G3.1a Temperate mountain Picea woodland

Summary

This is evergreen coniferous woodland of the montane and sub-alpine belt in the nemoral zone of Europe, where increased winter coldness towards the more easterly Continental mountains favour *Picea abies* against its main competitors of more temperate ranges, *Fagus sylvatica* and *Abies alba*. Here spruce can dominate on a variety of soils, even those that are very nutrient-poor, wet and cold, or fragmentarily developed on scree or rock exposures. On the more usual acid soils, the field layer characteristically has a rather generalised calcifuge and heathy flora, with montane tall herbs at higher altitudes and, more locally, there can be herbs of base-rich soils. More distinctive floristic elements appear in the Carpathians and Balkans. Intensive forest exploitation, illegal logging, deforestation and pollution are the main threats and the habitat may be adversely affected by climate change. Conservation measures require both sustainable forest management and meaintenance of a network of unmanaged forests.

Synthesis

Due to a relatively small decline in both quality and quantity over the last 50 years, the habitat type has been assessed as Least concern (LC) both for EU28 and EU28+.The separate assessment of some rare subtypes, especially at lower altitudes, on peat, rocks or with *Picea omorika*, would have led to a higher category of threat for those types. Pressures from logging and abiotic pressures due to global change are likely to increase in the future but such a negative trend can't be supported by sufficient facts and data yet.

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

Some local types (e. g. with *Picea omorika*) or low-altitude subtypes are likely to be more sensitive to climate change, and should be assessed separately in the future. Also rare azonal subtypes, on rocks and cold slopes, are probably more endangered.

Habitat Type

Code and name

G3.1a Temperate mountain Picea woodland

Fir virgin forest in Gemenele scientific reserve, Retezat National Park, Carpathian Mountains, Romania (Photo: Benoît Renaux).

Fir stand on limestone pavement, Risoux forest, French Jura, France (Photo: Benoît Renaux).

Habitat description

These are evergreen coniferous woodlands of the montane and sub-alpine belt in the nemoral zone of Europe, where increased winter coldness towards the more easterly Continental mountains favour *Picea abies* against its main competitors of more temperate ranges, *Fagus sylvatica* and *Abies alba*. Here, at altitudes usually between 1000 and 2000m in the Alps, on the borders of Czechia, Germany and Poland, through the Carpathians, and in the Balkan mountains, spruce dominates on a variety of soils, even those that are very nutrient-poor, wet and cold, or fragmentarily developed on scree or rock exposures. These woodlands can give way at lower altitudes to G3.1b *Abies* woodland (though the forester's preference for spruce has often extended its lower limits) and above, where spruce thins to a more open patchy cover, to G3.2/3 Temperate subalpine *Larix*, *Pinus cembra* or *P. uncinata* woodland. Exceptional relict populations of *Picea* in the lowlands (natural occurrences) are also included. The relict *Picea omorika* woodland of the Dinaric mountains is also included here. Depending on the particular site conditions, other trees in the canopy include *Abies alba*, *Larix decidua* (particularly in the Alps where it is a pioneer for spruce establishment), *Pinus sylvestris, P. cembra, P. peuce* and rarely *Fagus*. There can be some *Sorbus aucuparia*, *Lonicera nigra*, *L. caerulea, L. xylosteum* and *Rosa pendulina* in a patchy understorey. On the more usual acid soils, the field layer characteristically has a rather generalised calcifuge flora with *Vaccinium myrtillus*, V*. vitis-idaea, Deschampsia flexuosa, Luzula luzulina, L. sylvatica, Calamagrostis villosa, Melampyrum sylvaticum, M. pratense, Lycopodium annotinum, Oxalis acetosella, Homogyne alpina, Moneses uniflora, Blechnum spicant, Dryopteris dilatata, D. expansa* and bulky mosses such as *Rhytidiadelphus triquetrus*, *Hylocomium splendens*, *Pleurozium schreberi*, *Polytrichum formosum* and *Sphagnum girgensohnii*. At higher altitudes, a tall herb contingent can be prominent with *Adenostyles alliariae, Chaerophyllum hirsutum* and *Rumex arifolius* while, on the more base-rich soils derived from limestones and dolomite, such more basiphilous plants as *Adenostyles glabra, Valeriana tripteris, Calamgrostis varia, Carex alba, Polystichum lonchitis, Sesleria albicans, Cirsium erisithales* are typical with some beech forest species like *Mercurialis perennis, Daphne mezereum, Veronica urticifolia, Primula elatior* and, in the eastern Alps and Dinarids, *Helleborus niger* and *Cardamine enneaphyllos.* Distinctive

geographical floras are associated with the Picea woodlands of the Western Carpathians, the Eastern and Southern Carpathians, the central Balkan peninsula and in Bulgaria and north-east Greece where spruce reaches its southern limit in Europe. On the mountains of the Bosnia/Serbia border, *Picea omorika*, a rather uncompetitive tree but one able to thrive on limestone screes, in timber clearings or after fire, dominates in woodlands of this same general type with a well- developed understorey and numerous Illyrian and south-east European species including *Daphne blagayana, Hieracium rotundatum, Aremonia agrimonoides, Festuca drymeja, Epimedium alpinum, Cardamine trifolia* and the Balkan *Doronicum columnae, Dianthus petraeus, Athamantha turbith, Sesleria rigida* and *Edraianthus graminifolius*.

Indicators of quality:

- Natural dominance of *Picea abies* with modest canopy contributions from *Abies alba, Fagus sylvatica* and pines
- Uneven-age canopy with signs of spruce regeneration, distinctively patchy where favourable microsites extend spruce cover into the sub-alpine
- Presence of old trees and a variety of dead wood (lying and standing) and the associated flora, fauna and fungi
- Presence of natural disturbance such as windfall openings with natural regeneration
- Sufficient proportion of historically old (ancient) woodland with high species diversity
- Presence of well-developed associated flora and fauna reflecting soil conditions and regional climate
- Absence of non-native tree species and absence of invasive aliens in all layers (fauna, flora)
- No signs of eutrophication or pollution with e.g. pronounced invasion on nutrient-demanding herbs
- No fragmentation and isolation with enough stands to support species which need large undisturbed forest habitats (such as wildcat, lynx etc.)

Characteristic species:

Flora:

Vascular plants:

Tree layer: *Picea abies* (incl. *P. omorika), Abies alba*.

Understorey: *Sorbus aucuparia*.

Field layer: *Vaccinium myrtillus, V. vitis-idaea, Deschampsia flexuosa, Luzula luzulina, L. sylvatica, Calamagrostis villosa, Melampyrum sylvaticum, M. pratense, Lycopodium annotinum, Oxalis acetosella, Homogyne alpina, Moneses uniflora, Blechnum spicant, Dryopteris dilatata, D. expansa.*

Bryophytes:

Hylocomium splendens, Pleurozium schreberi, Polytrichum formosum, Rhytidiadelphus triquetrus, Sphagnum girgensohnii.

Classification

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

EUNIS:

G3.1 *Abies* and *Picea* woodland

EuroVegChecklist:

Piceion excelsae Pawlowski *et al.* 1928

Abieti-Piceion (Br.-Bl. in Br.-Bl. et al. 1939) Soó 1964

Chrysanthemo rotundifolii-Piceion (Krajina 1934) Brezina et Hadac *in* Hadac 1962

Calamagrostio arundinaceae-Abietion Horvat 1962 *nom. invers. propos.*

Aconito rubicundi-Abietion sibiricae Anekhonov et Chytrý 1998

Annex 1:

9410 Acidophilous Picea forests of the montane to alpine levels (Vaccinio-Piceetea)

Emerald:

G3.1B Alpine and Carpathian subalpine Picea forests

G3.1C Inner range montane Picea forests

G3.1D Hercynian subalpine Picea forests

G3.1E Southern European Picea abies forests

G3.1F Enclave Picea abies forests

G3.1G Picea omorika forests

MAES-2:

Woodland and forest

IUCN:

1.4 Temperate Forest

EFT:

6.2.3 Nemoral spruce forest

6.3.2 Subalpine and mountainous spruce and mountainous mixed spruce-silver fir forest

VME:

D4.2 Altimontane, partly montane, spruce and mixed spruce forests

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

Regions
Continental

Justification
The habitat type represents the climax vegetation of the upper mountain belt in many continental mountain ranges. These forests types are the natural habitat of many typical animal species, including birds and large mammals, and primary habitat of *Picea abies* (with local populations of genetical interest), or rarer species like *Picea omorika.*

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	4500 Km^2	Decreasing	Stable
Bulgaria	Present	842 Km^2	Decreasing	Decreasing
Croatia	Present	136 Km^2	Unknown	Decreasing

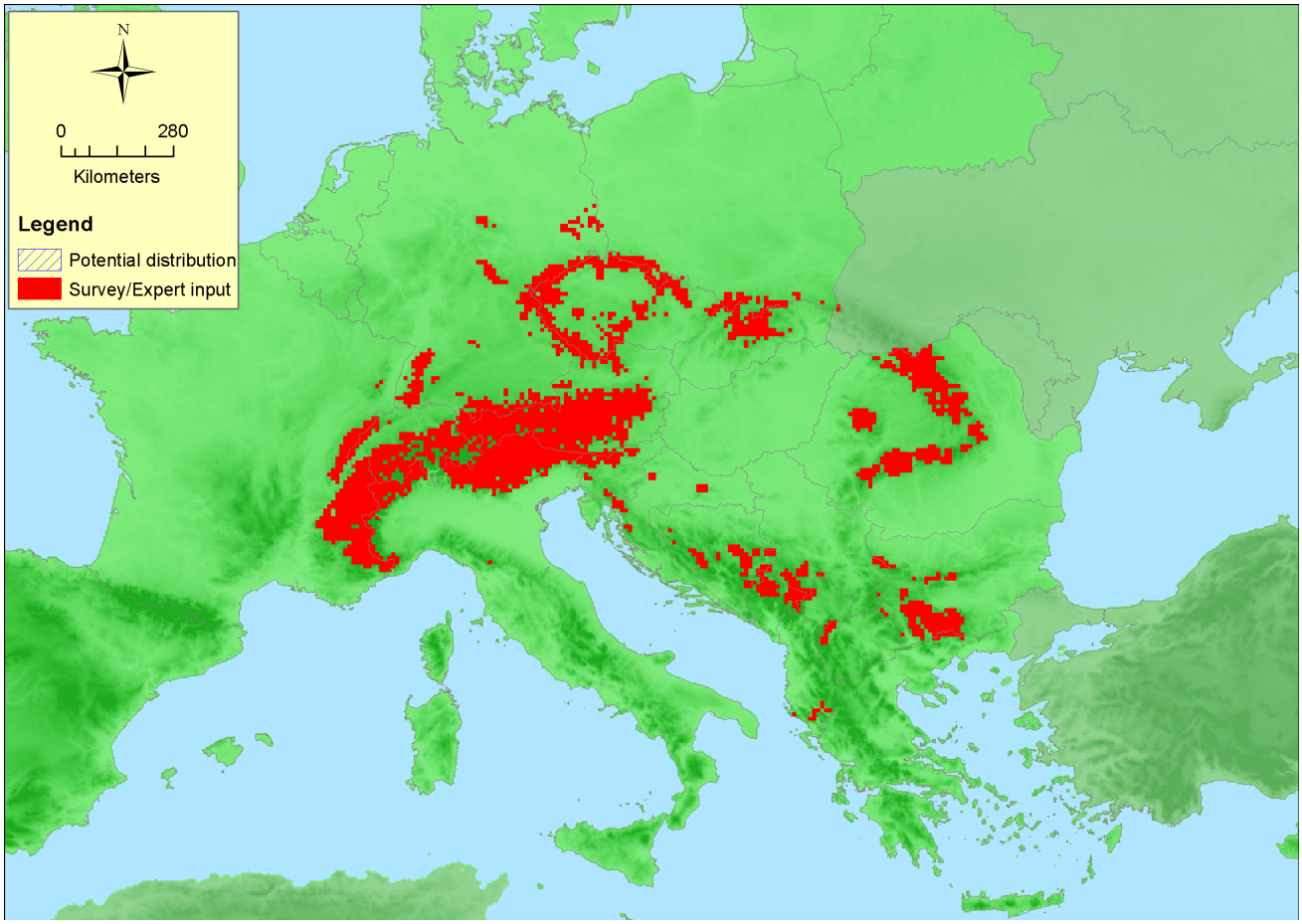
EU 28	Present or Presence Uncertain	Current area of habitat	Recent trend in quantity (last 50 yrs)	Recent trend in quality (last 50 yrs)
Czech Republic	Present	772 Km^2	Decreasing	Decreasing
France	France mainland: Present	500 Km^2	Increasing	Decreasing
Germany	Present	500 Km^2	Increasing	Decreasing
Greece	Greece (mainland and other islands): Present	80 Km^2	Stable	Increasing
Italy	Italy mainland: Present	5905 Km^2	Decreasing	Stable
Poland	Present	4700 Km^2	Unknown	Unknown
Romania	Present	5580 Km^2	Decreasing	Decreasing
Slovakia	Present	420 Km^2	Stable	Stable
Slovenia	Present	109 Km^2	Stable	Stable

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	1200 Km^2	Decreasing	Decreasing
Former Yugoslavian Republic of Macedonia (FYROM)	Present	7 Km^2	Decreasing	Stable
Montenegro	Present	840 Km^2	Stable	Unknown
Serbia	Present	Unknown Km^2	Unknown	Unknown
Switzerland	Present	1800 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	1308600 Km^2	2261	23,000 Km^2	Poland missing, estimated from art 17 report for 9410 habitat (6,331 km^2 for whole 9410, containing also more or less a quarter of Fir forests).
EU 28+	1485000 Km^2	2600	around 31,000 (+/- 3000) Km^2	Poland missing, estimated from art 17 report for 9410 habitat (6,331 km^2). Data missing for other countries in the Balkans with probalby large surfaces in Serbia. The whole area can only be roughly e

Distribution map



The map is rather complete. Data sources: EVA, Art17, BOHN.

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

About 85% lies in the EU28, the rest in EU28+.

Trends in quantity

According to some territorial experts, the total area has probably increased between the late 18th/mid 19th and early/mid 20th century. In contrast, a slight decline has been observed during the last 50 years (EU28: -8.5%; EU28+:-6.4%). A lot of spruce has been planted, but those artificial stands, often outside the natural range of the spruce, are not included in the habitat we are dealing with.

The current trend is still a decrease in 4 out of 14 countries (Austria, Bulgaria, Republic of Macedonia and Romania) representing almost half of the area, stable in 8 countries (Bosnia and Herzegovina, Croatia, Czech Republic, Greece, Italy, Slovakia, Slovenia and Switzerland) representing 47% of the area, and increasing in a few countries (Germany and France).

The trends in quantity are given for 96% of the EU28+ (93% of the EU28) but are certainly mostly based on experts estimates.

- 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
  The EOO is > 50000 km².
- Does the habitat have a small natural range by reason of its intrinsically restricted area?

No

Justification

The occurrence of the habitat type is neither restricted to small spots, nor does it have a small total area because of naturally restricted distribution range and area.Some variants, with *Picea omorika* for example, have a restricted area.

Trends in quality

A slight decrease in quality has been reported by most of the countries for last the 50 years but only affects a small area (16% of the area). The current trend is somewhat better but is still a decrease (decrease on 40 % of the area, stable on 60 %). The habitat quality is still decreasing in Bosnia and Herzegovina, Bulgaria, Czech Republic, Romania, France and Croatia; increasing in Greece and Germany; stable in the rest of the reported countries.

The territorial data concerning historical trends are lacking. Concerning future trends, an impact of climate change on mountain forests can be expected, according to national studies and models (Marage & Gégout 2011; Van der Veken et al. 2004; Lenoir et al. 2008; Lenoir 2009; Grabherr et al. 1994; Klanderud & Birks 2003). The increase of drought and temperature can lead to forest dieback in spruce mountain forest at lower altitudes, with a replacement of fir by beech or pines, and a degradation in quality (before a complete loss of the habitat occurs).

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

Pressures and threats

In most countries, the main pressures and threats are related to forestry: forest exploitation without replanting or natural regrowth or just logging are mentioned, but other pressures such as removal of forest undergrowth or cutting of dead and dying trees may be included. Deforestation or cutting is mentioned in some countries (and certainly occurs in all countries where surfaces are decreasing (Romania, Austria, Macedonia, Bulgaria). This deforestation is sometimes due to the construction or expansion of skiing complexes and sports and leisure structures, and these pressures also induce degradation in remaining spruce forests, such as pollution, damages to the undergrowth etc.

Other pressures are due to pollution (especially air pollution) and climate change (global warming, droughts). As it has been reported for Bulgaria, it causes a replacement of spruce by beech at low altitudes but this may also occur in other countries. Furthermore, phytopathogens and bark-beetle calamities are natural phenomena but can be a problem if they occur too frequently and on vast surfaces. This happens frequently in forests weakened by acid rain, drought or too intensive silviculture (in Bayerischer Wald National park for instance). The habitat type is also affected by eutrophication, which may be linked to nitrogen deposits. Additionally, fires have been reported as a threat in Montenegro (an increase of forest fires can possibly result from climate change).

Damages by herbivores are also cited. Though it is a natural pressure it can be a problem due to excess population density, especially where predators have been eliminated or where herbivore density is artificial (due to feeding of game animals).

List of pressures and threats

Sylviculture, forestry

Forest and Plantation management & use

Human intrusions and disturbances

Sport and leisure structures

Pollution

Air pollution, air-borne pollutants

Climate change

Changes in abiotic conditions
Temperature changes (e.g. rise of temperature & extremes)
Droughts and less precipitations

Conservation and management

Both integrative and segregative approaches are needed for the conservation of temperate mountain spruce woodlands. On most surfaces, the development of sustainable forest management measures can help conserving most of the structures, functions and characteristic species. The prevention of large clear-cuttings and planting of exotic trees, 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 economic functions (forest productivity especially concerning deadwood, protection against erosion or avalanches if no large clear-cuttings are made, etc.). Sustainable forest management can be promoted by forest certification, in the Natura 2000 network, public forests, category V and VI of IUCN protected areas.

Even in the most sustainably managed forest, logging cuts the end of the forest cycle (the mature and veteran stands are rare, deadwood volumes can never be the same as in unmanaged forests). It stresses the need for 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 especially be located in category I and II IUCN protected areas, and should also protect the most remarkable forests (rare habitats, virgin or quasi-virgin forests, semi-natural forests unmanaged for a long time etc.).

To face global warming, the ability of spruce mountain forests to colonize new sites at higher altitudes is very important, especially on actual open land. For variants on peat, the restoration of the hydrological regime is crucial if it has been perturbated.

Finally, for some rare subtypes on peat or wet soil, restoring or improving the hydrological regime may be necessary.

List of conservation and management needs

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

Conservation status

Annex 1 types:

9410: ALP U1, CON U1, MED FV

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

If the habitat has been severely damaged by intensive logging (with a removal of all deadwood and large trees), it takes more than 50 years to recover large enough trees and enough deadwood for the specific fauna, fungi and flora. The first positive effects of an abandonment of exploitation can be seen after 30 years of free evolution (Paillet et al. 2010). A clear-cutting followed by agricultural use would make all characteristic species disappear, and the forest soil would turn to agricultural one, and it would take centuries to recover the typical flora (Dupouey et al. 2002). Plantation can quicken the habitat recovery a little but most of the recovery process would have to occur naturally, with a slow recolonization of typical forest species.

Effort required

50+ years	200+ years
Naturally	Naturally

Red List Assessment

Criterion A: Reduction in quantity

Criterion A	A1	A2a	A2b	A3
EU 28	-8.5 %	unknown %	unknown %	unknown %
EU 28+	-6.4 %	unknown %	unknown %	unknown %

The provided figures have been calculated from the territorial data sheet. The trend in quantity for the last 50 years is a slight decrease both in EU28 and EU28+. The surface of the habitat is only slightly increasing in Germany, Switzerland and maybe France (no data for France because it is impossible to separate facts and developments concerning spruce plantations from facts and developments concerning natural and semi-natural spruce forests). The overall surface of spruce stands is increasing in Europe but most of them correspond to plantations outside the natural range of spruce mountain forests and are not included in this habitat type.

Criterion B: Restricted geographic distribution

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

Both EOO and AOO are well above the thresholds to qualify for category Near threatened (NT).

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	16 %	30 %	unknown %	unknown %	unknown %	unknown %
EU 28+	16 %	33 %	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%	unknownunknown %	unknown%	unknown %	unknown%
EU 28+	unknown %	unknown%	unknown %	unknown%	unknown %	unknown%

The reduction in quality is not substantial (between no and slight degradation on half of the surface) and leads to the Least concern (LC) category. Models (Piedallu et al. 2009) predict that climate change would threaten *Picea abies* over the next 100 years by an increase of temperatures (favouring spruce competitors) and an increase of drought. This would lead to a degradation of most of the surfaces, especially at lower altitudes or in southern Europe. The response of spruce is not certain within the next 50 years all over Europe. The demand for conifer wood is probably increasing in the next years, and will affect the conservation of spruce forests with intensive management. Such a bad trend (concerning forestry and climate change) would lead to the Vulnerable (VU) category, but can't be supported by facts yet. Therefore, future trends in quality have to be evaluated as Data deficient (DD).

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	LC	LC	LC	LC	LC	DD	DD	DD	DD	DD	DD	DD	DD	DD
EU28+	LC	DD	DD	LC	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)

Assessors

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