G1.2b Temperate and boreal hardwood riparian woodland

Summary

Temperate and boreal hardwood riparian woodland is one of the richest woodland types in Europe with often majestic and diverse canopy, well-developed and tangled understorey and rich and distinctive field layer. It typically occurs in the middle to lower reaches of large rivers through the temperate and boreal zones, where there is a deep but wide water table, with flooding occuring some years and bringing rich silt and often also side-valley flushing. Canalisation of rivers, building of dams and watergates, clearance for agriculture, afforestation, urbanisation and industrialisation, with associated infrastructures along easy communication pathways, and the invasion of non-native species have all affected this habitat and remain threatening. Conservation demands the maintenance or restoration of natural hydrographic functionality, prevention of pollution and limiting encroachment by development.

Synthesis

The category Endangered (EN) can be assessed on EU28+ and is also chosen in EU28, because of a very substantial reduction in quantity over a historical period. This decline has continued more recently (last 50 years), with values close to the Near Threatened thresholds. The area is still decreasing, mostly in countries where the habitat has already been destroyed in most places (North-western Europe). The trend in quality is also bad leading to a Vulnerable (VU) category in the EU28, and slightly lower negative trends in EU28+. This assessment is in agreement with the conservation status of the corresponding Natura 2000 habitat (91F0), which has been assessed as "unfavourable-bad" in most regions.

Overall Category & Criteria			
EU 28		EU 28+	
Red List Category	Red List Criteria	Red List Category	Red List Criteria
Endangered	A3	Endangered	A3

Sub-habitat types that may require further examination

The habitat has (historically) decreased through all of the range, so no subtypes are needed.

Habitat Type

Code and name

G1.2b Temperate and boreal hardwood riparian woodland

Riparian woodland with *Quercus robur*, *Fraxinus excelsior* and *Populus* (association *Ulmo minoris-Quercetum roboris*) in Val d'Allier, France, after a flood (Photo: Benoît Renaux).

Understorey of an Quercus-dominated riparian woodland, Sooma National Park, Estonia, with *Rubus saxatilis Melica nutans,Trientalis europaea, Equisetum* (Photo: John Janssen).

Habitat description

These are mixed broadleaved woodlands typical of less-frequently flooded, well-aerated mineral soils in floodplains and around flushes on valley sides cut into shales and clay rocks or clayey superficial deposits throughout the nemoral and boreal zones with some extension into the sub-mediterranean. The flooding regime can be by inundation of river water and/or by rising ground water in river valleys. They are especially characteristic of the middle and lower reaches of major European rivers such as the Rhine, Danube, Emst, Elbe, Saale, Weser, Loire-Allier and Rhone-Saône but also occur throughout Europe as smaller stands in younger river valleys. Occasional deposition of flood-borne silt or the concentration of nutrients and bases in flushes keep the soils fertile and, with the free drainage, there is a typically brisk turnover with mull humus. The high productivity of the soils has meant that these woodlands have been highly valued as sources of timber and the structure and composition have been much modified by exploitation.

The canopy in high-forest stands can be very tall and multi-layered and is typically dominated by various mixtures of *Fraxinus excelsior, F. angustifoliae, Alnus glutinosa* with *A. incana* towards the upper reaches of rivers outside the Atlantic zone, *Populus alba, P. tremula, P. nigra, P. canescens, Acer pseudoplatanus, Quercus robur, Prunus avium, Ulmus glabra, U. minor* and *U. laevis.* There is typically an abundant and varied understorey, again often structurally complex, with a range of small trees, shrubs and lianes that are more typical of mesic deciduous woodlands (such as G1.Aa *Carpinus* and *Quercus* woodland) than the wet woodlands of floodplains, swamps and fens. Among these species, *Crataegus monogyna, Malus sylvestris, Eunomyus europaeus, Prunus padus, Clematis vitalba, Humulus lupulus, Tamus communis* and *Vitis vinifera* are distinctive. Stands on spring-fed slopes with incompetent substrates often suffer landslips on the surface of which the trees and shrubs keel over at crazy angles.

The field layer also has much in common with that of mesic deciduous woodland though some of the typical vernal dominants there, such as *Hyacinthoides non-scripta,* are excluded by the wetness of the ground, so it is geophytes like *Anemone nemorosa, A. ranunculoides, Ranunculus ficaria, Ornithogalum*

umbellatum or sometimes *Fritillaria meleagris* which provide the springtime colour here. Becoming prominent later in the year is a contingent of plants of moist to wet, fresh fertile soils including some tall fen herbs such as *Angelica sylvestris, Lysimachia vulgaris, Lythrum salicaria, Lycopus europaeus, Rumex sanguineus, Allium scorodoprasum* and *Filipendula ulmaria* together with a diversity of bulky plants, for example *Carex remota, C. pendula, C. strigosa, C. laevigata*, *Juncus effusus*, *Equisetum telmateia,* whose local abundance can lend different stands a strikingly distinctive appearance. Ground-carpeting plants such as *Aegopodium podagraria, Ranunculus repens* and *Poa trivialis* and particular assemblages of herbs along the fringes of trickling water can add further character and complexity. Bryophytes are often extensive and luxuriant, providing a continuing green ground cover as the herbaceous plants die back in autumn.

Indicators of quality:

Less modified stands are reckoned to preserve some of the richest of the original European forests of larger floodplains but the diverse structures related to sylvicultural exploitation need not necessarily reduce or impair the overall floristic quality of the habitat.

Indicators of good quality are:

- Signs of natural regeneration with an uneven-aged structure
- Structural complexity, including old trees and the retention of fallen, dying and dead timber with a diversity of available niches for associated flora, fauna and fungi
- Sufficient proportion of historically old (ancient) woodland with high species diversity
- Intact natural hydrology: maintenance of the periodical to occasional flooding or flushing characteristic of the habitat
- Survival of larger stands of forest without fragmentation and isolation
- Absence of non-native tree species and of invasive aliens in all layers such as *Impatiens glandulifera*

Characteristic species:

Tree canopy: *Acer pseudoplatanus, Alnus glutinosa, A. incana, Fraxinus excelsior, Populus alba, Populus nigra, Prunus padus, Quercus robur, Ulmus glabra, U. laevis, U. minor, Carpinus betulus, Prunus avium.*

Understorey: *Cornus sanguinea,Corylus avellana, Crataegus monogyna, Euonymus europaeus, Rubus caesius, Sambucus nigra,*

Field layer: *Aegopodium podagraria, Anemone nemorosa, Angelica sylvestris, Brachypodium sylvaticum, Carex acutiformis, C. laevigata*, *C. pendula, C. remota, C. strigosa, Equisetum telmateia, Elymus caninus, Festuca gigantea, Filipendula ulmaria, Galium aparine, Geranium robertianum, Geum urbanum, Glechoma hederaea, Hedera helix, Lycopus europaeus, Lysimachia vulgaris, Lythrum salicaria, Ranunculus ficaria, Rumex sanguineus, Silene dioica, Stachys sylvatica, Urtica dioca.*

Classification

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

EUNIS:

G1.2 Mixed riparian floodplain and gallery woodlandAnnex 1:

91F0 Riparian mixed forests of *Quercus robur, Ulmus laevis* and *Ulmus minor, Fraxinus excelsior* or *Fraxinus angustifolia* along the great rivers (Ulmenion minoris)

Emerald:

G1.22 Mixed Quercus - Ulmus - Fraxinus woodland of great rivers

MAES:

Woodland and forest

IUCN:

1.1 Boreal Forest

1.4 Temperate Forest

Other relationships

EFT:

12.2 Fluvial forest

VME:

U3.1 Hardwood alluvial forests in combination with willow and poplar alluvial forests

˃U3.2 Alder-ash forests

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

Justification
This is an azonal habitat type found along large rivers throughout the temperate European lowlands.

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	Present	185 Km^2	Decreasing	Decreasing
Belgium	Present	0.65 Km^2	Decreasing	Decreasing
Bulgaria	Present	60 Km^2	Decreasing	Decreasing
Croatia	Present	<1300 Km^2	Decreasing	Decreasing
Czech Republic	Present	230 Km^2	Decreasing	Decreasing
Estonia	Present	7 Km^2	Stable	Unknown
France	France mainland: Present	305 Km^2	Decreasing	Decreasing
Germany	Present	152 Km^2	Decreasing	Decreasing
Greece	Greece (mainland and other islands): Present	11.4 Km^2	Unknown	Unknown
Hungary	Present	350 Km^2	Decreasing	Decreasing
Italy	Italy mainland: Present	473.47 Km^2	Decreasing	Decreasing
Latvia	Present	6 Km^2	Decreasing	Decreasing
Lithuania	Present	4 Km^2	Decreasing	Decreasing
Netherlands	Present	6.9 Km^2	Increasing	Unknown
Poland	Present	276.6 Km^2	Decreasing	Decreasing
Portugal	Portugal mainland: Present	<176 Km^2	Decreasing	Unknown
Romania	Present	<400 Km^2	Decreasing	Decreasing
Slovakia	Present	68 Km^2	Decreasing	Unknown

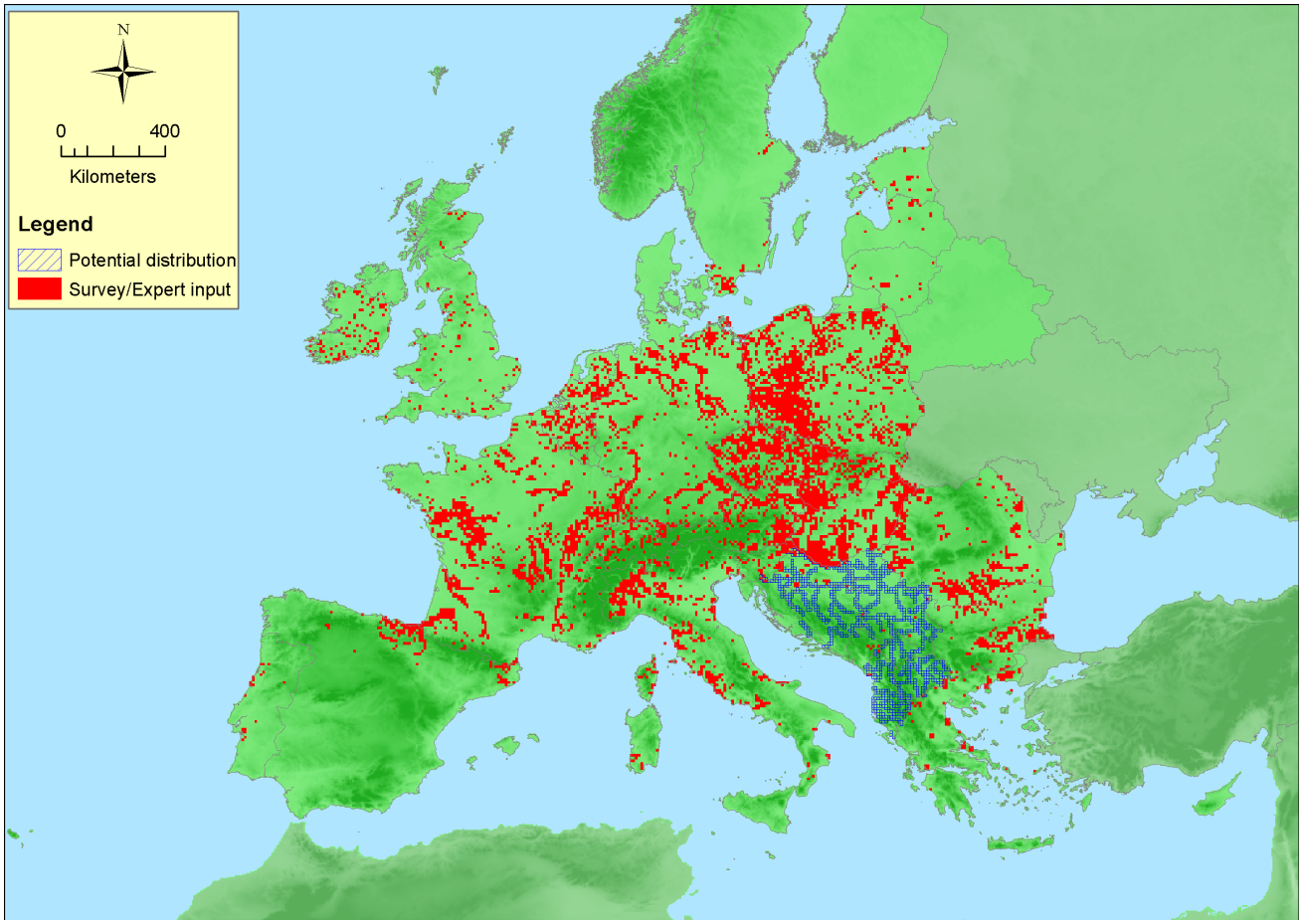
EU 28	Present or Presence Uncertain	Current area of habitat	Recent trend in quantity (last 50 yrs)	Recent trend in quality (last 50 yrs)
Slovenia	Present	57.55 Km^2	Decreasing	Decreasing
Sweden	Uncertain	Km^2	-	-
UK	Northern Island: Uncertain United Kingdom: Present	320 Km^2	Stable	Decreasing

EU 28 +	Present or Presence Uncertain	Current area of habitat	Recent trend in quantity (last 50 yrs)	Recent trend in quality (last 50 yrs)
Bosnia and Herzegovina	Present	180 Km^2	Decreasing	Decreasing
Norway	Norway Mainland: Present	only fragments Km^2	Decreasing	Decreasing
Serbia	Uncertain	unknown Km^2	-	-
Switzerland	Present	800 Km^2	Decreasing	Decreasing

Extent of Occurrence, Area of Occupancy and habitat area

	Extent of Occurrence (EOO)	Area of Occupancy (AOO)	Current estimated Total Area	Comment
EU 28	4999300 Km^2	4077	2900 Km^2	2857 km^2 reported + separate data missing for Portugal Romania (no separate data for G1.2a/b) and Sweeden. the area is <400 km^2 in Romania, <176 in Portugal.Area overestimated in Croatia.
EU 28+	4999300 Km^2	4077	3900 Km^2	The area reported is 3837 km^2 but data is missing for Serbia and Norway (fragments).

Distribution map



The map is rather complete, with potential distribution for the Balkan. Data sources: EVA, Art17, BOHN.

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

No precise facts, but about 50 % of the worldwide distribution of the habitat could lie in EU 28+, and among those 50 % 2/3 in EU 28.

Trends in quantity

Litterature indicates that most of the original area of the habitat has been destroyed before the XVIIIth century, especially in North-western Europe (British Isles, Benelux, France...), because the areas occupied by former riparian forest in lower reaches of large rivers are located on very good agricultural lands (flat lands on fertile soil, easy to irrigate...). Moreover, many towns and infrastructures in Europe lie on former location of temperate and boreal hardwood riparian woodlands (most large cities are located near large rivers).

Clearing to make agricultural lands, towns and after the industrial revolution infrastructures and factories has gone on during the historical period (last 2 centuries), but another phenomenon has been even more damaging : most large European rivers have been regulated (canalisation, floodgates, damming...) in the XIX th century for the main Rhine, Rhône, Seine, Danube....). This has caused direct loss of riparian forests (to dig the canal replacing the former natural channels) but also a drastic reduction of the area of the floodplain (loss of flooding, vital for this habitat), as mensioned by territorial experts.

In most countries that are reporting an historical trend, it is a strong decrease (more than -50 to -95 % in Bosnia and Herzegovina, Bulgaria, France, Germany, Hungary, "drastic decrease" in Italy). Swirzerland and Lithuania only report a -20 % historical decrease. The only countries to report an historical increase are Austria and the Netherlands. In Austria, it is an increase of degradated hardwood stands at the expense of G1.1 softwood riparian woodland due to river regulations, with a strong degradation in quality due to a

lack of floods (the area has increased but the quality has dropped). In the Netherlands, the positive historical trend "results from an increase from almost nothing to rare and fragmented with very low quality" and only concerns a small arae.

An historical trend can be assessed by data from territorial experts on 58 % of the current area in EU 28+ (39% in EU 28), and the decline is -88 % in EU 28+ (-91% in EU 28). Even if we lack precise facts in some countries (Romania, Slovenia, Czech Republic, Austria, Slovakia, Italy) where large surfaces of the habitat can be found (and larger areas in the past), the trends are the same in those countries according to territorial experts (a "drastic decline" is reported in Italy) and litterature (Schnitzler-Lenoble 2007 ; Tockner, Uehhlinger and Robinson, 2009). 2 large European rivers gives a good example : the Danube and the Rhine. The Danube is the second largest European river (after the Volga in Russia), and flows accross (or along) Germany, Austria, Slovakia, Hungary, Croatia, Romania, Serbia, Bulgaria, Moldavia and Ukraine. About 72 to 75 % (15 000 km²) of the original floodplain (and the area of corresponding riparian habitats) of this large river has been lost in the middle and lower Danube valley (Tockner, Uehhlinger and Robinson, 2009). In Poland, where we don't have precise data (no territorial expert), only 1% of the original flooded (alluvial) forests remains (Schnitzler-Lenoble 2007). According to Dynesisus & Nilsson (1994), most large European rivers have been strongly (2/3rd) to moderately (less than 1/3rd) degradated, including a loss of riparian forests. The effect of Johann Gottfried Tulla correction of the Rhine river has been observed and former riparian woodlands have been not only degradatet in quality, but in the worst cases have evolved toward non-riparian beech-hornbeam forests, naturally or after beech plantation (Carbiener R. 1970 ; Michiels 2000, Boeuf et al. 2005, Boeuf 2014 p. 218-219). In France, Boeuf (comm. pers) reports a loss of 80% of the former Rhine river since XIXth century, according to maps made just before the regulation ("Etat-major" maps).

The decline is still going on according to territorial experts. A strong decreasing recent past trend is still reported in almost every country. The only country reporting an increase is the Netherlands but it is "an increase from almost nothing to rare and fragmented with very low quality". The situation is unknown in Norway and Sweeden, and stable in Estonia, but the area must be small there (only 7 km² in Estonia). The situation is also unknown in Serbia.

The current trend is still bad in most countries (decreasing in Bosnia and Herzegovina, Bulgaria, Croatia, France, Germany, Greece, Hungary, Italy, Latvia, Lithuania, Portugal, Romania, Slovakia, Slovenia), because of the long term effects of a loss in quality (river regulation, no more floods, invasions of alien species, clearings). The situation is not as bad as the past one, an there is a stable current trend in some countries (Belgium, Czech Republic, Estonia, Greece, the Netherlands, Austria, Switzerland). Future trend remains unknown in most countries, and is mostly stable (Czech Republic, Estonia, the Netherlands, Switzerland) or decreasing (Bosnia and Herzegovina, Bulgaria, France, Hungary, Italy, Latvia, Slovakia). An increase is only expected for the future in Germany and Belgium.

- 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
  Even if the decline in quantity is very important, the AOO and EOO remain large.
- Does the habitat have a small natural range by reason of its intrinsically restricted area?
  Yes
  Justification
  This habitat only occurs on the banks of large enought rivers, in their middle to lower courses.

Trends in quality

A past-present trend in quality can be assessed on 86 % (in EU 28+) to 89 % (in EU 28)of the current area): a more than moderate decline (55% severity) is reported on 50 % of the area in EU 28. A similar decline (56% severity) is reported in EU 28+ but only on 42 % of the area.

The quality of the habitat is bad and has decreased in almost every country, because of a loss in hydraulic functionning (lowering of water table and loss of floods, invation of alien species, pollution especially eutrophisation since World war II.). Where the habitat has recolonised former riparian grasslands in north-western Europe (Allier river in France, in the Netherlands...), the quality remains poor (young stands with few deadwood and no veteran trees, many alien pioneer species as *Robinia pseudoacacia*...). An historical trend is only reported in a few countries, but a present past decline in quality is reported in most countries. The current trend is still bad (decrease in quality in 15 countries, stable in only 5, no trend in 3 countries). The future trend is only reported in a few countries but is not good (further decline expected in Italy and France due to land use change, river engineering and water pollution). Invasive species, disease (Phytophthora alni and Ask dieback) are expected in the UK, Belgium, Austria and Italy. Only Belgium and the Netherlands expect a good trend in the future, due to aging in protected areas).

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

Pressures and threats

Changes in hydrological conditions (especially lack of flooding and river regulation, also in some countries drying out and water abstraction for agriculture irrigation) is reported in most countries. The competition from invasive species is also frequently reported, followed by pollution and forestry (alien poplar plantation for example), and forestry clearance (for agriculture and urbanisation).

Agriculture is mentioned but for different reasons : pollution, forest clearing to make agricultural lands, and in some cases grazing in forests. Though rarely cited, fragmentation is also a big problem.

List of pressures and threats

Agriculture

Cultivation

Sylviculture, forestry

Forest and Plantation management & use
- Forest replanting
- Forestry clearance
- Removal of dead and dying trees

Forest exploitation without replanting or natural regrowth

Pollution

Pollution to surface waters (limnic, terrestrial, marine & brackish)
- Diffuse pollution to surface waters due to agricultural and forestry activities

Invasive, other problematic species and genes

Invasive non-native species

Natural System modifications

Human induced changes in hydraulic conditions
- Canalisation & water deviation

Lack of flooding

Conservation and management

Unlike other less endangered forest types, most of the last remaining Temperate and boreal hardwood riparian woodland should be strictly protected, at least in areas where the habitat has almost disappeared.

The keys to the conservation of the last Temperate and boreal hardwood riparian woodland are :
- a strict protection of the remaining sites, especially from expansion of land uses for urbanisation and agriculture, but also from Poplar plantation ;
- the last examples of nearly free flowing rivers should be protected from damming and river regulation. A free flowing river, with floodings allowing aggradation and nutriment deposits, soil and vegetation rejenuvation (erosion and destruction of trees). This mesure is easier to apply on small rivers (see "Alnus woodland on riparian and mineral soil") but much more difficult here, because large rivers often flown in urbanized areas. Where it is possible, it should be a priority, as Temperate and boreal hardwood riparian woodland is certainly one of the most endangered forest type. Such sites are located along rivers that are still free flowing, with floodings (at least in part of the middle to lower course), as the Allier river.

On damaged rivers, restoration is possible (restoring natural river banks by removing armour rocks, removing dams... if possible. Conservation or improvement of water quality. Even if the hydrological functionning is partly affected, the conservation of the habitat is crucial : maintaining only the habitat where the hydrological and biological conditions are perfect and the floristical composition completely unaltered would be impossible, because they have been degradated in most cases.

List of conservation and management needs

Measures related to forests and wooded habitats

Restoring/Improving forest habitats

Measures related to wetland, freshwater and coastal habitats

Restoring/Improving water quality
Restoring/Improving the hydrological regime

Measures related to spatial planning

Establish protected areas/sites
Establishing wilderness areas/allowing succession

Measures related to hunting, taking and fishing and species management

Specific single species or species group management measures

Conservation status

Annex 1:

91F0: ATL U1, ALP U2, BLS U1, BOR U2, CON U2, MED U2, PAN U1, STE U1

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

Most interventions concern the hydrological functionning, but also in some cases a limitation of alien tree species if native ones cannot replace them (*Robinia pseudoacacia* if it is overabundant). When the typical trees have been replaced by alien poplar, the best thing to do is to let the spontaneous dynamic : poplars are neither shade tolerant nor not long-living trees, and native oaks, ashes, alders, elms, mapples etc...

will grown easily under their cover until the poplar dies, and then replace them. The dead poplar will bring deadwood. A clearcut would favorize alien competitive species (*Reynoutria, Impatiens glandulifera, Robinia*...) and would make a restoration not only more expensive but also less efficient.

Effort required

50+ years	200+ years
Through intervention	Naturally

Red List Assessment

Criterion A: Reduction in quantity

Criterion A	A1	A2a	A2b	A3
EU 28	-23 %	unknown %	unknown %	-91 %
EU 28+	-22 %	unknown %	unknown %	-88 %

The past-present trend in quantity is assessed on 83% of the area in EU28+ and 77% in EU28. It is a negative trend, but it is under the limit of -25% that qualifies the NT category. The historical reduction in quantity is worse and the EN category is reached. Even if this trend can only be assessed by facts on half of the area (48 % in EU28+), territorial experts opinion and litterature confirms this trend in most countries. In Italy, where 23% of the current EU28 area of the habitat can be found, territorial experts report a "drastic decline" in quantity during the historical period. Even if we lack precise data on half of the area, the historical decline in several countries (especially Germany, France, Bulgaria, Hungary in EU28, Bosnia and Herzegovina outsite EU28) has been so important that even a 25 to 50 % decline in Italy ("drastic" certainly correspond to much more than a 50% decline) would lead to more than 70% decline in the European area, even with the reported increase in Austria. With a hypothesis of +100 % increase in Austria (certainly very overestimated) and a hypothesis of -25% decrease in Italy (certainly very underestimated) on average a -85% decrease would be reached in EU28+ (covering 66 % of the EU28 area), which means the figures still qualify for the EN category. Because of the uncertainty the conclusion for A3 is Endangered (EN) for both EU28 and EU28+.

Criterion B: Restricted geographic distribution

Criterion B	B1				B2				B3
	EOO	a	b	c	AOO	a	b	c	
EU 28	>50000 Km^2	Yes	No	No	>50	Yes	No	No	No
EU 28+	>50000 Km^2	Yes	No	No	>50	Yes	No	No	No

EOO, AOO and number of locations are much larger than the thresholds for criterion B.

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	50 %	56 %	unknown %	unknown %	unknown %	unknown %
EU 28+	41 %	56 %	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%

A more than moderate decline (55% severity) is reported on 50% of the area in EU28, qualifying the VU category. A similar decline (56% severity) is reported in EU28+ but only on 42 % of the area, qualifying the NT category.

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	EN	LC	LC	LC	VU	DD	DD	DD	DD	DD	DD	DD	DD	DD
EU28+	LC	DD	DD	EN	LC	LC	LC	NT	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
Endangered	A3	Endangered	A3

Confidence in the assessment

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

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