

THE CONSERVATION OF *DIDYMODON GLAUCUS* RYAN IN BRITAIN

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Abstract: *Didymodon glaucus* is listed as Critically Endangered in Britain and it is fully protected under domestic legislation. It is known from a single site in England, discovered in 1961, growing on weathered and shaded chalk in a disused chalk pit which is protected within a Site of Special Scientific Interest. However, neglect of the chalk pit lead to successional changes and the apparent loss of *D. glaucus*. A recovery programme was initiated involving removal of talus and debris from the chalk pit using a mechanical digger. Within one year *D. glaucus* was observed on the freshly exposed chalk face, probably originating from persistent moniliform gemmae. A second excavation in 2003 also resulted in similar success. Conservation management for this moss therefore involves regular disturbance and exposure of fresh chalk, exploiting the moss's ability to produce persistent asexual propagules.

Didymodon glaucus is listed as Critically Endangered in the British Red Data Book (Church *et al.*, 2001), fully protected under domestic legislation and is a priority Biodiversity Action Plan species (Convention on Biological Diversity). It is classified as Vulnerable in the European Red Data Book (ECCB, 1995) and is scattered through about 13 European countries (not known from Spain), and is a European and Macaronesian endemic. H. N. Dixon collected a plant from Baveno, Italy in 1912 that recalled a moss sent to him two years earlier by W. E. Nicholson from England; they concluded the English plant was a form of *Ceratodon purpureus* (Hedw.) Brid. However, Dixon realised his Italian plants were the same as that collected by Nicholson, and revised his opinion. He decided the plant in question was an undescribed species, an opinion supported by Nicholson, and it was published under the name of *Eucladium verbanum* Nicholson & Dixon (Dixon, 1912). It was subsequently placed in *Didymodon* (as *D. glaucus*) and then transferred to *Barbula* [as *B. glauca* (Ryan) H. Möller]. Some authorities regard it as *D. rigidulus* Hedw. var. *glaucus* (Ryan) Wijk & Margad., an ecotype with bluish-green leaves adapted to very shady habitats. Kučera (2000) recognises it at species rank.

There is little current information on its status in the various European countries. In Italy it is rare (Cortini, 2001), although it is said to be not rare in the Italian Lakes Region (Düll, 1984), in Switzerland it is Vulnerable (Schnyder, 2004) and very rare in Scandinavia (Hill *et al.*, 1992).

W. E. Nicholson first discovered *Didymodon glaucus* in Britain in 1908 in a chalk pit near Shoreham, Sussex, although at the time it was not recognised as a new species. Nicholson last saw it at Shoreham in 1915. R. Barnes found it near Richmond, Yorkshire, on limestone rocks no later than 1914 but it has not been seen since at either locality. It was to be another 47 years before it was seen again, by J. Appleyard, in a disused chalk pit near Swindon, North Wiltshire, in 1961. *Didymodon glaucus* is still present here today, it is only known extant site in Britain. Sporophytes are unknown in *D. glaucus*, though both sexes occur in different parts of its range; British plants are female or lack gametangia. It produces characteristic moniliform (like a string of beads) gemmae on modified rhizoids in leaf axils and on the protonema.

Since the discovery of *D. glaucus* in Wiltshire in 1961, the population size has fluctuated, mainly because of successional changes in the chalk cliff that it is growing on. By the early 1980s it was apparent that the habitat was deteriorating, with the chalk face crumbling, exacerbated by growth of *Hedera helix* L. and herbs such as *Taraxacum officinale* agg. and *Urtica dioica* L. occupying or shading niches occupied by *D. glaucus*. Substantial amounts of talus had accumulated at the base of the face. The chalk pit was also used for (illegal) dumping of rubbish and a tree fall from above the pit compounded the problem. The site had been designated a Site of Special Scientific Interest in 1971 largely for the woodland communities, the interest of the chalk pit and the presence of *D. glaucus* unknown at the time to the Nature Conservancy Council (NCC).



Figure 1. A view of the chalk face cleared in 1988. Today it supports a strong colony of *Didymodon glaucus* in the deep cleft to the right of centre.

In 1978 Harold Whitehouse visited the site but failed to find *D. glaucus*. However, soil samples removed from the talus were taken back to Cambridge, and the characteristic gemmae

of *D. glaucus* were detected, confirming that the moss was still present. Whitehouse then alerted the NCC to the presence of the moss, and the NCC revised the boundary of the SSSI and re-notified the site with *D. glaucus* listed as an interest feature. However, the condition of the chalk pit continued to deteriorate, so pressure was put on NCC to address the issue. Following protracted discussions between all interested parties, in 1988 a mechanical excavator was brought in and all earth and rubbish was removed exposing a fresh chalk cliff face (Fig. 1).



Figure 2. A view of the area exposed in 2003, before (left) and after (right) the excavation. A visit one year later showed that *Didymodon glaucus* had already colonised the new face.

Within a few months *D. glaucus* was observed in clefts on the freshly exposed chalk, and by 1989 a colony covering an area of about 15 cm² had established on thin talus in one main cleft with a few small outliers. The remedial action was therefore deemed a great success. The chalk face continues to support a healthy population of *D. glaucus* and two or three smaller colonies are also known at the base of cliffs that border a lane leading to the chalk pit. In 2001 the decision was taken to expose more chalk (Fig. 2), immediately adjacent to the existing chalk face, which had been buried for many years under much collapsed earth. Again a mechanical excavator was used, and in February 2003 a section of exposed chalk face was created. A visit in May 2004 revealed that *D. glaucus* had colonised fresh talus on the newly exposed chalk face, present not only as small gametophores but also as protonemal gemmae (easily visible as a dark purple patches against the pale talus). Whether diaspores had been uncovered during the removal of earth or whether the new colonies had arisen from propagules originating from the nearby (c. 3 m) existing population is unknown. However, it is possible that *D. glaucus* is dispersed by rabbits, as these were seen to be using narrow ledges on the chalk face as ‘runs’.

The conservation action outlined demonstrates that *Didymodon glaucus* responds well to management. Freshly exposed chalk and intermittent disturbance is essential for its survival. It does not appear to establish directly on the chalk, but on talus or thin soil derived from the weathered chalk. It thrives at low light levels, deep in clefts where talus has accumulated, and also in places where light levels are higher. Individual colonies are dynamic, migrating to

suitable niches as others become unsuitable. English Nature visits the site annually and checks on the condition of the site and for the occurrence of *D. glaucus*. Complimentary to management of the habitat (*in situ* conservation) is the *ex situ* cultivation of *D. glaucus*. The moss has been grown *in vitro*, and ‘weaned’ onto chalk fragments. In the future it is proposed to place these into the wild as part of an experimental translocation project.

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