# Information Note: Management of Lichen Rich Woodland in Britain and Ireland.

**Habitat and Management**: in general terms the habitat requirements of lichen assemblages in lichen rich woodlands are similar in all types of British and Irish woodlands. Responses of individual species greatly differ and even the same species can respond differently in distant areas. The availability of light is a major constraint for leafy *Lobarion* community species in humid rainforest sites, but the shared species can be much more sensitive to the availability of shelter from summer sun in drier Southern Oceanic Woodland sites. The exact demands of many species are unknown and managing for specific species is not a practical option. **The only viable method of ensuring the maintenance of rich lichen assemblages is wood or landscape scale management that sustains suitable habitat structures.**

A full literature review of the published evidence on lichens woodland management and restoration is currently being consulted on (Acton, in preparation), the following information note is a summary of the issues. In general, slow colonising lichen and bryophyte species require undisturbed environments and occupy very narrow ecological niches. Old woodland lichens typically require continuity (e.g. a succession of veteran trees and bushes), within sheltered but well-lit habitats, with a ground flora / understory that is open and relatively clear of invasive native species (e.g. ivy, bramble and dense thickets of holly) as well as invasive exotic species such as rhododendron. Ideal conditions are found in sustainably grazed old-growth woodlands, grazed by either managed domestic or wild herbivores. The best sites have a long continuity back into the deep past. Woodlands of recent or planted origin are invariably species poor and hundreds of years are required for full recovery.

**The practical methods of producing or maintaining this habitat are highly dependent on local factors and will differ between nearby woods in different ownership**, depending on the resources available. For example, cattle grazing may be generable preferable to sheep grazing, but upland cattle herds are not common, so carefully managed sheep grazing may be the only option. Individual woods need bespoke management plans.

Slow colonising lichen species require undisturbed environments and occupy very narrow niches. **The best conditions for woodland lichen assemblages are typically found in extensively grazed old growth pasture woodland with a mixture of open canopied high forest, glades and savanna like stands** (Sanderson & Wolseley, 2001). The main positive features appear to be:

- Many trees surviving to senescence.
- Varying, but generally good light levels (with different lichen species having widely different tolerances).
- Shelter producing humid conditions.
- Slow woodland dynamics.

**The basic mechanism driving this is a varying browsing pressure on tree regeneration that suppresses regeneration for long periods**. A major interaction is between the shrub layer and the browsers; this can rapidly and drastically change the light and humidity levels without immediately altering the canopy layer (Coppins & Coppins 1998). Interactions between browsers and the canopy are much more long term, but frequent glades are required. Glades need to be dynamic but permanent features and slow dynamics are crucial. Coppins & Coppins (2002), as an initial guide, suggested a requirement for at least 30% glades within the canopy of lichen rich woodlands and that the glades have a permanence of at least 30 years, but there will be a lot of variation around these figures. Local factors and

history will modify these suggestions. In contrast, tree cover of less than 20 to 30% will result in the loss of sheltered woodland conditions and the resultant decline in the old growth dependent lichen assemblages. Exceptions to the latter are found in parklands with veteran trees with wide spreading crowns in very sheltered valley bottoms or humid areas. In very wet oceanic areas, woodland conditions can also be maintained with less shelter and more open areas. In these special conditions woodland lichen assemblages can survive in more open conditions. Special stands such as dwarfed Atlantic Hazelwoods can have quite dense canopies (Coppins & Coppins, 2012), but even these require small glades to be maintained for maximum lichen diversity.

There is no reason why such conditions could not be created by management outside of pasture woodlands, but this would not be easy. In particular it is important to appreciate the scale of management required. **Rare lichens typically have very low rates of occupation, as they require specialised niches found on only a few veteran trees. As a result, they tend to occur on very small numbers of trees within large populations of veteran trees**. Each veteran tree will have different combinations of niches. Rather than just maintaining a few especially rich trees, sustainable management requires the maintenance of good conditions around dozens or hundreds of trees (depending of the size of the site), both veteran and maturing. To imitate browsing impacts fully, management would also be required to be annual. For example, without browsing, coppice regrowth around haloed veteran trees (trees with shrubs and maturing trees cut from around them) can cast a very dense shade on the lower trunks within three years or so. Extensive grazing appears to be the only practical method of maintaining large blocks of nationally or internationally important lichen rich woodland in the long term. Suitable conditions are unlikely to be found in woodlands managed efficiently for timber. Neither are they likely to be found within non-intervention woodland with low browsing levels.

More detail on habitat structure and management can be read in Sanderson & Lamacraft (2022) and at the Plantlife Website Rainforest lichens and bryophytes - a toolkit for woodland managers. A guide for assessing grazing impact in pasture woodlands is given in **Annex 1**.

**At a landscape scale the implications of the veteran tree habitat and the slow colonisation rates of lichens need to be appreciated**. Within woodlands within distances of a few hundred meters it seems that lichens are limited by the time the habitat takes to mature; they are well adapted to their habitat. The time for the habitat to develop can vary from a few decades for a Sallow bush to mature for leafy *Lobarion* species, to over 300 years for specialist lichens of dry bark on ancient Oaks (Sanderson, 2010). Many are much less well adapted for longer distance dispersal. Only a few kilometres of separation from source populations in old growth stands results in marked differences between the density of colonisation of old woodland species into 19th century Oak stands (Sanderson, 2010 & Wolseley et al, 2016). Post 1840 colonisation of rainforest Hazel woods in Fermanagh, from ancient relics into developing woodland showed a range of responses with some crust forming species being still limited to the relic sites. In contrast many leafy *Lobarion* species had advanced into older recent woodland dating from the 19th century but were rare or absent from stands dating from the 20th (Sanderson, 2012). Fragmentation of many 10kms, is likely to result in very limited colonisation.

**Rich lichen assemblages depend on ecological continuity and have deep links into the past; lichen conservation needs to preserve and cherish rich sites; they cannot be recreated**. Relic sites are also important (Ellis & Coppins, 2007)); the links into the past are now fragile and easily lost forever if the habitat is not carefully restored.

**Threats & Restoration**: it is important to assess the varied threats to individual nationally and internationally important lichens assemblages (Sanderson et 2018). It is easy to carry

out inappropriate restoration management, which causes as much, or more damage than the current threats. The most widespread inappropriate action is total removal of grazing to obtain tree regeneration that works too well and drastically increases the shade within woodlands (Moore & Crawley, 2014). This can severely damage internationally important lichen assemblages within a decade, while a lack of young trees is often a long-term problem that could be solved in more gradually in a carefully planned manner.

Given the long time scales of lichen population dynamics there is a need to have a good understanding of the land use history of an area. For example, many areas with rich Atlantic lichen assemblages, have a long history of low intensity of woodland management with woodland grazing a major use of woodlands (Cannell, 2005 & Smout et al, 2005). These produced landscapes with extensive areas of grazed old growth woodland; ideal habitat, for rich lichen assemblages. From the 17th century onwards intensification of woodland management removed both grazing, veteran trees and their associated lichens and replaced them with industrial Oak plantations. It is important to appreciate the differences between lichen poor residues of intensive woodland exploitation and the older lichen rich relic pasture woodlands. The “Atlantic Oak woods” trope is a poor representation of the kinds of woodland that are important with in the Atlantic woods (Coppins & Coppins, 2005). Also grazing, often as wintering cattle in woods, continued for longer into the 20th century than is often appreciated and in unexpected habitats, such as the Southern Oceanic coast slope woods at Peppercombe being cattle grazed into the 1960s (Coppins & Coppins, 1999).

Although native pinewoods differ from other woods in the dominance of a conifer rather than broadleaved trees, lichen rich stands have similar woodland structures to lichen rich broadleaved woodlands. They are also well gladed old growth pasture woodlands with frequent veteran trees and, of particular importance in these woods, standing dead trees. They also require significant varying grazing pressures to maintain these structures and allow the iconic granny pines to develop. This grazing dependence is shared with lichen assemblages in boreal woodland in Norway. Here (Tønsberg et al, 1996) lists closure of forest canopies as a major threat to many rare lichens; they considered that a dramatic decline in grazing of domestic stock within boreal woodlands has resulted in overgrowth and too shaded an environment for many threatened lichens. One major difference with other British woodlands, however, could be the role of controlled and wild fires. In Sweden, pinewoods with a similar structure to classic Caledonian pinewoods are listed as a key habitat for biodiversity conservation (Karlson et al., 1995). These described as ‘fire-influenced coniferous natural woodlands’ and are the result of regular cool fire maintaining openness and preventing biomass build up and stand destroying wild fires. Up to the early modern prescribed fires were a general tool of woodland grazing in boreal woodlands in Sweden, but were latterly discouraged to allow the development of densely stocked production forests.

The major threats to rich lichen assemblages include:

- **Fragmentation from habitat loss**: this has been occurring for millennia, most recently by the creation of conifer plantations, but action needs to be prioritised. Fragmentation occurring over the last few hundred years in areas with surviving rich lichens assemblages is the priority to tackle (Ellis & Coppins, 2007).

- **Deterioration in habitat quality from intensification of grazing**: where traditional extensive, often seasonal, grazing has intensified, leading to long term issues with woodland survival. This is mainly a problem in northern and upland areas. Heavy browsing is commonly perceived as the main problem for upland woodlands but for lichens it is not necessarily an immediate threat. However, the response to perceived over browsing can be rapidly damaging if not managed carefully (Moore & Crawley,

2014). Long term answers require the redevelopment of sustainable landscape scale grazing regimes similar to those that allowed the woods to survive previously, rather than very localised grazing exclosure. Loss of tree diversity may also be an issue where there has been very long-term heavy grazing.

- **Deterioration in habitat quality from abandonment of extensive grazing management**: this is commoner to the south and in woods in more intensively managed landscapes everywhere. Removal of grazing from traditionally grazed woods results shaded dense woods that can seriously lose lichen diversity. The return of careful and sustainable grazing is vital in a large number of lichen rich woodlands, especially in England and Wales, where a large proportion of the habitat is declining in condition due to insufficient grazing.

- **Deterioration in habitat quality from past intensification of woodland management**: the 18th and 19th century intensification of Oak management has produced a large-scale legacy of Oak high forest with lower lichen diversity than less disturbed woods. These are now aging and being colonised by more mobile old woodland lichens. They have great potential for further colonisation as they age; at over 100 years old they have far more potential than new plantations. Such stands are a very important resource for effectively counteracting past habitat fragmentation. In many stands colonisation would be speeded up by patchy felling to restructure evenly spaced dense stands into more varied and locally more open stands. This, however, would need careful assessment of the existing levels of interest. Creating de novo woods from bare ground will have no useful impact on fragmentation for well over 100 years in most lichen rich woodland meta-sites.

- **Threats from air pollution**: this has been a major issue in impoverishing lichen assemblages in wide areas south of the Highlands. Acidification is still a local problem, especially in the Lake District and there is a threat of ammonia producing industrial animal units spreading in parts of upland Wales and from general ammonia impacts in woods in more enclosed landscapes. Recovery may require some population reinforcement or reintroduction of declining or lost leafy species which are impacted more seriously than crust forming species at moderate levels of pollution. However, prevention by campaigning for clean air is important; prevention is better than cure (Sanderson & Lamacraft, 2022).

- **Threats from tree diseases**: Ash Dieback is likely to have serious impacts locally, especially in areas with past or current acidification impacts, where Ash has become a main, or even sole, host for base rich bark dependant species (Sanderson & Lamacraft, 2022). Effective mitigation for lichens will mainly involve improving habitat quality allowing threatened species to flourish and colonise alternative substates. Planting alternative tree species and regenerating tolerant Ash now will be ineffective on the short to medium terms and as much longer-term mitigations will do little to mitigate against imminent/current ongoing decline for rare lichens growing on Ash trees now.

- **Lack of knowledge**: incomplete knowledge of lichen distribution is a potential large constraint on effective conservation of lichen rich woodlands. This is especially so for relic sites that desperately need restoration.

- **Integration with other woodland interests**: lichens are not the only important biodiversity interest within old growth woodlands and the needs of other interests should be also taken into account. Typically, lichens are likely to set the lower limits of grazing intensity within pasture woodlands but other features of high interest will set the upper limit of grazing pressure. Ideally other interest features integrated into management

should be also be of national significance; conservation of national and internationally important lichen assemblages should not be secondary to local features of interest.

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**Annex 1 Grazing Impact & Lichens**

The following is a guide for assessing grazing impact in pasture woodlands, adapted from Sanderson & Lamacraft (2022) and the Plantlife website "Rainforest lichens and bryophytes - a toolkit for woodland managers" link

**Hard Grazing Impact**: potentially acceptable for periods and will maintain good conditions for epiphytic lichens, but will require reducing periodically for the long term health of the woodland. Indicators:

- No tree regeneration.
- On less acidic soils, no Bramble.
- On acid soils, Bilberry grazed very short and moss mats overwhelmingly dominant.
- Hazel often growing in a single stemmed tree like form; under long term heavy grazing, no regeneration of Hazel bushes by the growth of sun shoots from the base.
- No Ivy on trees.
- Lots of boulders scraped bare of late succession moss mats, less accessible rocks with mid-succession communities, but with Bramble absent.

**Moderate Grazing Impact**: grazing and browsing levels allow some regeneration, while generally maintaining good conditions for epiphytic lichen assemblages but some occasional management of shading shrubs or regeneration may be required. Indicators:

- Suppressed (browsed) tree regeneration surviving and occasionally escaping.
- On less acidic soils, Bramble present, especially around fallen wood debris but Bramble patches contained by browsing.
- On acid soils, Bilberry forming an open canopy with moss mats surviving.
- Hazel bushes perpetuated by some sun shoots escaping browsing but no mass growth of sun shoots. The sun shoots not shading the old shoots, which are remaining healthy.
- Rare to occasional Ivy on trees.
- Boulders have a mixture of early and late succession bryophyte communities. Early succession communities of lichens and bryophytes on small boulders are being maintained. Less accessible rocks may have Bramble or Ivy

**Low Grazing Impact**: grazing and browsing are not containing regeneration and rich epiphytic assemblages are likely to be under threat. Survival of lichen assemblages will require large scale intervention. Indicators:

- Tree regeneration not significantly constrained by browsing.
- On less acidic soils, Bramble extensive and tending to dominate in open areas.
- On acid soils, Bilberry forming a dense and tall canopy with moss mats being shaded out.
- Many sun shoots growing from the base of Hazel bushes, casting heavy shade on older stems and old stems often dying prematurely.
- Ivy widespread on trees and tending to dominate well lit trunks.
- Small boulders are being smothered by late succession moss mats and colonised by grasses/vascular plants, with early and mid-succession communities including lichens absent.

Rich lichen assemblages are likely to set the lower levels of grazing and browsing levels but other interests and criteria are likely to set the upper limits. In most habitats, varied levels of grazing over time, rather than one particular browsing level is likely to be ideal.

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