C1.6a Temperate temporary waterbody

Summary

This habitat of fluctuating water bodies is related to very particular geological, geomorphological and climatic conditions which permit rise and fall of ground water through underlying limestone or gypsum. Turloughs and related limestone karst depressions vary in size and flood in autumn through swallow holes and fissures in the limestone, emptying in the spring. Gypsum karst lakes are very rare and develop where water accumulates in depressions and dries out periodically. The vegetation in such situations can include more or less permanent pools with aquatics, water margin vegetation, fens and wet meadows. The main threats are from interruption of the natural hydrology, eutrophication from farming and climate change. Restoration after substantial damage is difficult and strict protection is necessary.

Synthesis

This habitat qualifies for Least Concern (LC) according to the wide distribution and small declines in quality and quantity. However trends in area are very close to the Near Threatened thresholds. Besides, the data are incomplete, especially for some Balkan countries which may contain large areas. The results of the assessment could change a lot, either positively or negatively, if more data from Balkan countries were available.

Overall Category & Criteria			
EU 28		EU 28+	
Red List Category	Red List Criteria	Red List Category	Red List Criteria
Least Concern	-	Least Concern	-

Sub-habitat types that may require further examination

For the Habitats Directive the subtypes 'lakes of gypsum karst' and 'turloughs' have been distinguished. Also the assessments for the Article 17 report a lack of information about the conservation status of 'lakes of gypsum karst' in most of the countries where this subtype is supposed to occur. Such and other geogrpahic subtypes may be more threatened in those geographical areas where calcareous geological formations are not abundant. In such areas, the subtypes may also contain a high number of endemics.

Habitat Type

Code and name

C1.6a Temperate temporary waterbody

Turlough at Lough Gealain, Burren National Park, County Clare, Ireland (Photo: L. Lysaght).

Temporary lake in the Annifo Karst Plain, Central Apennines, Italy (Photo: Flavia Landucci).

Habitat description

This habitat type includes temporary freshwaters in the European temperate region. The associated plant communities seem not to be significant in the definition of the habitat which is mainly determined by hydrogeological and geomorphological conditions rather than by the biological component. These water bodies are characterized by large fluctuations of water level, which is related to the level of the underlying water table and to the amount of precipitation. In parts of the year, water is absent from these habitats and the plant and animal communities are mainly dependent by the seasonal hydrological regime, especially by the speed of drying out. The habitat can include a wide range of vegetation types, from wetland ones characterizing the areas where the water remains longer, to terrestrial ones in those areas where the water remains for a shorter time. The habitat includes the following distinct sub-types:

Turloughs have been described first as a habitat unique to Ireland but with a location also in Scotland and maybe Wales. However considering that this habitat is mainly determined by hydrological and geomorphological conditions it was recently recognized also in the Slovenian karst and other karstic areas of the temperate Europe and Mediterranean calcareous mountains. Turloughs are depressions of variable size developing on limestone, supporting vegetation and soils indicative of the prevalence of flooded conditions over at least part of the year. Flooding occurs annually in autumn mainly through springs and fissures in the underlying limestone though direct rainfall can have a secondary effect. Some turloughs in Ireland are affected by the tidal movements of coastal waters. In spring or summer draining often occurs through the same fissures or swallow-holes. Some turloughs can flood at any time within a few hours after heavy rainfall and subsequently may dry up again a few days later. This makes this habitat rather dynamic. The vegetation includes a range of vegetation alliances depending on flooding patterns, geomorphology, trophic status, grazing and climatic conditions. Mostly turloughs are grass- or sedge-dominated basins, which sometimes have a marsh or occasionally a permanent pond in the most depressed point. In the Burren, the high-water mark is often shown by *Potentilla fruticosa*. In Ireland the presence of the black moss *Cinclidotus fontinaloides* is a regular indicator of the location of a turlough. Moreover the habitat can includes rare wetland species such as the fen violet *Viola persicifolia*, the annual northern yellowcress *Rorippa islandica* and *Callitriche palustris*. In the Slovenian and Southern European karst systems, due to the different climatic and hydrological regimes, turloughs host mainly wet meadows. In these communities species such as *Lotus corniculatus, Centaurea jacea, Galium verum, Ranunculus acris, R. repens, Agrostis stolonifera, Achillea millefolium* are common. Turlough wetland communities can be classified into three main phytosociological classes: the *Scheuzerio palustris-Caricetea fuscae* of small-sedge communities, the *Molinio-Arrhenatheretea* including wet meadows and disturbed habitat communities, and the *Littorelletea uniflorae* lakeshore communities found on the margins of more permanent water bodies within turloughs. *Caricion davallianae* and *Potentillion anserinae* are the phytosociological alliances listed in the Habitats Directive as characteristic of this habitat. Aquatic and marsh communities often occur in the lower parts of turlough basins.

Lakes of gypsum karst is a very rare habitat, that includes small lakes that have developed by springs or spring complexes of active gypsum karst areas. The underlying rock might be gypsum or limestone, characterized by calcium sulphate and carbonate, respectively. Karst sinkholes might have a different shape and depth. They may appear as chains of funnel-shaped sinkholes and small hollows. They usually accumulate water but also fall dry periodically. The lakes are characterized by pronounced fluctuations of water level as well as high concentrations of calcium sulphate. Since lakes of gypsum karst significantly differ in shape, size, age and origin, their vegetation can be quite diverse. Older sinkholes can develop in lakes or bogs or into a terrestrial wet meadows vegetation. Younger ones can have a diverse vegetation including submerged and free-floating aquatic macrophytes. In general the vegetation is well adapted to fluctuating water levels (including semi-permanent conditions) and relatively high sulphate levels. Therefore, a number of alliances of the Littorelletea might be found in these habitats: *Subularion aquaticae, Deschampsion litoralis, Lobelion dortmannae, Littorellion uniflorae, Hyperico elodis-Sparganion*.

Indicators of good quality:

- The periodical alternation of wet-and-dry regimes
- The absence of heavy anthropogenic activities that can alter the hydrogeological system (e.g. water capitation and drainage)
- The absence of communities and species indicating an excessive nitrification or disturbance such as ruderal and exotic species

Characteristic species:

The species of vascular plants that can occur in this habitat type are many and are usually not exclusive of this habitat. Therefore some species can be considered diagnostic of the habitat only in combination with the geomorphological and hydrogeological conditions.

Vascular plants: *Viola persicifolia, Potentilla fruticosa, Rorippa islandica Callitriche palustris, Subularia aquatica, Deschampsia setacea, Lobelia dortmanna, Littorella uniflora, Hypericum elodis, Sparganium gramineum, Chara* spp., *Lotus corniculatus, Centaurea jacea, Galium verum, G. palustre, Ranunculus acris, R. repens, Agrostis stolonifera, Achillea millefolium, Juncus inflexus, J. effusus, Eleocharis palustris, Carex acuta, C. davalliana, C. paniculata, C. vesicaria, Lysimachia vulgaris, Trifolium fragiferum, Thalictrum flavum, Filipendula ulmaria, Mentha longifolia, Glyceria notata, G. fluitans, Alopecurus rendlei, Hordeum secalinum.*

Bryophytes: *Cinclidotus fontinaloides, Fontinalis antipyretica, Drepanocladus* spp., *Calliergon* spp.

Macroinvertebrates: insects, crustaceans, flatworms and snails are often abundant. Species frequently reported are *Cleon dipterum, C. simile, Bithynia tentaculata, Lymnea peregra, L. palustris, L. stagnalis, Polycelis nigra, Chydorus sphaericus, Daphnia pulex, D. longispina, Diaptomus castor, D. cyaneus, Cyclops agilis, Ostracoda* spp. *Gammarus* spp., *Asselus* spp., *Hydroporus palustris, Porhydrus lineatus, Eurycercus glacialis, Eurycercus lamellatus, Hydra* spp., *Hygrotus quinquelineatus, Berosus signaticollis, Hygrotus impressopunctatus, Helophorus* spp., *Tanymastix stagnalis, Agonum lugens, A. livens, Badister meridionalis, Blethisa multipunctata, Pelophila borealis, Beetle species, Agonum lugens, Philonthus furcifer, Chirocephalus* spp.

Vertebrates: When turloughs retain some water all year, they may be important bird haunts, e.g. *Anser albifrons*, *Cygnus cygnus*, *Anas* spp. and many waders can occur in winter. Amphibians such as *Triturus* spp., *Bombina* spp., *Bufo* spp., *Hyla* spp. and *Rana* spp. can use this temporary water bodies for reproduction during spring.

Classification

This habitat may be equivalent to, or broader than, or narrower than the habitats or ecosystems in the following typologies.

EUNIS:

C1.6 Temporary lakes, ponds and pools

EurovegChecklist alloances:

Charion fragilis Krausch 1964

Subularion aquaticae Hadac 1971

Rorippion islandicae Béguin et Theurillat ined.

Deschampsion litoralis Oberd. et Dierßen in Dierßen 1975

Lobelion dortmannae Vanden Berghen 1964

Littorellion uniflorae Koch ex Klika 1935

Hyperico elodis-Sparganion Br.-Bl. et Tx. ex Oberd. 1957

Magno-Caricion gracilis Géhu 1961

Caricion davallianae Klika 1934

Potentillion anserinae Tx. 1947

Loto tenuis-Trifolion fragiferi Westhoff et Den Held ex de Foucault 2009

Thalictro flavi-Filipendulion ulmariae de Foucault in Royer et al. 2006

Mentho longifoliae-Juncion inflexi T. Müller et G.rs ex de Foucault 2009

Annex 1:

3180 Turloughs

3190 Lakes of gypsum karst

Emerald:

C1.66 Temporary inland saline and brackish waters

C1.67 Turlough and lake bottom meadows

MAES-2:

Fresh water, Rivers and lakes, Inland surface waters (water coursed and bodies)

IUCN:

5.6 Seasonal/Intermittent Freshwater Lakes [over 8 ha]

5.8 Seasonal/Intermittent Freshwater Marshes/Pools [under 8 ha]

5.18. Karst and Other Subterranean Hydrological Systems [inland]

WFD:

101, 201

Does the habitat type present an outstanding example of typical characteristics of one or more biogeographic regions?
No

Justification
The occurrence of this habitat is mainly determined by suitable geological and geomorphological conditions. It occurs in all temperate Europe and some of the calcareous mountain systems of the Mediterranean area.

Geographic occurrence and trends

EU 28	Present or Presence Uncertain	Current area of habitat	Recent trend in quantity (last 50 yrs)	Recent trend in quality (last 50 yrs)
Austria	Uncertain	Unknown Km^2	Unknown	Unknown
Bulgaria	Present	Unknown Km^2	Decreasing	Decreasing
Croatia	Present	19 Km^2	Unknown	Unknown
Estonia	Present	4.2 Km^2	Decreasing	Decreasing

EU 28	Present or Presence Uncertain	Current area of habitat	Recent trend in quantity (last 50 yrs)	Recent trend in quality (last 50 yrs)
Finland	Finland mainland: Uncertain	Unknown Km^2	Unknown	Unknown
France	France mainland: Present	Unknown Km^2	Unknown	Unknown
Germany	Present	Unknown Km^2	Decreasing	Decreasing
Greece	Greece (mainland and other islands): Uncertain	Unknown Km^2	Unknown	Unknown
Ireland	Present	69 Km^2	Stable	Stable
Italy	Italy mainland: Present	Unknown Km^2	Decreasing	Decreasing
Latvia	Present	Unknown Km^2	Unknown	Unknown
Lithuania	Present	0.15 Km^2	Stable	Decreasing
Poland	Uncertain	Unknown Km^2	Unknown	Unknown
Portugal	Portugal mainland: Uncertain	Unknown Km^2	Unknown	Unknown
Romania	Present	4 Km^2	Stable	Stable
Slovakia	Present	0.01 Km^2	Decreasing	Decreasing
Slovenia	Present	33 Km^2	Stable	Stable
Spain	Spain mainland: Uncertain	Unknown Km^2	Unknown	Unknown
Sweden	Uncertain	Unknown Km^2	Unknown	Unknown
UK	Northern Island: Present United Kingdom: Present	0.07 Km^2	Stable	Decreasing

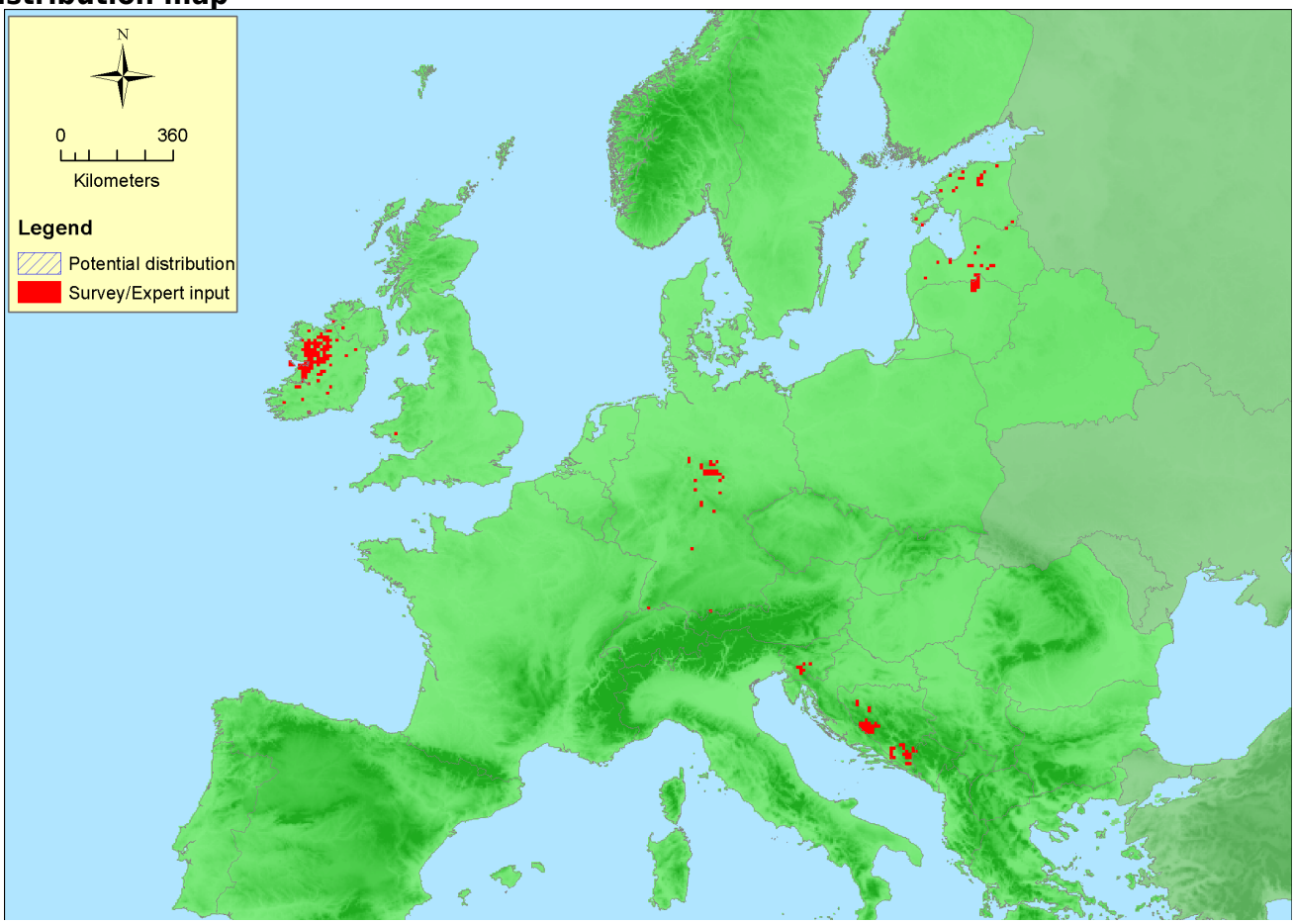
EU 28 +	Present or Presence Uncertain	Current area of habitat	Recent trend in quantity (last 50 yrs)	Recent trend in quality (last 50 yrs)
Albania	Uncertain	Unknown Km^2	Unknown	Unknown
Bosnia and Herzegovina	Present	260 Km^2	Decreasing	Decreasing
Former Yugoslavian Republic of Macedonia (FYROM)	Uncertain	Unknown Km^2	Unknown	Unknown
Kaliningrad	Uncertain	Unknown Km^2	Unknown	Unknown
Kosovo	Uncertain	Unknown Km^2	Unknown	Unknown
Montenegro	Uncertain	Unknown Km^2	Unknown	Unknown
Serbia	Uncertain	Unknown Km^2	Unknown	Unknown

Extent of Occurrence, Area of Occupancy and habitat area

	Extent of Occurrence (EOO)	Area of Occupancy (AOO)	Current estimated Total Area	Comment
EU 28	2071600 Km^2	196	129 Km^2	Only 8 countries provided the actual total area of the habitat.

	Extent of Occurrence (EOO)	Area of Occupancy (AOO)	Current estimated Total Area	Comment
EU 28+	2487600 Km^2	240	389 Km^2	Only Bosnia and Herzegovina provided the actual area. This country reported a very large area, which seems to be reliable considering the extension of calcareous massifs in the Balkans.

Distribution map



Map is incomplete, especially for Karst areas outside the EU28 like in Croatia. The habitat has been reported from 12 EU 28 countries (Bulgaria, Croatia, Estonia, France, Germany, Ireland, Italy, Lithuania, Romania, Slovakia, Slovenia, United Kingdom) and one EU 28+ (Bosnia and Herzegovina). Data sources: Art17, NAT.

How much of the current distribution of the habitat type lies within the EU 28?

About 60% of this habitat type is expected to be within EU28 and the other 40% within EU28+. The habitat should occur especially in the Balkans (Albania, Serbia, Monte Negro, Kosovo) where karst systems are extensively developed. However such estimation is very hypothetical considering that for many countries there are no data about this habitat. Similar habitat types determined by similar geological and geomorphological conditions, but hosting different species and therefore attributable to other vegetation types, are also present in other part of the world.

Trends in quantity

The habitat type is reported to have a decreasing trend in quantity in half of the countries (Germany, Italy, Bulgaria, Bosnia and Herzegovina, Estonia, Slovakia) that provided data, while the other half of the

countries (United Kingdom, Slovenia, Romania, Lithuania, Ireland and Croatia) reported a stable situation. The extent of this habitat is higher in the Northern and Southern Europe where the habitat is also better preserved. The quantity decrease is higher in central Europe, where the habitat is occurring in very few locations with small extent. Germany and Slovakia reported a decrease in the last 50 years between 50 and 90%, however this decrease almost did not influence the trend in quantity at the European scale because Germany, even if should have at least three locations, as known from the official Natura 2000 manual, did not specified the current area of the habitat and Slovakia reported an area of 0.01 km^2.

- Average current trend in quantity (extent)
  EU 28: Decreasing
  EU 28+: Decreasing
- Does the habitat type have a small natural range following regression?
  No
  Justification
  Some countries reported that the habitat is stable, others that the regression is ongoing due to anthropogenic factors. However the geographical range of the habitat (EOO) is very wide and seems to go far beyond 50,000 Km^2.
- Does the habitat have a small natural range by reason of its intrinsically restricted area?
  No
  Justification
  The geographical range of the habitat (EOO) is very wide.

Trends in quality

All the countries that provided data reported between a slight to severe degradation of 10 to 100% of the habitat area. Consistently with the trend in quantity, the areas more affected by the degradations were reported to be the central European ones, while those with higher habitat area had slight to moderate degradation influencing not more than 30% of the areas. The causes of degradation mainly affect the groundwater – diffuse groundwater pollution, changes in the hydrology of the karst system due to water abstraction, canalization and amelioration. Pollution of soil and superficial water due to agricultural practices, tourism, climate changes, biocenotic changes, succession are also recorded as common causes of degradation. The extent of degradation is probably rather influenced by the position of this habitat in the landscape (whether in lowlands or in mountain areas) and the resources available in the surrounding, by cultural reasons (historical use and management of the landscape) and the inclusion or not of this habitat in protected areas.

- Average current trend in quality
  EU 28: Decreasing
  EU 28+: Decreasing

Pressures and threats

Main pressures are of anthropogenic origin, especially those that have direct or indirect influence on the groundwater level and quality. Several karst plains can be affected by increasing farming activities, which can lead to water drainage, direct habitat destruction and an increase of water and soil pollution due to fertilization and the use of pesticide. Climate changes, especially the frequent changes of seasonal precipitation could cause the shifting groundwater level and consequently of the vegetation as far as the complete disappearance of some species and communities. Natural events like earthquake and underground collapse could also influence changes of the groundwater level, however these phenomena have usually only local impact.

List of pressures and threats

Agriculture

- Cultivation
- Mowing / Cutting of grassland
  - Abandonment / Lack of mowing
- Grazing
  - Intensive grazing
  - Abandonment of pastoral systems, lack of grazing
- Livestock farming and animal breeding (without grazing)
- Annual and perennial non-timber crops
- Use of biocides, hormones and chemicals
- Fertilisation

Mining, extraction of materials and energy production

- Mining and quarrying
- Renewable abiotic energy use
  - Wind energy production

Pollution

- Pollution to groundwater (point sources and diffuse sources)
- Soil pollution and solid waste (excluding discharges)

Natural System modifications

- Human induced changes in hydraulic conditions
  - Landfill, land reclamation and drying out, general
  - Canalisation & water deviation
  - Flooding modifications
  - Lack of flooding
  - Modification of hydrographic functioning, general
  - Water abstractions from groundwater
- Other ecosystem modifications
  - Anthropogenic reduction of habitat connectivity

Climate change

- Changes in abiotic conditions
  - Flooding and rising precipitations
- Changes in biotic conditions
  - Habitat shifting and alteration
  - Desynchronisation of processes
  - Decline or extinction of species

Conservation and management

This habitat is threatened especially by anthropogenic activities that could alter the physical and chemical conditions, or even cause the progressive erosion of the habitat. Therefore measures for farming activities such as the regulation of the minimum distance of crops from the flood areas, the use of biocides, fertilizers and irrigation should be introduced in every country. Moreover measures should be also taken regarding the catchment of groundwater in the surrounding areas. In many cases, large areas in which this habitat occurs are already included in protected areas, however probably most of the smallest systems are not protected in any way in all of the countries. The inclusion of this habitat in protected areas is surely useful to limit the reduction of the habitat due to anthropogenic use of the land. Grazing and mowing may

be positive for the maintenance of some vegetation types and a high biodiversity and for limiting the vegetation succession processes. However these activities should be properly regulated preventing overgrazing, nitrification and the reduction of the natural dispersal of seeds. Considering that this habitat develops exclusively on karst and gypsum geological formations, measures related to mining and quarrying may also be needed in some countries both to avoid direct and indirect erosion and damage of the habitat.

List of conservation and management needs

Measures related to agriculture and open habitats

Maintaining grasslands and other open habitats
Adapting crop production

Measures related to wetland, freshwater and coastal habitats

Restoring/Improving water quality
Restoring/Improving the hydrological regime
Managing water abstraction

Measures related to spatial planning

Establish protected areas/sites
Legal protection of habitats and species
Manage landscape features

Measures related to urban areas, industry, energy and transport

Specific management of traffic and energy transport systems

Conservation status

Annex 1 types:

3180: ALP U1, ATL U1, BOR U1, CON U1

3190: ALP FV, BOR XX, CON U1

When severely damaged, does the habitat retain the capacity to recover its typical character and functionality?

The capacity of this habitat to naturally recover is different according to the kind of damage that the habitat has undergone. If the damage concerned the groundwater level it may be possible to recover the habitat only through intervention, if at all. If the damage concerned only the land surface such as in the case of nitrification, pollution of soil or destruction of the natural vegetation due farming activities, the habitat can probably partially or totally recover through intervention (seed dispersal, removal of pollutants) in approximately a decade. Without intervention the habitat could require more years to recover. Although the functionality of the habitat can be easily recovered, the natural recovering of species composition could be difficult if the seed bank is destroyed.

Effort required

10 years	20 years	50+ years	200+ years
Through intervention	Naturally	Naturally	Naturally

Red List Assessment

Criterion A: Reduction in quantity

Criterion A	A1	A2a	A2b	A3
EU 28	-23 %	unknown %	unknown %	unknown %
EU 28+	-24 %	unknown %	unknown %	unknown %

The calculated trend in quantity resulted in a reduction of 23-24% during the last 50 years that corresponds to the category Least Concern. This calculation was performed using the quantitative data available, which however represent only 40-45% of the total countries in which the habitat should occur. This value is very close to the threshold of category Near Threatened. If we consider the extended lack of data, especially from Balkan countries within EU 28+ and Italy, France and Germany within EU 28, the habitat could also be Near Threatened both in EU 28 and EU 28+. However there is not sufficient information available to make such assumption.

Criterion B: Restricted geographic distribution

Criterion B	B1				B2				B3
	EOO	a	b	c	AOO	a	b	c	
EU 28	> 50000 Km^2	Yes	Unknown	unknown	> 50	Yes	Unknown	unknown	unknown
EU 28+	> 50000 Km^2	Yes	Unknown	unknown	> 50	Yes	Unknown	unknown	unknown

The habitat is largely extended in Europe therefore both EOO and AOO are far above the thresholds required by criterion B to consider the habitat threatened. However spatial extent, biotic and abiotic quality of the habitat are in continuing decline.

Criterion C and D: Reduction in abiotic and/or biotic quality

Criteria C/D	C/D1		C/D2		C/D3	
	Extent affected	Relative severity	Extent affected	Relative severity	Extent affected	Relative severity
EU 28	29 %	49 %	unknown %	unknown %	unknown %	unknown %
EU 28+	16 %	37 %	unknown %	unknown %	unknown %	unknown %

Criterion C	C1		C2		C3	
	Extent affected	Relative severity	Extent affected	Relative severity	Extent affected	Relative severity
EU 28	unknown %	unknown %	unknown %	unknown %	unknown %	unknown %
EU 28+	unknown %	unknown %	unknown %	unknown %	unknown %	unknown %

Criterion D	D1		D2		D3	
	Extent affected	Relative severity	Extent affected	Relative severity	Extent affected	Relative severity
EU 28	unknown %	unknown%	unknown %	unknown%	unknown %	unknown%
EU 28+	unknown %	unknown%	unknown %	unknown%	unknown %	unknown%

The reduction in biotic and abiotic quality over the last 50 years affected 29% of the extent of the habitat in EU 28 countries with a severity of 49% and 19% of the extent of the habitat in EU 28+ with a severity of 37%. This calculation is based on data provided by only 30% of the countries in which the habitat is

expected to occur. According to criterion C/D the habitat is Least Concern, however an underestimation or overestimation of the reduction in biotic and abiotic quality may be due to the large gap of data for countries with large extension of calcareous formations like Italy, France and most of the Balkan countries.

Criterion E: Quantitative analysis to evaluate risk of habitat collapse

Criterion E	Probability of collapse
EU 28	unknown
EU 28+	unknown

There is no quantitative analysis available that estimates the probability of collapse of this habitat type..

Overall assessment "Balance sheet" for EU 28 and EU 28+

	A1	A2a	A2b	A3	B1	B2	B3	C/D1	C/D2	C/D3	C1	C2	C3	D1	D2	D3	E
EU28	LC	DD	DD	DD	LC	LC	LC	LC	DD	DD	DD	DD	DD	DD	DD	DD	DD
EU28+	LC	DD	DD	DD	LC	LC	LC	LC	DD	DD	DD	DD	DD	DD	DD	DD	DD

Overall Category & Criteria			
EU 28		EU 28+	
Red List Category	Red List Criteria	Red List Category	Red List Criteria
Least Concern	-	Least Concern	-

Confidence in the assessment
Medium (evenly split between quantitative data/literature and uncertain data sources and assured expert knowledge)

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