E1.9b Inland sanddrift and dune with siliceous grassland

Summary

Here are included usually sparse grasslands on sand drifts of inland dunes and other open landscapes, mainly in the north central European lowlands, where the nutrient-poor and highly acidic surface is prone to wind erosion and hot droughty summers. Small tussocks of *Corynephorus canescens* and other graminoids form an open matrix among which there can be rich contingents of mosses and lichens. The habitat probably originated in over-exploitation and desertification of woodlands and heaths since the Middle Ages, and it provides a highly distinctive landscape which can host far-flung outposts of steppe fauna. Abandonment of extensive grazing and concerns about sand erosion may encourage succession to closed swards, especially where there is eutrophication from atmospheric inputs, and afforestation can also be a threat. Enclosure for military training has sometimes provided a distinctive kind of protection but grazing and disturbance from agricultural or even recreational activities could also be beneficial. New occurrences developed after abandoned lignite mining should be welcomed.

Synthesis

Based on a 50 year reduction in quantity of more than 70%, this habitat type is assessed as Endangered (EN) both in EU28 and EU28+. Furthermore, long-term reduction data from just a few countries indicate a similar level of threat, while a significant reduction in biotic and abiotic quality results in a near-threat status (NT).

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

Sub-habitat types that may require further examination

No sub-habitats have been distinguished for further analysis.

Habitat Type

Code and name

E1.9b Inland sanddrift and dune with siliceous grassland

Inland dunes in the National Park Hoge Veluwe, the Netherlands, dominated by stands of the *Corynephorion canescentis* (Photo: John Janssen).

Details of a *Corynephorion canescentis* stand in East Poland with tussocks of the Grey Hair-grass (*Corynephorus canescens*) and the creeping branches of *Thymus serpyllum* in a carpet dominated by the moss *Polytrichum piliferum* and the lichen *Cladonia foliacea* (Photo: Jürgen Dengler).

Habitat description

These are open grasslands on inland sand-drift areas, dunes and other sites with poorly developed sandy, acidic and nutrient-poor soils, characterized by a pattern of small tussocks of the grass *Corynephorus canescens* and/or patches of the stoloniferous graminoids *Agrostis vinealis* and *Carex arenaria* in a matrix of lichens, mosses and open sand. The habitat has its main distribution in the North Central European lowland of the Netherlands, Germany and Poland, and in this region the large open landscapes formed by the habitat are known as 'Atlantic deserts'. The habitat is considered to be the result of overexploitation of woodlands and heathlands since the Middle Ages, and these sand drifts had their largest distribution in the middle of the 19th century.

The open sand is an extreme habitat, with high temperatures and extreme drought during summer, where only a few plants and animals can live. Some of the characteristic fauna here have their main distribution in the Southeast European steppes, for example the grasshopper *Oedipoda caerulescens* and the butterfly *Hipparchia semele semele*.

Soil development occurs very slowly, due to wind erosion and nutrient poverty. In the Netherlands and Germany the following succession stages have been distinguished: open sand, pioneer communities with *Polytrichum piliferum*, lichen-rich open grassland with *Corynephorus canescens*, lichen-rich open grassland with *Agrostis vinealis* and *Festuca* spp., and more closed grasslands with *Carex areanaria* and *Deschampsia flexuosa* with few lichens. Further development leads to heathland with *Calluna vulgaris*. This succession is exaggerated by nutrient input, for example from nitrogen deposition, which also favours the dominance of the non-native moss *Campylopus introflexus*. Characteristic lichens of the younger succession stages are *Stereocaulon condensatum* and small-cup lichens, like *Cladonia pulivinata*, *Cladonia cervicornis*, *Cladonia glauca*, *Cladonia strepsilis* and *Cladonia borealis*. The *Agrostis vinealis* stage is also indicated by *Cladonia portentosa*, *Cladonia zopfii* and *Cladonia uncialis*. Where wind erosion of sand occurs up to a deeper soil layer, moist depressions develop, in which typically *Juncus sqarrosus* is found.

The habitat occurs in mosaics with heathland, scrub and forest, and such mosaics are an especially suitable habitat for birds like *Lullula arborea* and *Anthus campestris*. Small patches of open *Corynephorus* vegetation occur as open spots in heathlands, but in such cases these patches should be considered as part of dry heathlands, providing some differentiation in structure and some additional species diversity and therefore adding to the quality of the heathland habitat.

Outside the North Central European plains, the habitat is found in lowlands of southern Central Europe, the Baltic states, Southern Sweden and Denmark, Western Ukraine and the region Aquitaine of Southwest France. It occurs rarely in the UK, Italy and the Iberian Peninsula.

Habitat type E1.9b represents the part of the phytosociological order *Corynephoretalia canescentis* with its only alliance *Corynephorion canescentis* that occurs on sites not located close to the sea coast. On coastal dunes, there are floristically and ecologically very similar to indistinguishable stands, which in the current typology are considered as part of the habitat type *B1.4a − Atlantic and Baltic coastal stable dune grasslands (grey dunes)*.

With decreasing sand mobility, the natural succession of the habitat type typically leads to meso-xeric sandy grasslands with closed swards (order *Trifolio arvensis-Festucetalia ovinae*; habitat type *E1.9a − Oceanic to sub-continental inland sand grassland on dry acid and neutral soils*). Under subcontinental to continental climates on base-rich soils, often sandy grasslands of the order *Sedo acris-Festucetalia* (habitat type E1.1a Pannonian and Pontic sandy steppe) are inserted in this sequence, while under the most oceanic climates and most acidic soils, *Deschampsia flexuosa* grasslands or *Calluna vulgaris* heaths of the class *Calluno-Ulicetea* might follow more or less immediately.

Indicators of good quality

- Maintenance of open sand, and open grassland in different stages of succession
- Active processes of sand transport by wind
- High diversity in lichens
- Presence and maintenance of populations of characteristic fauna (birds, insects)
- Part of a landscape mosaic with forest and heathland
- No dominance of non-native species, such as *Campylopus introflexus*
- Little or no regeneration of trees
- Absence of high levels of nitrogen deposition

Characteristic species

Flora:

Vascular plants: *Agrostis capillaris, Agrostis vinealis, Carex arenaria, Corynephorus canescens, Filago minima, Hieracium pilosella, Hypochaeris radicata, Jasione montana, Ornithopus perpusillus, Rumex acetosella, Scleranthus perennis, Scleranthus polycarpos, Spergula morisonii, Teesdalia nudicaulis, Thymus serpyllum.*

Bryophytes: *Campylopus introflexus*, *Cephaloziella divaricata*, *Ceratodon purpureus*, *Pohlia nutans*, *Polytrichum piliferum*, *Racomitrium canescens* agg.

Lichens: *Cetraria aculeata*, *Cetraria islandica*, *Cetraria muricata*, *Cladonia portentosa*, *Cladonia borealis*, *Cladonia cervicornis*, *Cladonia cornuta*, *Cladonia crispata, Cladonia deformis, Cladonia floerkeana, Cladonia foliacea*, *Cladonia furcata*, *Cladonia glauca*, *Cladonia gracilis*, *Cladonia grayi*, *Cladonia macilenta*, *Cladonia mitis*, *Cladonia monomorpha, Cladonia phyllophora, Cladonia pleurota, Cladonia portentosa, Cladonia pulvinata, Cladonia strepsilis, Cladonia subulata, Cladonia uncialis*, *Cladonia verticillata*, *Cladonia zopfii*, *Placynthiella icmalea*, *Placynthiella oligotropha*, *Placynthiella uliginosa*, *Stereocaulon condensatum, Trapeliopsis granulosa.*

Fungi: *Tulostoma brumale*.

Fauna

Birds: *Anthus campestris*, *Lullula arborea*, *Caprimulgus europaeus*, *Oenanthe oenanthe*

Butterflies: *Hipparchia semele semele, Hipparchia statilinus*

Grasshoppers: *Oedipoda caerulescens*

Classification

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

EUNIS:

E1.9 Open non-Mediterranean dry acid and neutral grassland, including inland dune grassland

EuroVegChecklist:

Corynephorion canescentis Klika 1931 (only inland occurrences)

Thero-Airion Tx. ex Oberd. 1957 (marginal, within a context of Corynephorion)

Koelerion glaucae Volk 1931 (marginal, within a context of Corynephorion)

Annex 1:

2330 Inland dunes with open Corynephorus and Agrostis grasslands

23408 Pannonic inland dunes

Emerald:

E1.9 Open non-Mediterranean dry acid and neutral grassland, including inland dune grassland

MAES-2:

Sparsely vegetated land

IUCN:

4.4. Temperate grassland

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

Regions
Atlantic
Continental

Justification
This is a very distinctive habitat type that emerged in the central and northern parts of the Atlantic and Continental biogeographic regions in consequence of centuries of landscape overexploitation and then became a typical element of nutrient poor, sandy landscapes in the North Central European plains, together with *Calluna* heaths and oligotrophic birch-oak-pine woodlands.

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	0.08 Km^2	Decreasing	Decreasing
Belgium	Present	8.4 Km^2	Decreasing	Decreasing
Czech Republic	Present	2 Km^2	Decreasing	Decreasing
Denmark	Present	Unknown Km^2	Unknown	Unknown
Estonia	Present	0.5 Km^2	Decreasing	Decreasing
Finland	Aland Islands: Uncertain Finland mainland: Uncertain	Unknown Km^2	Unknown	Unknown
France	France mainland: Present	30 Km^2	Decreasing	Decreasing
Germany	Present	81 Km^2	Decreasing	Decreasing
Hungary	Present	1.3 Km^2	Decreasing	Decreasing
Ireland	Uncertain	Unknown Km^2	Unknown	Unknown
Italy	Italy mainland: Present	0.034 Km^2	Decreasing	Unknown
Latvia	Present	4.3 Km^2	Decreasing	Decreasing
Lithuania	Present	4.7 Km^2	Decreasing	Decreasing
Luxembourg	Uncertain	Unknown Km^2	Unknown	Unknown
Netherlands	Present	43 Km^2	Stable	Decreasing
Poland	Present	68 Km^2	Unknown	Stable

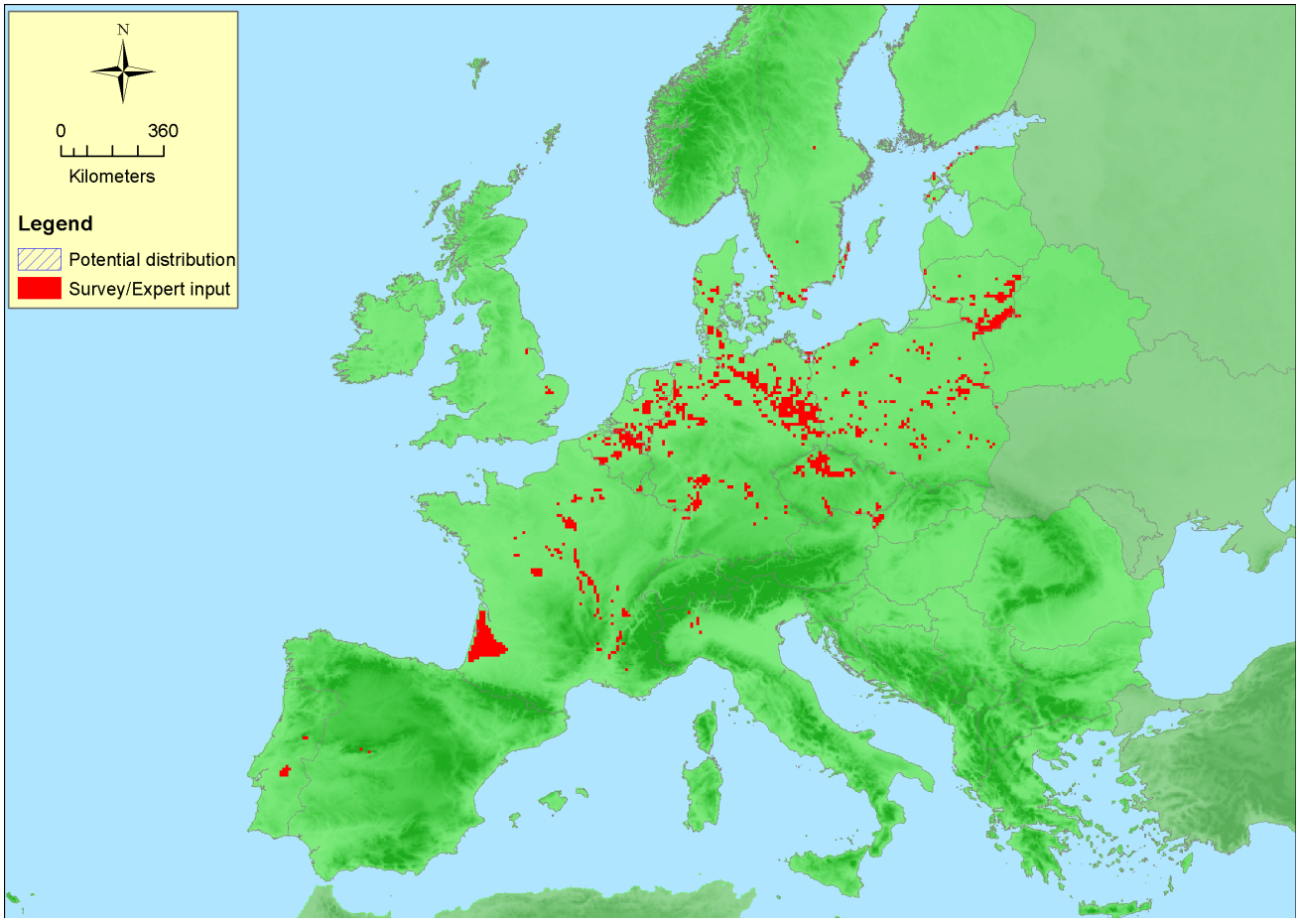
EU 28	Present or Presence Uncertain	Current area of habitat	Recent trend in quantity (last 50 yrs)	Recent trend in quality (last 50 yrs)
Portugal	Portugal mainland: Present	40 Km^2	Stable	Unknown
Romania	Uncertain	Unknown Km^2	Unknown	Unknown
Slovakia	Present	Unknown Km^2	Unknown	Unknown
Spain	Spain mainland: Uncertain	Unknown Km^2	Unknown	Unknown
Sweden	Present	Unknown Km^2	Unknown	Unknown
UK	United Kingdom: 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)
Kaliningrad	Present	Unknown Km^2	Unknown	Unknown
Norway	Norway Mainland: Uncertain	Unknown Km^2	Unknown	Unknown

Extent of Occurrence, Area of Occupancy and habitat area

	Extent of Occurrence (EOO)	Area of Occupancy (AOO)	Current estimated Total Area	Comment
EU 28	2811350 Km^2	1241	380 Km^2	Provided country data say 284 km^2, but several countries with occurrences did not provide data and figures for Germany and Poland appear too low
EU 28+	2811350 Km^2	1241	400 Km^2	Kaliningrad and possibly Norway

Distribution map



The map is reasonably good. However, the habitat type is much more frequent in the Polish lowlands, throughout the Baltic states, while the occurrence in Southern Portugal is doubtful, but there should be some occurrences in northern Iberia. Data sources: Art17, EVA.

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

90%

Trends in quantity

Recent trend EU28: -80% - EU28+: -80% (based on 76% of the total area reported). Long-term trend EU28: -83% - EU28+: -83% (based on 53% of the total area reported). The trends are rather consistent among the countries with well-founded data. For the future, most countries expect a continuing decrease. However, some countries believe that due to conservation efforts the area will remain stable (on a low level) in the next years (Estonia, Austria) or even slightly increase (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
  EEO is >> 50,000 km².
- Does the habitat have a small natural range by reason of its intrinsically restricted area?
  No
  Justification
  EEO is >> 50,000 km².

Trends in quality

Within EU28, 58% of the remaining area are degraded with 31% severity, while within EU28+ 58% of the remaining area are degraded with 31% severity.

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

Pressures and threats

This habitat type largely emerged due to human overexploitation of sandy landscapes during past centuries and is characterised by very nutrient-poor, acidic soils. Since the land use systems that created this type (e.g. by deforestation followed by intensive overgrazing or even arable cultivation) are no longer in place, the main threatening factor is natural succession towards more closed grassland habitats on better developed soils, followed by heathlands, shrublands and finally forests. Eutrophication by atmogenic nitrogen input is a second major threat as it speeds up the natural succession and also might facilitate invasion of competitive non-native (like the moss *Campylopus introflexus*) and native (like the tall grass *Calamagrostis epigejos*) species. Sometimes the areas no longer agriculturally used are also afforested. Individual countries also mentioned urbanisation and mining as threats. Sometimes outdoor sports (e.g. motocross) are considered as threats; however, in reality, they might often rather help to keep the sands mobile and thus the habitat alive. Likewise with military activity, which occurs in some areas.

List of pressures and threats

Sylviculture, forestry

Forest planting on open ground

Pollution

Nitrogen-input

Invasive, other problematic species and genes

Invasive non-native species
Problematic native species

Natural biotic and abiotic processes (without catastrophes)

Biocenotic evolution, succession

Conservation and management

The most extensive and best developed stands of this habitat type are currently found on active military training areas where soil disturbance continues through driving of tanks with no agricultural nitrogen input. This seems to be the most effective way to retain the habitat in a good state. In abandoned military training areas and other sites with this habitat type, year-round grazing with robust cattle, sheep and other herbivores in large-scale pasture landscapes seems to be the most promising approach. Human activities like walking on the dunes or motocross (as often) should not be forbidden because they keep the habitat alive, except in places with occurrences of particularly rare species. New stands of this habitat can emerge from open lignite mining, when extremely nutrient-poor, acidic sand is exposed to the surface. In such cases therefore part of the former mines should be excluded from usual kinds of recultivation.

List of conservation and management needs

Measures related to agriculture and open habitats

Maintaining grasslands and other open habitats

Conservation status

Annex I:

2330: ATL U2, BOR U2, CON U2, MED U1, PAN FV

2340: CON U1, PAN U2

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

When severely damaged, i.e. normally meaning a development towards a denser/higher vegetation on more nutrient-rich, fixed soils, the habitat can recover its typical character only via intervention, i.e. removing the nutrient-rich top-soil (or turning it upside-down) and/or reintroducing soil disturbance. If this is done and there are still diaspores of the typical species available, a recovery is possible within a few years.

Effort required

10 years
Through intervention

Red List Assessment

Criterion A: Reduction in quantity

Criterion A	A1	A2a	A2b	A3
EU 28	-73 %	Unknown %	Unknown %	unknown %
EU 28+	-73 %	Unknown %	Unknown %	unknown %

The values for A1 and A3 are calculated from the territorial data sheets, which provided trend data for 12 and 4 countries, for the 50-yr and long-term trend, respectively, including the countries with the largest occurrences (Germany). The provided data were far too incomplete to allow assessment of A2a and A2b. Trend data from Poland (second largest present area) were missing. A calculation of long term trend (-83%) is based on data from two countries only, and therefore not reliable for the whole of Europe.

Criterion B: Restricted geographic distribution

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

EOO and AOO are far larger than the thresholds for the criteria B1 and B2. The habitat type has many occurrences in about 20 European countries.

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	58 %	31 %	Unknown %	Unknown %	Unknown %	Unknown %

Criteria C/D	C/D1		C/D2		C/D3	
	Extent affected	Relative severity	Extent affected	Relative severity	Extent affected	Relative severity
EU 28+	58 %	31 %	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 data for C/D1 were calculated from the territorial data sheets, which provided assessments for 11 countries. No data were available for C/D2 and C/D3. The degradation quality refers to both biotic features and abiotic circumstances.

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	EN	DD	DD	DD	LC	LC	LC	NT	DD	DD	DD	DD	DD	DD	DD	DD	DD
EU28+	EN	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
Endangered	A1	Endangered	A1

Confidence in the assessment

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

Assessors

J. Dengler

Contributors

Type description: J.A.M. Janssen (revised by J. Dengler)

Territorial data: S. Armiraglio, S. Assini, G. Buffa, J. Capelo, M. Chytrý, J.M. Courvreur, D. Espírito-Santo, P.

Finck, Z. Kącki, G. Király, A. Mikolajczak, D. Paelinckx, D. Paternoster, V. Rašomavičius, U. Raths, U. Riecken, E. Roosaluste, S. Rusina, A. Ssymank, E. Weeda.

Working Group Grasslands: I. Biurrun, J. Dengler, D. Gigante, Z. Molnar, D. Paternoster, J. Rodwell, J. Schaminée, R. Tzonev

Reviewers
J. Rodwell

Date of assessment
21/02/2016

Date of review
25/03/2016

References

Hentschel, M. 2011. *Die Gliederung des Corynephorion Klika 1931 (Silbergrasfluren) in Europa*. PhD. thesis, University of Münster, Münster, DE.

Jentsch, A. and Beyschlag, W. 2003. Vegetation ecology of dry acidic grasslands in the lowland area of central europe. *Flora* 198: 3–25.

Jeckel, G. (1984): Syntaxonomische Gliederung, Verbreitung und Lebensbedingungen nordwestdeutscher Sandtrockenrasen (*Sedo-Scleranthetea*). *Phytocoenologia* 12: 9–153.

Juśkiewicz-Swaczyna, B. 2009. The psammophilous grassland community *Corniculario aculeatae-Corynephoretum canescentis* in the Masurian Lake District (NE Poland). *Tuexenia* 29: 391–408.

Sparrius, L.B. 2011. *Inland dunes in the Netherlands: soil, vegetation, nitrogen deposition and invasive species*. PhD thesis University of Amsterdam, Amsterdam, NL.