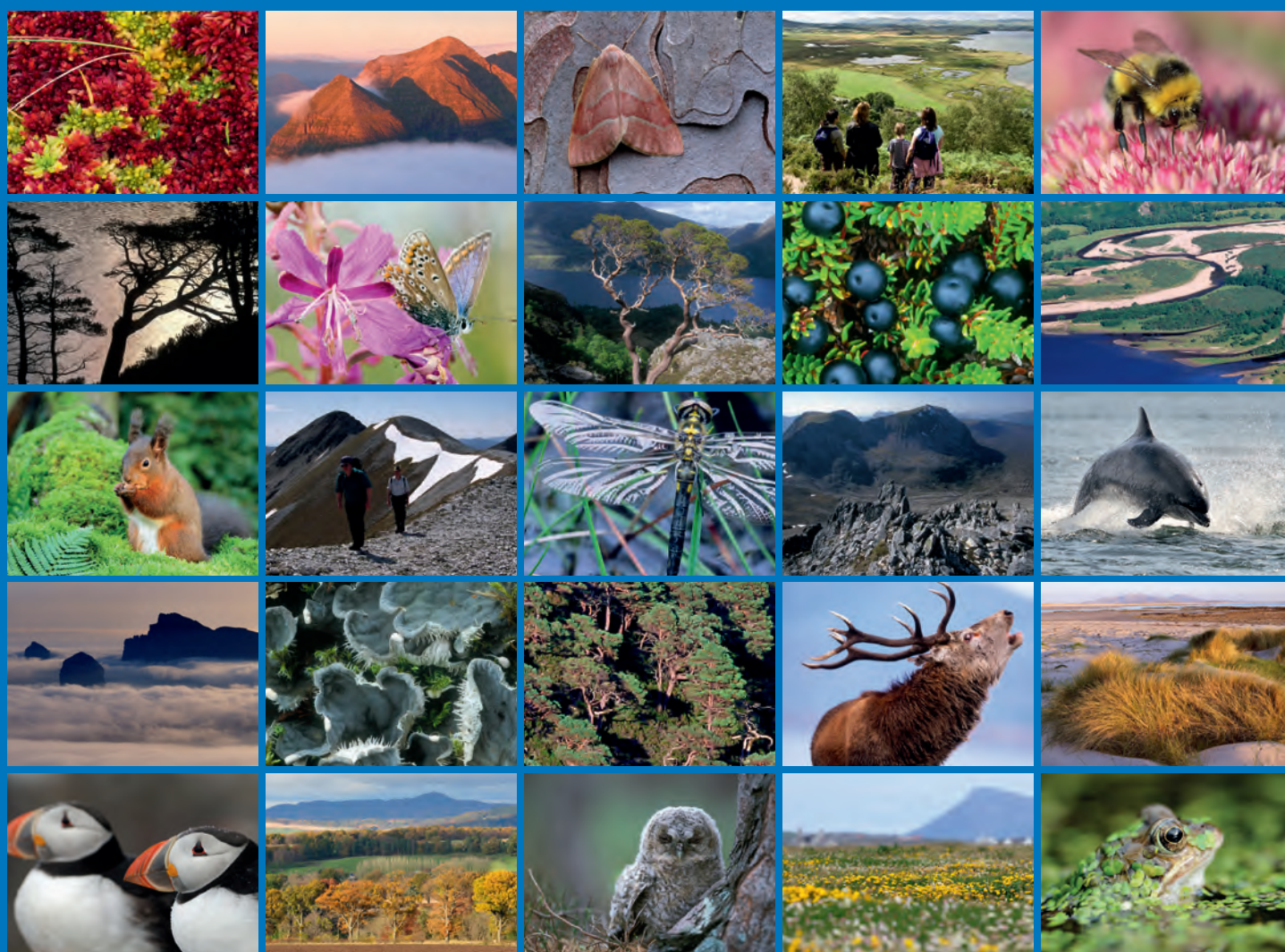


Third cycle Site Condition Monitoring report for bryological interest – Achnahaird SSSI/SAC



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RESEARCH REPORT

Research Report No. 881

Third cycle Site Condition Monitoring report for bryological interest – Achnahaird SSSI/SAC

For further information on this report please contact:

Bob Bryson
NatureScot
Silvan House
231 Corstorphine Road
EDINBURGH
EH12 7AT
Telephone: 0131 3162677
E-mail: bob.bryson@nature.scot

This report should be quoted as:

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Third cycle Site Condition Monitoring report for bryological interest – Achnahaird SSSI/SAC

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Keywords

Petalophyllum ralfsii, *Bryum salinum*, *Bryum knowltonii*, *Bryum calophyllum*, *Bryum warneum*, surveillance, dune habitat, Site of Special Scientific Interest, Special Area of Conservation

Background

This report provides an assessment of the condition of the bryophyte interest of Achnahaird SSSI. An introduction to the bryophyte interest of the site is provided by previous assessments made during the first and second cycles of SCM (Rothero, 2004, 2009), with which this report should be read in conjunction.

Main findings

- *Petalophyllum ralfsii* and all the rare *Bryums* except *B. salinum* were refound. However, *P. ralfsii* is much reduced, and this is beginning to look like a trend; overall the site was rather dry, with denser vegetation developing, and possibly eutrophicated to some extent.
- Monitoring plots look superficially similar to previous assessments in September 2014 but because the recorded number of *P. ralfsii* had gone down, a follow-up survey was carried out in March 2015.
- The follow-up survey found *P. ralfsii* in similar numbers to September 2014 for some plots but others were covered in a thick layer of sand following recent storms and no plants were found. Large numbers of *P. ralfsii* plants were found at two plots, including a large population that was covered in sand in 2014 but uncovered and recovering from swollen stems in 2015 (Plot 12). This demonstrates the difficulties of relying on count data and the ability of *P. ralfsii* to recover following burial.
- The March 2015 visit revealed considerable changes brought about by winter storms, with substantial movement of sand over the site and dune dynamics very much under way, with some areas being more covered, others more exposed, some wetter, some drier. This highlights the important relationship between dune dynamics and persistence of *P. ralfsii* and such dynamics must be maintained.
- Grazing pressure from stock is currently variable, with sheep much more numerous in March 2015 than they were in September 2014. Rabbit grazing is locally intense, however. This is leading to a situation with some patches of short rabbit-grazed turf and much coarser

vegetation elsewhere. Grazing may not be as important as natural processes at this site in keeping the habitat in favourable condition.

- Visitor pressure is quite intense, but trampling is unlikely to be a significant threat. However, evidence of campfires was found in *Petalophyllum* habitat, and this could have an impact locally on populations. Extensive use by dog-walkers, with consequent faeces.
- The rare *Bryum* species are probably at about the same level as in previous years, but it is very difficult to be sure. *B. salinum* was not recorded this time, but it is probably still here somewhere. There continues to be a healthy population of *Moerckia flotoviana*.
- On balance it is recommended that the site condition is assessed as **Favourable – maintained**. However, the apparent overall decline since monitoring began is perhaps still a cause for concern, and monitoring needs to continue.

For further information on this project contact:

Bob Bryson, NatureScot, Silvan House, 231 Corstorphine Road, Edinburgh, EH12 7AT.

Tel: 0131 3162677 or bob.bryson@nature.scot

For further information on our research programme contact:

Research Coordinator, NatureScot, Great Glen House, Leachkin Road, Inverness, IV3 8NW.

Tel: 01463 725000 or research@nature.scot

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Petalophyllum ralfsii

1. INTRODUCTION

This report provides an assessment of the condition of the bryophyte interest of Achnahaird SSSI. An introduction to the bryophyte interest of the site is provided by the previous assessments (Rothero, 2004; 2009) and is not repeated here. This report should be read in conjunction with those assessments. *Petalophyllum ralfsii* was first found here in 1974 by David Long and the site has been visited by other bryologists over the years and the rare *Bryum* species added to the list.

2. METHODS

There are two aims to this third cycle of monitoring. The first is to look at the site as a whole and compare the bryophyte communities present with those described in the dossier from the first cycle, paying particular attention to those problems identified in that dossier. The second is to assess the direct monitoring plots set up during the first cycle.

The bryological features of interest at this site are:

- bryophyte assemblage – Sand dunes and slacks (Special habitat 15);

Information gathered during the direct monitoring, combined with general observations across the site, have been used to complete the corresponding Site Attribute and Target tables (SATs) (Section 3.3)

Field surveying was undertaken during 24-25 September 2014 in variable weather. All the monitoring plots established during the previous assessments (Rothero, 2003, 2009) were revisited. A subsequent visit was made with Dr. David Genney of SNH on 18 March 2015.

Taxonomy follows Hill *et al.* (2008) and information on conservation status is taken from Preston (2006), Preston (2010) and Hodgetts (2011). Oceanic, or 'Atlantic', species are indicated according to the definitions of Hill *et al.* (2007), and 'Western British' species according to the definitions of Ratcliffe (1968).

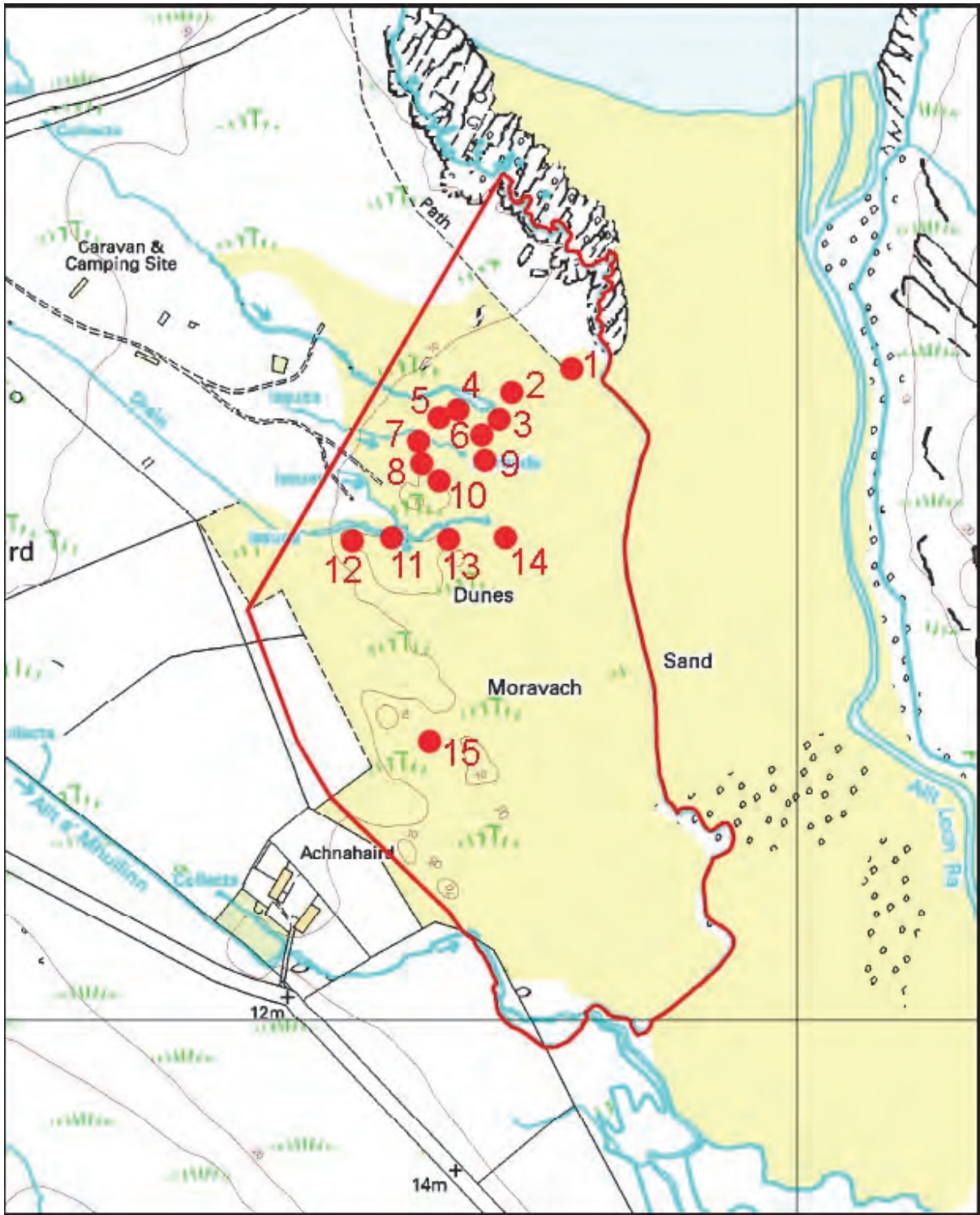


Figure 1. Achnahaird SSSI, showing position of monitoring plots. © Crown copyright and database right 2015. Ordnance survey 100017908.

3. RESULTS AND DISCUSSION

3.1 Species inventory

A total of 74 species were found (Annex 1). All species data have been passed on to the British Bryological Society for incorporation into the national bryophyte database and will be accessible via the National Biodiversity Network Gateway. A database of current and past bryophyte records from the site, with associated metadata, is also maintained by SNH in document A1584755. Although conditions were rather dry, the site as a whole appeared to be in reasonable condition (to someone who has not visited it before). *Petalophyllum ralfsii* was refound, but in smaller quantity than in previous years. It is difficult to ascertain whether this is a long-term decline or simply an effect of temporarily dry conditions, restricting many plants to their underground axes, but the long-term decline is beginning to look significant (see below). As the ground dries, it tends to be colonised by large common mosses, such as *Brachythecium* spp., *Homalothecium lutescens*, *Hypnum* spp., *Rhytidiadelphus* spp. and *Syntrichia ruralis* var. *ruraliformis*. The common *Calliergonella cuspidata* was common on wetter ground. All the rare *Bryums* except *B. salinum* were refound, albeit in small amounts and in rather restricted areas of wet ground. There was much sterile *Bryum*, however, and some of these sterile plants may have been rare *Bryums*. It cannot be asserted that *B. salinum* has disappeared. Again, dry conditions may have led to a poorer crop of sporophytes (necessary for identification) this autumn, and it cannot yet be inferred that the site as a whole is deteriorating. The Data Deficient liverwort *Moerckia flotoviana* (recorded previously as *M. hibernica*) was locally abundant on damp sandy turf, and the Nationally Scarce moss *Amblyodon dealbatus*, not previously known at this site, was also found in one of the slacks. A plant that may have been *Bryum dyffrynense* (Near Threatened) was found, which would be new to Scotland, but the specimen was too poor to be confirmed by a specialist. Another visit would be useful to determine whether this species is actually present. As well as many of the monitoring plots being drier than previously, some had significant amounts of fresh blown sand on them, possibly making it more difficult for bryophytes (especially *P. ralfsii*) to appear. In other areas, apparently suitable *P. ralfsii* habitat (bare, open compacted ground in dune slacks) was being colonised by other thallose liverworts (*M. flotoviana*, *Preissia quadrata*). *Moerckia hibernica sens. lat.* has been subjected to a taxonomic revision recently (Crandall-Stotler & Stotler, 2007) and it is now known that *M. hibernica sens. strict.* is a plant of upland acid or mildly base-rich flushes, and the plant of dune slacks is *M. flotoviana*. *Aneura pinguis* is also under study, and preliminary results suggest that it consists of several cryptic species in Europe. The plant of dune slacks, found at Achnahaird Bay, is apparently endemic to the British Isles.

Table 1. The counts of thalli of *Petalophyllum ralfsii* on 15 monitoring plots at Achnahaird in 1998, 2004, 2008, 2014 and 2015. The 2015 count is only partial, as not all the plots were revisited.

Monitoring plot	1998	2004	2008	2014	2015
1	250	300	300	0	0
2	2250	300	400	0	19
3	4550	900	300	150	65
4	200	150	50	3	50
5	15	20	0	5	3
6	2950	700	150	100	100
7	900	50	0	50	-
8	2000	300	130	20	-
9	6000	750	500	0	-
10	700	250	100	0	-
11	1000	375	50	0	-

12	320	600	450	0	1500
13	970	950	700	400	5
14	300	350	50	0	-
15	200	2800	500	50	-
Total	22605	8795	3680	578	1742

The following is extracted from Rothero (2009):

*“Assessing the condition of the feature of interest where this is an assemblage of ruderal species on a dynamic habitat is fraught with difficulty. Populations of ruderal species can fluctuate dramatically as a result of changes in the habitat and this can mean large increases as well as decreases. It may be that one large winter storm could create large areas of new habitat that *Petalophyllum ralfsii* could exploit while a period of stability would have the opposite effect. This was the interpretation put on the large drop in the number of thalli estimated in 2004 compared with that in 1998 and it may still be true of the further drop in numbers recorded in this survey. There is also the problem with *Petalophyllum ralfsii* that it disappears during dry spells and that a survey at the ‘wrong time’ could give a false impression. However, the change in grazing pressure does need to be considered. The assessment here is that the reduction in grazing over time has reduced the niche availability for *Petalophyllum ralfsii* and the rare *Bryum* species and that the site is in **unfavourable declining** condition.”*

The same comments apply in 2014. There has been a further large reduction in *Petalophyllum* thalli, which may be part of a natural fluctuation, but the steady decline since monitoring began does suggest that it is significant. It is not known why Rothero (2009) assesses the site as ‘unfavourable declining’ here, but later in the same report the table assesses it as ‘favourable maintained’.

The supplementary visit, in March 2015, revealed a large population of *P. ralfsii* at Plot 12, previously hidden by sand. Changes in other plots were relatively minor.

3.2 Monitoring plots

3.2.1 Plot 1

Grid reference: NC01782.13637, ca. 10 m. Contributes to ‘sand dunes and slacks’ SAT.

1998:

250+ thalli of *Petalophyllum ralfsii*.

September 2004:

300+ thalli of *P. ralfsii*. A slightly higher count than in 1998 and there are thalli sparsely scattered outside of the area outlined.

September 2008:

300- thalli of *P. ralfsii*. Probably fewer thalli than in 2004 and distinctly clumped, often with 10-20 thalli occurring close together. Sparsely scattered across the area outlined; the more open sand below seems to be too dry.

September 2014:

0 thalli of *P. ralfsii*. This plot was very dry, and *P. ralfsii* was either confined to its underground axes or not here at all (Figure 2). A layer of new sand amongst the vegetation suggested that *P. ralfsii*, if still present, may not yet have managed to 'catch up' with the accretion of sand.

March 2015:

0 thalli of *P. ralfsii*. Winter storms had covered the plot with a thick layer of sand, burying the vegetation (Figure 3 & Figure 4). Some scraping revealed no *P. ralfsii* axes.



Figure 2. Plot 1, September 2014. Area of damp sand east of Burn 1.

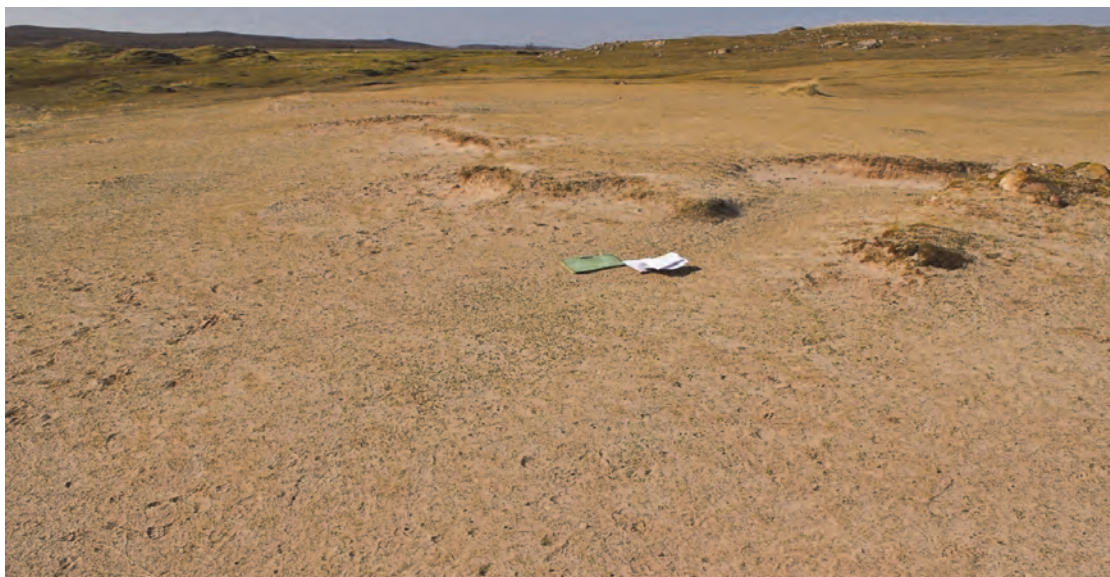


Figure 3. Plot 1, March 2015. Plot has been covered with a thick layer of fresh sand.



Figure 4. Plot 1. March 2015. Detail of habitat lost to wind-blown sand. Fresh leaves of *Trifolium repens* were found 4-5 cm under the sand in places indicating recent deposition.

3.2.2 Plot 2

Grid reference: NC01733.13608, ca. 10 m. Contributes to 'sand dunes and slacks' SAT.

1998:

Petalophyllum ralfsii stands:

Upper part of burn 1 (above top arrow): 100 thalli of *P. ralfsii*

Lower part of Burn 1 (below top arrow): 750 thalli of *P. ralfsii*

Upper part of Burn 2 (above top arrow): 500 thalli of *P. ralfsii*

Middle part of Burn 2 (top arrow to in line with rucksack: 600 thalli of *P. ralfsii*

Lower part of Burn 2 (below level of rucksack and link with Burn 1); 200 thalli of *P. ralfsii*.

September 2004:

Petalophyllum ralfsii stands:

Upper part of burn 1 (above top arrow): 0 thalli of *P. ralfsii*

Lower part of Burn 1 (below top arrow) 100 thalli of *P. ralfsii*

Upper part of Burn 2 (above top arrow) 0 thalli of *P. ralfsii*

Middle part of Burn 2 (top arrow to in line with rucksack 100 thalli of *P. ralfsii*

Lower part of Burn 2 (below level of rucksack and link with Burn 1) 100 thalli of *P. ralfsii*

Small stands of *Bryum calophyllum*, *Bryum warneum* and *Bryum salinum* occur next to the drainage lines at the small steepening level with the rucksack.

September 2008:

Petalophyllum ralfsii stands:

Upper part of burn 1 (above top arrow): 0 thalli of *P. ralfsii*

Lower part of Burn 1 (below top arrow): 200 thalli of *P. ralfsii*

Upper part of Burn 2 (above top arrow): 0 thalli of *P. ralfsii*
Middle part of Burn 2 (top arrow to in line with rucksack: 100 thalli of *P. ralfsii*
Lower part of Burn 2 (below level of rucksack and link with Burn 1): 100 thalli of *P. ralfsii*

The thalli of *Petalophyllum ralfsii* are clumped, sometimes with 20-30 in a small area, so generally they are very sparse over the area. The favoured sites tend to be damp flat areas above but immediately adjacent to the drainage lines. The turf in the upper section of both burns is now closed and there is little available habitat for *Petalophyllum ralfsii*.

As in 2004, small stands of *Bryum calophyllum*, *Bryum warneum* and *Bryum salinum* occur next to the drainage lines at the small steepening in the slope in the lowest section of both burns. *Bryoerythrophyllum caledonicum* (see comment against 2014 below) is very limited here but it is not possible to estimate the size of the populations of the other two species but they are certainly also small.

September 2014:

Petalophyllum ralfsii stands:
No *P. ralfsii* seen.

As at Plot 1, this area was quite dry and showed no sign either of *P. ralfsii* or the rare *Bryum* species (Figure 5). '*Bryoerythrophyllum caledonicum*', mentioned by Rothero (2009) is presumably an orthographic error for *Bryum calophyllum*.

March 2015:

19 thalli of *P. ralfsii* found scattered in the upper burn 2 area (Figure 7). The ground generally was wetter than in September 2014 but the lower burn was covered in more recent sand (Figure 6).

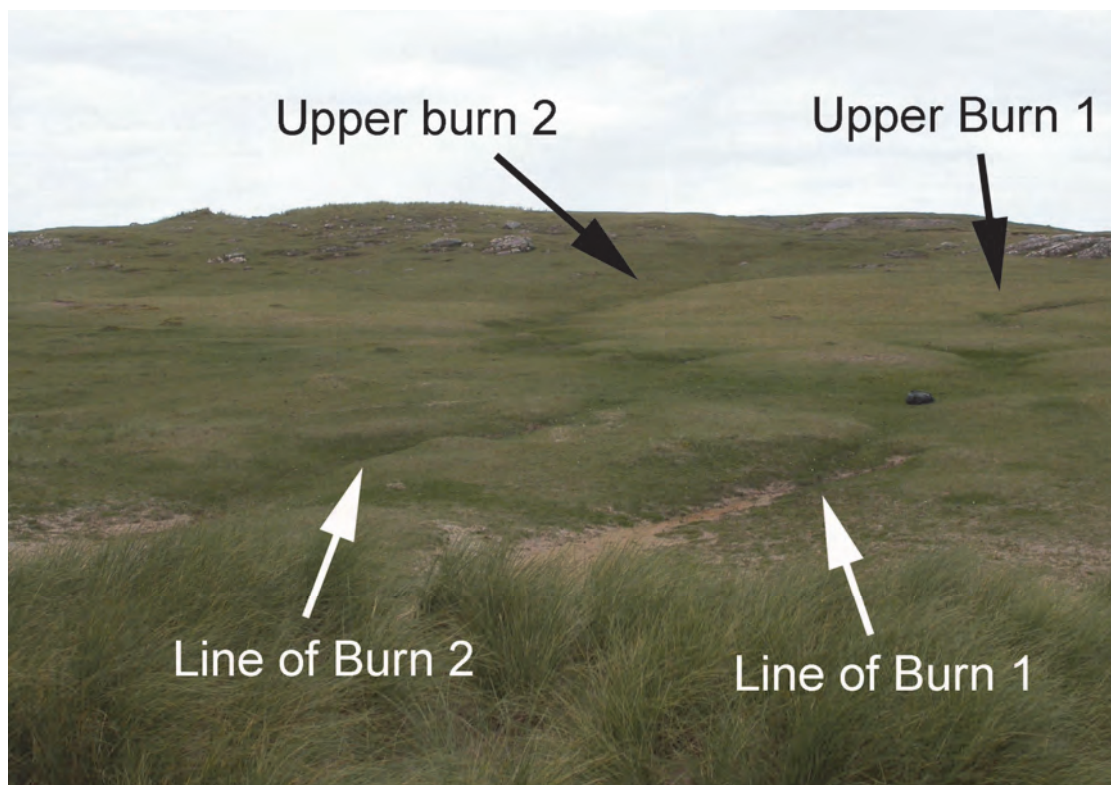


Figure 5. Plot 2, September 2014. The area around Burns 1 & 2, looking up the slope.



Figure 6. Plot 2, March 2015. Repeat of Figure 5 showing extent of recent wind-blown sand deposited around the lower burn area.



*Figure 7. Plot 2, March 2015. Location of 19 *Petalophyllum ralfsii* plants around upper burn 2 indicated by white markers.*

3.2.3 Plot 3

Grid reference: NC01733.13608 - NC01718.13577, ca. 10 m. Contributes to 'sand dunes and slacks' SAT.

1998:

The area between Burns 2 &3: 4000 thalli of *Petalophyllum ralfsii*
Lower Burn 3: 550 thalli of *P. ralfsii*.

September 2004:

The area between Burns 2 &3: 500 thalli of *P. ralfsii*
Lower Burn 3: 400 thalli of *P. ralfsii*

This is a big drop in stand size between 1998 and 2004. Two things may have affected the stand here: the open damp sand here had a build-up of lime at the surface giving a marl effect and *Petalophyllum ralfsii* was absent in such areas. The violent wind the day before the survey could have shifted the drier sand and covered rosettes.

Bryum calophyllum occurs in the wetter ground near to Burn three, near to the lower flag in Photo 3.2 (Rothero 2004).

September 2008:

The area between Burns 2 &3: 2008: 250+ thalli of *P. ralfsii*
Lower Burn 3: 2008: 50+ thalli of *P. ralfsii*

The dramatic decline in stand size between 1998 and 2004 is continued. The build up of a marl-like crust on the sand noted in 2004 is still apparent and *Petalophyllum ralfsii* is absent from such areas. Another perceived difference is the scarcity of suitable open habitat for *Petalophyllum ralfsii* in the area. The most obvious change is in the area next to the lower part of Burn 3 where an increase in the area of rushes has completely changed the habitat closest to the burn leaving only a narrow strip of suitable habitat next to the drier vegetation above.

In 2004, *Bryum calophyllum* occurred in the wetter ground near to Burn three, near to the lower flag in Photo 3.2a (Rothero, 2009) but could not be found here in 2008.

September 2014:

The area between Burns 2 &3: ca. 50 thalli of *P. ralfsii*, very sparse (Figure 8). This area is now rather dry, with much *Pellia endiviifolia*, along with *Ditrichum gracile*, *Aneura pinguis sens. strict.*, *Moerckia flotoviana* and various small Pottiaceae.

Lower Burn 3: 2008: ca. 100 thalli of *P. ralfsii*. This area is still wet, with abundant *Pellia endiviifolia*, *Moerckia flotoviana* and sterile *Bryum* (Figure 10 & Figure 11).

P. ralfsii has continued its decline in one area but appears to have recovered somewhat at the other. Other associates recorded here include *Cratoneuron filicinum*, *Hypnum cupressiforme*, *Homalothecium lutescens*, *Bryum pallens* and *B. pseudotriquetrum*.

Bryum calophyllum was refound, having not been seen in 2008, in almost exactly the same place that it was found in 2004, forming a stand ca. 3 x 3 cm, with immature sporophytes. In general, this area is now too dry, with much new sand blown in, except for a narrow wet zone next to the burn, where *B. calophyllum* occurs.

March 2015:

The area between Burns 2 & 3: ca. 65 thalli (Figure 9). Still dry but wetter than in September 2014.

Lower Burn 3: 0 thalli: now filled with sand blown in from winter storms (Figure 12).

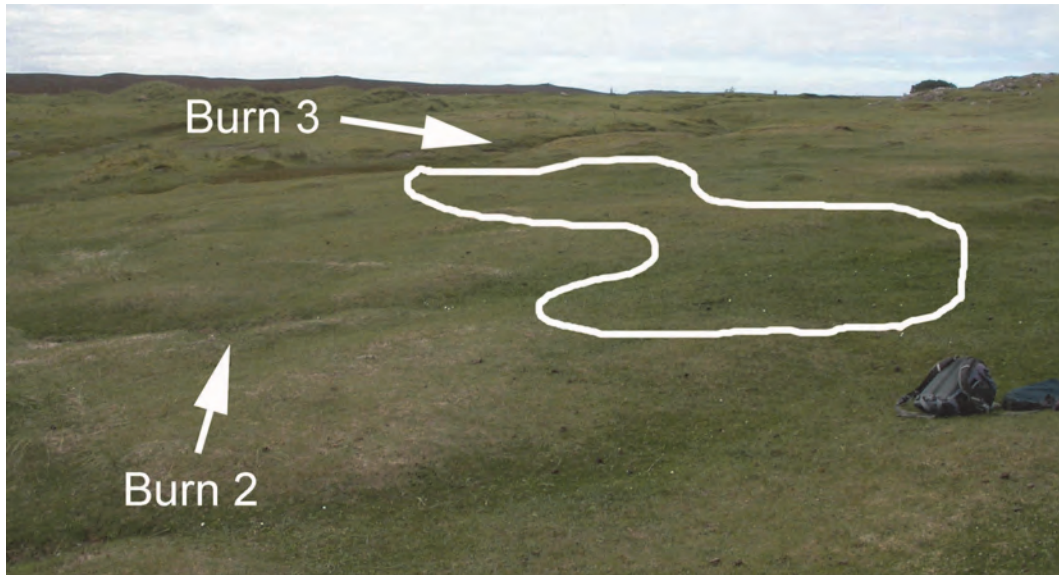


Figure 8. Plot 3, September 2014. The area between Burns 2 & 3 looking west across the slope. ca. 50 thalli of P. ralfsii present.



Figure 9. Plot 3, March 2015. Repeat of Figure 8 but showing location where 35 Petalophyllum ralfsii plants were located.

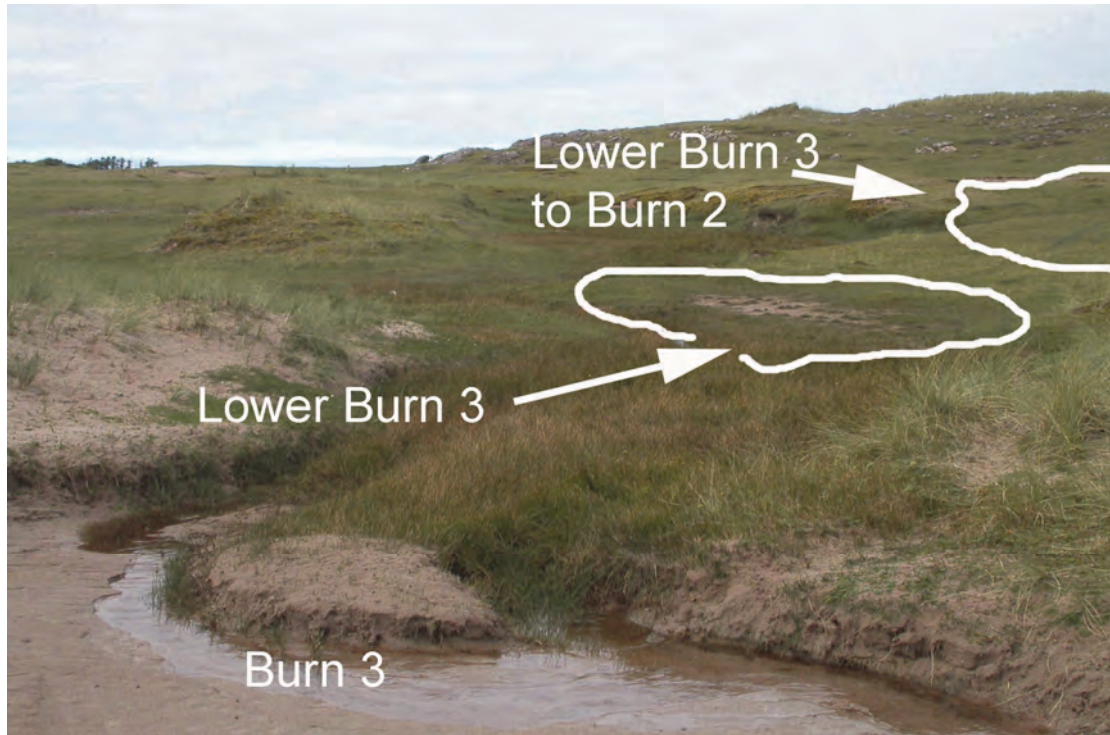


Figure 10. Plot 3, September 2014. The lower section of Burn 3 showing the area where *Petalophyllum ralfsii* occurs (ca. 100 thalli) and the west part of the area between Burns 2 & 3, looking up the slope.



Figure 11. Plot 3, September 2014. The lower section of Burn 3 showing the area where *Petalophyllum ralfsii* occurs (ca. 100 thalli), and *Bryum calophyllum*.



Figure 12. Plot 3, March 2015. Lower section of Burn 3 covered in sand. No *Petalophyllum ralfsii* found.

3.2.4 Plot 4

Grid reference: NC0167.1359, ca. 10 m. Contributes to 'sand dunes and slacks' SAT.

1998:

N tributary of Burn 3: 150 thalli of *Petalophyllum ralfsii*
 Upper slope west of Burn 2: 50 thalli of *P. ralfsii*.

September 2004:

N tributary of Burn 3: 100 thalli of *P. ralfsii*
 Upper slope west of Burn 2: 50 thalli of *P. ralfsii*.

September 2008:

N tributary of Burn 3: 50 thalli of *P. ralfsii*
 Upper slope west of Burn 2: 0 thalli of *P. ralfsii*.

There is now only a very small area of suitable habitat by the first obvious bend in this tributary and all of the thalli were in one small patch and were very small. The sward in the upper section would now appear to offer little scope for *Petalophyllum ralfsii*.

September 2014:

N tributary of Burn 3 (Figure 13): 17 thalli of *P. ralfsii*
 Upper slope west of Burn 2: 3 thalli of *P. ralfsii*, with *Pinguicula vulgaris*. This area is now rather dry.

March 2015:

N tributary of Burn 3: ca. 50 thalli of *P. ralfsii*

Upper slope west of Burn 2: 0 thalli of *P. ralfsii*. Dry.



Figure 13. Plot 4, September 2014. The N tributary of Burn 3 with the stands of *Petalophyllum ralfsii* outlined. The upper area is the open section between this tributary and west of the upper part of Burn 2.

3.2.5 Plot 5

Grid reference: NC01649.13598, ca. 10 m. Contributes to 'sand dunes and slacks' SAT.

1998:

Small area by burn: 15 thalli of *Petalophyllum ralfsii*

Some stands of *Petalophyllum ralfsii* (300 rosettes) were found beyond the small bridge over the burn in the background of Photo 5.1 In Rothero (2004) and beyond the line of posts.

September 2004:

Small area by burn: 20+ thalli of *P. ralfsii*

The stands of *Petalophyllum ralfsii* beyond the small bridge over the burn and beyond the line of posts referred to in 1998 were not seen, but no extensive search was made.

September 2008:

Small area by burn: 0 thalli of *P. ralfsii*

The sward is now complete in the area outlined and the habitat is longer suitable for *Petalophyllum ralfsii*.

The stands of *Petalophyllum ralfsii* beyond the small bridge over the burn and beyond the line of posts referred to in 1998 were not seen, but again no extensive search was made. In 2008 about 50 thalli were seen in the area indicated by the arrow in Photo 5.1b in Rothero (2009) but again no extensive search was made up into the caravan site.

September 2014:

Small area by burn (Figure 14 & Figure 15): 5 thalli of *P. ralfsii*

These thalli were found in the area that was determined as 'no longer suitable' in 2008, so they are clearly surviving longer than was anticipated. Associates were *Moerckia flotoviana*, *Ditrichum gracile*, *Brachythecium glareosum*, *Rhytidiadelphus squarrosus*, *Hypnum cupressiforme* var. *lacunosum*, *Bryum* spp. and Pottiaceae.

The small bridge is still there but only two posts remain of the line of posts referred to previously. A short search was made beyond, but again no *P. ralfsii* was found. It was not refound in the area indicated by the arrow in Rothero (2009), although *Distichium inclinatum* was found here.

March 2015:

Small area by burn: 3 thalli of *P. ralfsii* (Figure 16).



Figure 14. Plot 5, September 2014, The middle and upper parts of Burn 3 looking upstream; the two remaining posts run along the back of the photo and the small bridge is just visible.



*Figure 15. Plot 5, March 2015. The middle and upper parts of Burn 3 looking upstream with area with *Petalophyllum ralfsii* outlined; the small bridge is just visible.*



*Figure 16. Plot 5, March 2015. Close-up of area where three *Petalophyllum ralfsii* recorded (approximate location outlined).*

3.2.6 Plot 6

Grid reference: NC01689.13566, ca. 10 m. Contributes to 'sand dunes and slacks' SAT.

1998:

Upper part of the area outlined: 1750 thalli of *Petalophyllum ralfsii*

Lower part: 1200 thalli of *P. ralfsii*.

September 2004:

Upper part of the area outlined: 350 thalli of *P. ralfsii*.

Lower part: 350 thalli of *P. ralfsii*.

Another large drop in the numbers of thalli visible despite there being ample areas of open sand.

Bryum calophyllum, *Bryum warneum* and *Bryum knowltonii* occur near the lower right Xs in Photo 6.1 in Rothero 2004.

September 2008:

Upper part of the area outlined: 2008 100 thalli of *P. ralfsii*.

Lower part: 2008: 50 thalli of *P. ralfsii*.

A further drop in the numbers of thalli visible despite there being a reasonable amount of open sand. The patches of thalli are well scattered but the best areas are much the same as in 2004 and marked in Photo 6.1a (Rothero, 2009).

In 2004, *Bryum calophyllum*, *Bryum warneum* and *Bryum knowltonii* were recorded near the lower right Xs in Photo 6.1a (Rothero, 2009) but were not seen here in 2008. There has been an increase in coarse vegetation in this lowest section.

September 2014:

Upper part of the area outlined: 2008 ca. 100 thalli of *P. ralfsii*.

Lower part: 2008: 0 thalli of *P. ralfsii*.

P. ralfsii occurs in several small clusters and scattered single thalli, with *Moerckia flotoviana*, *Distichium inclinatum*, *Aneura pinguis sens. strict.*, *Didymodon fallax* and *Dichodontium pellucidum* (Figure 17). The lower part of the area is wet and has much *Bryum* (sterile), *Campylium protensum*, *Pellia endiviifolia*, *Ditrichum gracile* and Pottiaceae. In between, the ground is dry with new sand blown in.

Nothing that was identifiable as any particular species of rare *Bryum* was seen.

March 2015:

Upper part of the area outlined: 2008 79 thalli counted, so probably ca. 100 thalli of *P. ralfsii*.

Lower part: 12 thalli of *P. ralfsii* (all in one cluster)

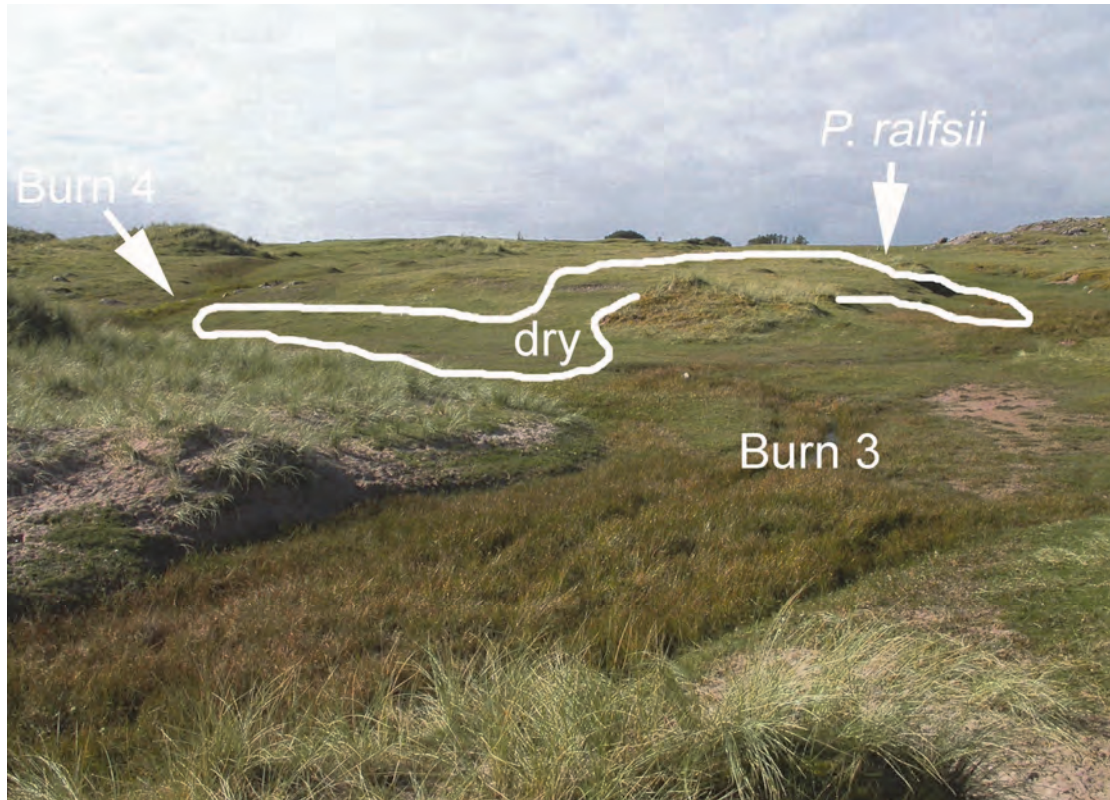


Figure 17. Plot 6, September 2014. The area between Burns 3 and 4 looking up from the confluence; *P. ralfsii* in upper part, not in lower part to the left of the dry area.

3.2.7 Plot 7

Grid reference: NC01648.13580, ca. 10 m. Contributes to 'sand dunes and slacks' SAT.

1998:

In the area outlined in Rothero (2009): 900 thalli of *Petalophyllum ralfsii*.

September 2004:

In the area outlined in Rothero (2009): 50+ thalli of *P. ralfsii*.

September 2008:

In the area outlined in Rothero (2009): 0 thalli of *P. ralfsii*.

There would seem to be scattered patches of suitable open damp sand in this area but no thalli of *Petalophyllum ralfsii* were seen.

September 2014:

In the area outlined in Rothero (2009): ca. 50 thalli of *P. ralfsii* (Figure 18).

Other species recorded here include *Campyllum protensum*, *Ditrichum gracile*, *Leiocolea badensis*, *Moerckia flotoviana*, *Pellia endiviifolia*, *Preissia quadrata*, *Riccardia chamedryfolia* and small Pottiaceae. A good stand of *Philonotis calcarea* grows in the burn nearby.



Figure 18. Plot 7, September 2014. Two tributaries on the N side of lower Burn 4 looking up the slope; the best patches of *Petalophyllum ralfsii* are marked with an 'x'.

3.2.8 Plot 8

Grid reference: NC01627.13556, ca. 10 m. Contributes to 'sand dunes and slacks' SAT.

1998:

In the two areas outlined in Rothero (2009): 2000 thalli of *Petalophyllum ralfsii*.

September 2004:

In the two areas outlined in Rothero (2009): 300+ thalli of *P. ralfsii*.

September 2008:

In the two areas outlined in Rothero (2009): 130+ thalli of *P. ralfsii*.

Most of the thalli seen in 2008 were in the lower part, largely on the terrace just above the line of the burn. Much of the upper section now seems rather dry.

September 2014:

In the two areas outlined in Rothero (2009): ca. 20 scattered thalli of *P. ralfsii* (Figure 19 & Figure 20).

All the usual associates (see Plot 7) were also recorded here, as well as *Entodon concinnus*. However, much of the area immediately above the burn is now too vegetated, and with most potential *Petalophyllum* niches occupied by *Pellia endiviifolia* or *Preissia quadrata*. There is much *Calliergonella cuspidata* and *Philonotis calcarea* in the nearby burn.



Figure 19. Plot 8, September 2014. South side of mid Burn 4 with the lower and upper stands outlined, looking down the line of the burn.

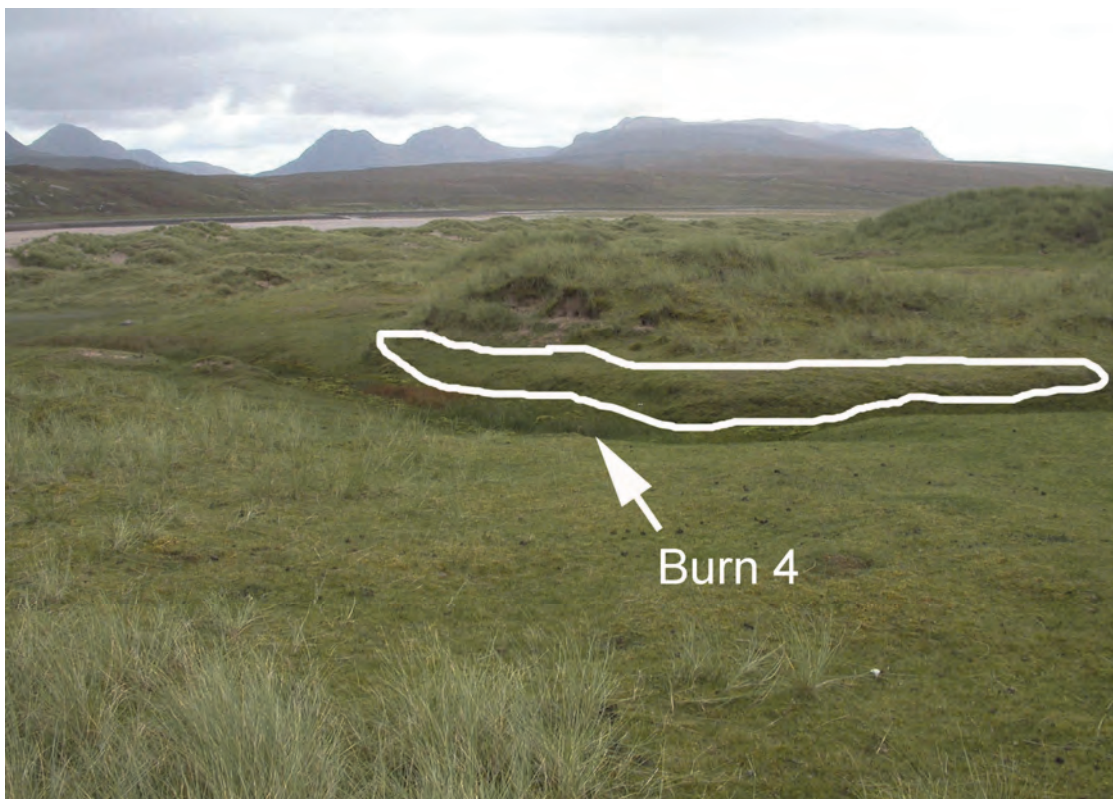


Figure 20. Plot 8, September 2014. The south side of upper Burn 4 with the upper stand outlined looking down the line of the burn.

3.2.9 Plot 9

Grid reference: NC01695.13546, ca. 10 m. Contributes to 'sand dunes and slacks' SAT.

1998:

In the area outlined in Photo 9.1 (Rothero, 2004): 6000 thalli of *P. ralfsii*.

September 2004:

In the area outlined in Photo 9.1 (Rothero, 2004): 750+ thalli of *P. ralfsii*.

This is the biggest drop in numbers on any one stand; the area is less open now than it was in 1998 and the sand surface seemed to have marl crust on it which *Petalophyllum ralfsii* seemed to dislike. All rosettes were rather small and it is possible that the estimate is on the low side.

Bryum calophyllum occurs in the wetter ground on the extreme right of Photo 9.1 (Rothero, 2004).

September 2008:

In the area outlined in Photo 9.1 (Rothero, 2009): 2008: 500+ thalli of *P. ralfsii*.

This stand had the biggest drop in numbers on any one stand in 2004 and this trend has continued although this is still the largest stand on the site. The sward is far more complete now than in 1998 and so there is much less suitable habitat for *Petalophyllum ralfsii*. The 'marly' surface noted in 2004 is still present in the wetter areas and again this seems to preclude the presence of *Petalophyllum ralfsii*. Most of the thalli are in the lower right of the area outline in Photo 9.1b (Rothero, 2009). All rosettes were rather small and it is possible that the estimate is on the low side.

Bryum calophyllum still occurs in the wetter ground on the extreme right of Photo 9.1b (Rothero, 2009).

September 2014:

In the area outlined in Photo 9.1 (Rothero, 2009): 2008: 0 thalli of *P. ralfsii* (Figure 21 & Figure 22).

The trend observed in previous visits has continued to zero. Bryophytes present include *Bryum capillare*, *B. pseudotriquetrum*, *Didymodon fallax*, *Ditrichum gracile*, *Pellia endiviifolia* (abundant) and other small Pottiaceae. The site looks as though it may have suffered inundation recently, with a 'marly' surface.



Figure 21. Plot 9, September 2014. The flat area associated with the bottom of Burn 4.



Figure 22. Plot 9, September 2014. The flat area associated with the bottom of Burn 4.

3.2.10 Plot 10

Grid reference: NC01629.13542, ca. 10 m. Contributes to 'sand dunes and slacks' SAT.

1998:

In the area outlined: 700 thalli of *P. ralfsii*.

September 2004:

In the area outlined: 250+ thalli of *P. ralfsii*.

September 2008:

In the area outlined in both photos (Rothero, 2009): 100 thalli of *P. ralfsii*.

Very sparsely scattered indeed, with very few thalli in the upper area. Much of this stretch seems to be unsuitable with few bare patches and seemingly rather dry.

September 2014:

In the area outlined in both photos (Rothero, 2009): 0 thalli of *P. ralfsii* (Figure 23 & Figure 24).

However, a few thalli of *P. ralfsii* were found nearby, at NC01690.13495.

Pleurocarpous mosses are now dominant here (*Hylocomium splendens*, *Rhytidiadelphus triquetrus*, *R. squarrosus*, *H. cupressiforme* var. *lacunosum*, *Homalothecium lutescens*), with *Ditrichum gracile*. The plot is now too dry and overgrown for *P. ralfsii*. There are also campfire remains, and faeces of sheep and dogs.



Figure 23. Plot 10, September 2014. The lower section of the damp sand between Burns 4 and 5, looking down the slope.



Figure 24. Plot 10, September 2014. The upper section of the damp sand between Burns 4 and 5, looking down the slope.

3.2.11 Plot 11

Grid reference: NC01649.13527, ca. 10 m. Contributes to 'sand dunes and slacks' SAT.

1998:

In the area outlined: 1000 thalli of *P. ralfsii*.

September 2004:

In the areas outlined: 375+ thalli of *P. ralfsii*.

September 2008:

In the areas outlined: 2008: 50 thalli of *P. ralfsii*.

There seems little suitable habitat on this site now and *Petalophyllum ralfsii* is consequently sparse. The frequency of worm casts here suggests that an organic soil has built up here and the structure of such soil is usually unsuitable for both *Petalophyllum ralfsii* and the rarer *Bryum* species.

September 2014:

In the areas outlined: 0 thalli of *P. ralfsii* (Figure 25 & Figure 26).

This plot is now much too heavily vegetated with grass and large competitive pleurocarpous mosses (including *Ctenidium molluscum*) to be suitable for *P. ralfsii*.



Figure 25. Plot 11, September 2014. The lower section of Burn 5 looking down the slope.



Figure 26. Plot 11, September 2014. The whole of Burn 5 looking down the slope.

3.2.12 Plot 12

Grid reference: NC01574.13458 - NC01620.13465, ca. 10 m. Contributes to 'sand dunes and slacks' SAT.

1998:

The area in Photo 12.1 (Rothero, 2004): 120 thalli of *Petalophyllum ralfsii*.

The areas in Photo 12.2 (Rothero, 2004): 200 thalli of *P. ralfsii*.

September 2004:

The area in Photo 12.1 (Rothero, 2004): 500+ thalli of *P. ralfsii*.

The areas in Photo 12.2 (Rothero, 2004): 100+ thalli of *P. ralfsii*.

Frequent in the worn sand in the upper part of Burn 6 but much less so below the tributary that come in from the north. In 1998 damp sand associated with that tributary had 100+ rosettes but none this time. In 1998 rosettes were seen further up Burn 6 onto the caravan site but this area was not checked in 2004.

Bryum calophyllum occurs in the small L-most area marked in Photo 12.2 of Rothero (2004).

September 2008:

The area in Photo 12.1 (Rothero, 2009): 400 thalli of *P. ralfsii*.

The areas in Photo 12.2 (Rothero, 2009): 50 thalli of *P. ralfsii*.

Still quite frequent in the worn sand in the upper part of Burn 6 but much less so below the tributary that come in from the north. In 1998 damp sand associated with that tributary (ie the upper right, beyond the main burn, in Photo 12.2a) had 100+ rosettes but none in 2004 or on this survey. In 1998 rosettes were seen further up Burn 6 onto the caravan site but this area was not checked in 2004.

Bryum calophyllum occurs in one or two places along the burn here and a tiny amount of *Bryum knowltonii* was collected from the uppermost area outlined in Photo 12.1b.

September 2014:

The area in Photo 12.1 (Rothero, 2009): 0 thalli of *P. ralfsii*.

The areas in Photo 12.2 (Rothero, 2009): 0 thalli of *P. ralfsii*.

The south tributary at the top of Burn 6 (Figure 27) was rather 'marly', suggesting recent inundation. It is possible that *P. ralfsii* still survives underground but that conditions were not suitable for its development. *Bryum knowltonii* with four old capsules was found here.

The mid-section of Burn 6 (Figure 32) was dominated by vascular plant vegetation (mainly grasses, sedges and daisies), with much new blown sand.

March 2015:

The area in foreground of Figure 27: 0 thalli of *P. ralfsii*. Very wet and colonised with pleurocarps and vascular plants.

The areas in background of Figure 27 (Figure 28 & Figure 29): ca. 1500 thalli of *P. ralfsii*. A layer of dry sand had been blown away from the base of the dune, exposing the layer of wet sand beneath it, which had abundant chlorophyllose rhizome-like axes of *P. ralfsii*, here very

unusually exposed, and visible before the above-ground rosettes had started to form (Figure 30 & Figure 31).



Figure 27. Position of Plot 12, September 2014. The south tributary at the top of Burn 6, looking down the line of the burn. Now rather 'marly'; *Bryum knowltonii* marked with an 'x'.



Figure 28. Plot 12, March 2015. Area recently exposed to reveal a large population of *Petalophyllum ralfsii* (estimated at 1500 by counting the number in four semi-random 1 m² quadrats and extrapolating to area of habitat). Photo taken from the west.



Figure 29. Plot 12, March 2015. Close up of area where sand blown back to water-table.



*Figure 30. Plot 12, March 2015. Thallus of *Petalophyllum ralfsii* apparently recently uncovered.*



Figure 31. Plot 12, March 2015. Wider view of thalli of *Petalophyllum ralfsii*.



Figure 32. Plot 12, September 2014. The mid-section of Burn 6 above the large central flush, looking up the slope with the N tributary on the right. Now with new blown sand and vascular vegetation dominant.

3.2.13 Plot 13

Grid reference: NC0167.1346, ca. 10 m. Contributes to 'sand dunes and slacks' SAT.

1998:

Over the whole of the flush area outlined in Photo 13.1: 450 thalli of *P. ralfsii*.

The 'N Braid' in Photo 13.2 (Rothero, 2004): 400 thalli of *P. ralfsii*.

The 'S Braid' in Photo 13.3 (Rothero, 2004): 120 thalli of *P. ralfsii*.

September 2004:

Over the whole of the flush area area outlined in Photo 13.1: 500+ thalli of *P. ralfsii*.

The 'N Braid' in Photo 13.2 (Rothero, 2004): 400 thalli of *P. ralfsii*.

The 'S Braid' in Photo 13.3 (Rothero, 2004): 50 thalli of *P. ralfsii*.

A good part of the flush area is probably too wet for too long to be suitable for *Petalophyllum ralfsii* and rosettes are scattered in the more open area outlined in Photo 13.1 (Rothero, 2004).

Patches of *Bryum calophyllum* and more limited amounts of *Bryum warneum* occur, particularly on the N side of the flushed area on the drainage line that leads to the 'N Braid'. *Bryum salinum* was collected from the S Braid in the L-most area marked in Photo 13.3 (Rothero, 2004).

September 2008:

Over the whole of the flush area outlined in Photo 13.1 (Rothero, 2009): 400.

The 'N Braid' in Photo 13.2 (Rothero, 2009): 2008: 300 thalli of *P. ralfsii*.

The 'S Braid' in Photo 13.3 (Rothero, 2009): 2008: 0 thalli of *P. ralfsii*.

A good part of the flush area is probably too wet for too long to be suitable for *Petalophyllum ralfsii* and rosettes are scattered in the more open area outlined in Photo 13.1 (Rothero, 2009). Most of the thalli are in the lower part of this area along the SE edge of the flush. Despite the greener look in Photo 13.1b (Rothero, 2009), there is still a lot of open sand in this area but much of it has a crust on it that seems to preclude both *Petalophyllum ralfsii* and the rarer Bryums. *Petalophyllum ralfsii* is still reasonably frequent in the lower part of the N braid outline in Photo 13.3b (Rothero, 2009) but the habitat by the S braid now seems totally unsuitable.

As in 2004 patches of *Bryum calophyllum* and much more limited amounts of *Bryum warneum* occur, particularly on the N side of the flushed area on the drainage line that leads to the 'N Braid'. *Bryum salinum* was collected from the N Braid in the upper part of the area marked in Photo 13.2b (Rothero, 2009), and *Bryum calophyllum* also occurs here.

September 2014:

Over the whole of the flush area outlined in Photo 13.1 (Rothero, 2009): ca. 200 thalli of *P. ralfsii*.

The 'N Braid' in Figure 34 & Figure 36: ca. 200 thalli of *P. ralfsii*.

The 'S Braid' in Figure 37: 2008: 0 thalli of *P. ralfsii*.

The central flush area (Figure 33) supports *Bryum knowltonii* and *B. warneum*, as well as *Amblyodon dealbatus*. The northern braid, with *P. ralfsii*, has an old camp fire and dog and sheep faeces. The southern braid is now rather vegetated with grasses, sedges and common large mosses; although there are some bare patches, these are occupied by *Preissia quadrata* rather than *Petalophyllum ralfsii*. This area is heavily grazed by rabbits. Other bryophytes

found in this plot include *Bryum algovicum* var. *rutheanum*, *B. pseudotriquetrum* var. *bimum* and *Riccardia chamedryfolia*.

March 2015:

The 'N Braid' in Figure 34 to Figure 36: a few scattered thalli of *P. ralfsii*. Very wet, possibly having been submerged for much of the winter.

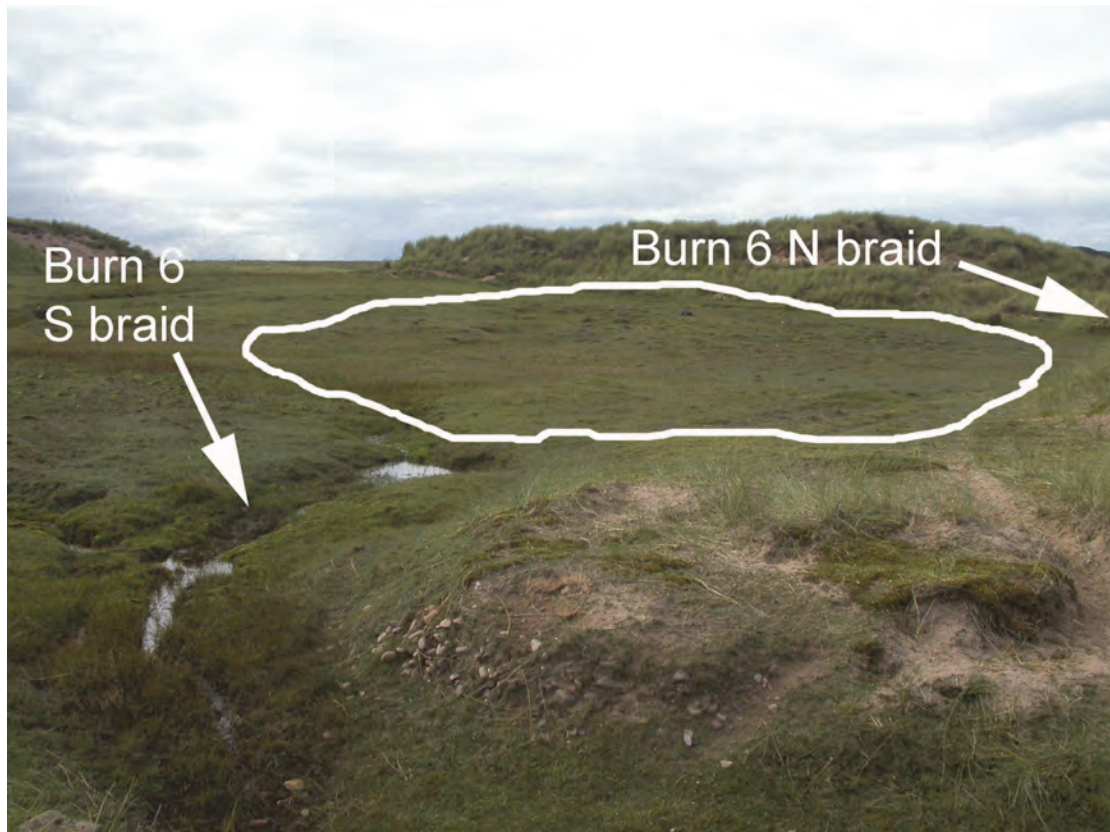


Figure 33. Plot 13, September 2014. The central flush area of Burn 6 where the burn splits. Rare Bryums and *Amblyodon dealbatus* occasional to frequent.

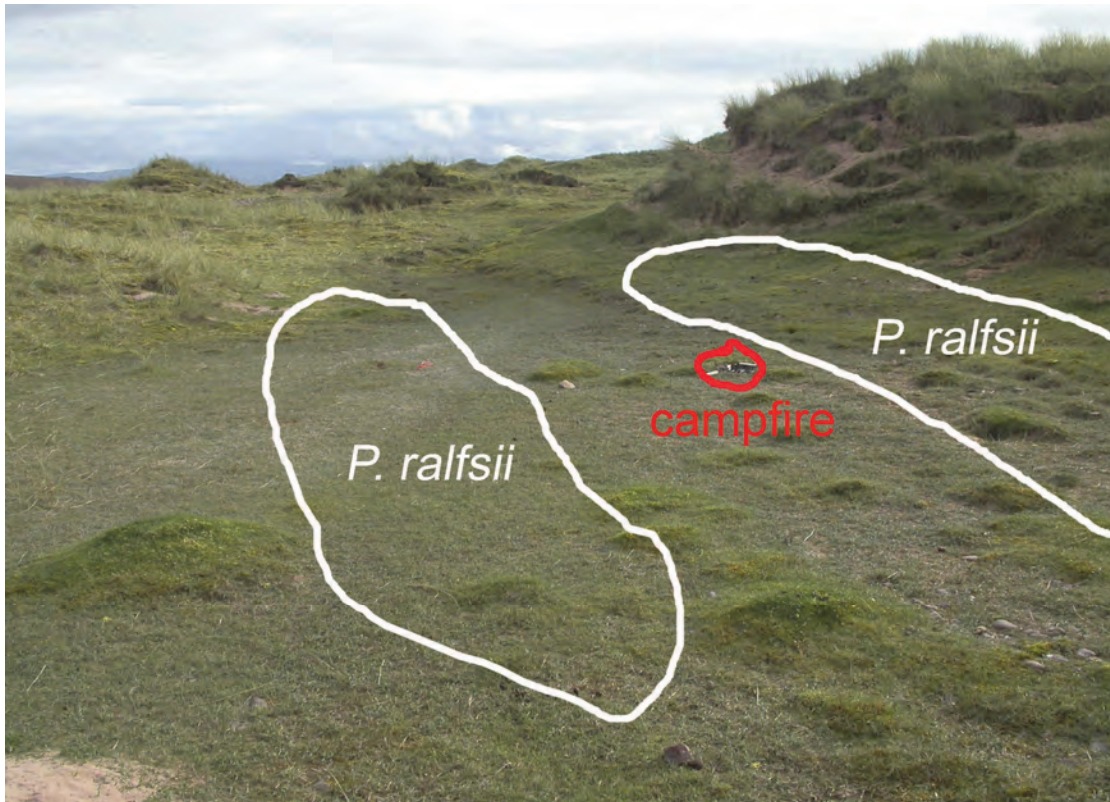


Figure 34. Plot 13, September 2014. The northern braid of Burn 6, looking up and across the slope towards the large flushed area, with areas with *Petalophyllum ralfsii* outlined.



Figure 35. Plot 13, March 2015. Repeat photo of area in Figure 34 showing much wetter conditions. Only a few scattered *Petalophyllum ralfsii* thalli were found.



*Figure 36. Plot 13, September 2014. The northern braid of Burn 6, looking down the slope, with areas with *P. ralfsii* outlined.*



Figure 37. Plot 13, September 2014. The southern braid of Burn 6, looking up the line of the burn towards the central flush area.

3.2.14 Plot 14

Grid reference: NC01725.13463, ca. 10 m. Contributes to 'sand dunes and slacks' SAT.

1998:

In the area outlined: 300 thalli of *Petalophyllum ralfsii*.

September 2004:

In the area outlined: 350 thalli of *P. ralfsii*.

Most frequent at the back (upper) part of the area outlined with the best patches by the yellow flags.

September 2008:

In the area outlined: 50- thalli of *P. ralfsii*.

A considerable reduction in the number of thalli here; the only area where they now occur is in the upper right lobe of the area outlined in Photo 14.1b (Rothero, 2009). The grass sward seems tighter and more complete over much of the area outlined in 2004 with a consequent reduction in the available habitat for *Petalophyllum ralfsii*. This effect is much more apparent in the foreground of the photo, outwith the area in which *Petalophyllum ralfsii* was found in 2004.

September 2014:

In the area outlined (Figure 38): 0 thalli of *P. ralfsii*

The grass sward has continued to tighten and become more complete. There is locally much fruiting *Distichium inclinatum*, however, and a depauperate *Bryum* was collected that may be *B. dyffrynense*. The specimen was too poor for it to be confirmed by a specialist, but it would be worth another visit to try to refind it, as this would be a new moss to Scotland.

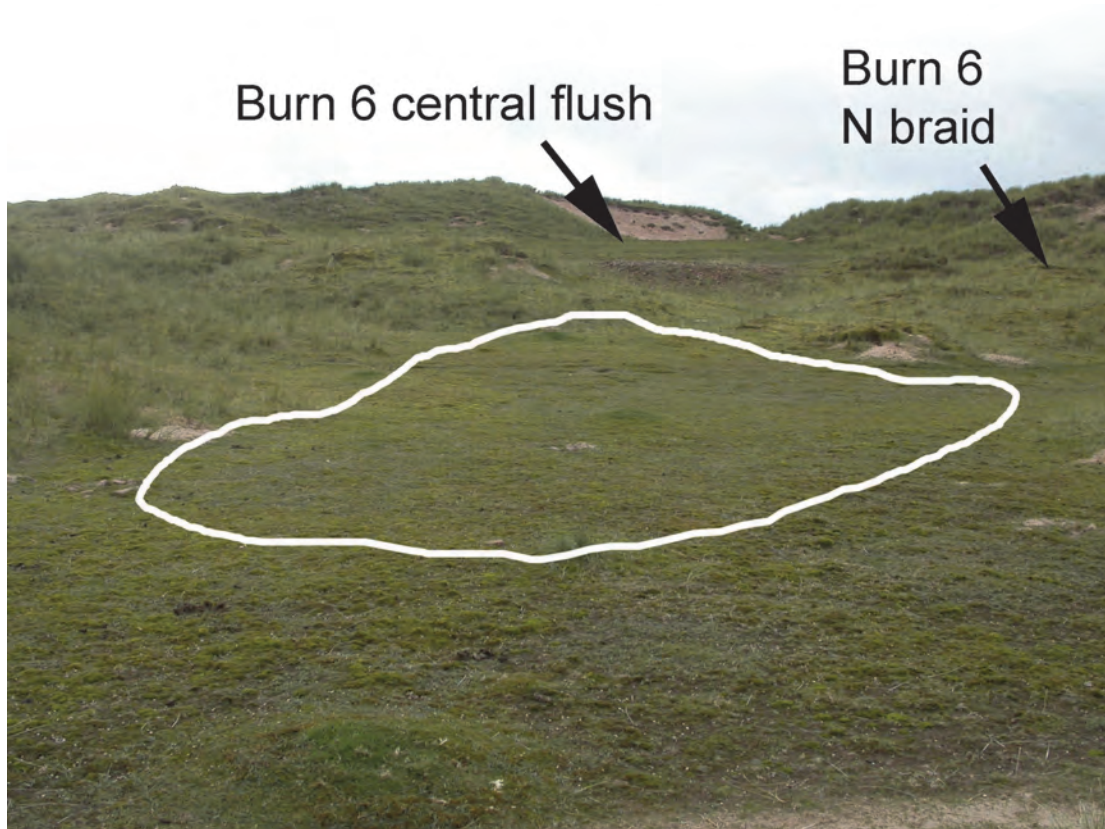


Figure 38. Plot 14, September 2014. The area of damp sand below the central flush area of Burn 6, looking up the slope to the flush which is above an obvious shingle bank.

3.2.15 Plot 15

Grid reference: NC01648.13285 - NC01642.1332, ca. 10 m. Contributes to 'sand dunes and slacks' SAT.

1998:

Stands by the main burn: 1200 thalli of *Petalophyllum ralfsii*.
 Detached area just to the N: 0 thalli of *P. ralfsii*.

September 2004:

Stands by the main burn: 2400+ thalli of *P. ralfsii*.
 Detached area just to the N: 400 thalli of *P. ralfsii*.

A big increase in the number of thalli compared with 1998.

Bryum calophyllum and *Bryum warneum* both occur near the burn, particularly in the area near the rucksack in Photo 15.1 (Rothero, 2004).

September 2008:

Stands by the main burn: 400 thalli of *P. ralfsii*.
 Detached area just to the N: 100+ thalli of *P. ralfsii*.

A catastrophic drop in numbers on this site where there still seem to be good patches of suitable habitat. There has been a build up of a dense mossy layer in some places in which *Moerckia hibernica* seems to compete quite well but where *Petalophyllum ralfsii* is absent.

Bryum calophyllum and *Bryum warneum* occur near the burn, particularly in the lowest part of the outlined area in Photo 15.1b.

September 2014:

Stands by the main burn: 0 thalli of *P. ralfsii*.

Detached area just to the N: ca. 50 thalli of *P. ralfsii*.

Bryum calophyllum and *B. warneum* still occur near the burn (Figure 39 & Figure 41), and there is much *Philonotis calcarea*, *Cratoneuron filicinum*, *Bryum pseudotriquetrum* and *Pellia endiviifolia*.

The detached area to the north (Figure 40) has abundant *Bryum algovicum* var. *rutheanum*. Bare patches have mainly been colonised by *Pellia endiviifolia* and *Preissia quadrata*, but there are scattered thalli of *Petalophyllum ralfsii*.



Figure 39. Plot 15, September 2014. The lower section of the site on the north side of Burn 8, looking up the line of the burn, with *Bryum calophyllum* and *B. warneum* marked with an 'x'.



Figure 40. Plot 15, September 2014. The detached area of damp sand just north of Burn 8, looking N from near the lower part of Burn 8. Thalli are well scattered over the area, but most bare patches are colonised by Moerckia and Preissia.



Figure 41. Plot 15, September 2014. The middle section of Burn 8, looking across and up the line of the burn which is on the left.

3.3 Site attribute and targets

Site: Achnahaird (SSSI)
Feature: Bryophyte assemblage
Report Category: Bryophytes
Site Feature ID:

Visit Date: 24-25 September 2014

Guidance: CSM Guidance - Bryophytes & Lichens, JNCC
Guidance July 2005

Version:

Attribute Set: Bryophyte assemblage: sand dunes and slacks (Specialist habitat 15)

Notes: Drawing on monitoring plots 1-15, and general observations.

Attribute	Standard Target	Site-specific Target	Site-specific Method	Target Result	Target Met (Y/N)
No loss of important bryophyte species and communities	Presence of threatened species as outlined in site report		See first & second cycle reports	All target species except <i>Bryum salinum</i> still present	Yes
	No significant change in important bryophytes in fixed quadrates/reference photos		See first & second cycle reports	The estimate of thalli numbers for <i>Petalophyllum</i> is substantially down on 2008 counts but numbers will fluctuate dramatically in ruderal populations and, with no other changes visible on the site, the drop may well be part of a natural variation. While this is beginning to look like a long term trend, the visit in March 2015 revealed a substantial 'hidden'	Yes

				population of <i>P. ralfsii</i> , and so the population as a whole is probably secure	
	Presence of indicator species outlined in site report		See first & second cycle reports	All indicator species present	Yes
Niche availability	Sufficient area of suitable habitat to maintain population		See first & second cycle reports	There would appear to be sufficient area of open sand	Yes
	No loss in area of habitat supporting the feature		See first & second cycle reports	The dune area is essentially the same size	Yes
Water level	Water table at or above surface of slack for prolonged period during winter months		See first & second cycle reports	This is not really applicable to this site where it is the water flushing down the slopes that keeps the sand damp	Yes
Negative indicators: pollution	No evidence of excessive algal growth in dune slacks		See first & second cycle reports	None seen, unless the 'marly' surface in some areas is due to algae	Yes?
Negative indicators: disturbance	No evidence of excessive disturbance to slack (or other sandy ground)		See first & second cycle reports	There is no excessive disturbance	Yes
Negative indicators: scrub	Slacks and other sandy ground supporting the interest feature should be predominantly free from scrub		See first & second cycle reports	Mainly scrub-free	Yes

3.4 Pressures

Pressures	Comments
1. Agricultural operations	
2. Burning	Camp fires
3. Development with planning permission	
4. Dumping/spreading/storage of materials	Some minor dumping
5. Extraction - dredging (capital, maintenance)	
6. Extraction - maerl	
7. Extraction - quarrying	
8. Extraction - sand & gravel	
9. Extraction - water (freshwater catchment; industrial, e.g. power station)	
10. Fishing - recreational	
11. Flood defence/coastal defence works	
12. Forestry operations	
13. Game or fisheries management	
14. Grazing - appropriate level	
15. Grazing - over	
16. Grazing - under	Grazing pressure from stock is currently variable, with sheep much more numerous in March 2015 than they were in September 2014 (Figure 42). Rabbit grazing is locally intense, however. This is leading to a situation with some patches of short rabbit-grazed turf and much coarser vegetation elsewhere. Grazing may not be as important as natural processes at this site in keeping the habitat in favourable condition.
17. Inter-specific competition	Coarse mosses, grasses and sedges are tending to take over where the ground is drier
18. Maintenance activities carried on site by an organisation	
19. Mineral extraction	
20. Natural event	The March 2015 visit revealed considerable changes brought about by winter storms, with substantial movement of sand over the site and dune dynamics very much under way, with some areas being more covered, others more exposed, some wetter, some drier.
21. No on-site activities related to feature condition noted	
22. Non intervention	
23. Pollution - air-based sources (inc. greenhouse gases)	
24. Pollution - land-based sources	
25. Pollution - sewerage	
26. Presence/changing extent invasive species - NATIVE	
27. Presence/changing extent invasive species - NON NATIVE	
28. Pressure to be identified	
29. Proactive on-site management	
30. Recreation/disturbance	Visitor pressure is quite intense, but trampling is unlikely to be a significant threat. However, evidence of campfires was found in <i>Petalophyllum</i> habitat, and this could have an impact locally on populations. Extensive use by dog-walkers, with consequent faeces (Figure 42).

31. Statutory undertaker	
32. Tourism & recreation	Popular with tourists.
33. Trampling	Yes, but not significant.
34. Waste disposal - quarrying (geological material)	
35. Water Dependant Pressure- abstraction	
36. Water Dependant Pressure- artificial recharge	
37. Water Dependant Pressure- diffuse source pollution	
38. Water Dependant Pressure- flow regulation	
39. Water Dependant Pressure- morphological alteration	Site seems to be drier than in the past, but it is not known if this is a trend or a temporary result of dry weather.
40. Water Dependant Pressure- point source pollution	Caravan site above now permanently closed so this source has disappeared.
41. Plant pests and diseases: <i>Phytophthora ramorum/kernoviae</i> on Blaeberry of heathland and woodland habitats	
42. Plant pests and diseases: <i>Phytophthora austrocedrae</i> on Juniper (Juniper dieback)	
43. Plant pests and diseases: <i>Dothistroma septosporum</i> on conifers (Dothistroma needle blight, or Red-band needle blight)	
44. Plant pests and diseases: <i>Phytophthora ramorum/kernoviae</i> on Rhododendron, Larch http://tinyurl.com/d6wbe8a , other hosts	
45. Plant pests and diseases: Alder dieback (Including <i>Phytophthora alni</i> and other causes)	
46. Plant pests and diseases: Heather beetle	
47. Plant pests and diseases: Other/unidentified suspected pest/pathogen	

3.5 Condition assessment

Favourable	Maintained	X
	Recovered	
	Declining	
Unfavourable	Recovering	
	No change	
	Declining	
Destroyed	Partially destroyed (Area in hectares)	
	Totally destroyed	

3.6 Management notes

The numbers of thalli of *Petalophyllum ralfsii* continued their downward trend, from a peak of 22500+ 1998 to the estimate of just 578 in September 2014. However, Rothero (2009) reports that a sample survey by Genney in February 2008 found many more thalli than in the SCM survey, and a repeat visit by Rothero and Genney in February 2009 gave an estimate of numbers greater than in September but less than in February 2008. Similarly, a visit by Hodgetts and Genney in March 2015 revealed an increase, due to the exposure of a large 'hidden' population at Plot 12. Natural dune dynamics are clearly an important feature of this site, and have a profound effect on the numbers of *P. ralfsii* seen at any one time. It is possible

that it is much more important than the grazing regime, although continued sheep grazing is desirable. Therefore, so long as the dune system continues to exist, be dynamic, and the grazing regime and water regimes are more or less as they are at present, it may be that the best response is to assess the site as **Favourable – maintained**. However, the apparent overall decline since monitoring began is perhaps still a cause for concern, and monitoring needs to continue. The rare *Bryum* species are probably at about the same level as in previous years, but it is very difficult to be sure. *B. salinum* was not recorded this time, but it is probably still here somewhere. There continues to be a healthy population of *Moerckia flotoviana*.

The caravan site above the dunes has now closed, but there is still some (residual?) eutrophication, apparent in the lush green growth in the lower, wetter parts of Burns 3, 4 and 6. However, much will depend on what use is made of the land once the caravans have gone. Rothero (2009) speculated that the crust observed on some areas of open sand and described in his (and this) report as ‘marly’, ie due to lime deposits, may in fact have an algal origin due in part to some degree of eutrophication. Whatever its origin, this crust over the sand seems to preclude the occurrence of both *Petalophyllum ralfsii* and the *Bryum* species. The ‘marly’ crust is still evident in several parts of the site.



Figure 42. March 2015. A flock of sheep were grazing the site, which was also well used by walkers and dog walkers during the monitoring visit.

3.7 Site check recommendations

The following indicators of favourable condition could be checked during a quick survey by a non-specialist.

- Open damp sandy soil present in good amounts, with plenty of bare ground and thin mats of small bryophytes; NOT dense turfs of grasses and sedges
- Margins of burns and flushes with good and varied bryophyte cover and a wet spongy surface, but not exclusively *Calliergonella cuspidata*
- The continuing presence of ‘marly’ surfaces in slacks is a negative indicator, as this is unsuitable for the rare bryophytes
- Burns flowing as normal and with good water quality

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ANNEX 1: SPECIES INVENTORY

Species	Conservation/oceanic status
<i>Amblyodon dealbatus</i>	Least Concern/Nationally Scarce
<i>Amblystegium serpens</i>	Least Concern
<i>Aneura pinguis</i>	Least Concern
<i>Barbula convoluta</i>	Least Concern
<i>Brachythecium albicans</i>	Least Concern
<i>Brachythecium glareosum</i>	Least Concern
<i>Brachythecium rivulare</i>	Least Concern
<i>Bryoerythrophyllum recurvirostrum</i>	Least Concern
<i>Bryum algovicum</i> var. <i>rutheanum</i>	Least Concern
<i>Bryum argenteum</i>	Least Concern
<i>Bryum calophyllum</i>	Vulnerable
<i>Bryum capillare</i>	Least Concern
<i>Bryum dichotomum</i>	Least Concern
<i>Bryum knowltonii</i>	Vulnerable
<i>Bryum pallens</i>	Least Concern
<i>Bryum pseudotriquetrum</i>	Least Concern
<i>Bryum warneum</i>	Near Threatened/Nationally Scarce
<i>Calliergonella cuspidata</i>	Least Concern
<i>Campyliadelphus chrysophyllus</i>	Least Concern
<i>Campylium protensum</i>	Least Concern
<i>Campylium stellatum</i>	Least Concern
<i>Ceratodon purpureus</i>	Least Concern
<i>Climacium dendroides</i>	Least Concern
<i>Cratoneuron filicinum</i>	Least Concern
<i>Ctenidium molluscum</i>	Least Concern
<i>Dichodontium pellucidum</i>	Least Concern
<i>Dicranella varia</i>	Least Concern
<i>Dicranum scoparium</i>	Least Concern
<i>Didymodon fallax</i>	Least Concern
<i>Didymodon insularis</i>	Least Concern
<i>Didymodon spadiceus</i>	Least Concern
<i>Didymodon tophaceus</i>	Least Concern
<i>Distichium inclinatum</i>	Least Concern/Nationally Scarce
<i>Ditrichum gracile</i>	Least Concern
<i>Drepanocladus polygamus</i>	Least Concern
<i>Encalypta streptocarpa</i>	Least Concern
<i>Entodon concinnus</i>	Least Concern
<i>Fissidens adianthoides</i>	Least Concern
<i>Fissidens dubius</i>	Least Concern
<i>Fissidens osmundoides</i>	Least Concern
<i>Fossombronia</i> sp.	Least Concern
<i>Homalothecium lutescens</i>	Least Concern
<i>Hylocomium splendens</i>	Least Concern
<i>Hypnum cupressiforme</i> var. <i>cupressiforme</i>	Least Concern
<i>Hypnum cupressiforme</i> var. <i>lacunosum</i>	Least Concern
<i>Isothecium myosuroides</i>	Least Concern
<i>Kindbergia praelonga</i>	Least Concern
<i>Leiocolea badensis</i>	Least Concern
<i>Lophocolea bidentata</i>	Least Concern
<i>Mnium hornum</i>	Least Concern
<i>Moerckia flotoviana</i>	Data Deficient
<i>Palustriella falcata</i>	Least Concern
<i>Pellia endiviifolia</i>	Least Concern

<i>Petalophyllum ralfsii</i>	Least Concern/Nationally Scarce, oceanic Mediterranean-Atlantic
<i>Philonotis calcarea</i>	Least Concern
<i>Philonotis fontana</i>	Least Concern
<i>Plagiomnium ellipticum</i>	Least Concern
<i>Plagiomnium undulatum</i>	Least Concern
<i>Pleurozium schreberi</i>	Least Concern
<i>Pohlia wahlenbergii</i>	Least Concern
<i>Preissia quadrata</i>	Least Concern
<i>Pseudoscleropodium purum</i>	Least Concern
<i>Rhytidiadelphus loreus</i>	Least Concern
<i>Rhytidiadelphus squarrosus</i>	Least Concern
<i>Rhytidiadelphus triquetrus</i>	Least Concern
<i>Riccardia chamedryfolia</i>	Least Concern, Western British
<i>Scorpidium revolvens</i>	Least Concern
<i>Syntrichia ruralis</i> var. <i>ruraliformis</i>	Least Concern
<i>Thuidium delicatulum</i>	Least Concern, Western British
<i>Thuidium philibertii</i>	Least Concern
<i>Thuidium tamariscinum</i>	Least Concern
<i>Tortella flavovirens</i>	Least Concern
<i>Trichostomum brachydontium</i>	Least Concern
<i>Trichostomum crispulum</i>	Least Concern



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Great Glen House, Leachkin Road, Inverness, IV3 8NW
T: 01463 725000

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