

Red List of Ecosystem assessment series

Produced by JNCC and NatureScot, supported by Natural Resources Wales, Natural England, and Northern Ireland Environment Agency.

This resource is one in a series/number of Ecosystem Red List assessments developed to accompany the UK Biodiversity Indicator '[Red List of Ecosystems](#)'. The assessments are available at: <https://jncc.gov.uk/resources/7b922dfc-708b-4c8c-9e6a-e2040447fb39>.

Resilient ecosystems are crucial for preventing biodiversity loss and species extinction. Maintaining healthy ecosystems safeguards the essential services they provide, which are fundamental to human well-being and a thriving economy. However, pressures and threats such as deforestation, overfishing, or climate change, can disturb the balance of ecosystems and threaten their health and functioning. Assessing the level of threat facing ecosystems is important in helping us understand the current status of the environment, and on a practical level, assessments can be used to help prioritise conservation funding decisions and where to take conservation management action on the ground.

The 'Red List of Ecosystems' (RLE) is a global assessment approach set out by the International Union on Conservation of Nature (IUCN). The approach includes consideration of a series of criteria, including change in geographic distribution through time; whether the ecosystem distribution is geographically restricted; evidence for any environmental degradation; and disruption to biotic processes or interactions. We have not carried out the quantitative analyses of the probability of ecosystem collapse necessary to assess criterion E as we do not have the data needed to carry out such analyses consistently. The IUCN methodology is widely used as a robust approach to assessing the status of ecosystems. Further details of the criteria used in these assessments are available on the [IUCN portal](#).

This assessment series sets out the RLE assessment conclusions for ecosystems found in the UK, alongside the details of how the assessment was made, including for each IUCN component criterion. The assessments have been peer-reviewed, and source data is referenced. Once complete, the series will cover the full range of natural and seminatural habitats that occur in the UK, throughout marine, terrestrial and freshwater environments.

Assessments are conducted according to the [Global Ecosystem Typology Level 3](#) (Ecosystem Functional Groups). This enables the assessments to feed into the Kunming-Montreal [Global Biodiversity Framework](#) (GBF) headline indicator A.1 Red List of Ecosystems. This indicator, which has been incorporated into the UK Biodiversity Indicator suite, is designed to measure progress against [Goal A](#) ('Protect and restore') and [Target 1](#) ('Plan and manage all areas to reduce biodiversity loss') of the GBF.

Any gridded maps are derived from public sector information licensed under the Open Government Licence v3.0. Coastline boundary is derived from the Oil and Gas Authority's and Lloyds Register SNS Regional Geological Maps (Open Source).

F2.3 Oceanic cool temperate rainforest

1. Key facts

Ecosystem description: Oceanic cool temperate rainforests occupy a cooler, wetter climate than warm temperate forests, but oceanic influence promotes very high precipitation and limits persistence of winter snow. Tree diversity is low, but abundant epiphytic and terrestrial mosses and liverworts, ferns, lichens, and conspicuous fungi contribute to seasonal productivity. Food webs are simple, with low vertebrate diversity and few large herbivores and predators, but with many species found nowhere else.

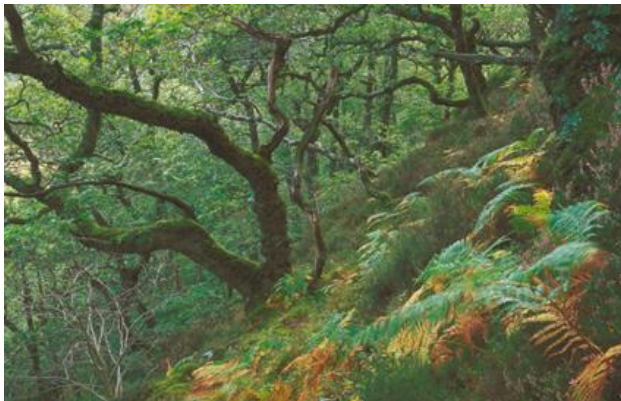


Image credit: Taynish NNR, Argyll ©Lorne Gill/ NatureScot

Overall assessment conclusion: Vulnerable (VU) based on criteria A1, A3, B1b, C2a, D1, D2a

Date assessment published: 02.12.2025

Assessor: Duncan Stone

Reviewer: Jeanette Hall; Ed Mountford; David O'Brien

Corresponding habitat classifications:

EUNIS codes: [G1.8](#) Acidophilous *Quercus*-dominated woodland, [G1.9](#) Non-riverine woodland with *Betula*, *Populus tremula* or *Sorbus aucuparia*, [G1.A](#) Meso- and eutrophic *Quercus*, *Carpinus*, *Fraxinus*, *Acer*, *Tilia*, *Ulmus* and related woodland

UK BAP Priority Habitats: Upland birchwoods, Upland mixed ashwoods, Upland oakwoods, Native pine woodlands, Wet woodlands and Wood-pasture & parkland (where these occur within the rainforest zone)

Habitats Directive Annex I habitats: [H9180](#) *Tilio-Acerion* forests of slopes, screes and ravines, [H91A0](#) Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles, [H91C0](#) Caledonian forest, [H91E0](#) Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*)

2. Assessment against IUCN criteria

Criterion A: Reduction in geographic distribution

Criterion A considers reduction in geographic distribution over ANY of the defined time periods for criteria A1, A2a, A2b or A3. For details of time periods and criteria see [IUCN Red List of Ecosystems Criteria Summary Sheet 2.2 EN.pdf](#)

This ecosystem occurs in the western Highlands of Scotland, Wales, north-west and south-west of England and, potentially, parts of Northern Ireland. It is estimated that the total area of this habitat is 1,578km² (Mountford et al., 2025). This includes all pine-dominated rainforest, which is included in this GET category rather than T2.1, which comprises native pinewood in more boreal conditions, outside of the rainforest zone (Alliance for Scotland's Rainforest 2022). The area also excludes Plantations on Ancient Woodland Sites (PAWS) in order to avoid double counting and thus produce figures consistent with areas calculated for other woodland ecosystem types.

There is broad agreement that the drivers of woodland decline for this habitat have been operating since 1750 and over the last 50 years. These include conversion to plantation (both oak coppice and modern conifer forest), clearance for agriculture and progressive loss due to continuous overgrazing. No reliable data specific to this woodland type are available for these periods, but it is considered likely that the area has declined sufficiently to warrant at least vulnerable status. Analysis of trends in the area of ancient woodland more generally has found declines across the UK. In England and Wales, about 8% of all ancient woodland that existed in c.1920 had been cleared by the mid-1980s; 37% had been converted to plantations (often coniferous); and only 55% remained as semi-natural woodland (Spencer and Kirby, 1992). Similarly, in Scotland, 41% of all the woods which had survived from the mid-18th century had been stocked with plantations (Roberts et al. 1992). By 2014, an analysis carried out for the Native Woodland Survey for Scotland (Patterson et al, 2014), estimated that there had been an overall reduction of 14.2% in the area of ancient woodland since it was compiled using the Ordnance Survey (OS) 1:25,000 second series maps (Ordnance Survey, 1965-1997). The majority of this was to open land, and it is likely that it was largely the result of high herbivore impact.

Assessment: Vulnerable (VU) A1, A3,

Criterion B: Restricted geographic distribution

Criterion B considers restricted geographic distribution indicated by ANY of the time periods for criteria B1, B2 or B3. For details of time periods and criteria see [IUCN Red List of Ecosystems Criteria Summary Sheet 2.2 EN.pdf](#).

Temperate rainforest has a limited range in the hyperoceanic west of the country, with a range surface area of 40,000-50,000km². The woodlands of this habitat are fragmented and much reduced in size from natural levels. They are characterised across their range by high and damaging grazing impacts, principally from deer, and also sheep in some places. Invasive non-native species are present at high levels, especially *Rhododendron ponticum* and Sitka spruce from nearby plantations (Alliance for Scotland's Rainforest 2022). A key foundational tree species, ash *Fraxinus excelsior*, is suffering sizeable losses due to ash dieback, an introduced fungal disease (Forestry Commission, 2025). Furthermore, Dutch elm disease is continuing to spread across the UK rainforest zone, impacting a second commonly occurring tree species, wych elm *Ulmus glabra* (Peterken and Mountford, 1998). In some parts, especially eastern areas at the drier margins, climate change may lead to drier conditions that will reduce or eliminate the key bryophyte and lichen diversity that characterises these woodlands (Ellis & Eaton 2021; Kirkpatrick Baird et al., 2023). All these drivers seem very likely to cause further quality and area declines in the next 20 years and beyond.

Assessment: Vulnerable (VU) B1b

Criterion C: Environmental degradation

Criterion C considers environmental degradation over ANY of the time periods for criteria C1, C2a, C2b or C3. For details of time periods and criteria see [IUCN Red List of Ecosystems Criteria Summary Sheet 2.2 EN.pdf](#).

Climate change is a driver whose impacts in detail are uncertain but likely to have a large impact on this woodland ecosystem whose richness depends on stable environmental conditions. In eastern areas at the drier margins, climate change may lead to drier conditions that will reduce or eliminate the key bryophyte and lichen diversity that characterises these woodlands (Ellis & Eaton, 2021). A general decline has been observed since the 1990s in Scottish bryophytes associated with wetter conditions (Pakeman et al., 2019). There is an interaction with herbivore impact (see Criterion D), as the fragmented canopy and depauperate understorey of many overgrazed woodlands exacerbates drying.

Air pollution is also considered to be problematic, due to the sensitivity of lichens and bryophytes, which are such an important component of this habitat. Whilst detailed information for this habitat is not available, the nutrient nitrogen critical load for 'Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles' (one of the principal Annex I habitat types of the rainforest zone) is exceeded across >25% of the habitat area (JNCC, 2019). However, studies of bryophytes show a degree of recovery since the baseline year 1960 in nitrogen pollution sensitive species in Scotland, including the areas hosting this ecosystem (Pakeman et al., 2019).

Assessment: Endangered (EN) C2a based on severe impacts across over 80% of this ecosystem's UK range.

Criterion D. Disruption of biotic processes or interactions

Criterion D considers Disruption of biotic processes or interactions over ANY of the time periods for criteria D1, D2a, D2b or D3. For details of time periods and criteria see [IUCN Red List of Ecosystems Criteria Summary Sheet 2.2 EN.pdf](#)

Recent and future impacts of ash dieback and Dutch elm disease have and will have significant impacts on the functioning of the habitat. Natural selection of resistant individuals has the potential to rebuild ash (Semizer-Cuming et al., 2021) and (with lower confidence) elm populations and function within the rainforest, but only with significant effort to control herbivore impact to ensure sufficient regeneration to enable natural selection. Breeding resistance may also have a role, but there are well-established difficulties of transferring resistance into field conditions, and the time-period required to grow mature and veteran trees is sizeable. Other pests and pathogens not yet present in UK are capable of damaging rainforest species – for example the bacterium *Xylella fastidiosa* (Defra, 2025) - and these may act in concert with the impacts of climate change, including increasing extreme events.

At larger scales, invasive plant species like Rhododendron and spruce are major damaging agents in rainforest woodland (Alliance for Scotland's Rainforest, 2022), but newer invasives are also developing, particularly *Gaultheria* (salal).

Assessment: D1, D2a based on severe impacts across over 80% of this ecosystem's UK range.

Conservation measures in place

The most important rainforest sites are protected as SSSIs and/ or SACs, although many are in unfavourable condition.

Coordinated and encouraged by the members of the Alliance for Scotland's Rainforest, efforts are being made to tackle many of the negative drivers affecting rainforest condition and extent in Scotland. The establishment of Gene Conservation Units (GCU) for ash and sessile oak at Ariundle NNR, and sessile oak at Glasdrum NNR, also has a role in the resilience of the keystone species through adapting to changing conditions, whether caused by climate change, novel pests and pathogens or other pressures (Cavers et al. 2022). These efforts are not yet sufficient to deliver a more secure future for this habitat, and rely particularly on reducing herbivore impact to enable regeneration. The threats from climate change, drought and novel pests and pathogens are not yet being addressed, and additional work is necessary to resolve these.

In Wales, the Celtic Rainforest Project (<https://celticrainforests.wales/>) aims to improve the habitat of the characteristic communities of mosses, liverworts, lichens and ferns within these woodlands by tackling the issue of invasive species, especially *Rhododendron ponticum*, that threaten the conservation status of the woodlands. The project will also develop active management of the woodland including demonstrating active grazing control, and woodland restoration techniques which in turn will improve habitat condition, demonstrate best practice, increase resilience and enhance the woodlands' ecosystem function.

Overall assessment conclusion

Oceanic cool temperate rainforest in the UK is assessed as Vulnerable (VU) based on criteria A1, A3, B1b, C2a, D1, D2a.

3. Literature references

Alliance for Scotland's Rainforest (2022). The state of Scotland's rainforest. Available at: <https://www.woodlandtrust.org.uk/publications/2019/05/state-of-scotlands-rainforest/>

Cavers, S., Lobo-Guerrero, J.-P. and Perry, A. (2022). *Pilot study to find potential new sites for genetic conservation units for native trees in Scotland*. NatureScot Research Report 1306.

Defra (2025). [High profile pests and diseases - xylella](#).

Ellis, Christopher & Eaton, Sally (2021). Climate change refugia: landscape, stand and tree-scale microclimates in epiphyte community composition. *The Lichenologist*. 53. 135-148. 10.1017/S0024282920000523

Forestry Commission (2025). Map of distribution of Chalara (*Hymenoscyphus fraxineus*). Available at: https://cdn.forestresearch.gov.uk/2022/02/Chalara_UK_outbreak_Map_20241029_v2.pdf.

JNCC (2019). Conservation status assessment for the habitat: H91A0 - Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles. Fourth Report by the United Kingdom under Article 17 on the implementation of the Habitats Directive from January 2013 to December 2018. JNCC, Peterborough. Available at: <https://jncc.gov.uk/jncc-assets/Art17/H91A0-UK-Habitats-Directive-Art17-2019.pdf>

JNCC (2025a). 9180 Tilio-Acerion forests of slopes, screes and ravines <https://sac.jncc.gov.uk/habitat/H9180/>

JNCC (2025b). 91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles <https://sac.jncc.gov.uk/habitat/H91A0/>

Kirkpatrick Baird, F., Spray, D., Hall, J. and Stubbs Partridge, J., 2023. Projected increases in extreme drought frequency and duration by 2040 affect specialist habitats and species in Scotland. *Ecological Solutions and Evidence*, 4(3), p.e12256.

Mountford, E., Baulch, V. & Hill, E. (2025). Technical Documentation for the UK Biodiversity Indicator on the Extent of Natural Ecosystems: 2025 version. *JNCC Report 809*. JNCC, Peterborough, ISSN 0963-8091. <https://jncc.gov.uk/resources/ee44fbd1-81de-4c5b-8210-83a24e799555>.

Pakeman, R.J., Brooker, R.W., O'Brien, D. and Genney, D., 2019. Using species records and ecological attributes of bryophytes to develop an ecosystem health indicator. *Ecological Indicators*, 104, pp.127-136.

Patterson, G., Nelson, D., Robertson, P. and Tullis, J. (2014) Scotland's Native Woodlands - results from the Native Woodland Survey of Scotland. Forestry Commission Scotland, Edinburgh

Peterken, G.F. and Mountford, E.P. (1998) Long-Term change in an unmanaged population of Wych elm subjected to Dutch elm disease. *Journal of Ecology* 86, 205-218.

Roberts, A.J., Russell, C., Walker, G.J. and Kirby, K.J., (1992). Regional variation in the origin, extent and composition of Scottish woodland. *Botanical Journal of Scotland*, 46(2), pp.167-189. Semizer-Cuming, D., Chybicki, I.J., Finkeldey, R. *et al.* Gene flow and reproductive success in ash (*Fraxinus excelsior* L.) in the face of ash dieback: restoration and conservation. *Annals of Forest Science* 78, 14 (2021). <https://doi.org/10.1007/s13595-020-01025-0>

Spencer, J.W. and Kirby, K.J., (1992). An inventory of ancient woodland for England and Wales. *Biological conservation*, 62(2), pp.77-93.