D4.1c Calcareous quaking mire

Summary

Calcareous quaking mire develops in topogenic basins fed by very calcareous, nutrient-poor ground water, with generally thin peat, less than 2m thick. It occurs widely through Europe but the vast bulk of present extent is in Finland and Sweden. The surface is kept permanently very wet and covered by an extensive moss carpet with only sparse vascular plants, sometimes disposed over irregular patterns of flanks and hollows. Calcium precipitation can occur on the surface and the carpet is often interrupted by stretches of open water. Clearance for agriculture and changes in hydrology have much depleted the extent and quality of this habitat and it is vulnerable also to eutrophication.

Synthesis

Calcareous quaking mires are assessed as Vulnerable (VU) based on the criterion A1. Better data cover and quality might have resulted in more critical assessment, especially by criterion A3 of historic decline in area. These habitats are estimated to have lost about one third of their area during the past 50 years. This can be an underestimate but even the upper bound of estimation was below the threshold for the Endangered (EN) category.

Overall Category & Criteria			
EU 28		EU 28+	
Red List Category	Red List Criteria	Red List Category	Red List Criteria
Vulnerable	A1	Vulnerable	A1

Sub-habitat types that may require further examination

Separation of subtypes and reassessment should be explored between boreal and nemoral areas. The northern habitats are generally less calcareous and less threatened e.g. by nitrogen deposition and landuse.

Habitat Type

Code and name

D4.1c Calcareous quaking mire

Calcareous quaking mire in Estonia with dominating brown mosses (*Scorpidium cossonii*, *S. scorpioides*, *Cinclidium stygium*, *Pseudocalliergon trifarium*) and, locally, semi-aquatic calcium-tolerant peatmosses (*Sphagnum contortum*); *Carex lasiocarpa*, *C. lepidocarpa*, *C. limosa*, *C. dioica*, *Eriophorum angustifolium*, *Pedicularis palustris*, *Salix rosmarinifolia* and other fen species occur in herb layer (Photo: Petra Hájková).

Calcareous quaking mire vegetation with *Scorpidium scorpioides* and *Carex limosa* in northern Finland (Photo: Teemu Tahvanainen).

Habitat description

Very wet mires with rich fen vegetation of topogenic basins fed by calcareous ground water from the catchment. Water pH is always high (pH 6.5-8.5) due to high alkalinity. Calcium concentrations are typically very high (>20 mg/l) but sometimes lower, especially in boreal regions. Peat layer is usually relatively thin (0.5-2 m) but also sites with thicker peat layer occur, as depending on basin and catchment topography. Calcium precipitation can take place on peat surface. Water table is always close to peat surface and open water surfaces are common. Regular surface patterning can be absent, while irregular patterns of flarks, pools and hollows are common. In boreal region, typical string-flark patterning is common. In such cases, calcareous quaking mires differ from D3.2 Aapa mires by the abundance of calciphilous species, especially among bryophytes. This also is the main distinction from D2.3a Quaking mires.

Vegetation is strongly minerotrophic and characterized by abundance of Amblystegiaceae mosses, especially *Scorpidium scorpioides*. Other characteristic mosses include *Scorpidium revolvens, Scorpidium cossoni, Calliergon richardsonii* and *Pseudocalliergon trifarium*. In the boreal region, weaker minerotrophy indicating species like *Sphagnum contortum* and *Warnstorfia procera* can also be frequent. Vascular plant cover is characteristically sparse. Typical species include *Carex chordorrhiza, Carex diandra, Carex flava, Carex lasiocarpa, Carex limosa, Carex rostrata, Carex livida, Drosera longifolia, Equisetum fluviatile, Eriophorum gracile, Juncus stygius, Liparis loeselii, Menyanthes trifoliata, Pedicularis palustris, Potentilla palustris, Schoenus ferrugineus* and *Utricularia intermedia.* Sometimes sparse stands of *Phragmites australis* are found.

Indicators of good quality:

Under natural conditions, water table is close to surface and it can always be readily observed. Open water surfaces are common. Calcite precipitation takes place in richly calcareous situations, but when calcium levels are not supersaturated, precipitation can be absent. Rich fen mosses are abundant, although not necessarily forming continuous carpets. *Sphagnum* mosses are mainly absent from main mire surfaces, while they may be found in hummock strings or other isolated microsites. Vascular plant cover is sparse, leaving space and light for mosses.

Drainage ditches can affect calcareous quaking mires by lowering water level or by interrupting the inflow of calcareous water from the catchment. In such cases, rich fen mosses are rapidly lost and replaced by generalist species. Eutrophication by nitrogen deposition also threatens these habitats. Over growth e.g. by *Sphagnum subnitens* and *Calliergonella cuspidata* have been observed in high N deposition areas. General increase of vascular plant biomass can also indicate weakening of habitat quality.

Characteristic species:

Flora

Vascular plants: *Carex buxbaumii, Carex chordorrhiza, Carex diandra, Carex flava, Carex heleonastes, Carex jemtlandica, Carex lasiocarpa, Carex limosa, Carex livida, Carex viridula, Drosera longifolia, Drosera intermedia, Eriophorum angustifolium, Eriophorum latifolium, Eriophorum gracile, Equisetum fluviatile, Equisetum palustre, Juncus biglumis, Juncus stygius, Juncus subnodulosus, Juncus triglumis, Liparis loeselii,Menyanthes trifoliata, Pedicularis palustris, Phragmites australis, Potentilla palustris, Schoenus ferrugineus, Trichophorum alpinum, Triglochin maritimum, Triglochin palustre, Utricularia intermedia, Utricularia minor.*

Mosses: *Aneura pinguis, Bryum pseudotriquetrum, Calliergon richardsonii, Campylium stellatum, Catoscopium nigritum, Cinclidium stygium, Fissidens adianthoides, Hamatocaulis lapponicus, Hamatocaulis vernicosus, Leiocolea rutheana, Loeskypnum badium, Meesia longiseta, Meesia triquetra, Meesia uliginosa, Paludella squarrosa, Pseudocalliergon trifarium, Rhizomnium pseudopunctatum, Scorpidium cossoni,*

Scorpidium revolvens, Scorpidium scorpioides, Sphagnum contortum, Warnstorfia procera.

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

EUNIS:

D2.3 Transition mires and quaking bogs

EuroVeg Checklist:

Stygio-Caricion limosae Nordhagen 1943

Caricion davallianae Klika 1934 (marginally)

Sphagno warnstorfii-Tomentypnion nitentis Dahl 1956 (marginally)

Annex 1:

7230 Alkaline fens

7140 Transition mires and quaking bogs (*marginal*)

Emerald:

D4.1 Rich fens, including eutrophic tall-herb fens and calcareous flushes and soaks

MAES-2:

Wetlands

IUCN:

5.16. Permanent Saline, Brackish or Alkaline Marshes/Pools

5.4. Bogs, Marshes, Swamps, Fens, Peatlands

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

Justification
Widespread type in temperate and boreal zones. Dependent mainly on regional or local calcareous geochemistry and topogenic basins with rich water supply.

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	2 Km^2	Decreasing	Decreasing
Belgium	Present	unknown Km^2	Decreasing	Decreasing
Bulgaria	Present	7 Km^2	Decreasing	Decreasing
Czech Republic	Present	0.1 Km^2	Decreasing	Decreasing
Denmark	Present	3 Km^2	Decreasing	Decreasing
Estonia	Present	13 Km^2	Stable	Stable
Finland	Aland Islands: Present Finland mainland: Present	320 Km^2	Decreasing	Decreasing

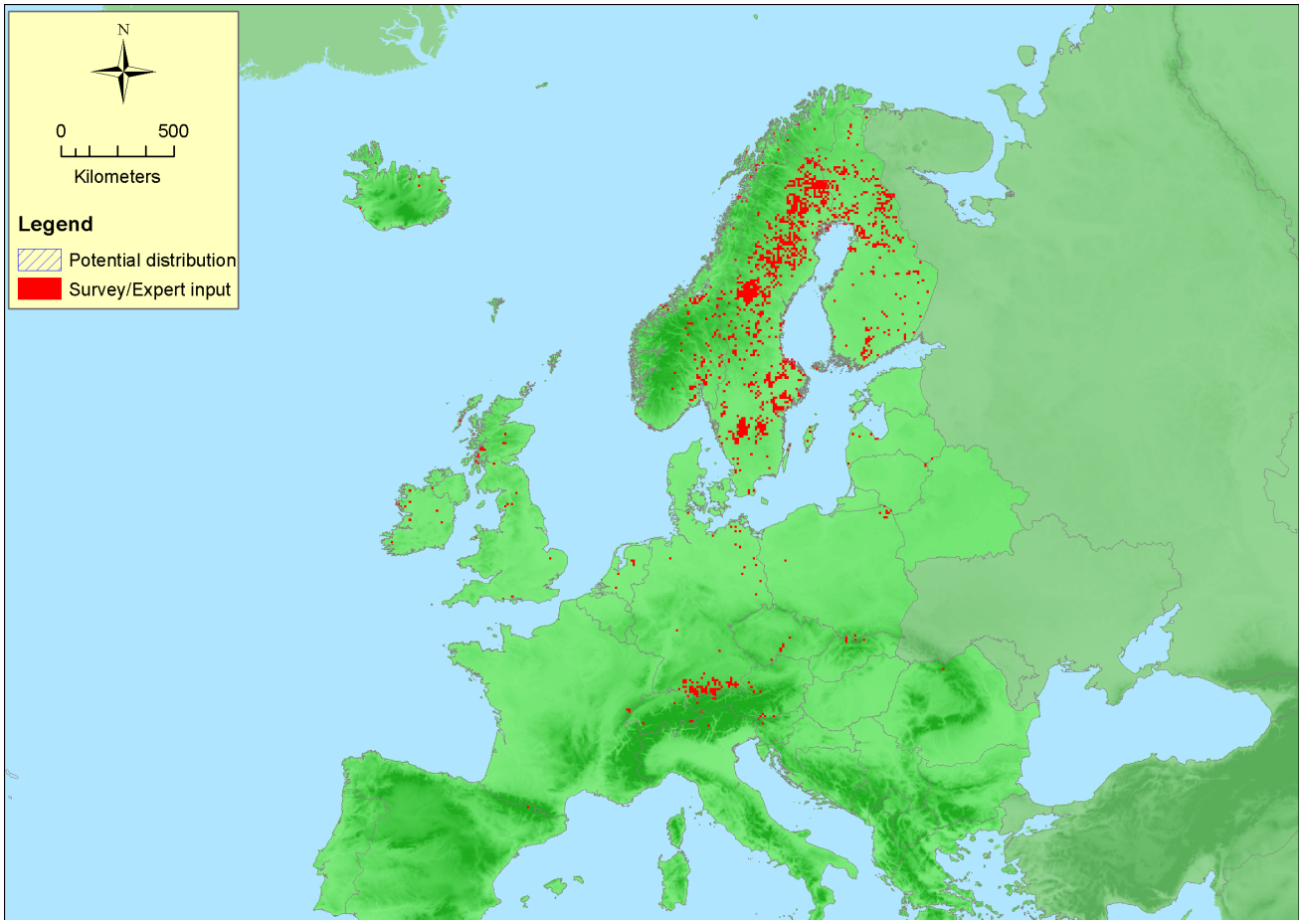
EU 28	Present or Presence Uncertain	Current area of habitat	Recent trend in quantity (last 50 yrs)	Recent trend in quality (last 50 yrs)
France	France mainland: Present	1-5 Km^2	Decreasing	Decreasing
Germany	Present	<1 Km^2	Decreasing	Decreasing
Ireland	Present	unknown Km^2	Decreasing	Decreasing
Latvia	Present	unknown Km^2	Decreasing	Decreasing
Lithuania	Present	<1 Km^2	Decreasing	Decreasing
Netherlands	Present	2 Km^2	Decreasing	Decreasing
Poland	Present	10 Km^2	Decreasing	Decreasing
Slovakia	Present	0.1 Km^2	Decreasing	Decreasing
Spain	Spain mainland: Present	unknown Km^2	Unknown	Unknown
Sweden	Present	500 Km^2	Decreasing	Decreasing
UK	United Kingdom: Uncertain	Km^2	-	-

EU 28 +	Present or Presence Uncertain	Current area of habitat	Recent trend in quantity (last 50 yrs)	Recent trend in quality (last 50 yrs)
Norway	Norway Mainland: Present	10 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	4778200 Km^2	1318	860 Km^2	Minor areas missing due to lack of data from some countries
EU 28+	6297500 Km^2	1438	870 Km^2	Minor areas missing due to lack of data from some countries

Distribution map



The habitat is distributed in Scandinavia where it is mainly connected to local calcareous bedrock, in Netherlands, Belgium and lowlands around Baltic Sea and in the Alps and the Carpathains. In southern Europe the habitat is extremelly rare. The map is incomplete in some regions, but the overall range is relatively well indicted. Data sources: EVA, GBIF, EXP.

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

2-10% of the habitat type may be located within EU28. The habitat is wide spread in boreal calcareous areas especially in Alaska, Canada and Russia.

Trends in quantity

Strong decline is indicated in most countries, mainly between 40-60% in recent decades. Historical decline has been remarkable too but only scanty data is available. Decreasing future trend is indicated in most countries. Estonian data indicates stable or increasing trend, in contrast to other territorial data.

- 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
  Widespread in temperate and boreal zones, although quite patchy and rare in much of the geographical range.
- Does the habitat have a small natural range by reason of its intrinsically restricted area?
  No
  Justification
  Widespread in temperate and boreal zones.

Trends in quality

Most data (with exception of Estonia) indicates decline of quality in recent past with 42% overall extent of degradation and 50% relative severity. Few countries provide input on future and historic trends. These mainly indicate decreasing quality, again with exception of Estonia.

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

Pressures and threats

Main pressures and threats are different types of hydrological modifications like canalizations, ditchings and ground water abstraction. Increase of nutrients due to fertilisation and nitrogen deposition and connected succession are other main threat factors. Few minor threats are mentioned: overgrazing and peat mining.

List of pressures and threats

Agriculture

Cultivation
Abandonment of pastoral systems, lack of grazing
Fertilisation

Sylviculture, forestry

Forestry activities not referred to above

Mining, extraction of materials and energy production

Peat extraction
Mechanical removal of peat

Pollution

Pollution to surface waters (limnic, terrestrial, marine & brackish)
Diffuse pollution to surface waters due to agricultural and forestry activities
Nutrient enrichment (N, P, organic matter)

Natural System modifications

Human induced changes in hydraulic conditions
Infilling of ditches, dykes, ponds, pools, marshes or pits
Canalisation & water deviation
Modification of hydrographic functioning, general
Water abstractions from groundwater
Other human induced changes in hydraulic conditions

Natural biotic and abiotic processes (without catastrophes)

Biocenotic evolution, succession
Species composition change (succession)
Eutrophication (natural)
Acidification (natural)

Conservation and management

Establishing protected areas and restoration by improving hydrological regime of disturbed sites are the

main approaches. In addition, liming may be needed in some areas to improve water quality.

List of conservation and management needs

Measures related to wetland, freshwater and coastal habitats

Other wetland related measures
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

Measures related to hunting, taking and fishing and species management

Regulation/Management of hunting and taking

Measures related to special resouce use

Regulating/Management exploitation of natural resources on land

Conservation status

Annex 1:

7230: BOR U1, ALP U1, ATL U2, CON U2

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

When severely damaged in terms of hydrological disturbance, restoration by blocking and damming ditches can effectively help habitat recovery. Problems may arise if hydrological connection to calcareous ground water supply from the catchment is not regained or if nutrient mineralisation causes eutrofication. Liming may be necessary in some cases to prevent acidification and connected unfavourable vegetation succession. If loss of key species like characteristic mosses has taken place, reintroduction by transplantations should be considered, as well as active measures to suppress overgrowing by unwanted plant cover.

Effort required

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

Red List Assessment

Criterion A: Reduction in quantity

Criterion A	A1	A2a	A2b	A3
EU 28	-32 %	unknown %	unknown %	unknown %
EU 28+	-32 %	unknown %	unknown %	unknown %

Assessment based on the criterion A1 is Vulnerable (VU). The A1 bounds are estimated to be 22-44 % based on uncertainties indicated by territorial data. Historic reduction has been extensive but data is scarse and does not allow assessment of the A3 criterion. Continued reduction in the future is indicated by nearly all entries in the data.

Criterion B: Restricted geographic distribution

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

The habitat is wide spread and assessed as Least Concern (LC) concerning the B criteria.

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	42 %	50 %	unknown %	unknown %	unknown %	unknown %
EU 28+	42 %	50 %	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 assessment of C/D1 criterion is NT, since reduction in quality with extent 42% and severity 50% is close to VU threshold. Data was missing from many countries with probably strong reduction in quality (Ireland, UK, Latvia) and a more critical assessment would be possible with better data. However, Finnish and Swedish data govern this type (both EU28 and EU28+) and in these countries, northern areas have mainly good quality. Future trend is expected to be negative, while historic decrease of quality is not considered so remarkable. Separation between C and D criteria was generally not indicated in the data and these are therefore not evaluated separately.

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	VU	DD	DD	DD	LC	LC	LC	NT	DD	DD	DD	DD	DD	DD	DD	DD	DD
EU28+	VU	DD	DD	DD	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
Vulnerable	A1	Vulnerable	A1

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

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