

Varnished Hook-moss (*Drepanocladus vernicosus*) - The Netherlands



Photo: Laurens Sparrius

Conservation status	Atlantic: U1 (=) NL: U2 (+)
Protection status	HD: Annex II Bern Convention: Appendix I
Population	EU27: > 15,300,000 – 35,000,000 individuals and 161,000 – 236,000 m ² NL: 87,100 – 87,100 m ²
MS with genuine improvement	NL
Other MS	AT, BE, BG, CZ, DE, DK, EE, ES, FI, FR, IE, IT, LT, LV, PL, RO, SE, SI, SK, UK

Summary: *Drepanocladus vernicosus* is a rare wetland moss, which has declined in numbers drastically over the past century. Only in the Netherlands, and to some extent Belgium, has the species recently shown a positive trend, due to local improvements at the few sites where the species survives. In the Meppelerdieplanden, one of the two sites for the species in the Netherlands, numbers have tripled over the last ten years. Here a combination of factors appears to have been responsible for this improvement. Increased inputs of clean, nutrient-poor water into the area improved both the wetness and nutrient status of the species' habitat. Also, during summer the water level is lowered temporarily and the area is mowed and litter is removed, which not only contributes to lower nutrient levels, but also helps the species to colonise new parts of the site, by spreading vegetative growth modules. The improved management was enabled and funded by the 2006 National Plan for Survival of Nature.

Background

Introduction

*Drepanocladus vernicosus*¹ (synonym: *Hamatocaulis vernicosus*, Dutch name: Geel schorpioenmos, English name: Varnished Hook-moss / Slender Green Feather-moss) is a medium-sized pleurocarpous wetland moss. It is widely distributed across Europe, usually being found on open, spring-influenced fens, shores or lakes and watercourses. Its habitat is mineral-rich, but calcium levels are usually not very high. Sexual reproduction is rarely seen, so dispersal takes place by vegetative growth and fragmentation.

Status and EU occurrence

In the EU *Drepanocladus vernicosus* numbers have declined drastically over the last century, mainly due to habitat loss and desiccation. According to Article 17 reports for 2007-2012, the species still occurs in 23 Member States (Annex 1), but it has been red listed in 16 due to ongoing declines (Annex 1; EEA/ETC-BD undated). For example, in France it is present in the east and south, but has declined elsewhere; in Germany it now occurs only in eastern and southern regions; in Spain the species is decreasing; in the United Kingdom it has declined substantially and has become locally extinct in East Anglia; and in Belgium, it has recently only been reported from one location (EEA/ETC-BD).

Over the 2007-2012 reporting period it was assessed as unfavourable-inadequate in the Alpine, Atlantic, Boreal and Mediterranean biogeographical regions and unfavourable-bad in the Continental region (Annex 1; ETC-BD, 2018). Across all biogeographical regions and Member States, no improvements in overall conservation status occurred between 2001-06 and 2007-12, or positive trends, except in the Netherlands, where despite having an unfavourable-bad status, it was considered to be genuinely increasing at the last assessment (EEA/ETC-BD, undated).

In the Netherlands, the species appeared to be extinct since 1965. However, since its inclusion on Annex II of the Habitats Directive, it has been found and monitored as part of Network Ecological Monitoring, see CLO (2016) for the species' trend details. In the period 2001-2006 the Netherlands reported a range for the species

¹ Natura 2000 code 1393

of 100 km², but with only 3 km² of suitable habitat range available, and with it being restricted to one location and with poor future prospects; consequently its status was assessed as unfavourable-bad. In the 2007-2012 period, the possible range for the species had grown to 300 km², with 8 km² of suitable habitat and its population increased to cover 871,000 m² (ETC-BD, 2018). It then occurred in two locations in the north of the country: Meppelerdieplanden and the neighbouring Kiersche Wijde, with 100% of its population in the Natura 2000 network. Despite the increases, the species' prospects are uncertain and its overall assessment remained as unfavourable-bad.

In the last few years a few specimens have been found at other locations, but these are not increasing (van Tweel et al, 2015).

Pressures and threats

The main human-inflicted pressures on the species reported under the 2007-2012 Member States' Article 17 assessments (EEA/ETC-BD, undated) were changes in water condition, natural succession, mowing/grazing of grasslands, pollution of water and air, changes in cultivation and disturbance by recreational activities. More natural pressures were vegetation succession, abiotic natural processes and interspecific floral relations. The same factors were reported as threats, with some more specific additions: fertilisation in agriculture, afforestation, drainage of wetlands and nitrogen deposition. The threats are serious because nature sites are hydrologically connected with neighbouring agricultural areas and watercourses carrying (partly purified) waste water from cities and industries. Ammonia deposition from agricultural activities also causes high nitrogen loads in the nature areas.

Ecological requirements

Drepanocladus vernicosus prefers permanently wet, low-nutrient grasslands. It requires small amounts of calcium and iron in the soil. It grows in bogs in peat areas, on places with rising seepage water. While low-nutrient habitats are missing, current growth locations are wet, moderately nutrient-rich meadows, that are under the influence of base-rich surface water, but on the other hand superficially acidified by stagnant rainwater. The moss can survive drought periods of a few weeks and can regrow after mowing (Synbiosys, 2008).

It is a typical species of the Caricion-davallianae association. The moss grows in transitions between *Calthion palustris* and the association of Black Sedge (*Caricion nigrae*). Accompanying species include Bladder Sedge (*Carex vesicaria*), Black Sedge (*Carex nigra*), Marsh Cinquefoil (*Potentilla palustris*), Lesser Spearwort (*Ranunculus flammula*), Marsh Marigold (*Caltha palustris*) and Marsh lousewort (*Pedicularis palustris*).

Drivers of improvements: actors, actions and their implementation approaches

Organisers, partners, supporters and other stakeholders

In 2006, the Dutch Ministry of LNV started a policy initiative named OBN (Overlevingsplan Bos en Natuur, in English, Survival Plan for Forest and Nature), in order to 'help nature and forests survive' by funding restoration and bringing scientists and site managers together. Nowadays the acronym OBN has a new meaning: 'knowledge network for management and restoration of nature' (OBN, 2016). One of the projects carried out under the initiative was the restoration of the Meppelerdieplanden, a 30 ha nature area in the peatlands of the north-east part of the Netherlands, on the border of the provinces Drenthe and Overijssel. This plan was carried out in cooperation with Natuurmonumenten, the nature management organisation responsible for this nature reserve.

Contributions / relevance of strategic plans

The OBN Survival Plan for Forest and Nature was the main instrument that steered and facilitated improvements in the habitat of *Drepanocladus vernicosus*. Although the species itself was not mentioned in the plan, it has benefited from the actions that were taken under it. The OBN acknowledged that pressures on nature needed to be reduced, but that nature would not improve without end-of-pipe restoration measures. Based on this framework various restoration projects were financed, such as in the Meppelerdieplanden.

Measures taken and their effectiveness

The measures reported as being taken in the Netherlands for *Drepanocladus vernicosus* over the 2007-12 period are shown below.

Application of conservation measures for *Drepanocladus vernicosus* over 2007-2012 in the Netherlands

Code	Measure	Type	Ranking	Inside / outside N2k	Broad Evaluation
2.1	Maintaining grasslands and other open habitats	contractual - recurrent	High	Inside	Maintain
4.1	Restoring/improving water quality	recurrent	High	Inside	Maintain
6.3	Legal protection of habitats and species	legal	High	Inside	Maintain
7.4	Specific single species or species group measures	recurrent	High	Inside	Maintain

Source: The Netherlands Article 17 report 2013 at <https://bd.eionet.europa.eu/article17/reports2012/>

At Meppelerdieplanden, the responsible nature management organisation, Natuurmonumenten, has taken initiatives on improving water quality and on establishing a mowing regime on the meadows. In addition, in 1999, the water supply was changed. A new waterway was created that allowed relatively nutrient-poor water from the neighbouring nature area De Wieden to enter the reserve. At the same time a dam was built to prevent the entry of nutrient-rich water from the Meppelerdiep, which comes from a neighbouring agricultural area and the City of Meppel. However, a sluice was also incorporated to allow water from the Meppelerdiep to enter the reserve when needed. This is used in summer, after mowing has taken place, to recover from droughts. As a result of the Water Framework Directive, other measures are in progress to reduce nutrients in the Meppelerdiep water, but the water quality is still worse than that of De Wieden (Martens, pers. comm.).

Habitat management has also included the annual mowing of grasslands during summertime, and the removal of cuttings to reduce nutrients. Mowing is done using light machines and starting only after 15th July. Prior to the mowing the water inlet is closed completely so the area will become dry enough to operate light machines. Another beneficial result of the mowing is that fragments of the moss have been spread throughout the area and have colonised new locations.

In other areas in the Netherlands, where it is suspected that *Drepanocladus vernicosus* may occur, a comparable mowing regime has been implemented. However, it was not possible to improve the water quality at the same time at these sites, because they are surrounded by agricultural areas. Therefore, although some occasional specimens have been found at some sites, no additional viable populations have been reported (Van Tweel et al, 2015).

Funding sources (current and long-term) and costs (one-off and ongoing)

The main funding for restoring the Meppelerdieplanden was provided by the Dutch Ministry of LNV. The exact costs of restoration (under the OBN project) are unknown. The costs of the hydrological works mentioned above can be estimated to be over one million euros (Martens, pers. comm.). Natuurmonumenten, the organisation responsible for the management of Meppelerdieplanden, is an NGO which is funded partly by members and private donations. However, its funds appear not to have been used for the restoration project and its ongoing yearly management costs for the site are provided by governmental grants.

Future actions

In the Netherlands, although a specific Natura 2000 management plan does not yet exist for the Meppelerdieplanden, the current management at the site is expected to be continued, as it is included in the current management policy for the area. The expansion of *Drepanocladus vernicosus* to other suitable areas in the Netherlands is not guaranteed and no specific plans for this exist.

Achievements

Impacts on the target species

The presence of *Drepanocladus vernicosus* in the Meppelerdieplanden, measured in number of 10x10m squares where the species is observed, has risen from 388 in 2004 to 1,097 in 2014 (Van Tweel et al, 2015; CLO, 2016).

Other impacts (e.g. other habitats and species, ecosystem services, economic and social)

Most of the measures taken did not strictly aim to improve *Drepanocladus vernicosus*, but to more generally improve habitats, such as Habitats Directive Annex I Molina-meadows (6410) and Northern Atlantic wet heaths (4010). As the increase in the moss is also dependent on improving the ecological conditions of the habitats, it provides an indication that the aim of improving the habitats has probably been achieved. Although the species itself does not attract great public attention, the improved habitats will.

Conclusions and lessons learnt

The key targeted conservation measures that led to the improvements

- A combination of improving water quality, permanent wet conditions and mowing to remove biomass appears to be a winning combination.

Conservation measures that have not been sufficiently effective

- Mowing or sod-cutting without rewetting and improving water quality appears to be insufficient, as this species did not improve in other protected areas where these measures were taken.

Factors that supported the conservation measures

- Good cooperation between government and nature management organisations (for example with respect to funding restoration measures). The possibility to obtain clean water without hindering agricultural practices was a benefit.

Factors that constrained conservation measures

- When supply of nutrient-poor water was not possible, e.g. due to agricultural requirements, no increases in the moss occurred.
- *Drepanocladus vernicosus* has low dispersal capacities, as it only normally spreads by vegetative growth. So even when areas of habitat become suitable, (re)colonisation may be a problem.

Quick wins that could be applied elsewhere for the species

- When present, the species might benefit from mowing management as this can help the species disperse and colonise new areas within a site.

Examples of good practice, which could be applied to other species

- As for many species the conservation and restoration of *Drepanocladus vernicosus* requires improvements in habitat quality (in this case particularly the amount and quality of available water). This was achieved through a tailored combination of measures, some of which were rather drastic (changing the sites' water supply); with good ecological knowledge being essential. Whilst some luck may have been involved, monitoring and scientific research helped to identify the key influencing factors, as nature managers cannot always pinpoint why their approach has been successful or not.

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Authorship

Prepared by Onno Knol of PBL as part of the European Commission study on identifying the drivers of successful implementation of the Birds and Habitats Directives (under contract ENV.F.1/FRA/2014/0063), carried out by the Institute for European Environmental Policy, BirdLife International, Deloitte, Denkstatt, Ecologic, ICF Consulting Services and PBL Netherlands Environmental Assessment Agency.

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Annex 1. Status of the Varnished Hook-moss (*Drepanocladus vernicosus*) at Member State and biogeographical levels

Favourable	FV	Unknown	XX	Unfavourable - inadequate	U1	Unfavourable - bad	U2
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	2001-06	2007-12				
	Overall	Range	Area	Habitat	Future	Overall
AT (ALP)	U2	U1	U1	U1	U1	U1 (=)
BG (ALP)	N/A	FV	FV	FV	U1	U1 (=)
DE (ALP)	U1	XX	XX	XX	XX	XX
ES (ALP)	XX	U2	U2	XX	XX	U2 (-)
FI (ALP)	XX	FV	FV	FV	FV	FV
FR (ALP)	U2	XX	U1	XX	XX	U1 (x)
IT (ALP)	U1	XX	XX	XX	XX	XX
PL (ALP)	U1	U1	U2	U2	U2	U2 (=)
RO (ALP)	N/A	FV	FV	FV	FV	FV
SE (ALP)	FV	FV	FV	FV	FV	FV
SI (ALP)	U1	FV	XX	U1	U1	U1 (-)
SK (ALP)	XX	U1	U1	U1	U1	U1 (=)
EU overall (ALP)	XX	U1	U1	U1	U1	U1 (-)
BE (ATL)	U2	U2	U2	U2	U2	U2 (=)
DE (ATL)	N/A	U2	U2	U2	U2	U2 (-)
DK (ATL)	U2	U1	U2	U2	U2	U2 (x)
ES (ATL)	N/A	FV	XX	U1	U1	U1 (=)
IE (ATL)	FV	FV	FV	FV	FV	FV
NL (ATL)	U2	U2	U2	FV	U2	U2 (+)
UK (ATL)	FV	FV	FV	FV	FV	FV
EU overall (ATL)	FV	U1	U1	FV	FV	U1 (=)
EE (BOR)	FV	FV	FV	FV	FV	FV (0)
FI (BOR)	U1	FV	FV	U1	U1	U1 (=)
LT (BOR)	U1	FV	U1	U1	XX	U1 (=)
LV (BOR)	FV	U1	U1	FV	FV	U1 (=)
SE (BOR)	U2	FV	FV	FV	FV	FV
EU overall (BOR)	U1	FV	FV	U1	U1	U1 (=)
AT (CON)	U2	U2	U2	U1	U1	U2 (x)
BE (CON)	XX	U2	U2	U2	U2	U2 (-)
BG (CON)	N/A	FV	FV	FV	U1	U1 (=)
CZ (CON)	U1	U1	U1	U1	U1	U1 (=)
DE (CON)	U2	U2	U2	U1	U1	U2 (-)
DK (CON)	U2	U1	U2	U2	U2	U2 (x)
FR (CON)	U2	U1	U1	U1	XX	U1 (x)
IT (CON)	U1	XX	XX	XX	XX	XX

PL (CON)	FV	FV	U1	U1	U1	U1 (=)
SE (CON)	U2 (-)	U2	U2	U2	U2	U2 (-)
SI (CON)	U2	FV	U2	U2	U2	U2 (-)
EU overall (CON)	U2	U2	U2	U1	U1	U2 (-)
ES (MED)	XX	FV	U1	U1	U1	U1 (=)
EU overall (MED)	XX	FV	U1	U1	U1	U1 (-)

Source: Member State Article 17 reports as compiled by ETC-BD on EIONET
<http://bd.eionet.europa.eu/article12/summary?period=1&subject=A405>