

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.

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F1.1 Permanent upland streams

1. Key facts

Ecosystem description: These permanently flowing lower stream order watercourses in mountainous or hilly areas are characterised by steep gradients, coarse substrates, fast and frequently turbulent flows, periodic (usually seasonal) high-flow events, and a mosaic of habitats. Their biota are adapted to high flow velocities. Nutrient inputs are relatively low.



Image credit: Beinn Eighe NNR, Highland (© John MacPherson / NatureScot)

Overall assessment conclusion: Endangered (EN) based on criteria C1, C2b, C3, D1, D2a and D3

Date assessment published: 02.12.2025

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Corresponding habitat classifications: The following habitats were considered in the production of this assessment.

EUNIS codes: [C2.1](#) Springs, spring brooks and geysers; [C2.2](#) Permanent non-tidal, fast, turbulent watercourses

UK BAP Priority Habitats: Rivers

Habitats Directive Annex I habitats: [H3260](#) Water courses of plain to montane levels with the *Ranunculus fluitantis* and *Callitriche-Batrachion* vegetation

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](#)

The geographic distribution of this ecosystem is considered to remain unchanged because there have been limited changes to upland watercourses, which are generally located upstream of areas of intensive land use. However, climate change related changes in precipitation and so stream flow suggest that some perennial streams may become intermittent, i.e. their geographic distribution *may* change in the future (Curtis et al., 2014; Natural England 2020).

Assessment: Vulnerable (VU) A2a

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](#).

This is a widely distributed ecosystem within the UK and globally.

Assessment: Least Concern (LC)

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](#).

Below the tree line, dead wood and the riparian woodland from which it originates are essential elements of naturally functioning permanent upland streams (Perfect et al., 2013). Bankside tree roots and woody debris influence the geomorphology and hydraulics and so the habitats and development of these watercourses. Grazing by (notably unchecked and proliferating numbers of) deer has severely depleted riparian woodland and herb communities, thus adversely affected the form, functioning, evolution and conservation value of permanent upland streams (Watts et al., 2022).

Historically the pH of upland streams has been lowered by acid rain (sulphur dioxide or nitrogen oxides produced principally by the combustion of fossil fuels, combined with water vapour) and led to depauperate aquatic communities (Defra, 2025). In some catchments the scavenging of acidic precipitation by largely non-native coniferous forest plantations increased deposition (Curtis et al., 2014). Many watercourses have been impacted on by agriculture, notably livestock grazing, fertilizers and pesticides (e.g. sheep dip and anthelmintic medications) and to a lesser extent sewage.

Both run-of-river and pumped storage hydroelectric power schemes have modified the flow and sediment transport regimes of some permanent upland streams, affecting the quantity, quality, and diversity of aquatic habitat (Williams et al., 2025).

Climate change related changes in precipitation (and so stream flow) and temperature suggest that the habitats and biota associated with permanent upland streams will change (Curtis et al., 2014). Despite a likely overall increase in annual precipitation, models suggest that it will become more seasonal leading to greater frequency and duration of droughts (Kirkpatrick Baird et al., 2023).

These pressures affect over 80% of this ecosystem in the UK with varying degrees of severity.

Assessment: Endangered (EN) C1, C2b, C3

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](#)

The loss of riparian trees reduces the shading of permanent upland streams, increasing water temperature and rendering habitats unsuitable for some species which will be killed or displaced (Perfect et al., 2013; Watts et al., 2022). The reduction in organic matter associated with the loss of riparian trees affects food webs, for example a reduced supply of leaf litter will reduce the number of primary consumers (invertebrates) and so secondary consumers (fish) (Watts et al., 2022).

The impacts of the abiotic pressures noted under Criterion C are also likely to have a cascade of biotic impacts, including habitat and species composition and richness across the majority of this ecosystem.

Invasive non-native species known to impact adversely on native species abundance and diversity in this ecosystem include American mink and signal crayfish (Gaywood et al., 2016).

While some of these pressures are localised, many, particularly those related to biotic consequences of abiotic pressures affect over 80% of this ecosystem in the UK with varying degrees of severity.

Assessment: Endangered (EN) D1, D2a, D3

Conservation measures in place

Pollution control legislation has led to sizeable increases in UK freshwater invertebrates (e.g. insect groups providing freshwater nutrient cycling have recovered to above the 1970 value with an average 64% increase in species' distributions: Burns et al., 2023). However, while emissions of sulphur and many other pollutants have declined markedly since 1990, there is a lag in the ecological response (Defra, 2025).

Many permanent upland streams are within protected areas and as such are covered by designations such as SSSI, Special Areas of Conservation and Special Protection Areas (JNCC, 2025). These approaches are sometimes complemented by agri-environmental schemes that target river restoration or natural flood management (e.g. Spray et al., 2022). INNS control has seen some local improvements (e.g. Gaywood et al., 2016) but it would be premature to consider efforts successful. Similarly, the reintroduction of European beaver *Castor fiber*, an ecosystem engineer, may lead to improvements in the status of this ecosystem but at present they are limited in range and their long-term impacts are uncertain.

The need to plant riparian woodland to increase shading and restore the natural form, functioning, evolution, habitats, and species associated with permanent upland streams is attracting increasing attention (Addy et al., 2016). Riparian planting features in many river restoration schemes (Watts et al., 2022).

Sediment management plans are being used to address the disruption of sediment movement in rivers caused by hydroelectric power schemes (Williams et al., 2025). It is anticipated that licences for new schemes will stipulate that the design should ensure that sediment movement is maintained.

Overall assessment conclusion

Permanent upland streams in the UK are assessed as being Endangered (EN) based on criteria C1, C2b, C3, D1, D2a and D3.

3. Literature references

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