their only Hampshire sites at Beaulieu. Other significant churches are Minstead Church with 67 species and Bramshaw Church with 60 species, including one of only two records of *Protoblastenia calva* from the county and the nationally scarce *Hymenelia prevostii*.

Trees and woodlands

Beyond the pasture woodlands of the New Forest SAC, the adjacent parks and the Langley Wood complex covered above, there are there are scattered sites of at least county significance for their epiphytic interest. Again this habitat has been neglected compared to the much richer core New Forest woodlands. Before the advent of Dutch elm disease there was a significant flora of elm specialist lichens on the hedgerow elms in the enclosed land south of the New Forest commons. This has now been completely lost, with the total loss of veteran elms. Other habitats of interest are neglected coppices that have been invaded by the more mobile ancient woodland species and veteran boundary oaks. The former habitat normally harbours an attenuated version of the New Forest pasture woodland flora, but the richest example recorded, Sims Wood, on the banks of the Beaulieu estuary, has 12 NIEC indicator species. The mainly northern lichen *Pertusaria pupillaris* has its only known south Hampshire site on an old wild service-tree here.

The veteran boundary trees support the internationally rare Ancient Dry Bark community *Lecanactidetum premneae*. As the core New Forest is the single most important site in the world for this species assemblage, these are more significant. The current incomplete knowledge suggests that there are two significant areas:

- A scatter of rich veteran old trees extends down the Lymington River valley from Roydon Wood (part of the core New Forest woodlands) and then east along the coastal plain, intermittently to the Beaulieu estuary. This includes two known important concentrations of veteran oaks: field oaks on the National Park boundary at Ampress, and the landscape park of Pylwell Park, both with the Near Threatened *Opegrapha prosodea*. This species has

stronger populations in this area than within the core New Forest woodlands.
- A thinner scatter of veteran oaks along lanes on the west side of the Forest on the terraces of the River Avon. This area includes the impressive Moyles Court oak north of Ringwood, and extends as far south as Burton, but many of the trees identified within this area are outside of the National Park.

There are many other landscape parks recorded on 19th century maps around the New Forest but apart from New Park, Brockenhurst Park and Pyewell Park, these appear to be 19th century in origin and have no significant populations of veteran trees.

References

Alexander, K. N. A., Smith, M., Stiven, R. and Sanderson, N. A. (2002). *Defining 'Old Growth' in the UK Context*. English Nature research Reports No 494. English Nature, Peterborough.

Bakker, E. S., Olff. H., Vanderberghe, C., Maeyer, K. De, Smit, R., Gleichman, J. M., and Vera, F. W. M. (2004). Ecological anachronisms in the recruitment of temperate light-demanding tree species in wooded pastures. *Journal of Applied Ecology*, 41, 571–582.

Benfield, B. (1994). Impact of agriculture on epiphytic lichens at Plymtree, East Devon. *The Lichenologist*, 26, 91–94.

Biodiversity Reporting and Information Group (2007). *Report on the Species and Habitat Review.* Report to the UK Biodiversity Partnership. JNCC, Peterborough.

Chatters, C. and Sanderson, N. A. (1994). Grazing lowland pasture woodlands. *British Wildlife*, 6, 78–88.

Chatters, C., Sanderson, N. A. and Stern, R. C. (1999). Wild service trees in a New Forest wood pasture. *Proceedings of the Hampshire Field Club and Archaeological Society*, 54, 57–62.

Coppins, A. M. and Coppins, B. J. (1998). Lichen survey of Horner Woods NNR – 1998. Unpublished Report to the National Trust.

Coppins, A. M. and Coppins, B. J. (2002). Indices of Ecological Continuity for woodland epiphytic lichen habitats in the British Isles. British Lichen Society, London.

Coppins, B. J. and Shimwell, D. W. (1971). Variations in cryptogam complement and biomass in dry *Calluna* heaths of various ages. *Oikos*, 22, 204–209.

Cox, J. and Rose, F. (1996). *A preliminary assessment of proposed changes in camping and car parking provision in the New Forest*. An unpublished report to the New Forest Association and Hampshire Wildlife Trust.

Davey, S. (1994). *Dorset Lichen Survey: Contract No. 13/F2B/247*. An unpublished report to English Nature.

Edwards, B. (2001). *Relocation of New Forest campsites; lower plant assessment*. Dorset Environmental Records Centre, unpublished report for Terrence O'Rourke.

Edwards, B. (2002). *The past and present distribution of Bacidia incompta, Biatoridium monasteriense and Caloplaca luteoalba in England*. Plantlife, London.

Fletcher, A., Coppins, B. J., Hawksworth, D. L., James, P. W. and Rose, F. (1982). *Survey and assessment of epiphytic lichen habitats*. A report prepared by the Woodland Working Party of the British Lichen Society, for the Nature Conservancy Council [contract HF3/03/208].

Fletcher, A. (ed.) (1984). *Survey and assessment of lowland heathland lichen habitats*. [Report prepared by the Heathland Lichen Working Party of the British Lichen Society for the Nature Conservancy Council; Contract no.: HF 3/03/266]. 111 pp.

Gilbert, O. L. and Giavarini, V. J. (1997). The lichen vegetation of acid watercourses in England. *Lichenologist*, 29, 347–367.

Hayward, N. (1996). Conservation and safety: the beginnings of a veteran tree management strategy for the New Forest. In H. J. Read (ed.): *Pollard and Veteran Tree Management. II*. pp. 71–74. Corporation of London.

Hobbs, R. J. (1985). The persistence of *Cladonia* patches in closed heathland stands. *Lichenologist*, 17, 103–110.

Hodgetts, N. G. (1992) *Guidelines for selection of biological SSSIs: non-vascular plants*. JNCC, Peterborough.

James, P. W., Hawksworth, D. L. and Rose, F. (1977). Lichen communities in the British Isles: a preliminary conspectus. In M. Seaward (ed.), *Lichen ecology*, pp. 295–413. Academic Press, London.

Johansson, P. and Reich, P. B. (2005). Population size and fire intensity determine post-fire abundance in grassland lichens. *Applied Vegetation Science*, 8, 193–198.

Looney, J. H. H. and James, P. W. (1990). *The effects of acidification on lichens – Final report, 1989.* CSD Report 1057. Nature Conservancy Council, Peterborough.

Morgan, R. K. (1987a). Composition, structure and regeneration characteristics of open woodlands of the New Forest, Hampshire. *Journal of Biogeography*, 14, 423–438.

Morgan, R. K. (1987b). An evaluation of the impact of anthropogenic pressures on woodland regeneration in the New Forest, Hampshire. *Journal of Biogeography*, 14, 439–450.

Morgan, R. K. (1991). The role of protective understorey in the regeneration system of a heavily browsed woodland. *Vegetatio*, 92, 119–132.

Pasmore, A. (1976). *Verderers of the New Forest. A History of the New Forest 1877–1977*. Pioneer Publications Ltd., Beaulieu.

Peterken G. F. (1993). *Woodland conservation and management. Second edition*. Chapman and Hall, London and New York.

Peterken, G. F. and Tubbs, C. R. (1965). Woodland regeneration in the New Forest, Hampshire, since 1650. *Journal of Applied Ecology*, 2, 159–170.

Reeves, R. P. (2006). *Use and abuse of a forest resource: New Forest documents 1632–1700*. New Forest Ninth Centenary Trust, Lyndhurst.

Reeves, R. P., Cox, J., Frost, P., Tubbs, J. M., Sanderson, N. A. and Humbert D. (2006). *The New Forest Design Plan: recovering lost landscapes*. New Forest Association, Lyndhurst.

Richardson, D. H. S. and Cameron, R. P. (2004). Cyanolichens: their response to pollution and possible management strategies for their conservation in northeastern North America. *Northeastern Naturalist*, 11, 1–22.

Roberts, P. (2002). *Minstead. Life in a 17th century New Forest Community*. Nova Foresta Publishing, Southampton.

Rose, F. (1988). Phytogeographical and ecological aspects of *Lobarion* communities in Europe. *Botanical Journal of the Linnean Society,* 69, 69–79.

Rose, F. (1990). The epiphytic (corticolous and lignicolous) lichen flora of the Forêt de Fontainebleau. *Bulletin Société Botanique de France*, 137, 197–209.

Rose, F. (1992a). Temperate forest management: its effects on bryophytes and lichen floras and habitats. In Bates, J. W. and Farmer, A. M. (eds.) *Bryophytes and lichens in a changing environment*, pp. 211–233. Oxford University Press, Oxford.

Rose, F. (1992b). *Report on the remaining heathlands of West Sussex 1991–1992*. West Sussex County Council.

Rose, F. (1993). Ancient British woodlands and their epiphytes. *British Wildlife,* 5, 3–93.

Rose, F. and James, P. W. (1974). Regional studies on the British lichen flora I. The corticolous and lichenicolous species of the New Forest, Hampshire. *Lichenologist,* 6, 1–72.

Sandell, K. A. and Rose, F. (1996). The lichen flora. In: *The flora of Hampshire* (ed. Brewis A., Bowman P. and Rose F.), pp. 306–324. Harley Books, Colchester, Essex.

Sanderson, N. A. (1991). Notes on holly cutting in the New Forest. In H. J. Read (ed.), *Pollard and veteran tree management* , pp. 53–55. Corporation of London.

Sanderson, N. A. (1994a). *An ecological survey of the lichens Catillaria laureri and Parmelia minarum in the New Forest, Hampshire*. An unpublished Botanical Survey and Assessment report to Hampshire Wildlife Trust.

Sanderson, N. A. (1994b). *An ecological survey of the lichens Catillaria laureri and Parmelia minarum in the New Forest, Hampshire. Second Report*. An unpublished Botanical Survey and Assessment report to Hampshire Wildlife Trust.

Sanderson, N. A. (1994c). *Lichen survey of Langley Wood NNR Wiltshire*. A unpublished Botanical Survey and Assessment report to English Nature.

Sanderson, N. A. (1995). *Ambersham and Heyshott Commons Lower Plant Survey*. An unpublished Botanical Survey and Assessment report to English Nature.

Sanderson, N. A. (1996a). *New Forest heathland management and lichens*. An unpublished Botanical Survey and Assessment report to the British Lichen Society.

Sanderson, N. A. (1996b). *Lichen conservation within the New Forest timber Inclosures*. An unpublished report to Hampshire Wildlife Trust.

Sanderson, N. A. (1996c). The role of grazing in the ecology of lowland pasture woodland with special reference to the New Forest. In H. J. Read (ed.) *Pollard and veteran tree management. II*, pp. 111–118. Corporation of London.

Sanderson, N. A . (1996d). *Lower Plant Survey of the southern verge of the A35 between Ashurst and Lyndhurst*. An unpublished report to Hampshire Wildlife Trust.

Sanderson, N. A. (1996e). *New Forest heathland management and lichens*. An unpublished Botanical Survey and Assessment report to the British Lichen Society.

Sanderson, N. A. (1997a). *A lichen survey of South Bentley Inclosure*. An unpublished Botanical Survey and Assessment report to the Forestry Commission.

Sanderson, N. A. (1997b). *A review of holly cutting in the New Forest*. An unpublished report to Hampshire Wildlife Trust.

Sanderson, N. A. (1998). *New Forest epiphytic lichen data base, volume 4. Part 3. Summary of results*. An unpublished report to Hampshire Wildlife Trust.

Sanderson, N. A. (1999). *New Forest Rare Lichen Monitoring Project.* (*Catillaria laureri, Parmelia minarum and Enterographa elaborata*). An unpublished report to Hampshire Wildlife Trust.

Sanderson, N. A. (2001). *Epiphytic lichen monitoring in the New Forest 2000. LIFE Job L33A2U*. An unpublished report by Botanical Survey and Assessment to Forest Enterprise.

Sanderson, N. A. (2002). *Species dossier for Enterographa sorediata*. An unpublished report by Botanical Survey and Assessment to English Nature.

Sanderson, N. A. (2003a). *Lichen survey of Whiteparish Common 2003*. An unpublished report by Botanical Survey and Assessment to English Nature.

Sanderson, N. A. (2003b). *Epiphyte survey of Round Hill, New Forest, Hampshire 2003*. An unpublished report by Botanical Survey and Assessment to Terrence O'Rouke.

Sanderson, N. A. (2004a). *Lichen survey of Loosehanger Copse, Wiltshire 2003*. An unpublished report by Botanical Survey and Assessment to English Nature.

Sanderson, N. A. (2004b). *Epiphyte Survey of Hollands Wood campsite, New Forest, Hampshire*. An unpublished report by Botanical Survey and Assessment to Terrence O'Rourke.

Sanderson, N. A. (2007a). *New Forest Inclosure habitats, habitat fragmentation and landscape history*. Hampshire & Isle of Wight Wildlife Trust, Botley.

Sanderson, N. A. (2007b). *Enterographa elaborata*: canopy collapse and lichen diversity in New Forest beech woods. *British Lichen Society Bulletin*, 100, 27–30.

Sanderson, N. A. (in prep). Recolonisation by epiphytic lichens after clear felling in the New Forest, Hampshire, UK. *Lichenologist*.

Sanderson, N. A., Bannister, N. and Colebourn P. C. (1994). *A restoration plan for Brockenhurst Park*. An unpublished report by Ecological Planning and Research to the Countryside Commission.

Sanderson, N. A. and Wolseley, P. (2001). Management of pasture woodlands for lichens. In A. Fletcher (ed.) *Habitat management for lichens*. pp. 05-1 – 05-25. British Lichen Society, London.

Smith, C. W., Aptroot, A., Coppins, B. J., Fletcher, A., Gilbert, O. L., James, P.W. & Wolseley. P. A. (2009) *The Lichens of Great Britain and Ireland*. London: British Lichen Society.

Stagg, D. J. (1983). *A calendar of New Forest documents. The Fifteenth to the Seventeenth Centuries*. Hampshire County Council, Winchester.

Stagg, D. J. (1989). Silvicultural inclosure in the New Forest to 1780. *Proceedings of the Hampshire Field Club and Archaeological Society,* 45, 135–145.

Tubbs, C. R. (2001). *The New Forest*. New Forest Centenary Trust, Lyndhurst.

Vera, F. W. M. (2000). *Grazing ecology and forest history*. CABI Publishing, Wallingford.

Wolesey, P. A., James, P. A., Theobald, M. R. and Sutton, M. A. (2006). Detecting changes in epiphytic lichen communities at sites effected by atmospheric ammonia from agricultural sources. *The Lichenologist,* 38, 161–176.

Wright, R. N. and Westerhoff, D. V. (2001). *New Forest SAC Management Plan*. English Nature, Lyndhurst.

Woods, R. G. and Coppins, B. J. (2003). A *conservation evaluation of lichens*. British Lichen Society, London.

Appendix 1
Lichen species of conservation concern occurring in the New Forest.
NIEC refers to the New Index of Ecological Continuity (see text). RDB refers to Red Data Book.

Species	Conservation status	NIEC	Habitat	Number of woods	Comment
Critically Endangered RDB species					
Bacidia subturgidula ***	EX NR BAP		Dry lignum	2	Very rare species of standing holly lignum
Enterographa elaborata **	CR NR BAP		Rain track	3	On three beech in rain tracks in ancient old growth
Ramonia nigra ***	CR NR IR BAP E		Base rich and wound track	9	Rare inside hollow beech, ash and holly and on oak bark in old growth
Total 3					
Endangered RDB species					
Caloplaca flavorubescens	EN NS BAP		Park	1	Recorded on an ash in Langley Wood
Collema fragrans **	EN NS IR BAP		Wound track	17	Occasional, sap runs and root knot holes on beech and ash old growth
Megalaria laureri **	EN NR IR		Rain track	8	Rare sp. of beech rain tracks in ancient old growth
Strigula stigmatella var. *stigmatella*	EN NR BAP		Base rich	1	Recorded once on oak in Great Wood
Total 4					
Vulnerable RDB species					
Bacidia circumspecta *	VU NS BAP		Wound track	3	Rare in wound tracks on old beech
Bacidia incompta **	VU BAP		Wound track	37	Local in hollow holly and sap runs on beech in old growth, once ash
Buellia hyperbolica	VU NR BAP		Acid	2	Rare on old acidic ancient oak, Rowbarrow and Denny Wood
Cryptolechia carneolutea	VU NS IR BAP		Wound	6	Rare in rain tracks (six beech and one ash) in ancient old growth
Lecanographa amylacea *	VU NS IR BAP		Ancient dry	14	Occasional on dry bark on ancient oak in ancient old growth
Parmelinopsis minarum **	VU NR		Acid	14	Very local on acid beech in ancient old growth
Pertusaria pustulata	VU NR		Mesic	5	Rare but probably overlooked species of beech in ancient old growth
Pertusaria velata ***	VU NS IR BAP		Mesic	33	Widespread beech, rare oak and ash in old growth. Very rare in Europe
Pyrenula nitida **	VU NR BAP		Rain track	11	Very local but frequent on beech in ancient old growth
Rinodina colobinoides **	VU NR		Park	1	On an old field maple in pasture Brockenhurst Park
Schismatomma graphidoides *	VU NR BAP		Dry	1	Rare on ash and oak in Drivers Nursery
Total 11					
Near Threatened RDB species					
Agonimia octospora **	NT NS IR	1	Base rich	62	Widespread and frequent in old-growth woodlands
Anaptychia ciliaris	NT BAP		Park	2	Recorded from a wayside oak and a parkland oak
Arthonia astroidestera **	NT NS IR	1	Smooth	31	Widespread and occasional in ancient old growth on holly, rare beech
Arthonia invadens ***	NT NR IR BAP E		Acid	22	Rare parasite of *Schismatomma quercicola* in dense populations
Arthonia zwackhii	NT NR		Mesic	2	Rare two modern records, parasitic on *Phlyctis argena*
Blarneya hibernica	NT NR IR BAP		Ancient dry	2	Rare species of dry side ancient oaks, initially a parasite
Calicium parvum	NT NR		Conifer	1	Pine specialist, recorded once on pine in sheltered glade, Wood Crates
Caloplaca herbidella	NT NR		Base rich	2	Rare in ancient old-growth ash and oak
Chaenothecopsis caespitosa	NT NR		Dry lignum	0	Yew stump, SU2603
Collema occultatum	NT NS		Base rich	1	Recorded from field maple in Ivy Wood
Cyphelium tigillare	NT		Dry lignum	1	Seen once on lignum on fence post, not seen recently

Species	Conservation status	NIEC	Habitat	Number of woods	Comment
Near Threatened RDB species … continued					
Enterographa sorediata ***	NT NR IR BAP E	1	Ancient dry	27	Occasional on dry bark on ancient oak in ancient old growth
Fuscopannaria sampaiana	NT NS BAP		Base rich	1	Recorded from one ash Lucas Castle, not seen recently
Gyalecta flotowii	NT NS		Wound track	1	Recorded once from Pinnick Wood on ash
Heterodermia japonica	NT NS	1	Branch	1	Rare recorded once from Busketts Wood, possibly overlooked as a twig species
Lecania chlorotiza	NT NS IR BAP		Base rich	1	On a base rich oak in Langley Wood
Lecanora horiza	NT NS		Park	7	Rare on well light trunks of old trees
Lecanora quercicola	NT NS IR BAP	1	Park	9	Rare on old well lit oak trunks in ancient old growth
Lecanora sublivescens	NT NS IR BAP	1	Park	1	Rare on old oak in Frame Wood in ancient old growth
Megalospora tuberculosa	NT NS IR BAP	1	Base rich	13	Rare on base rich trees in ancient old growth (possibly over recorded)
Melaspilea amota **	NT NR		Mesic	13	Recent recorded and overlooked species of older oaks
Melaspilea lentiginosa **	NT NR IR		Mesic	19	Rare parasite on *Phaeographis dendritica*, on beech
Micarea pycnidiophora **	NT NS IR	1	Acid	57	Widespread acid beech and holly plus oak and birch mainly in old growth
Mycoporum lacteum **	NT NR		Smooth	57	Widespread on old holly in old growth, rare oak, English HQ
Opegrapha prosodea	NT NS IR	1	Ancient dry	2	Rare on dry bark of ancient oak in ancient old growth and parkland
Parmeliella testacea	NT NS IR BAP		Base rich	1	Recorded from one ash Lucas Castle, not seen recently
Parmelinopsis horrescens	NT NS IR		Acid	12	Very locally frequent on acid bark in old growth
Parmotrema arnoldii	NT NS		Branch	4	Very rare on branches in sheltered sites in ancient old growth
Pertusaria coronata	NT NS		Unclear	2	Very rare recorded twice oak and ash
Phaeographis lyellii	NT NS IR		Smooth	14	Rare on smooth bark, mainly old beech and hawthorn
Phlyctis agelaea	NT NS		Mesic	1	Pollution sensitive species recorded once on field maple, Ivy Wood
Porina hibernica **	NT NR IR BAP	1	Base rich	47	Often frequent, if localised, old base rich oaks in old growth
Porina rosei **	NT NS IR		Base rich	51	More widespread than *P. hibernica* but not as frequent
Protoparmelia oleagina	NT NS		Dry lignum	2	Recorded once on lignum on fallen old oak, Jacks Wood
Ramonia chrysophaea **	NT NS IR BAP		Base rich	39	Occasional, base rich bare bark and lignum, on old trees
Ramonia dictyospora	NT NR IR BAP E		Unclear	3	Rarer than *R. chrysophaea*, possibly on more acid habitat?
Rinodina isidioides **	NT NS BAP	1	Base rich	20	Local in old-growth woods, mainly to north
Usnea articulata	NT IR BAP		Branch	10	Rare pollution-sensitive canopy species
Wadeana dendrographa	NT NS IR BAP	1	Base rich	15	Occasional old ash, rare oak in old growth
Wadeana minuta	NT NS IR BAP		Base rich	1	Rare recorded twice on oak in the Frame Wood area
Total 40					
Data Deficient RDB species					
Biatora britannica **	DD NR		Base rich	10	Local, sheltered base rich bark
Byssoloma leucoblepharum **	DD NR		Base rich	7	Very rare species in New Forest and Britain AOG on old oak in old growth

Species	Conservation status	NIEC	Habitat	Number of woods	Comment
Data Deficient RDB species ... continued					
Calicium hyperelloides **	DD NR		Mesic	1	Single record on old oak, very rare in Europe but a common tropical sp.
Cliostomum flavidulum **	DD NR		Mesic	44	Recent find, appears widespread on acid-mesic trunks
Lecanora barkmaneana	DD NR		Park	1	Not known on open forest, parkland oak tree in New Park
Opegrapha viridis	DD		Mesic	3	Rare on beech in ancient old growth
Opegrapha xerica	DD NS		Ancient dry	11	Local on dry bark on ancient oak in ancient old growth
Total 7					
Total RDB 65					
Non-threatened nationally rare species					
Absconditella lignicola	NR		Unclear	1	Ephemeral species found on grunge in crack on old oak trunk
Absconditella pauxilla	NR		Damp lignum	0	Ephemeral species found on conifer stump Appleslade Inclosure
Micarea viridileprosa	NR		Acid	5	Recently described sp of acid substrates, now NS likely to be common
Micarea xanthonica *	NR IR		Acid	3	Recently identified sp of oceanic woods, now NS likely to be uncommon
Pycnora sorophora *	NR		Dry lignum	2	A northern lignum specialist recorded rarely from oak and pine lignum
Thelocarpon strasseri	NR		Damp lignum	1	An ephemeral species seen once on beech lignum
Total 6					
Non-threatened nationally scarce species					
Absconditella delutula	NS		Unclear	2	Rarely recorded ephemeral of debris in rot holes
Agonimia allobata	NS	1	Base rich	20	Occasional in old-growth woodlands on base rich bark
Anisomeridium viridescens	NS IR		Smooth	4	On old hazel stems
Arthonia graphidicola *	NS IR		Mesic	3	Rare parasite of *Graphis scripta* on old beech
Arthonia leucopellaea *	NS		Acid	14	Local species of acid oak in old growth
Arthothelium ruanum	NS		Smooth	1	Hazel specialist Drivers Nursery only
Bacidia absistens	NS		Unclear	1	Record from pastures woodland Bakers Copse in Roydon Wood
Bacidia delicata	NS		Base rich	1	Field maple, Ivy Wood
Bacidia friesiana	NS		Wound track	1	Rare wound track on beech, Mark Ash Wood
Bactrospora corticola	NS		Dry	2	Rare on dry side old but not ancient oaks
Buellia erubescens	NS	1	Smooth and mesic	8	Rare in ancient old growth on beech and holly in ancient old growth
Caloplaca ferruginea	NS IR		Base rich	8	Rare in ancient old growth on base rich beech, ash and oak
Catillaria nigroclavata *	NS		Wound track and mesic	8	Recorded from aspen and elder and on rain tracks on beech
Celothelium ischnobelum	NS		Smooth	3	Rare on smooth bark of hazel and oak
Chaenotheca brachypoda	NS	0	Dry lignum and ancient dry	20	On beech and ash lignum in ancient old growth
Chaenotheca hispidula	NS	0	Dry lignum	19	Beech, ash, oak and alder lignum and dry bark on oak in old growth
Chaenotheca stemonea	NS	0	Ancient dry	3	Dry bark ancient oaks
Chaenothecopsis nigra *	NS		Dry lignum	19	Confined to oak, rarely beech, lignum on standing old or dead trees
Chaenothecopsis pusilla *	NS		Dry lignum	13	Confined to oak, rarely beech, lignum on standing old or dead trees

Species	Conservation status	NIEC	Habitat	Number of woods	Comment
Non-threatened nationally scarce species ... continued					
Cladonia incrassata	NS		Damp lignum	2	Oak lignum on damp lignum, more frequent on heaths
Eopyrenula grandicula	NS IR		Smooth	11	Specialist of old hazel stems
Fuscopannaria mediterranea	NS		Base rich	1	Single ancient oak, Shave Wood area
Gyalecta derivata	NS		Wound track	2	Rare on ash
Lecania cyrtellina	NS		Wound track	8	Wound tracks on beech and twice on field maple
Lecanora aitema	NS		Dry lignum	5	Probably under recorded on pine, yew and oak lignum
Lecanora albellula	NS		Dry lignum	7	Rare on beech and oak lignum in ancient old growth SW of Lyndhurst
Lecanora alboflavida *	NS	1	Acid	47	Widespread on acid bark in old growth rare in young growth
Lecanora argentata	NS		Mesic	8	Well lit trunks of old beech and ash
Lecanora compallens	NS		Dry lignum	7	Recently described, mainly lignum, outside Forest also polluted bark
Lecidea doliiformis	NS		Acid and conifer	25	Occasional on ancient oak lignum, acidifed bark and old conifers
Lepraria umbricola	NS		Acid	6	Acidic shaded bark on old oak
Leptogium subtile	NS		Wound track	1	Rare beech knot hole on root, Mallard Wood
Leptorhaphis maggiana	NS		Smooth	4	Young branches on old hazel bushes
Macentina stigonemoides	NS		Wound track	15	Over growing mosses on nutrient enriched bark, especially wound tracks
Melaspilea ochrothalamia	NS		Mesic	13	Under recorded on mature trees
Micarea coppinsii	NS		Acid	3	Under recorded, acid bark bog woodland
Micarea myriocarpa	NS			1	Pebbles in soil on root plate of fallen tree
Microcalicium ahlneri *	NS		Dry lignum	39	Widespread on dry oak lignum on standing trees
Mycocalicium subtile	NS		Dry lignum	10	Rare on standing oak and beech lignum in ancient old growth
Mycoglaena myricae *	NS		*Myrica gale*	16	Occasional on bog myrtle at the edge of woods, widespread in heaths
Ochrolechia microstictoides	NS		Acid and damp lignum	9	On old birch, especially bog woodland, also oak lignum
Opegrapha corticola	NS IR	1	Base rich	62	Common on old trees in ancient old growth rare in younger stands
Opegrapha fumosa *	NS IR		Acid	20	Abundant in the north of the Forest in old growth on acid bark
Phaeographis inusta	NS IR		Smooth	54	Widespread but occasional on smooth bark
Phaeophyscia endophoenicea	NS		Park	2	On several well lit oak Long Beech and beech branch at Busketts
Phyllopsora rosei *	NS	1	Base rich	24	Locally frequent in old growth on base rich bark
Porina borreri	NS		Wound and rain track	35	Occasional but widespread wound and rain tracks on beech in old growth
Porina coralloidea *	NS IR	1	Mesic and base rich	80	Old woodland species colonising 19th century Inclosures, mainly on oak
Ramonia interjecta	NS IR		Wound track	1	Wound track on beech, Gritnam Wood
Ropalospora viridis	NS		Acid	5	Rare on acid beech, once oak, in ancient old growth woodland
Thelocarpon lichenicola	NS			1	Sandy soil of upturned root-plate
Sphinctrina turbinata	NS		Mesic	13	Parasite on *Pertusaria* on trunks of old trees, occasional
Strangospora moriformis	NS		Dry lignum	1	On holly lignum
Strigula jamesii	NS		Wound and rain track	6	In rain tracks on holly and beech

Species	Conservation status	NIEC	Habitat	Number of woods	Comment
Non-threatened nationally scarce species ... continued					
Strigula phaea *	NS		Rain track	15	Mainly in rain tracks on beech and holly in old growth
Strigula taylorii	NS IR		Wound track	21	Under recorded in rain tracks on beech
Usnea wasmuthii	NS		Branch	1	Recorded once on beech branch, Undersley Wood, overlooked?
Total 57					
Non-threatened widespread species that are international responsibility species					
Arthonia ilicina *	IR	1	Smooth and mesic	37	Occasional in old growth on smooth bark on holly, beech and ash
Cresponea premnea **	IR	1	Ancient dry	68	Abundant mainly on old oaks in ancient old growth rare younger stands
Degelia plumbea	IR	1	Base rich	1	Single ash, Roydon Wood, now lost
Hypotrachyna sinuosa	IR		Acid	2	Very rare on sheltered acid bark
Hypotrachyna taylorensis	IR		Acid	2	A few trees in Anses Wood and South Bentley in old growth
Lecanactis subabietina	IR	1	Ancient dry	28	Occasional on dry bark on ancient oak in ancient dry bark
Lecanographa lyncea ***	IR	1	Ancient dry	47	Frequent on dry bark on ancient oak in ancient old growth
Lobaria amplissima	IR	1	Base rich	6	Ancient base rich trees, decline one extant tree
Lobaria pulmonaria	IR	1	Base rich	40	Still widespread on old trees but probably declining, rarely fertile
Lobaria virens *	IR	1	Base rich	26	Infrequent on old trees but often fertile
Nephroma laevigatum	IR	1	Base rich	1	Recorded from Vinney Ridge, probably extinct
Pannaria conoplea	IR	1	Base rich	10	Rare and declining species of base rich bark in ancient old growth
Rinodina roboris	IR		Mesic and base rich	68	Frequent well lit mature trees, especially oak, also on beech
Schismatomma cretaceum	IR		Ancient dry	61	Dry bark on old oak and occasional beech and ash in old growth
Schismatomma niveum **	IR	1	Acid, mesic and dry	103	Ubiquitous old woodland species on acid and mesic bark
Schismatomma quercicola **	IR E	1	Acid	103	Ubiquitous old woodland species on acid bark
Sticta limbata	IR	1	Base rich	12	Rare and declining sp of base rich bark in old growth
Total 17					
Total Notable 80					
Widely distributed and non-threatened NIEC ancient indicator lichens					
Anisomeridium ranunculosporum		1	Acid, smooth and mesic	105	Ubiquitous old woodland species
Arthonia vinosa		1	Mesic and base rich	100	Old woodland species widely colonising 19th century Inclosures
Bacidia biatorina		1	Mesic and base rich	78	Old woodland species widely colonising 19th century Inclosures
Catinaria atropurpurea		1	Base rich	74	Old woodland species colonising 19th century Inclosures
Cetrelia olivetorum		1	Acid	2	Recorded twice on acid beech in ancient old growth woodlands
Chaenotheca brunneola		1	Dry lignum and ancient dry	53	Lignum and dry bark on old trees, mainly old growth
Chaenotheca chrysocephala		0	Dry lignum and ancient dry	9	Rare dry bark on old oak and birch and beech lignum, old growth
Chaenotheca furfuracea		0	Ancient dry	3	Rare on dry bark
Chaenotheca trichialis		0	Ancient dry	14	Occasional on old oak and rare beech

Species	Conservation status	NIEC	Habitat	Number of woods	Comment
Widely distributed and non-threatened NIEC ancient indicator lichens ... continued					
Cladonia caespiticia		1	Acid	37	Local alder and other acid barked trees, soil on root plates, in old growth
Cladonia parasitica		1	Damp lignum	78	Oak lignum, more abundant in New Forest than elsewhere in UK
Collema subflaccidum		1	Base rich	4	Rare on ash in ancient old-growth woodland
Dimerella lutea		1	Base rich	56	Widespread but never frequent in old growth rare young growth
Lecanora jamesii		1	Mesic	49	Mainly on beech, but also willow, in old growth, rare young growth
Leptogium lichenoides		1	Base rich	27	Occasional on moss on oak, beech and ash in old growth
Leptogium teretiusculum		1	Base rich	16	Occasional on oak, ash and beech in old growth
Loxospora elatina		1	Acid	95	Old woodland species colonising 19th century Inclosures
Micarea cinerea		1	Acid	1	Recorded once on oak in Red Shoot Wood
Mycobilimbia epixanthoides		1	Base rich	20	Local old-growth woodland species on oak, beech and ash
Mycobilimbia pilularis		1	Base rich	33	Widespread old-growth sp. of shaded base rich bark
Mycoporum antecellens		1	Smooth and mesic	62	Old woodland species widely colonising 19th century Inclosures
Pachyphiale carneola		1	Base rich	99	Old woodland species widely colonising 19th century Inclosures
Parmotrema crinitum		1	Mesic and base rich	51	Fairly frequent on well lit trunks mainly in old growth
Peltigera horizontalis		1	Base rich	17	Local on sheltered base rich trees in old growth
Pertusaria multipuncta		1	Mesic	98	Ubiquitous old woodland species
Phaeographis dendritica		1	Mesic	88	Old woodland species colonising 19th century Inclosures
Punctelia reddenda		1	Mesic and base rich	69	Fairly frequent on well lit trunks mainly in old growth
Stenocybe septata		1	Smooth	103	Ubiquitous on holly and rare hazel, oak and wild service-tree
Strangospora ochrophora		1	Base rich	9	Occasional on base rich oak in old growth
Thelopsis rubella *		1	Base rich	71	Frequent in old-growth woods on base rich bark on old trees
Thelotrema lepadinum		1	Acid, smooth and mesic	107	Ubiquitous old woodland sp., population density up to over 400 trees/ha
Usnea ceratina		1	Branch	82	Old woodland sp of high well lit trunks and branches
Usnea florida	BAP	1	Branch	67	Locally frequent in sheltered canopy in woods with clean air
Total 33					
Recently confirmed and not used in the habitat analysis					
Bacidia assulata	NR DD		Wound track	1	Rain track on old beech in Mark Ash Wood
Strigula tagananae	NR DD BAP		Rain track	2	Rain tracks on old beeches in Busketts Wood area, new to England
Nationally under-recorded fungal parasites of lichens					
Abrothallus bertianus	NS			3	Parasitic on *Melanelia f. glabratula*, may be of conservation significance
Abrothallus microspermus	NS			23	Parasitic on *Flavoparmelia caperata*, a common species
Biatoropsis usnearum	NS			2	Parasitic on *Usnea cornuta*, probably rare in lowlands

Species	Conservation status	NIEC	Habitat	Number of woods	Comment
Nationally under-recorded fungal parasites of lichens ... continued					
Dactylospora parasitica	NS			23	Parasite on *Pertusaria pertusa* and *hymenea*, rare in lowlands
Epicladonia sandstedii	NR			2	Parasitic on *Cladonia*, rarely recorded
Epicladonia simplex	NR			1	Parasitic on *Cladonia*, new to Britain 1998
Homostegia piggotii	NS			14	Parasitic on *Hypogymia physodes*, rare in lowlands?
Intralichen christiansenii	NS			1	Parasitic fungus recorded Wood Crates 1998
Laeviomyces pertusariicola	NS			5	Parasitic on *Pertusaria leioplaca*, common species
Lichenoconium erodens	NS			2	A probably common parasitic fungus
Lichenoconium lecanorae	NS			1	A probably common parasitic fungus
Marchandiomyces corallinus	NS			11	A probably common parasitic fungus, attacks many species
Milospium graphideorum	NS			28	Parasite on *L. lyncea* and other spp. on old oaks, conservation significance
Plectocarpon lichenum	NS			1	Only lowland record of a *Lobaria pulmonaria* parasite
Pronectria anisospora	NR			2	Parasitic on *Hypogymnia physodes*, rarely recorded
Roselliniopsis sp.	NR			4	Parasitic on *Pertusaria petusa* on old beech, conservation significance, only collected from New Forest and Melbury Park
Skyttea nitschkei *	NS			66	Parasitic on *Thelotrema lepadinum* where population dense
Stigmidium microspilum	NS			7	Parasitic on *Graphis scripta*, common species
Taeniolina scripta	NR			7	Parasite on *Pertusaria leioplaca* and *Thelotrema*
Tremella pertusariae	NR			10	Parasitic on on *Pertusaria hymenea*, possibly uncommon species
Last records from the 19th century					
Arthonia anglica	EN BAP				Species of old hollies, currently only in a couple of sites in south-west
Arthopyrenia nitescens	NS				A strongly oceanic species of smooth bark
Calicium adspersum	CR BAP				An continental species of ancient oaks
Calicium lenticulare	NS				Oceanic species, found inside hollow oak on edge of range
Collema fasiculata	NS BAP				A highly pollution sensitive species
Graphina ruiziana	NS				A strongly oceanic species of smooth and acid bark
Lecania fuscella	EX				Extinct species in Britain
Lobaria scrobiculata	IR				A highly pollution sensitive species, lost from the lowlands
Meneggazzia terebrata	IR				A strongly oceanic species of acid bark species in Britain
Ochrolechia tartarea					An upland species, lost from all its few lowland sites
Pannaria rubiginosa	IR				A highly pollution sensitive species, lost from the lowlands
Pseudocyphellaria aurata	CR BAP				A highly pollution sensitive species
Sphinctrina tubiformis	DD NR				A parasite of *Pertusaria leioplaca*, currently only recorded from east Wales

Appendix 2
Important locations for lichen species in the New Forest. NIEC refers to the New Index of Ecological Continuity (see text).

Name	NIEC	Bonus spp	NIEC + B	Site Code	Grid Ref	Habitat	Status	NF Old Growth Meta Sites
Mark Ash Wood	47	46	93	NF02	SU 255075	Pasture woodland	SAC	Central Block
Busketts Wood	48	40	88	NF15	SU 307110	Pasture woodland	SAC	NE Block
Wood Crates	43	40	83	NF22	SU 270083	Pasture woodland	SAC	Central Block

Name	NIEC	Bonus spp	NIEC + B	Site Code	Grid Ref	Habitat	Status	NF Old Growth Meta Sites
Frame Wood	50	29	79	NF28A	SU 360035	Pasture woodland	SAC	Frame and Tantany Woods
Hollands Wood	47	29	76	NF18	SU 305050	Pasture woodland	SAC	Central Block
Bramshaw Wood	48	27	75	NF03	SU 260165	Pasture woodland	SAC	NE Block
Gritnam Wood	45	23	68	NF19B	SU 285065	Pasture woodland	SAC	Central Block
Red Shoot Wood	43	21	64	NF09	SU 188085	Pasture woodland	SAC	Pinnick and Red Shoot Woods Area
Shave Wood	40	23	63	NF14	SU 295122	Pasture woodland	SAC	NE Block
Emery Down	38	24	62	NF20	SU 280080	Pasture woodland	SAC	Central Block
Great Wood	45	16	61	NF08A	SU 255155	Pasture woodland	SAC	NE Block
Queen's Bower	42	19	61	NF36	SU 289043	Pasture woodland	SAC	Central Block
Stricknage Wood	44	16	60	NF11	SU 261125	Pasture woodland	SAC	NE Block
Bakers Copse	41	19	60	NF40A	SU 319017	Pasture woodland	SAC	Round Hill and Roydon Wood
Denny Wood	33	26	59	NF27	SU 357022	Pasture woodland	SAC	Matley and Denny Woods
Highland Water	40	18	58	NF38B	SU 254097	Pasture woodland	SAC	Central Block
Vinney Ridge	40	17	57	NF01	SU 257055	Pasture woodland	SAC	Vinney Ridge to Burley Old
Brinken Wood	40	16	56	NF19A	SU 282052	Pasture woodland	SAC	Central Block
Rushpole Wood	35	21	56	NF16	SU 310097	Pasture woodland	SAC	NE Block
South Ocknell Wood	44	11	55	NF37	SU 246106	Pasture woodland	SAC	Central Block
Ladycross area	39	15	54	NF51	SU 338030	Pasture woodland	SAC	Frame and Tantany Woods
Whitley Wood	38	15	53	NF17	SU 298055	Pasture woodland	SAC	Central Block
Knightwood Inclosure	36	16	52	NF30	SU 260066	Relic pasture woodland	SAC	Central Block
Sunny Bushes	36	15	51	NF08B	SU 261142	Pasture woodland	SAC	NE Block
Parkhill	35	16	51	NF57	SU 315065	Pasture woodland	SAC	Central Block
Ocknell Inclosure	33	17	50	NF34	SU 245115	18th century Inclosure/ pasture woodland	SAC	Central Block
Anses Wood	36	13	49	NF06	SU 230125	Pasture woodland	SAC	Anses to Eyeworth Woods
Coppice of Linwood	35	14	49	NF55A	SU 251135	18th century Inclosure/ pasture woodland	SAC	NE Block
Tantany Wood	31	18	49	NF28B	SU 365045	Pasture woodland	SAC	Frame and Tantany Woods
Canterton Glen	35	13	48	NF12	SU 273125	Pasture woodland	SAC	NE Block
Round Hill	31	17	48	NF71	SU 335016	Pasture woodland	SAC	Round Hill and Roydon Wood
Long Beech Inclosure	34	13	47	NF55B	SU 250143	18th century Inclosure/ pasture woodland	SAC	NE Block
Holidays Hill	32	15	47	NF21	SU 273070	Pasture woodland	SAC	Central Block
Bignell Wood	36	10	46	NF35	SU 280130	Pasture woodland	SAC	NE Block
Burley Old Inclosure	36	10	46	NF31	SU 248042	Pasture woodland	SAC	Vinney Ridge to Burley Old
Eyeworth Wood	36	10	46	NF04	SU 225150	Pasture woodland	SAC	Anses to Eyeworth Woods
Pinnick Wood	34	12	46	NF10	SU 192079	Pasture woodland	SAC	Pinnick and Red Shoot Woods Area
Ashurst Wood	34	11	45	NF47	SU 334093	Pasture woodland	SAC	NE Block
Undersley Wood	32	13	45	NF23	SU 230049	Pasture woodland	SAC	Undersley Wood
South Bentley	31	14	45	NF32	SU 234128	18th century Inclosure/ pasture woodland	SAC	Anses to Eyeworth Woods
Hincheslea Wood	33	10	43	NF49	SU 273007	Pasture woodland	SAC	Hincheslea Wood
Matley Wood	32	11	43	NF39	SU 334078	Pasture woodland	SAC	Matley and Denny Woods
Sloden Inclosure	36	6	42	NF33	SU 215126	18th century Inclosure/ pasture woodland	SAC	Anses To Eyeworth Woods
Jacks Wood	33	8	41	NF62	SU 312030	Pasture woodland	SAC	Round Hill and Roydon Wood
Mallard Wood	33	8	41	NF41	SU 320091	Pasture woodland	SAC	NE Block
Beaulieu River	30	11	41	NF48	SU 386050	Pasture woodland	SAC	Beaulieu River
Crows Nest Bottom	30	11	41	NF50	SU 241161	Pasture woodland	SAC	NE Block
Berry Wood	29	12	41	NF25	SU 215055	Pasture woodland	SAC	Bratley to Berry Woods
Lin Wood	30	9	39	NF05	SU 194094	Pasture woodland	SAC	Pinnick and Red Shoot Woods Area

Name	NIEC	Bonus spp	NIEC + B	Site Code	Grid Ref	Habitat	Status	NF Old Growth Meta Sites
Pitts Wood area	29	10	39	NF44	SU 198147	Pasture woodland	SAC	Pitts Wood
Rockram Wood	28	11	39	NF13	SU 293133	Pasture woodland	SAC	NE Block
Drivers Nursery	27	12	39	NF69	SU 287048	Riverine 19th century oak plantation	SAC	Adjacent to Central Block
Brockenhurst Park	29	8	37	NF40B	SU 310020	Landscape park, large population of old oak	none	Round Hill and Roydon Wood
Woodhouse Copse	29	8	37	NF40C	SU 310010	Pasture woodland	SAC	Round Hill and Roydon Wood
Bratley Wood	29	7	36	NF24	SU 230083	Pasture woodland	SAC	Bratley to Berry Woods
Mouse's Cupboard	23	11	34	NF87	SU 228062	Pasture woodland and relic pasture woodland	SAC	Bratley to Berry Woods
Wormstall Wood	27	6	33	NF43	SZ 360985	Pasture woodland	SAC	Wormstall Wood
Howen Bushes	26	7	33	NF07	SU 230145	Pasture woodland	SAC	Anses to Eyeworth Woods
Stonard Wood	25	8	33	NF38A	SU 295104	Pasture woodland	SAC	Central Block
Langley Wood	24	8	32	SW01	SU225205	Relic pasture woodland	SAC	Langley Wood Area
Ivy Wood	20	12	32	NF42	SU 316024	Riverine 19th century oak plantation	SAC	Adjacent to Round Hill and Roydon Wood
Burley Woods	22	9	31	NF67	SU 215030	Pasture woodland	SAC	Burley Woods
Cadnam Common	25	5	30	NF73	SU 290153	Pasture woodland, only small cores of old growth	SAC	Cadnam Common
Dames Slough Incosure	24	6	30	NF60	SU 246055	Pasture woodland	SAC	Vinney Ridge to Burley Old
Little Wood	23	7	30	NF28C	SU 357022	Relic pasture woodland	SAC	Frame and Tantany Woods
Ravensnest Inclosure	24	5	29	NF66	SU 255150	18th century Inclosure/ pasture woodland	SAC	NE Block
Fletchers Thorns Inclosure	22	6	28	NF63	SU 274044	Pasture woodland	SAC	Fletchers Thorns
Deazle Wood	19	9	28	NF92	SU269174	Pasture woodland	SAC	NE Block
Franchises Woods	23	4	27	NF59	SU 233168	Relic pasture woodland	SAC	NE Block
Loosehanger Copse	20	5	25	SW03	SU 215191	Old coppice with some veteran trees	SAC	Langley Wood Area
Avon Water	19	6	25	NF70	SZ 259994	Bog and riverine pasture woodland	SAC	Isolated from old growth
High Corner	18	6	24	NF61	SU 198107	Pasture woodland	SAC	Pinnick and Red Shoot Woods Area
Budgen Wood	17	7	24	NF93	SU264137	Pasture woodland	SAC	NE Block
Minstead Manor	19	4	23	NF56	SU 277107	Pasture woodland	SAC	Central Block
The Noads	18	5	23	NF58	SU 399057	Pasture woodland	SAC	The Noads
Burley Outer Rails	15	8	23	NF96	SU 235060	19th century oak plantation	SAC	Adjacent to Undersley Wood
Woodfidley	17	5	22	NF64	SU 345045	Pasture woodland	SAC	Woodfidley
Amberwood Inclosure	16	6	22	NF52	SU 213139	19th century oak plantation	SAC	Adjacent to Anses to Eyeworth Woods
Hanger Corner	16	6	22	NF91	SU 381078	Pasture woodland	SAC	Beaulieu River
Deerleap Inclosure	19	2	21	NF65A	SU 338092	Pasture woodland	SAC	NE Block
Park Ground Inclosure	17	4	21	NF68	SU 305065	19th century oak plantation	SAC	Adjacent to Central Block
Perrywood Inclosure	17	4	21	NF74	SU 325020	Relic pasture woodland, 19th century oak plantation	SAC	Round Hill and Roydon Wood
Ridley Wood	18	2	20	NF26	SU 202060	Pasture woodland	SAC	Ridley Wood
Busketts Lawn Inclosure	17	3	20	NF72	SU 320107	19th century oak plantation	SAC	Adjacent to NE Block
Beech Bed Inclosure	15	5	20	NF95	SU 230064	19th century oak plantation	SAC	Adjacent to Bratley to Berry Woods
Water Copse Inclosure	15	5	20	NF84	SU 295038	19th century oak plantation	SAC	Adjacent to Central Block

Name	NIEC	Bonus spp	NIEC + B	Site Code	Grid Ref	Habitat	Status	NF Old Growth Meta Sites
North Oakley Inlosure	12	7	19	NF94	SU 237072	19th century oak plantation	SAC	Adjacent to Vinney Ridge to Burley Old
New Park	13	4	17	NF97	SU 296046	Deer park converted to farmland	SAC	Central Block
Brockishill Inclosure	15	1	16	NF46	SU 300113	19th century oak plantation	SAC	Adjacent to NE Block
Blackwater	13	3	16	NF89	SU260046	19th century oak plantation	SAC	Adjacent to Vinney Ridge to Burley Old
Bramshaw Inclosure	14	1	15	NF80	SU 255170	19th century oak plantation	SAC	Adjacent to NE Block
Burley New Inclosure	14		14	NF86	SU 235049	19th century oak plantation	SAC	Adjacent to Vinney Ridge to Burley Old
Moyles Court Oak	11	3	14	NF29	SU 163083	Ancient oak and younger trees	SAC	Moyles Court Oak
Red Rise	11	3	14	NF54	SU 245038	Pasture woodland	SAC	Central Block
Whiteparish Common	11	3	14	SW02	SU 254223	Relic pasture woodland	SAC	Langley Wood Area
Wooson’s Hill Inclosure	13	0	13	NF82	SU 254072	19th century oak plantation	SAC	Adjacent to Central Block
Pondhead Inclosure	11	1	12	NF45	SU 310070	19th century oak plantation	SAC	Adjacent to Central Block
Ironshill Inclosure	10	1	11	NF53	SU 316099	19th century oak plantation	SAC	Adjacent to NE Block
Anderwood Inclosure	10		10	NF83	SU 250060	19th century oak plantation	SAC	Adjacent to Central Block
Bratley Inclosure	10		10	NF88	SU 225090	19th century oak plantation	SAC	Adjacent to Bratley to Berry Woods
Langley Hat	10		10	NF65B	SU 352096	Relic pasture woodland	SAC	NE Block
New Copse Inclosure	8		8	NF81	SU 325025	19th century oak plantation	SAC	Adjacent to Round Hill and Roydon Wood
Ober Corner	8		8	NF85	SU 284034	19th century oak plantation	SAC	Isolated from old growth
Churchplace Inclosure	7	1	8	NF77	SU 340010	19th century oak plantation	SAC	Adjacent to NE Block
Holmhill Inclosure	7	1	8	NF78	SU 255085	19th century oak plantation	SAC	Adjacent to Central Block
Slufters Inclosure	7		7	NF90	SU 223091	Relic pasture woodland	SAC	Bratley to Berry Woods
Stockley Inclosure	5	2	7	NF75	SU 345022	19th century oak plantation	SAC	Adjacent to Frame and Tantany Woods
North Bentley	4		4	NF79	SU 240134	18th century oak plantation	SAC	Anses to Eyeworth Woods
Godshill Wood	3		3	NF76	SU 175165	19th century oak plantation	SAC	Isolated from old growth

Post script

Since writing this account, exploration of the New Forest lichen flora has continued with a particularly important study of very old beech stands carried out (Sanderson 2009). There are now 449 taxa in The New Forest Epiphytic Lichen Database, an increase of 29 taxa. Of these, 14 are of epiphytic fungi not normally recorded by lichenologists. Of the remaining 435 taxa, 382 are lichens, 20 ecologically or taxonomically related fungi growing in lichen communities and 33 are parasitic fungi of lichens. Significant additions are *Anisomeridium robustum* NS, *Arthonia anombrophila* NS IR, *Normandina acroglypta* NS, *Micarea alabastrites* IR, *Opegrapha thelotrematis* NS IR, *Psilolechia clavulifera* NS, *Scoliciosporum sarothamni* NS, *Usnea esperantiana* NT NR IR and *Xerotrema quercicola* NR. Sanderson (2009) confirmed the exceptional importance of old open beech stands and raised the known population of *Enterographa elaborata* CR NR BAP from three trees to 20, suggesting a small but viable population.

Sanderson, N. A. (2009). *A Species Dossier for* Enterographa elaborata *in Britain*. A report by Botanical Survey & Assessment to Natural England.