The status of the known populations of *Rhynchostegium rotundifolium* in the British Isles

In 2008, Des Callaghan was sub-contracted by Natural England (NE) to undertake a survey and status assessment of the UK Biodiversity Action Plan moss *Rhynchostegium rotundifolium* at its two known sites in East Sussex (v.-c. 14) and East Gloucestershire (v.-c. 33). In this article, based on the report submitted to NE, Des summarizes his results.

The objectives of this study were to assess the current status of *Rhynchostegium rotundifolium*, collect material for an *ex situ* culture trial, and search potential new areas for its occurrence. Owing to the extreme rarity of the species, precise information of colony locations and detailed maps of areas surveyed have been omitted.

The known sites for *R. rotundifolium* were visited in Gloucestershire (near Bisley) and East Sussex (near Wilmington) on 16 and 18 December 2008, respectively, and a search for colonies was undertaken. Both sites are located on land with public access and subsequent searches for new colonies were limited to areas of such land. Once a colony was found it was marked with a temporary marker, a GPS reading was taken and its location was plotted onto a 1:1,250 Ordnance Survey basemap and a 25 cm resolution aerial photograph. Photographs were taken to show the general location of the colonies, plus close-up images were gathered to document the extent and micro-habitat of each colony. A pH measurement was also made of surface soil from beside colonies and, for each colony separately, the following information was collected:

- Aspect
- Slope
- Shade
- Substrate type
- Surface area of the colony
- Presence of sporophytes and their stage of development
- Notes on associated bryophytes
- Signs of damage or threats to the colony

A search was made in suitable habitat surrounding the known sites in order to try to locate further colonies and, under a license from Natural England, a small sample of the species was gathered from each site and sent to Dr Silvia Pressel at The University of London for an *ex situ* propagation trial.

**Bisley (East Gloucestershire)**

Four colonies of *Rhynchostegium rotundifolium* were found, all within the section of a roadside bank (Figs 1 & 2) from where it has been recorded previously (Hodgetts, 1991; Heaver, 2002; Callaghan, 2005). The site is surrounded largely by intensively managed agricultural grassland, together with some small patches of beech woodland. This bank is located on the north-west side of a narrow lane within the upper part of a sheltered Cotswold valley.

The bank supports a short plant community that is flailed to a height of about 10 cm periodically by the local farmer (presumably while cutting the adjacent hedgerows). The vegetation is dominated by *Hedera helix*, together with frequent *Brachypodium pinnatum*, *Geranium robertianum*, *G. lucidum*, *Urtica dioica* and *Mercurialis perennis*. The bank is composed of stone and earth, with the former comprising a loose scattering of oolitic limestone rocks of varying sizes. The soil is a thin, calcareous (pH 7.6), sandy loam.

Table 1 shows the information collected for each colony. The four colonies totalled approximately 216 cm² and all grew on stones of oolitic limestone located within the roadside bank under moderate shade. Comparing these data with those collected in 1991, 2002 and 2004 (Table 2) suggests that there has not been any dramatic change in the status of the species at this site. Some colonies have become extinct (e.g. on the base of a field maple and on a wall opposite this tree), while further colonies have
Table 1. R. rotundifolium colonies recorded in this study

<table>
<thead>
<tr>
<th>Location</th>
<th>Colony Order</th>
<th>Shade</th>
<th>Aspect</th>
<th>Size (m)</th>
<th>Completion (%)</th>
<th>Sporophytes*</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bisley</td>
<td>1</td>
<td>Small rock</td>
<td>N</td>
<td>50</td>
<td>89</td>
<td>2</td>
<td>Intermixed within a patch of Thamnobryum alopecurum shoots and did not appear to be having any significant influence on the growth of R. rotundifolium.</td>
</tr>
<tr>
<td>Bisley</td>
<td>2</td>
<td>Medium rock</td>
<td>N</td>
<td>70</td>
<td>89</td>
<td>2</td>
<td>Intermixed within a patch of Thamnobryum alopecurum shoots and did not appear to be having any significant influence on the growth of R. rotundifolium.</td>
</tr>
<tr>
<td>Bisley</td>
<td>3</td>
<td>Medium rock</td>
<td>N</td>
<td>562</td>
<td>90</td>
<td>2</td>
<td>Intermixed within a patch of Thamnobryum alopecurum shoots and did not appear to be having any significant influence on the growth of R. rotundifolium.</td>
</tr>
<tr>
<td>Bisley</td>
<td>4</td>
<td>Medium rock</td>
<td>N</td>
<td>390</td>
<td>90</td>
<td>2</td>
<td>Intermixed within a patch of Thamnobryum alopecurum shoots and did not appear to be having any significant influence on the growth of R. rotundifolium.</td>
</tr>
</tbody>
</table>

*Number of sporophytes approximate owing to inter-mixing with other bryophytes.

Status of *Rhynchostegium rotundifolium*

The site is designated as a local wildlife site for the moss, thus providing it with local planning policy protection, but is subject to no statutory safe-guarding.

**Wilmington (East Sussex)**

Two colonies of *R. rotundifolium* were found (Figs 3 & 4), both at the base of the old ash coppice within a hedgebank from where it was known previously (Pooley, 2005). The ash tree forms part of a hedge that lines an old cart track. The site is located in an exposed situation and the surrounding land use is become established on stones within the roadside bank. The reason for the loss of the species from the base of the field maple is unclear, but it was only ever recorded in small amounts and over-growth by *Homalothecium sericeum* may have been a contributing factor. The loss of the species from the wall base opposite the field maple, where it occurred ‘sparingly’ (Hodgetts, 1991), seems to have coincided with some renovation work on the wall owing to its partial collapse at some point prior to 2002 (Callaghan, 2005).

There is an increase in the extent of colonies occupying stones within the bank west of the field maple between 2004 and 2008 (Table 2), though the smaller amounts recorded in 1991 and 2002 may be an artefact of survey timing and/or effort. Small-scale trends aside, during each survey the species has only been found in small amounts and has remained rare.

Encouragingly, a total of 49 sporophytes were present during the current survey, including those with green capsules widened fully (n=15), brown capsules with lids closed (n=22) and brown capsules with lids open but with less than half of the spores liberated (n=11). A small number of the capsules (n=2) had been eaten and only the setae remained. No sporophytes were recorded during previous surveys conducted in July (Hodgetts, 1991), August (Heaver, 2002) and October/November (Callaghan, 2005).

The most frequent bryophyte growing with *R. rotundifolium* was *R. confertum*, and in fact colony 1 (Table 1) was largely a patch of the latter with the former inter-mixed. Other bryophytes recorded within the *R. rotundifolium* colonies or in close proximity included *Anomodon viticulosus*, *Thamnobryum alopecurum*, *Oxyrrhynchium hians*, *Homalothecium sericeum* and *Rhynchostegiella tenella*, but these were present in small amounts and did not appear to be having any significant influence on the growth of *R. rotundifolium*.
intensive arable farmland, though the fields adjacent to the *R. rotundifolium* colonies have conservation headlands (comprising 4–8 m wide uncultivated, coarse grassland strips around the field boundary).

The main sett of a badger clan is located within the hedgebank, with holes and latrines surrounding the ash coppice stool that supports the moss. This sett has been active since at least 1998 (Porley, 2005). The activity of the animals maintains bare soil conditions along the hedgebank, including around the *R. rotundifolium* colonies. The effect of the badgers on the status of the moss is unclear, and may be negative (e.g. by loss of colonies through abrasion), positive (e.g. by prevention of colonies being over-shadowed by the growth of a tall field layer under the hedge) or neutral. The dominant woody vegetation of the hedgerow comprises *Prunus spinosa* and *Sambucus nigra*. The soil surrounding the ash coppice stool where the moss grows is a calcareous (pH 7.8), sandy loam.

Table 1 shows the information collected for each colony. The two colonies totalled approximately 562 cm², and both grew on live bark in moderate shade at the base of the old ash coppice stool. The only other accurately documented status of the species at this site is provided by Porley (2005), who in November 2004 found a single colony on the ash stool, which covered an area of only about 25 cm². Thus, there has been a significant increase in the extent of the species between that survey and the present study, though it is still clearly very rare. Church *et al.* (2001) provide an unreferenced statement that the species at this site ‘is restricted to an area of about half a square metre on the bole of an old coppiced hedgerow ash’, which is either a substantial over-estimate of its extent or indicates that it was formerly much more abundant upon the coppice stool.

A total of about 137 sporophytes were present during the current survey, including those with green capsules widened fully (*n* = 33), brown capsules with lids closed (*n* = 65) and brown capsules with lids open but with less than half of the spores liberated (*n* = 36). A small number of the capsules (*n* = 3) had been eaten and only the setae remained. No sporophytes were present during the current survey, including those with green capsules widened fully (*n* = 33), brown capsules with lids closed (*n* = 65) and brown capsules with lids open but with less than half of the spores liberated (*n* = 36). A small number of the capsules (*n* = 3) had been eaten and only the setae remained. No sporophytes were present during the previous survey in November 2004 (Porley, 2005). Note that the sporophyte numbers presented here are approximate owing to substantial inter-mixing in colony 2 with *R. confertum* and its very similar sporophytes.
**Recommendation 2 – comparative ecology.**

Undertake a study of the comparative ecology of *R. rotundifolium* and *R. confertum*.

**Reason.** Field observations suggest that the closely related *R. confertum* is a dominant competitor of *R. rotundifolium* at the two known sites in Gloucestershire and East Sussex. A comparative investigation of their ecologies, perhaps focusing upon the environmental conditions required during the early stages of colony establishment (i.e. spore germination and protonemal growth), would provide some significant insights into the conservation needs of *R. rotundifolium*.

**Recommendation 3 – ex situ propagation and establishment of new colonies.** If the present *ex situ* propagation attempt proves successful, experimentally attempt to establish new colonies within suitable locations at Bisley (East Gloucestershire) and Wilmington (East Sussex).

**Reason.** Colony numbers could potentially be increased by introducing *ex situ*-cultured colonies in suitable locations, which would not risk the depletion of existing colonies and would, at the very least, provide some insights into the ecological needs of the species.

**Recommendation 4 – enhancement of local substrate availability.** Increase the local availability of suitable substrate around existing colonies by: (i) carefully planting limestone rocks from adjacent drystone walls within the roadside bank at Bisley; and (ii) establishing new ash trees within the hedgebank at Wilmington, perhaps by transplanting semi-mature specimens from the local area and subsequently beginning a coppice cycle.

**Reason.** The availability of suitable growth substrate may be an important factor that limits colony numbers and sizes at Bisley and Wilmington.

**Recommendation 5 – enhancement of spore deposition on suitable substrate.** Increase the frequency of spores landing upon suitable growth substrate by collecting mature spores from a sample of capsules and depositing them upon apparently suitable substrate in the local area, ensuring that monitoring is undertaken to help identify and understand successes and failures.

**Reason.** The vast majority of wind-blown spores are wasted since they do not land upon suitable growth substrate. Such an experiment could also provide valuable insights into the microhabitat requirements of the species.

**Recommendation 6 – spore viability.** Undertake studies to investigate the viability of spores from known populations.

**Reason.** The viability of spores being produced by current populations is unknown, but may be an important cause (or consequence) of the rarity of the species.

**Recommendation 7 – genetic population viability.** Undertake studies to investigate the genetic viability of remaining populations.

**Reason.** The genetic population viability of existing populations is unknown.

**Recommendation 8 – vegetation management.** Continue the present regime of bankside vegetation cutting at Bisley and hedgerow cutting at Wilmington.

**Reason.** To retain the present vegetation structure around *R. rotundifolium* colonies.

**Recommendation 9 – conservation headlands.** Maintain the conservation headlands in the fields bordering the Wilmington colonies and establish new conservation headlands within the fields that border the Bisley colonies.

**Reason.** To reduce the risk of fertilizer and pesticide drift.

**Recommendation 10 – population monitoring.** Establish annual monitoring of colonies during February, recording colony locations and sizes (including photographic documentation), sporophyte production and threats.

**Reason.** To track conservation status and inform management needs.

**Recommendation 11 – engagement with local people and farmers.** Communicate with local people and farmers to promote an understanding of the location, importance and conservation needs of known colonies.

**Reason.** Local knowledge and interest in the species will help conserve populations.

**Recommendation 12 – SSSI designation.** Designate the Bisley site as a SSSI.

**Reason.** The site qualifies for SSSI designation according to the criteria for non-vascular plants (Hodgetts, 1992). Designation will help to raise awareness of the importance of the site amongst appropriate people and bodies, such as local authorities and the Highways Agency, and hence reduce threats to the survival of the species at this site (e.g. damage from possible road maintenance works).

**Acknowledgements**

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**References**


