G3.2 Temperate subalpine Larix, Pinus cembra and Pinus uncinata woodland

Summary

This habitat consists of coniferous woodlands of the mid sub-alpine belt in high mountains of the temperate zone, where the growing season is becoming so short and cold that the limit for tree growth is approached but where snow-lie is not deep enough to favour willow shrub and tall-herb vegetation. The woodland structure is often rather clustered, open and lightly shading and the part- or wholly-evergreen dwarf-shrubs typical beneath often grow so dense that herbs can be sparse. The habitat occurs on a variety of rock types with different soils which, along with the contrasts in climate across the range, sustain a diversity of field layers, the distinctiveness of the flora increasing to the south. Graminoids are common and, in moist hollows and seepages, a contingent of montane tall-herbs is characteristic. Deforestation, mostly due to the development of skiing facilities, intensive grazing and climate change are important threats. Conservation measures include sustainable forest management and maintenance of a network of unmanaged forests.

Synthesis

The present trend in quantity is now slightly increasing or close to stability, but the present-past reduction in quality leads to the Near Threatened category because of the slight to moderate (40% in severity) recent decrease in quality on 47% of the area in EU 28 (42 % in EU 28+).

An assessment based on more precise data could have possibly led to the VU category, because even if the situation is probably close to stability in France, the quality is also decreasing in Austria. Even if a future trend is not possible to determine, studies about climate change impact on vegetation already show a shift in altitude for subalpine species and climate change is probably going to affect more subalpine habitats than lower altitudes one, both in quality and quantity (replacement of larch and Pine by Spruce and Fir at lower altitudes). Finally, some subtypes can be more endangered than others (Larch subtypes).

Overall Category & Criteria			
EU 28		EU 28+	
Red List Category	Red List Criteria	Red List Category	Red List Criteria
Near Threatened	C/D1	Near Threatened	C/D1

Sub-habitat types that may require further examination

Pasture Larch woods seems to be more endangered. A too intensive management (intensive logging, overgrazing due to large flocks let without shepherd) is a threat, but for this subtype a complete lack of management (no more grazing) is a problem to. In Spain, there are two important separate populations of *Pinus uncinata* in the Iberian Mountains in Central Spain which are more susceptible to being extinguished or degraded by ski resorts.

Habitat Type

Code and name

G3.2 Temperate subalpine Larix, Pinus cembra and Pinus uncinata woodland

European Larix woodland in Mercantour national park (french southern Alps). *Larix* dominates and *Pinus cembra* is rare because of grazing (Photo: Benoît Renaux).

Subalpine *Pinus cembra* forests in Romanian Carpathian (Retezat national park, Gemenele scientific reserve), here with mixture of *Pinus cembra*, *Picea abies* and *Pinus mugo* between 1600 m and 1800-1900 m a.s.l. Above, only *Pinus mugo* grows (Photo: Benoît Renaux).

Habitat description

This habitat consist of coniferous woodlands of the mid sub-alpine belt in high mountains of the temperate zone, forming the tree-line at 1,500 m Asl and above in the Carpathians and reaching 2,400 m Asl in the Alps and the Pyrenees. At these altitudes, the growing season is becoming so short and cold that the limit for tree growth is approached. Snow is long-lasting but not deep enough to favour willow shrub and tall-herb vegetation. *Pinus uncinata* can also be found in lower mountain ranges (such as Jura) on clifs or rocks exposed to harsh weather conditions. In the Pyrenees Mountains, only *Pinus uncinata* woodlands can be found. Depending on the habitat variant, the main dominant trees can be Larch (*Larix decidua*), Arolla pine (*P. Cembra*) and/or Mountain Pine (*Pinus uncinata*). Larch and Arolla pine only occur in the Alps and the Carpathians. Larch is often dominant in pastured wood, and Arolla Pine in more mature stands. In the Southern Alps and the Carpathians, Mountain dwarf pine (*P. mugo*) is often in the understorey. Where this dwarf pine dominates towards the upper sub-alpine belt, the vegetation is included in F 2.4 subalpine shrub. Included are also perialpine river valleys with *Pinus* forests of *Pinus mugo s.l.* (erect forms including *P. x rhaetica*) and/ or *Pinus uncinata* as rare relict forests reaching lower altitudes in the alpine river valleys. *Sorbus* spp. are characteristic associates in the canopy with *S. aucuparia*, *S. aria*, *S. mougeotii* and *S. chamaemespilus*, often along with some *Picea abies* and *Abies alba* (never dominant). The woodland structure is often rather clustered, open and lightly shading but the part- or wholly-evergreen dwarf-shrubs typical beneath often grow so dense that herbs can be sparse. Among these dwarf-shrubs, *Vaccinium myrtillus, V. vitis-idaea, V. uliginosum, Juniperus nana (= J. sibirica)* occur throughout the range. *Arctostaphylos uva-ursi* and *Cotoneaster integerrimus* can be found on warmer slopes. *Erica carnea* occurs outside the higher Alps on northern slopes. *Rhododendron spp.* is more restricted: *R. ferrugineum* and *R. hirsutum* in various parts of the Alps and the former in the Pyrenees, *R. myrtifolium* in the Carpathians, together with *Daphne oleoides.* Where the cover of these dwarf-shrubs exceeds the trees and the tree cover becomes rather open, the vegetation is included in F2.2a Alpine and sub-alpine ericoid heath. These woodlands occur on a variety of rock types with different soils which, along with the contrasts in climate

across the range, sustain a diversity of field layers, the distinctiveness of the flora increasing to the south. Graminoids are common and, in moist hollows and seepages, a contingent of montane tall-herbs is characteristic (*Calamagrostis villosa, Luzula albida, L. sieberi, Festuca flavescens, F. drymaeia*...). Subalpine and alpine plants such as *Homogyne alpina* or *Dryas octopetala* are also characteristic.

Indicators of quality:

- Tree-line at its natural limit with intact woodland structure.
- Sufficient structural diversity/ complexity (semi)natural age structure or completeness of layers.
- Presence of old trees and a variety of dead wood (lying and standing) and the associated flora, fauna and fungi.
- Typical flora and fauna composition of the region.
- Sufficient proportion of historically old (ancient) woodland with high species diversity.
- Survival of larger stands of forest without fragmentation and isolation.
- Absence of non-native tree species and absence of invasive aliens in all layers (fauna, flora).
- No signs of impacts of alpine pasturing.
- Absence of damage from trampling, skiing lanes and avalanches around winter sports centre.

Characteristic species:

Tree canopy: *Larix decidua, Pinus uncinata var. uncinata, P. mugo s.l.* (erect forms), *P. cembra, Sorbus aucuparia, S. aria, S. chamaemespilus, Picea abies, Abies alba, Juniperus communis, Acer pseudoplatanus*; Understorey: *Rhododendron hirsutum, R. ferrugineum, Arctostaphylos uva-ursi, Cotoneaster integerrimus, Juniperus sibirica, Rosa pendula, Rubus idaeus, Vaccinium myrtillus, V. vitis-idaea, Daphne mezereum, Erica herbacea (= E. Carnea), Calluna vulgaris;* Field layer*: Deschampsia flexuosa, Sesleria caerulea, Rubus saxatilis, Hieracium murorum agg.*, *Oxalis acetosella, Geranium sylvaticum, Melampyrum sylvaticum, Solidago virgaurea, Calamgrostis varia, C. villosa, Polygala chamaebuxus, Potentilla erecta, Valeriana tripteris, Carex alba, C. flacca, Luzula albida, Festuca flavescens, F. drymaeia, Homogyne alpina.*

Classification

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

EUNIS:

G3.2 Alpine [Larix] – [Pinus cembra] woodland and G3.3 Pinus uncinata woodland

EuroVegChecklist:

Erico carneae-Pinion Br.-Bl. in Br.-Bl. et al. 1939 nom. invers. propos.

Piceion excelsae Pawlowski et al. 1928

Seslerio caeruleae-Pinion uncinatae Vigo 1974

Annex 1:

9420 Alpine Larix decidua and/or Pinus cembra forests

9430 Subalpine and montane Pinus uncinata forests (* if on gypsum or limestone)

Emerald:

G3.21 Eastern Alpine siliceous Larix and Pinus cembra forests

G3.22 Eastern Alpine calcicolous Larix and Pinus cembra forests

G3.25 Carpathian Larix and Pinus cembra forests

G3.26 Larix polonica forests

G3.31 Pinus uncinata forests with Rhododendron ferrugineum

G3.32 Xerocline Pinus uncinata forests

MAES :

Woodland and forest

IUCN:

1.4 Temperate Forest

European Forest Types:

3.1 Subalpine larch-arolla pine and dwarf pine forest

VME:

C.3 Sub-alpine and oro-Mediterranean vegetation (forests, krummholz and dwarf shrub communities in combination with grasslands and tall-herb communities).

Does the habitat type present an outstanding example of typical characteristics of one or more biogeographic regions?
Yes

Regions
Alpine

Justification
Subalpine Larch and Pine forests represents the forest climax and the natural vegetation of subalpine belt, just below the tree line. Thoses forests are the natural habitat for emblematic species, as Grouse, eagles (whose large nest can be built in large pines or larches) or large mammals. They have been clearcut in many location for cattle grazing.

Geographic occurrence and trends

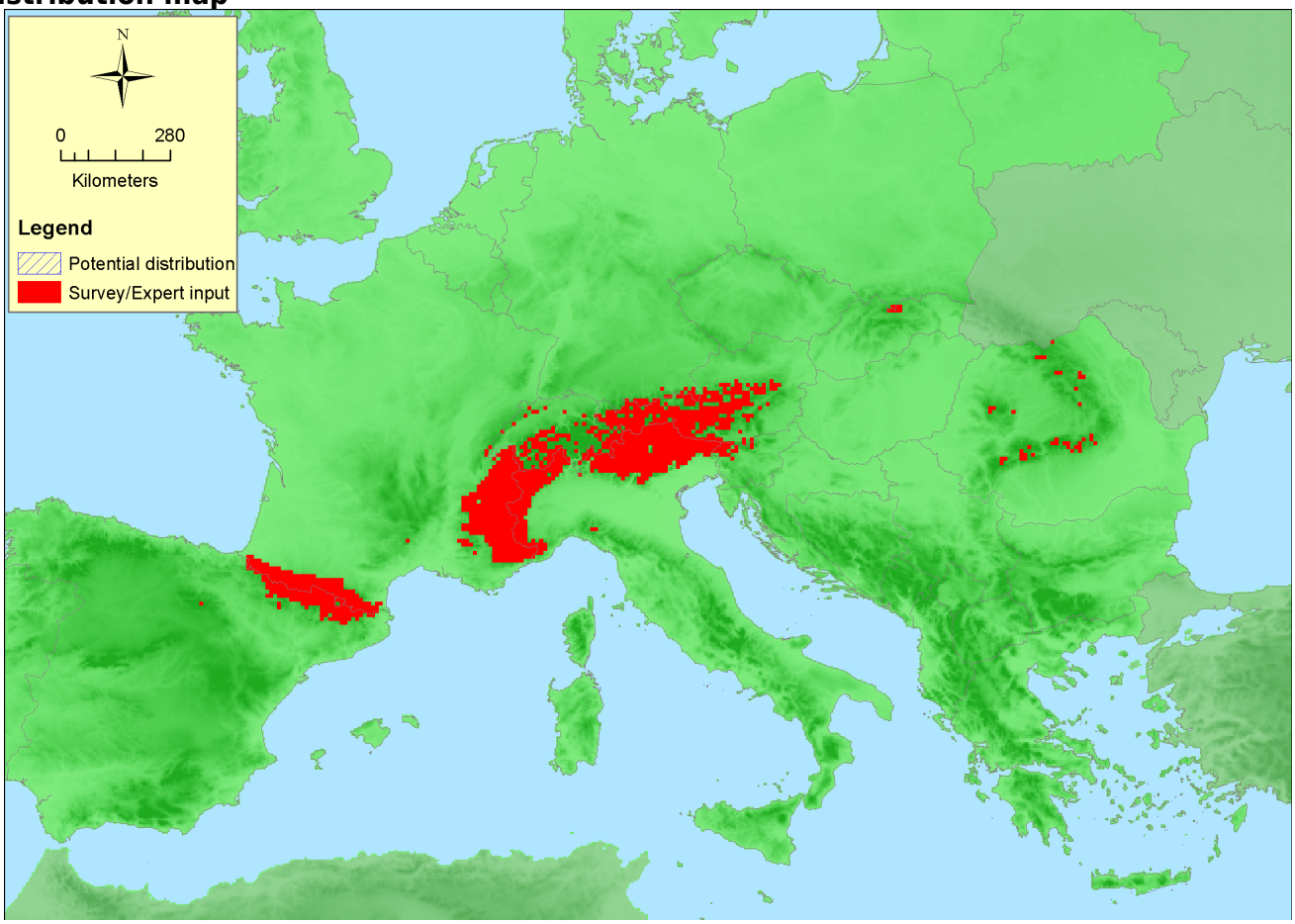
EU 28	Present or Presence Uncertain	Current area of habitat	Recent trend in quantity (last 50 yrs)	Recent trend in quality (last 50 yrs)
Austria	Present	920 Km^2	Stable	Decreasing
France	France mainland: Present	814 Km^2	Increasing	Unknown
Germany	Present	16 Km^2	Stable	Decreasing
Italy	Italy mainland: Present	3,193 Km^2	Stable	Decreasing
Poland	Present	Km^2	Unknown	Unknown
Romania	Present	40 Km^2	Decreasing	Decreasing
Slovakia	Present	6.1 Km^2	Decreasing	Unknown
Slovenia	Present	31 Km^2	Stable	Stable
Spain	Spain mainland: Present	194 Km^2	Stable	Increasing

EU 28 +	Present or Presence Uncertain	Current area of habitat	Recent trend in quantity (last 50 yrs)	Recent trend in quality (last 50 yrs)
Andorra	Uncertain	Km^2	-	-
Switzerland	Present	540 Km^2	Increasing	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	853100 Km^2	1569	5285 Km^2	Current area is 5,209 km² (reported for Austria, France, Germany, Italy, Romania, Slovakia, Slovenia and Spain) + 76 km² for Poland according to 76 km² according to art17 report.
EU 28+	880200 Km^2	1648	5825 Km^2	Current area is 5,749 km² (reported for Austria, France, Germany, Italy, Romania, Slovakia, Slovenia, Spain and Switzerland) + 76 km² for Poland according to 76 km² according to art17 report.

Distribution map



The map is likely to be complete, although the distribution in the Carpathians may be underestimated and in the Pyrenees and the Alps overstimated, as the habitat is not present or very rare at lower altitudes and in the outer Alps. Data sources: Art17, EVA.

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

Of the current distribution of the habitat type, 90% lies within the EU 28. Most of the remaining 10% can be found in Switzerland.

Trends in quantity

The original extend of this forest type has been decreasing for thousands of years because of clear cutting or burning for cattle grazing. Such grasslands have been used especially in the summer, when low altitude grasslands are dry.

There is no clear average trend for the last 200 years in Europe. A decline is reported for Spain (- 20%) and Germany (- 50 to 70 %). On the contrary, agricultural decline has been reported in many other countries from mid/late XIXth century (long historical trend), and has caused an expansion of forests in many mountain ranges (Schnitzler and Génot 2012). A 30% increase is reported in Switzerland, and the trend could be more or less the same in France (no precise data available).

Trends reported for the last 50 years indicate a slight increase in the EU 28 and EU 28+ on average, but there are slight differences between western and central Europe. The situation is more or less stable in Italy, Austria and Germany. The only reported increases come from Switzerland (+ 20 %) and France (+ 10 %), while a decrease is reported for a few countries (- 25 % in Romania, -10 % in Slovakia). The 20 % increase reported in France (IFN Data, BIR comm. pers) since 1970 but concerns all *Larix, Pinus cembra* and *P. uncinata* forests, including plantations and pioneer stands in mountain zones, evolving to Fir or spruce forest. These woodlands are not included in this habitat, and a 10 % increase might be assumed for the real Temperate subalpine *Larix , Pinus cembra* and *Pinus uncinata* woodlands in France.

The current trend is better than the past one. The situation is stable in France, Germany, Slovenia, Slovakia and Switzerland, and an increase is reported in Austria, Italy and Spain. The only country reporting a current decrease is Romania.

- Average current trend in quantity (extent)
  EU 28: Increasing
  EU 28+: Increasing
- Does the habitat type have a small natural range following regression?
  No
  Justification
  The EOO is larger than 50,000 km².
- Does the habitat have a small natural range by reason of its intrinsically restricted area?
  No
  Justification
  Natural range restricted to high mountain ranges but covering a large area.

Trends in quality

Most countries report a decrease in quality over the last 50 years (Austria, Germany, Italy, Romania and Switzerland). Spain reports an increase in quality and the situation is stable in Slovenia. There is no data from France and Slovakia. The average trend is a slight to moderate degradation (40% severity) affecting 40% of the area.

A stable current trend in quality is reported in most countries, except in Switzerland (increase in quality), Austria (decrease) and Romania (strong decrease). The situation is not clear in France with only expert estimations, but might be close to stability with important differences depending on the site. Quality can be getting better concerning deadwood or old trees in remote location for Pine subtypes (no more logging), or decreasing in more accessible sites with overgrazing due to very large sheep flocks and/or intensive logging. The average trend might be close to stable in Europe.

The trend might be slightly different for Larch subtypes, and is probably worse than the trend for the Arola pine subtype: an intensive grazing or logging is a degradation for both subtypes (lack of deadwood and destruction of saplings) but a complete lack of grazing is also a problem for Larch subtype, because a moderate grazing pressure eliminates Pine (Larch saplings can survive but Pine saplings can't).

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

Pressures and threats

The development of skiing facilities (causing deforestation and fragmentation), intensive grazing (affecting flora composition and regeneration of trees) and climate change are reported as threats in most countries. Pollution (especially air pollution) is reported in Germany and Romania. Deforestation is reported in Romania and Slovakia, road construction (causing deforestation and fragmentation). Inappropriate forestry management (forest replanting) is reported in Switzerland.

List of pressures and threats

Agriculture

Intensive sheep grazing

Sylviculture, forestry

Forest replanting
Forestry clearance

Transportation and service corridors

Roads, paths and railroads

Human intrusions and disturbances

Skiing complex

Pollution

Air pollution, air-borne pollutants

Climate change

Changes in abiotic conditions

Conservation and management

Both integrative and segregative approaches are needed for temperate subalpine *Larix , Pinus cembra* or *Pinus uncinata* woodlands. In most areas, the development of sustainable forest management measures can help conserve most structures, functions and characteristic species of this habitat. No exotic tree planting, small cuts instead of large clear cutting, the conservation of deadwood, veteran trees and trees with microhabitats (broken tops, cracks or scars, hollow chambers, stem cavities, bark bowls and pockets, burls...) play a key role in maintaining not only forest biodiversity but also social and economical functions (forest productivity especially concerning deadwood, protection against erosion or avalanches if no large clear cuts are made, etc...).

Sustainable forest management can be promoted through forest certification, in the Natura 2000 network of protected areas, public forests, and category V and VI of IUCN Protected Areas. Unlike most forest habitats, the management of some particular types of subalpine *Larix* woodlands (pastured *Larix* woods) includes moderate grazing. Grazing fosters Larch and rich undergrowth. Grazing should not occur too early, in order to avoid disturbance to birds (especially Black grouse -*Tetrao tetrix*- and western capercaillie -*Tetrao urogallus*), and is only appropriated in certain subtypes.

Even in the most sustainably managed forests, logging cuts the end of the forests cycle (the mature and veteran stands are rare, deadwood volumes can never be the same as in unmanaged forest). It stresses the need of a network of vast (more than 100 ha each) unmanaged forests, where the whole forest cycle can be fully accomplished. Those strictly protected areas should be located in categories I and II IUCN Protected Areas, and the most remarkable forests should also be protected.

To face global warming, the ability of those subalpine forests to colonize new areas on higher ground is very important, especially on present open land.

List of conservation and management needs

Measures related to agriculture and open habitats

Other agriculture-related measures

Measures related to forests and wooded habitats

Restoring/Improving forest habitats
Adapt forest management

Measures related to spatial planning

Establish protected areas/sites
Establishing wilderness areas/allowing succession
Legal protection of habitats and species

Measures related to hunting, taking and fishing and species management

Regulation/Management of hunting and taking

Conservation status

Annex 1 types :

9420 Alpine Larix decidua and/or Pinus cembra forests. Status : ALP : FV

9430 Subalpine and montane Pinus uncinata forests (* if on gypsum or limestone). Status : ALP : U1, CON : FV, MED : U2

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

Larch and Pines are some of the oldest living trees in Europe, and their growth is very slow in subalpine forest. Studies show that biodiversity linked to dead wood or veteran trees can increase 30 years after the cessation of forest management (Paillet *et al.* 2010), but it is certainly slower at such high altitudes. A minimum of 50 years seams required in case of small degradation, and 200+ years of effort if severely damaged. More extensive degradation such as removal of all deadwood, large trees, or even clearing followed by agriculture would take more than 200 years, according to the short growing season in subalpine forests and the time required to have large enough trees and deadwood. Most of the recovery would come from the recolonization of typical species but the plantation of pines or larch can speed up the process.

Effort required

200+ years
Naturally

Red List Assessment

Criterion A: Reduction in quantity

Criterion A	A1	A2a	A2b	A3
EU 28	0 %	Unknown %	Unknown %	Unknown %
EU 28+	0 %	Unknown %	Unknown %	Unknown %

There has been an increase in the quantity of this habitat in the last 50 years, 1.3% in the EU 28 and 3.1% in the EU 28+ (calculated on 81 % of the EU 28 area and 83 % of the EU 28+ area). There is not enough quantitative data to assess the historic or future trends in quantity for this habitat, which is therefore assessed as Least Concern under Criterion A.

Criterion B: Restricted geographic distribution

Criterion B	B1				B2				B3
	EOO	a	b	c	AOO	a	b	c	
EU 28	881,150 Km^2	No	Unknown	No	5,209	No	Unknown	No	Unknown
EU 28+	883,200 Km^2	No	Unknown	No	5,709	No	Unknown	No	Unknown

There is no continuing decline neither in the EOO or the AOO of this habitat type, and there is no threatening process foreseen in the next 20 years that is likely to cause continuing declines in quantity and/or quality. This habitat is therefore assessed as Least Concern under 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	47 %	40 %	Unknown %	Unknown %	Unknown %	Unknown %
EU 28+	42 %	40 %	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%

There has been a slight to moderate reduction in quality (40% severity) affecting almost half of the EU 28 area (47%), and 42% of the EU 28+ area. The available data includes 68% of the area in the EU 28 and 70% in the EU 28+. There is no trend for France, and a slight degradation is reported for Austria (unknown extent).

Reduction in quality in the future is still unknown but the result would likely lead to an assessment of Vulnerable because of climate change. Reduction in abiotic quality (temperature, snow cover...) would lead to a reduction in biotic quality because of the disappearing of species and tree dieback. Changes in plant distribution and community composition are not only predicted (Marage and Gégout 2011 ; Van der Veken *et al.* 2004) but are already reported, especially in the mountain and subalpine belts, with changes in the composition of the herb layer (Lenoir *et al.* 2008 ; Lenoir 2009 ; Grabherr *et al.* 1994 ; Klanderud and Birks 2003). Models only predict the Larch niche model, not the whole habitat niche, but without Larch or Pine there would be a shift to another habitat type.

Such changes may cause the habitat to colonize the actual alpine belt (not wooded yet) but also disappear

at lower altitudes because of the colonization of more shade tolerant mountain trees (fir, spruce, beech). Global warming is too fast and important to forecast just a shift in altitude (new surfaces at higher altitudes of the habitat with the same flora making up for the disappearance of the habitat at low altitudes), and it is likely that the flora will be less typical in both new sites and sites situated at lower altitudes. Most of the area could be affected within 100 years, except in cooler sites. A 30 % severity (corresponding to a slight or unknown decrease) can be expected. Even if such a negative trend is strongly possible, data is still judged as insufficient to estimate precise values. This habitat is therefore assessed as Near Threatened under C/D.

Criterion E: Quantitative analysis to evaluate risk of habitat collapse

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

There is no available information to do a quantitative analysis of the risk of habitat collapse. This habitat is therefore assessed as Data Deficient under Criterion E.

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	DD	NT	DD	DD	DD	DD	DD	DD	DD	DD	DD
EU28+	LC	DD	DD	DD	LC	LC	DD	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
Near Threatened	C/D1	Near Threatened	C/D1

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

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