C2.1a Base-poor spring and spring brook

Summary

Base-poor springs and spring brooks develop throughout Europe where ground water emerges from bedrock or superficial deposits and are usually small in size but can occur in extensive complexes. The speed, volume and chemistry of the waters are very variable and the associated flora and fauna accordingly diverse. Moss carpets often prevail among the vegetation cover, though distinctive vascular plants occur in less extreme situations, including some relic species. Very sensitive to disturbance, they are threatened by water abstraction, quarrying and mining, land clearance and construction. Restoration depends on recovering the natural hydrology.

Synthesis

The area of the habitat has decreased in most countries, on average about 20% in Europe. The remaining area suffered a strong decline in quality (severity 45-65%, affected area 45-55%), resulting in the category Vulnerable (VU) for EU28. Data from EU28+ covered two additional countries, leading to similar trends. However, base-poor springs are widespread in Iceland and Norway, countries from which no data were available, and it is likely that the habitat is in a relatively good status there. As information from these countries is likely to decrease trend values, the lower category Near Threatened (NT) is applied for EU28+.

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

Sub-habitat types that may require further examination

Lowland and alpine base-poor springs and spring brooks differ in biota, pressures and conservation status. Lowland base-poor springs are likely to have a much higher degree of threatening than the alpine sub-habitat. Geysirs are a specific sub-habitat that is part of the definition in the original EUNIS habitat. They may be considered and assessed as a separate habitat.

Habitat Type

Code and name

C2.1a Base-poor spring and spring brook

Large base-poor spring intergrades into a brook, with *Cardamine amara*, *Fontinalis antipyretica, Calliergon* spp., *Rhizomnium* spp. and some liverworts, below Siikakangas glacifluvial delta, Finland. (Photo: Heikki Toivonen).

Softwater spring with *Philonotis fontana*, *Carex nigra* subsp. *dacica* and *Caltha palustris* subsp. *laeta.* Cindriel Mountains, Romania (Photo: John Janssen).

Habitat description

Springs are habitats where groundwater discharges to earth surface or to a water body. Their microclimate, hydrology, water volume, chemistry and discharge type (rheocrene, limnocrene, and helocrene springs), and consequently animal and plant communities, are very variable. Sometimes springs are dominated by abiotic features, sometimes their biotic communities are very rich (particularly helochrenes with moss carpets, specialized plants and macroinvertebrates). Springs are usually small-sized but in some cases large complexes (up to several hectares) of pools, vegetation patches and moist seepage areas occur. As compared to other moist habitats spring habitats are characterized by low temperature, small annual fluctuation in the water temperature, and often by high content of oxygen in the water. These features are most representative in cold stenothermic springs where mean temperature is only a few degrees above 0^0C and the annual amplitude is very small. The pH of base-poor springs is typically from slightly acid, form pH > 5.5 to circumneutral or slightly alkaline. The diverse physical structure and the water chemistry are main determinants for spring biota, the former particularly to macroinvertebrates, the latter to bryophytes. Through groundwater, rich in nutrients and oxygen, springs have often locally enriching influence to adjacent habitats, for example to headwater streams or to mire, meadow or forest habitats. On the other hand, adjacent habitats, for example forest, can have strong influence on springs and spring brooks, both by shadowing and as a source of allochthonous material. The stenothermic springs in cold (arctic, alpine) areas are dominated by mosses, while cover of vascular plants (such as *Saxifraga* spp., *Koenigia islandica*, *Epilobium hornemanni*) is low or zero. In montane and subalpine springs vascular plants, representing alpine and arctic floristic elements, are more common, but in most cases moss communities prevail. In lowland springs vascular plants can be abundant. Due to their characteristic microclimate, with a low temperature during the growing season, springs can accommodate disjunct (often relict) occurrences of northern and alpine species. However, in northern locations, they can maintain also occurrences of species with southern origin, due to unfrozen water and soil during wintertime. Spring habitats are sensitive to disturbances, because they are affected by changes in their close surroundings but also in their catchment areas. Many springs have been destroyed or deteriorated in quality due to a range of activities related to groundwater abstraction, utilisation of spring brooks, forestry, clearing of agricultural land, soil and rock excavation, and construction activities. Threats include eutrophication and chemical contamination too. In arctic, alpine and north boreal areas spring habitats have remained to large extent in natural condition, in lowlands many of them have been destroyed or their quality declined.

Indicators of good quality:

- Natural hydrology and water chemistry in springs and spring brooks,
- Low anthropogenic influence (drainage, water exploitation, forestry, agriculture, eutrophication etc.) in springs, their surroundings and catchment areas,
- Presence of plants and animals adapted to spring conditions, including threatened species,
- High cover of mosses and specialized vascular plants,
- Rich macro-invertebrate fauna,
- Low cover of encroaching tall grasses and shrubs.
- Absence of invasive alien species.

Characteristic species:

Flora: Vascular plants: *Cardamine amara, Montia fontana, Epilobium alsinifolium, E. nutans, E. hornemannii, E. obscurum, E. palustre, Carex acutiformis, C. paniculata, C.remota, C. vaginata, Cardamine flexuosa, Chrysosplenium alterniflorum, C. oppositifolium, Circea alpina, C.* x *intermedia, Crepis paludosa, Impatiens noli-tangere, Myosotis stolonifera, Petasites frigidus, Poa remota, Saxifraga aizoides, Saxifraga stellaris, Stellaria alsine, Veronica nevadensis*.

Mosses: *Brachythecium rivulare, Bryum weigelii, Bryum schleicheri, Calliergon cordifolium, Chiloscyphus*

polyanthos, Cratoneuron filicinum, Mniobryum, Philonotis fontana, Philonotis tomentella, Pohlia wahlenbergii, Rhizomnium, Plagiomnium, Scapania uliginosa, Scapania undulata, Sphagnum riparium, Sphagnum squarrosum, Sphagnum teres, Warnstorfia exannulata.

Fauna: Birds: *Cinclus cinclus*.

Invertebrates: *Plecoptera,Trichoptera, Diptera (Chironomidae,Simulidae), Gammarus* spp., *Asellus aquaticus, Pallasea quadrispinosa, Cladocera.*

Classification

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

EUNIS:

C2.1. Springs, spring brooks and geysirs

EuroVegChecklist (alliances):

Caricion remotae Kästner 1941

Cratoneuro filicini-Calthion latae Hadac 1983

Mniobryo-Epilobion hornemannii Nordhagen 1943

Koenigio-Microjuncion Sörensen ex Hadac 1971

Cardamino-Montion Br.-Bl. 1926

Swertio perennis-Anisothecion squarrosi Hadac 1983

Epilobio nutantis-Montion Zechmeister in Zechmeister et Mucina 1994

Myosotidion stoloniferae Rivas-Martinez et al. 1984

Pinguiculo balcanicae-Cardaminion acris Carni et Matevski 2010

Ranunculion omiophyllo-hederacei Rivas-Martinez et al. 2002

Annex 1:

7160 Fennoscandian mineral-rich springs and springfens

Emerald:

C2.111 Fennoscandian mineral-rich springs and springfens

MAES-2:

Freshwater, Rivers and lakes

IUCN:

5.9. Freshwater Springs and Oases

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

No

Justification

The habitat is very widespread in Europe. Although it is best conserved in alpine regions, it is also occurring in lowland areas.

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	marginal Km^2	Decreasing	Decreasing
Belgium	Present	Unknown Km^2	Unknown	Decreasing
Bulgaria	Present	marginal Km^2	Decreasing	Decreasing
Croatia	Present	Unknown Km^2	Stable	Stable
Cyprus	Uncertain	Unknown Km^2	Unknown	Unknown
Czech Republic	Present	9.6 Km^2	Decreasing	Decreasing
Denmark	Present	Unknown Km^2	Unknown	Unknown
Estonia	Present	Unknown Km^2	Unknown	Unknown
Finland	Aland Islands: Present Finland mainland: Present	30 Km^2	Decreasing	Decreasing
France	Corsica: Present France mainland: Present	75 Km^2	Decreasing	Decreasing
Germany	Present	Unknown Km^2	Decreasing	Decreasing
Greece	Crete: Uncertain East Aegean: Uncertain Greece (mainland and other islands): Present	Unknown Km^2	Unknown	Unknown
Hungary	Uncertain	Unknown Km^2	Unknown	Unknown
Ireland	Present	Unknown Km^2	Unknown	Unknown
Italy	Italy mainland: Present	26 Km^2	Decreasing	Unknown
Latvia	Present	Unknown Km^2	Unknown	Unknown
Lithuania	Present	1 Km^2	Decreasing	Decreasing
Luxembourg	Present	Unknown Km^2	Unknown	Unknown
Malta	Uncertain	Unknown Km^2	Unknown	Unknown
Netherlands	Present	1 Km^2	Decreasing	Decreasing
Poland	Present	Unknown Km^2	Unknown	Unknown
Portugal	Madeira: Present Portugal mainland: Present	0.6 Km^2	Unknown	Unknown
Romania	Present	Unknown Km^2	Unknown	Unknown
Slovakia	Present	Unknown Km^2	Unknown	Unknown
Slovenia	Present	marginal Km^2	Decreasing	Decreasing
Spain	Canary Islands: Uncertain Spain mainland: Present	18 Km^2	Decreasing	Decreasing
Sweden	Present	Unknown Km^2	Unknown	Unknown

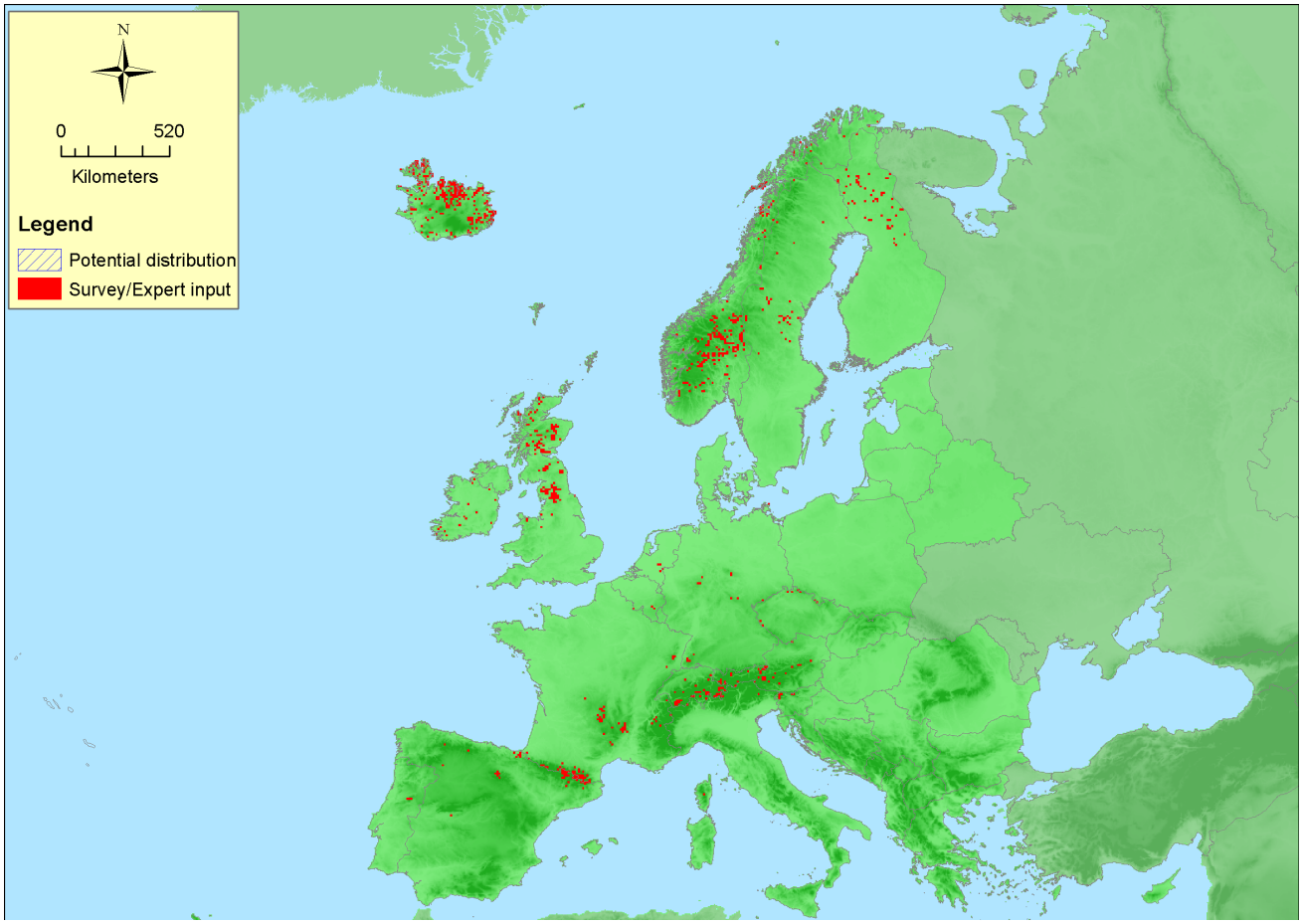
EU 28	Present or Presence Uncertain	Current area of habitat	Recent trend in quantity (last 50 yrs)	Recent trend in quality (last 50 yrs)
UK	Gibraltar: Present Northern Island: Present United Kingdom: Present	4 Km^2	Stable	Decreasing

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	Present	Unknown Km^2	Unknown	Unknown
Bosnia and Herzegovina	Present	1 Km^2	Decreasing	Decreasing
Faroe Islands	Present	Unknown Km^2	Unknown	Unknown
Former Yugoslavian Republic of Macedonia (FYROM)	Present	Unknown Km^2	Unknown	Unknown
Iceland	Present	Unknown Km^2	Unknown	Unknown
Kaliningrad	Present	Unknown Km^2	Unknown	Unknown
Kosovo	Present	Unknown Km^2	Unknown	Unknown
Montenegro	Present	Unknown Km^2	Unknown	Unknown
Norway	Norway Mainland: Present Svalbard: Present	Unknown Km^2	Unknown	Unknown
Serbia	Present	Unknown Km^2	Unknown	Unknown
Switzerland	Present	18 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	4707800 Km^2	431	unknown Km^2	Sites numerous, but usually small in size
EU 28+	6802900 Km^2	894	unknown Km^2	Sites numerous, but usually small in size

Distribution map



Map is incomplete. Data gaps exist amongst others in Italy, France, the Carpathians and on the Balkan. Data sources: EVA, GBIF.

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

Based on total distribution of some characteristic species (*Montia fontana, Cardamine amara, Epilobium alsinifolium*) about 60 % of base-poor springs and spring brooks with this type of vegetation lies within EU28.

Trends in quantity

Springs and spring brooks have severely declined in many countries, particularly in lowlands, due to water abstraction, land reclamation and pollution. However, this has been documented in detail only in a few countries. Declining trend of natural spring habitats is clear during the last 50 years. This trend is supposed to continue also in the future. Current total area of the habitat is difficult to estimate, as sites are numerous but often very small in size, and the methods used in inventories varies between the countries. Total area may be 200 - 300 km^2 in EU28.

- 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 habitat is widespread in Europe.
- Does the habitat have a small natural range by reason of its intrinsically restricted area?
  Yes
  Justification

Springs and spring brooks have a wide European range, but their total area is limited due to scattered occurrence of sites, all with small areas. This and a considerable regional and local variation make their communities sensitive to many kinds of changes in surrounding landscapes. Biotic components of the springs are more sensitive to changes than the abiotic ones.

Trends in quality

The quality of springs and spring brooks has declined in most countries (declining trend in 13 of 17 countries in analyses) during the last 50 years. In most countries severity of degradation has been estimated to be moderate or severe.

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

Pressures and threats

As small-scale habitats springs and spring brooks are very sensitive to various changes in their surroundings, as well as in their catchment areas. During last centuries they have been subjected to water abstraction, changes in the hydrology, land reclamation and many types of pollution. These pressures have caused decline in the quantity of springs, as well as losses in their biota. Losses in plant and animal communities are often much more severe than changes in abiotic conditions, for example groundwater volume. Consequently, springs were largely lost in many European lowland areas. In recent past hydrological changes have continued, as well as input of nutrients. Diffuse loading of nutrients from agriculture and forestry, and air-borne pollution, particularly nitrogen, is more common than earlier. Hydrological changes and increasing nutrient loads result in successions to more productive plant communties and overgrowth by taller plants. In future climate change is evidently going to enhance this trend. Recreation activities as well as soil excavation (sand, gravel, peat) can be locally important. In general, springs in lowland and southern regions are much more impacted by these pressures than springs in northern and alpine areas. Spring habitats and many spring species are qualified threatened in many national red lists.

List of pressures and threats

Pollution

Pollution to groundwater (point sources and diffuse sources)
Diffuse groundwater pollution due to agricultural and forestry activities

Natural System modifications

Human induced changes in hydraulic conditions
Landfill, land reclamation and drying out, general
Modification of hydrographic functioning, general
Water abstractions from groundwater

Climate change

Changes in abiotic conditions
Droughts and less precipitations
Changes in biotic conditions
Habitat shifting and alteration

Conservation and management

Maintaining natural hydrology and controlling eutrophication and contamination are main approaches in

conservation of springs and their surroundings. Water protection measures are needed also in catchment areas. Springs and spring brooks are often small-size habitats (often from a few to some tens of m^2), therefore their vegetation and fauna is sensitive to many kinds of changes. They should be taken into consideration when running agricultural and forestry practices. Representative spring sites should be legally protected. Sometimes it is necessary to develop specific management and restoration schemes to spring biota.

List of conservation and management needs

Measures related to forests and wooded habitats

Adapt forest management

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

Legal protection of habitats and species

Conservation status

Annex 1:

7160: ALP FV, BOR U2, CON U2

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

In many cases the habitat has some capacity to recover, but in most cases interventions related to restoration of hydrology, decreasing nutrient loads and other type of pollution are required. Often spring vegetation and fauna require specific restoration measures. Various restrictions in land use and recreation activities are often needed in close surroundings. The habitat may be restored within a relatively short period, but for some of the biota it may take many decennia to return to the habitat, because of isolated populations and limited dispersal potential.

Effort required

10 years
Through intervention

Red List Assessment

Criterion A: Reduction in quantity

Criterion A	A1	A2a	A2b	A3
EU 28	-20 %	unknown %	unknown %	unknown %
EU 28+	-20 %	unknown %	unknown %	unknown %

Reduction in quantity in the recent past (Criterion A1) is calculated from quantitative data from 14 EU28 countries. In many cases data derived from expert judgment. There are quantitative estimates from only few countries on area of base-poor spring habitats in last centuries or in future. So no assessment could be done for criteria A2a, A2b and A3. The average decline of -20% leads to a Least Concern (LC) assessment.

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 EOO and AOO of the habitat 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	45-55 %	45-65 %	unknown %	unkonwn %	unknown %	unknown %
EU 28+	45-55 %	45-65 %	unknown %	unkonwn %	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%

Data from 18 countries (16 from EU28) were available. Quantitative estimates of the extent of degraded areas were made from 13 countries (12 decrease, 1 stable, 5 unknown) and of the severity of the degradation from 14 countries (13 decrease, 1 stable, 4 unknown). Data combining extent and severity of degradation were, however, only available from 6 EU28 and 2 EU28+ countries. The data represents in many countries expert judgment and data coming from the WPD and Article 17 reporting, and is - compared to many other habitats - rather uncertain. In these reporting abiotic and biotic parameters are often combined to give an overall estimate.

Because of the uncertainty in data and data gaps several different calculations have been carried out, using assumptions about amount and trends of the habitat in countries with data gaps. This resulted in a degraded extent of the habitat of about 45 to 55 %, and a severity of about 45 to 65 %, both for EU28 and EU28+. With these figures the habitat is assessed as Vulnerable (VU) under criterion C/D1 for the EU28. For the EU28+, however, important data from Norway and Iceland is lacking, two countries where the habitat is widely distributed. It is assumed that the habitat in these countries is relatively well preserved. Therefore for the EU28+ the category NT is concluded.

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	DD	VU	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
Vulnerable	C/D1	Near Threatened	C/D1

Confidence in the assessment
Low (mainly based on uncertain or indirect information, inferred and suspected data values, and/or limited expert knowledge)

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