Research Report No. 916

Third cycle Site Condition Monitoring report for bryological interest – Craig Leek SSSI

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RESEARCH REPORT

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SCM Reports

This report was commissioned by NatureScot as part of the Site Condition Monitoring (SCM) programme to assess the condition of special features (habitats, species populations or earth science interests) on protected areas in Scotland (Sites of Special Scientific Interest, Special Areas of Conservation, Special Protection Areas and Ramsar). SCM is our rolling programme to monitor the condition of special features on protected areas, their management and wider environmental factors which contribute to their condition.

The views expressed in the report are those of the contractor concerned and have been used by NatureScot staff to inform the condition assessment for the individual special features. Where the report recommends a particular condition for an individual feature, this is taken into account in the assessment process, but may not be the final condition assessment of the feature. Wider factors, which would not necessarily be known to the contractor at the time of the monitoring, are taken into consideration by our staff in making final condition assessments.

RESEARCH REPORT

Summary

Third cycle Site Condition Monitoring report for bryological interest – Craig Leek SSSI

Research Report No. 916
Project No: 113952
Contractor: Des Callaghan
Year of publication: 2020

Keywords

Craig Leek, bryophytes, monitoring, *Tortula leucostoma, Athalamia hyaline*

Background

This report provides a third assessment of the condition of the bryophyte interest of Craig Leek SSSI. A thorough introduction to the bryophyte interest of the site is provided by the previous two assessments (Rothero 1999, 2009), plus an additional survey (Rothero, 2006).

Main findings

- Craig Leek continues to be a very rich site for bryophytes, with 166 species found during the present survey. Additions to the site list include eight Nationally Scarce (*Amphidium lapponicum, Bryum elegans, Encalypta ciliata, Jungermannia borealis, Racomitrium canescens, Schistidium robustum, Schistidium trichodon* and *Tortella bambergeri*) and three Nationally Rare (*Dicranella grevilleana, Eurhynchiastrum pulchellum* and *Schistidium papillosum*). Other notable species no doubt await discovery.
- The two most important species at Craig Leek are *Tortula leucostoma* and *Athalamia hyalina*. The former was again not found and the population of the latter has undergone a significant decline in the monitoring plots.
- Open soil, especially thin soil over limestone exposures, is a key niche for many of the species of conservation importance, including *Tortula leucostoma* and *Athalamia hyalina*. Photographs of monitoring plots clearly indicate that this habitat continues to decline across the site as a result of vegetation succession. Available evidence strongly suggests that the cause is under grazing.
- The site condition is again judged to be 'Unfavourable – Declining'.

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Acknowledgements

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1. INTRODUCTION

This report provides a third assessment of the condition of the bryophyte interest of Craig Leek SSSI. A thorough introduction to the bryophyte interest of the site is provided by the previous two assessments (Rothero 1999, 2009), plus an additional survey (Rothero, 2006).

Taxonomy follows Hill *et al.* (2008) and the inclusion of species within the following lists and categories is noted as appropriate: (i) Annex II of the Habitats Directive; (ii) priority species under the Natural Environment and Rural Communities Act 2006; (iii) Schedule 8 of the Wildlife and Countryside Act 1981 (as amended); (iv) UK Red List (Hodgetts, 2011); (v) Nationally Rare (Preston, 2010); (vi) Nationally Scarce (Preston, 2006); (vii) Atlantic, Sub-Atlantic and Western British (Ratcliffe, 1968); and (viii) Hyper-oceanic and Oceanic (Hill and Preston, 1998).

2. METHODS

Field surveying was undertaken over three days (20-22 May 2015), following the routes shown in Figure 2.1. All monitoring plots established by Rothero (2006) were revisited and their current condition was assessed, including the collection of photographs. A list of the species seen within the site was also compiled. Weather conditions were good throughout.

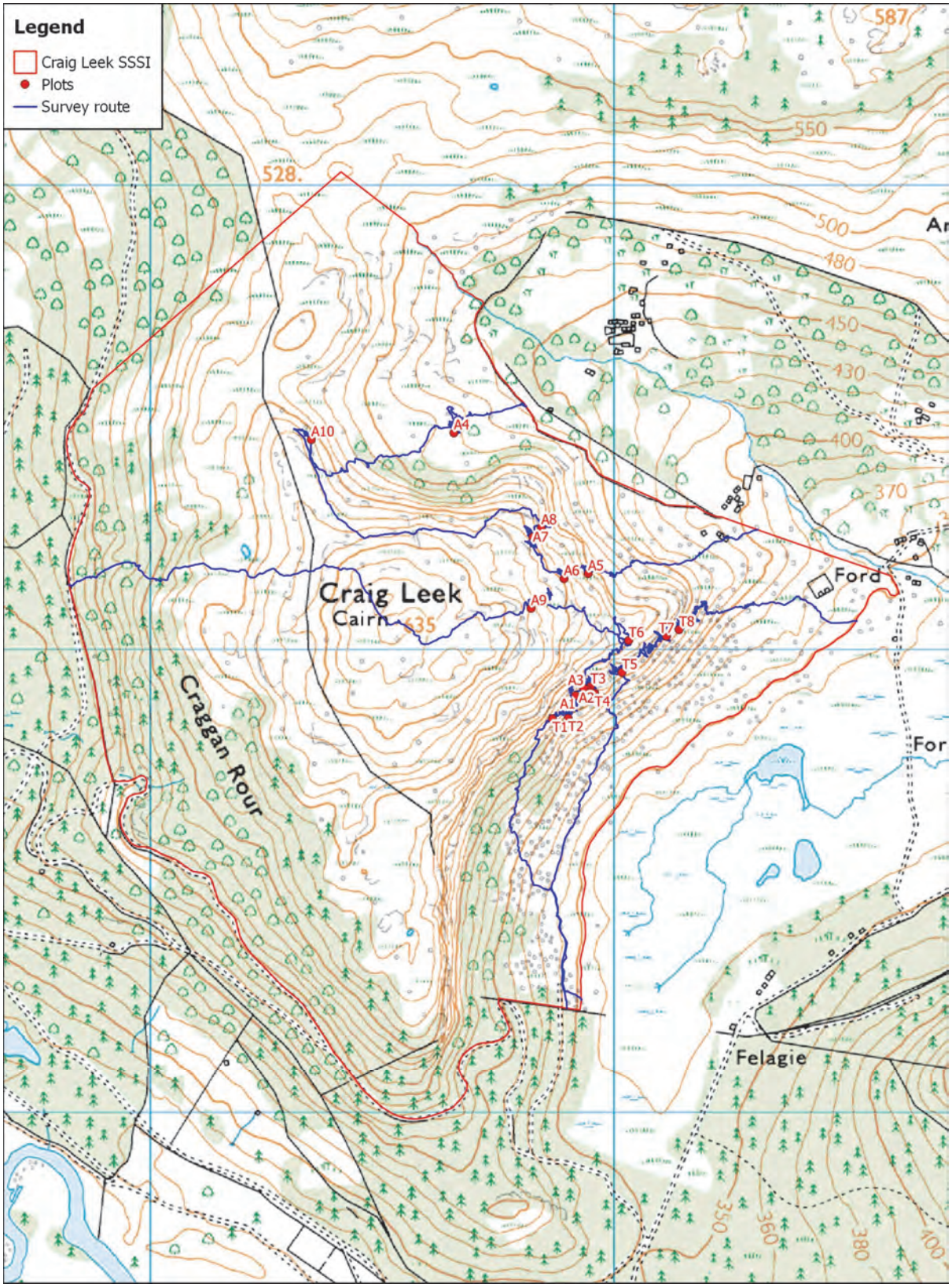

Figure 2.1. Location of monitoring plots and survey route. Based upon Ordnance Survey material with the permission of the Controller of HMSO © Crown copyright (2016) Licence no. 100017908.

3. RESULTS AND DISCUSSION

3.1 Species inventory

A total of 166 species were found (Annex 1), of which 22 were either Nationally Rare or Nationally Scarce (Table 1). GPS locations collected for some of the more notable species are provided in Annex 2. All species records will be submitted to the national recording database of the British Bryological Society (BBS), managed by BRC Wallingford, and will be subsequently uploaded to the NBN Gateway.

Table 1. Nationally rare and scarce bryophytes recorded during the present fieldwork.

Species	**UK hectads[1]**	**UK Red List**	**National status**	**Craig Leek status**
Amphidium lapponicum	46		Nationally scarce	Noted at one location
Anomobryum concinnatum	56		Nationally scarce	Frequent on thin soil over limestone
Bryum elegans	28		Nationally scarce	Frequent on thin soil over limestone
Clevea hyalina	2	VU	Nationally rare	See main text
Dicranella grevilleana	8	VU	Nationally rare	Noted at one location, beside calcareous flush
Ditrichum flexicaule	66		Nationally scarce	Frequent on thin soil over limestone
Encalypta ciliata	50		Nationally scarce	Noted at one location, on thin soil over limestone
Eurhynchiastrum pulchellum	5	EN	Nationally rare	Noted at one location, on thin soil over limestone
Grimmia montana	20		Nationally scarce	Occasional on insolated, acidic rocks
Jungermannia borealis	23		Nationally scarce	Noted at two locations, on thin soil over limestone
Lophozia longidens	57		Nationally scarce	Seemingly frequent on the bases of birch trees in the western side of the site
Pseudoleskeella catenulata	22		Nationally scarce	Rare on limestone
Pterigynandrum filiforme	79		Nationally scarce	Scarce on limestone and trees
Pterygoneurum ovatum	25		Nationally scarce	Noted at one location, on thin soil over limestone
Racomitrium canescens	43		Nationally scarce	Scarce on limestone outcrops
Scapania gymnostomophila	12	NT	Nationally rare	Noted at two locations, on thin soil over limestone
Schistidium papillosum	21	NT	Nationally rare	Occasional on limestone
Schistidium robustum	44		Nationally scarce	Frequent on limestone

Schistidium trichodon	22		Nationally scarce	Noted at one location
Seligeria pusilla	69		Nationally scarce	Noted at three locations on shaded limestone
Stegonia latifolia	9	NT	Nationally rare	Occasional on thin soil over limestone
Tortella bambergeri	72		Nationally scarce	Frequent on tops of limestone boulders

[1]Number of UK hectads with records during 1990-2014.

A number of new species were added to the site list, including eight Nationally Scarce (*Amphidium lapponicum, Bryum elegans, Encalypta ciliata, Jungermannia borealis, Racomitrium canescens, Schistidium robustum, Schistidium trichodon* and *Tortella bambergeri*) and three Nationally Rare (*Dicranella grevilleana, Eurhynchiastrum pulchellum* and *Schistidium papillosum*). The most notable addition is *Eurhynchiastrum pulchellum*, a very rare plant in Britain recorded in only five hectads during 1990-2014, all in Scotland and with a concentration on Skye (Blockeel *et al*., 2014). The distribution of OS 10 m grid cells found to be occupied by *Athalamia hyalina* (*n*=16) is shown in the following figure.

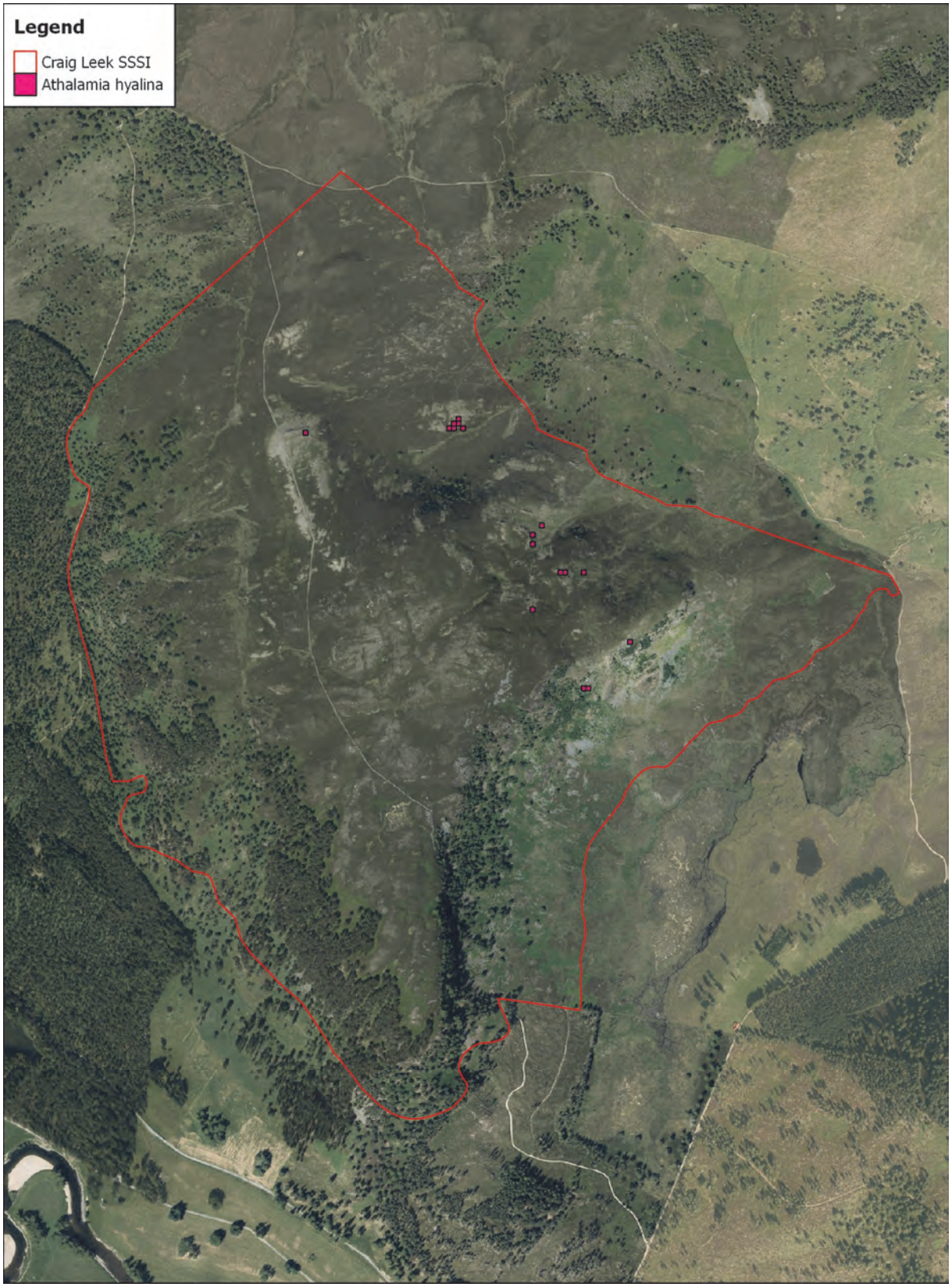

Figure 3.1. Distribution of OS 10 m grid cells occupied by Athalamia hyalina *in 2015.*

3.2 Monitoring plots

3.2.1 Plot T1

Grid reference: NO18867.92849
Species: *Tortula leucostoma*
2005: Two areas with scattered stems (seven stems and nine stems).
2009: Not refound.
2015: Figure 3.2. Not refound. Vegetation structure significantly different to October 2005, with grassier field layer and greater birch scrub. Rock falls have also altered the terrain. No exposed soil habitat that would be suitable habitat for *Tortula leucostoma*.

Figure 3.3. Plot T1 on 21 May 2015. Scene matches Photo 1.1 of Rothero (2006).

3.2.2 Plot T2

Grid reference: NO18901.92850
Species: *Tortula leucostoma*
2005: A tiny stand of approximately 10 stems.
2009: Not refound.
2015: Figure 3.3 and 3.4. Not refound. Vegetation structure significantly different to October 2005, with grassier field layer and greater birch scrub, plus associated litter. Very little exposed soil habitat that would be suitable habitat for *Tortula leucostoma*.

Figure 3.4. Plot T2 on 21 May 2015. Scene matches Photo 2.1 of Rothero (2006).

Figure 3.5. Plot T2 on 21 May 2015. Scene matches Photo 2.2 of Rothero (2006).

3.2.3 Plot T3

Grid reference: NO18949.92918
Species: *Tortula leucostoma*

2005: Upper patches: 45 stems and 30 stems. Lower patches: 34 stems and 36 stems.
2009: Not refound.
2015: Figure 3.5 and 3.6. Not refound. Grassier field layer than in October 2005 and associated reduction in suitable habitat for *Tortula leucostoma*, though frequent patches of exposed soil still present and notable ephemerals such as *Stegonia latifolia*.

Figure 3.6. Plot T3 on 21 May 2015. Scene matches Photo 3.1 of Rothero (2006).

Figure 3.7. Plot T3 on 21 May 2015. Scene matches Photo 3.2 of Rothero (2006).

3.2.4 Plot T4

Grid reference: Upper patches NO18958.92904; lower patches NO18958.92892
Species: *Tortula leucostoma*
2005: Upper patches: 45 stems and 30 stems. Lower patches: 34 stems and 36 stems.
2009: Not refound.
2015: Figure 3.7. Not refound. Vegetation and rock structure significantly different to October 2005, with grassier field layer and substantially different arrangement of boulder due to rock-falls from adjacent collapsing cliff. Little exposed soil habitat that would be suitable habitat for *Tortula leucostoma*.

Figure 3.8. Plot T4 on 21 May 2015. Scene matches Photo 4.1 of Rothero (2006). Boulder configuration is very different due to rock falls from unstable cliff above.

3.2.5 Plot T5

Grid reference: NO19017.92949
Species: *Tortula leucostoma*
2005: Approximately 45 stems scattered along the edge of the soil over the rock.
2009: Not refound.
2015: Figure 3.8. Not refound. Vegetation structure very different to October 2005, with much grassier field layer and, most notably, development of birch scrub. Suitable habitat for *Tortula leucostoma* has declined greatly. Two other notable ephemerals, *Stegonia latifolia* and *Microbryum curvicollum*, continue to survive on exposed soil patches scattered amongst the scrub.

Figure 3.9. Plot T5 on 20 May 2015. Scene matches Photo 5.1 of Rothero (2006).

3.2.6 Plot T6

Grid reference: NO19030.93016 (NB: this is the correct grid reference for this plot, which is 70 m SE of that given in Rothero 2006).
Species: *Tortula leucostoma*
2005: Two small patches, one of c.20 stems and the other of c.40.
2009: Not refound.
2015: Figure 3.9, 3.10 and 3.11. Not refound. Vegetation structure is different to October 2005, with a generally grassier field layer and early colonisation by scattered young birch which is progressing up slope. Plenty of apparently suitable habitat for *Tortula leucostoma* remains in the immediate vicinity, with ephemerals such as *T. lanceola* present, though seemingly less so than in 2005.

Figure 3.10. Plot T6 on 21 May 2015. Scene matches Photo 6.1 of Rothero (2006).

Figure 3.11. Plot T6 on 21 May 2015. Scene matches Photo 6.2 of Rothero (2006).

Figure 3.12. Plot T6 on 21 May 2015. Scene matches Photo 6.3 of Rothero (2006).

3.2.7 Plot T7

Grid reference: NO19113.93027
Species: *Tortula leucostoma*
2005: A tiny stand with c.10 stems.
2009: Not refound.
2015: Figure 3.12 and 3.13. Not refound. Vegetation structure is broadly similar to October 2005, though the frequency of suitable habitat for the moss appears to have reduced (i.e. less frequent exposed soil amongst rock crevices and greater frequency of grassy tussocks).

Figure 3.13. Plot T7 on 20 May 2015. Scene matches Photo 7.1 of Rothero (2006).

Figure 3.14. Plot T7 on 20 May 2015. Scene matches Photo 7.2 of Rothero (2006).

3.2.8 Plot T8

Grid reference: NO19140.93041
Species: *Tortula leucostoma*
2005: A tiny stand with just seven stems.
2009: Not refound.
2015: Figure 3.14 and 3.15. Not refound. Vegetation structure is broadly similar to October 2005, though the frequency of suitable habitat for the moss appears to have reduced (i.e. less frequent exposed soil amongst rock crevices and greater frequency of grassy tussocks).

Figure 3.15. Plot T8 on 20 May 2015. Scene matches Photo 8.1 of Rothero (2006).

Figure 3.16. Plot T8 on 20 May 2015. Scene matches Photo 8.3 of Rothero (2006).

3.2.9 Plot A1

Grid reference: NO18917.92899
Species: *Athalamia hyalina*
2005: One large and two smaller patches.
2009: No significant change.
2015: Population extinct. Vegetation structure is significantly different to October 2005, with the growth of tall birch scrub beside rock exposures that supported the plant. The area where colonies occurred has no suitable habitat, with coarser mosses now dominating and no exposed soil.

Figure 3.17. Plot A1 on 21 May 2015. Scene matches Photo A1.1 of Rothero (2006).

Figure 3.18. Plot A1 on 21 May 2015. Scene matches Photo A1.2 of Rothero (2006).

3.2.10 Plot A2

Grid reference: NO18941.92912
Species: *Athalamia hyalina*
2005: One large narrow broken patch and one much smaller patch, plus scattered scraps of thalli close by.
2009: No significant change.
2015: Figure 3.16 and 3.17. Present, but in much smaller quantity (just five thalli in one small patch). More competitive plants, including grasses, robust bryophytes and lichens, now dominate the area where the main colony occurred.

Figure 3.19. Plot A2 on 21 May 2015. Scene matches Photo A2.1 of Rothero (2006).

Figure 3.20. Plot A2 on 21 May 2015. Scene matches Photo A2.2 of Rothero (2006).

3.2.11 Plot A3

Grid reference: NO1893.9291
Species: *Athalamia hyalina*
2005: Broken but fairly contiguous patches in two areas giving a good stand size.
2009: No significant change.
2015: Shift in local distribution pattern, but seemingly similar population size (scattered over about 2 m x 1 m). Young birch saplings and grass cover have increased on adjacent ground, and there appears to be less exposed soil habitat overall.

Figure 3.21. Plot A3 on 21 May 2015. Scene matches Photo A3.1 of Rothero (2006).

3.2.12 Plot A4

Grid reference: NO1865.9346
Species: *Athalamia hyalina*
2005: By far the largest stand with 35 patches from 15cm diameter to large mats some 60 x 40cm plus scattered thalli close by the main patches.
2009: No significant change.
2015: Figure 3.220. Large population still present, but overall decline evident. Vegetation structure is similar to October 2005. Frost-heaving appears to be a key aspect of the plants niche at this location. About five additional small colonies were found above the crest of the crag pictured in the below images.

Figure 3.23. Plot A4 (upper area) on 22 May 2015. Scene matches Photos A4.2, A4.4 and A4.5 of Rothero (2006).

Figure 3.24. Plot A4 (lower area) on 22 May 2015. Scene matches Photos A4.2 and A4.3 of Rothero (2006).

3.2.13 Plot A5

Grid reference: Top – NO18938.93160; Middle – NO18944.93162; Bottom – NO18947.93150
Species: *Athalamia hyalina*
2005: 16 patches scattered over the crags with the largest in the more sheltered niches.
2009: No significant change.
2015: Figure 3.253 and 3.24. Significant decline, with only three small patches. Vegetation around crags appears to be grassier and the scattered young birch saplings seem to be new arrivals. Frost-heaving appears to be helping with the provision of suitable habitat for *A. hyalina*, causing significant fine-scale disturbance.

Figure 3.26. Plot A5 on 22 May 2015. Scene matches Photo A5.5 of Rothero (2006).

Figure 3.27. Plot A5 on 22 May 2015. Scene matches Photo A5.3 of Rothero (2006).

3.2.14 Plot A6

Grid reference: West patches: NO18892.93151; East patch: NO18904.93142
Species: *Athalamia hyalina*
2005: Nine patches in the western group, all small with most being 5cm or less in diameter. The eastern patch is larger, some 30cm x 10cm, with two smaller satellite patches.
2009: No significant change.
2015: Figure 3.285. Significant decline, with a total of five hand-sized patches. Vegetation around crags appears to be a little grassier and scattered young birch saplings seem to be new arrivals. Frost-heaving appears to be helping with the provision of suitable habitat for *A. hyalina*, causing significant fine-scale disturbance.

Figure 3.29. Plot A6 on 22 May 2015. Scene matches Photo A6.3 of Rothero (2006).

3.2.15 Plot A7

Grid reference: Lower crag NO18825.93240; Upper crag NO18816.93241
Species: *Athalamia hyalina*
2005: The lower crag has one very large patch, over 1m x 4m and directly below this a scrappy continuous patch some 30cm x 10cm. The other patches are small – to 8cm. The lower section of the upper crag has a complex area of large patches on its eastern edge with smaller patches further west. The upper crag central section has four large and four more moderate patches on a ledge that juts out plus a small patch on the crag and a larger one on soil of the terrace above. The upper crag top section has three small patches – to 8cm diameter.
2009: No significant change.
2015: Figure 3.306 to 3.30. Very large decline, with only two small patches on lower crag and one hand-sized patch in all of the upper area. Vegetation structure has changed since October 2005, with an increase in grass cover, appearance of frequent young birch saplings and reduction in exposed soil. Frost-heaving appears to be helping with the provision of suitable habitat for *A. hyalina*, causing significant fine-scale disturbance.

Figure 3.31. Plot A7 (lower crag) on 22 May 2015. Scene matches Photo A7.3 of Rothero (2006).

Figure 3.32. Plot A7 (upper crag) on 22 May 2015. No Athalamia hyalina*. Scene matches Photo A7.8 of Rothero (2006).*

Figure 3.33. Plot A7 (part of upper crag) on 22 May 2015. Two hand-sized patches of Athalamia hyalina*. Scene matches Photo A7.9 of Rothero (2006).*

Figure 3.34. Plot A7 (part of upper crag) on 22 May 2015. No Athalamia hyalina*. Scene matches Photo A7.11 of Rothero (2006).*

Figure 3.35. Plot A7 (upper crag) on 22 May 2015. No Athalamia hyalina*. Scene matches Photo A7.5 of Rothero (2006).*

3.2.16 Plot A8

Grid reference: NO18843.93260
Species: *Athalamia hyalina*
2005: The lower isolated patch is quite small at some 6cm in diameter. The main aggregation of Athalamia hyalina on the lower part of the east face of the nose could almost be regarded as one large complex patch with dense mats linked by scattered thalli. The biggest of the dense patches is 1.5m x 0.4m and there are others 40cm x 20cm and patches to 20cm diameter. Above this are further smaller patches. On the western facet the patches are smaller to 10cm but with two much larger mats.
2009: No significant change.
2015: Figure 3.31 and 3.32. Moderate decline. Main patch still present and scattered over 1 x 1 m, but smaller out-lying colonies apparently gone. Vegetation structure is broadly similar to October 2005, but seemingly with less exposed soil and more grass cover, plus scattered young birch. Frost-heaving appears to be helping with the provision of suitable habitat for *A. hyalina*, causing significant fine-scale disturbance.

Figure 3.36. Plot A8 (view from east side) on 22 May 2015. Scene matches Photo A8.6 of Rothero (2006).

Figure 3.37. Plot A8 (view from west side) on 22 May 2015. Scene matches Photo A8.4 of Rothero (2006).

3.2.17 Plot A9

Grid reference: NO18821.93087
Species: *Athalamia hyalina*
2005: A small broken patch of thalli some 15cm in diameter.
2009: No significant change.
2015: Figure 3.33, 3.34 and 3.35. No significant change. Vegetation structure is similar to October 2005 along the crag, but on the slope below there has been a significant decline in grassland and a corresponding increase in *Calluna* heath.

Figure 3.38. Plot A9 on 21 May 2015. Scene matches Photo A9.2 of Rothero (2006).

Figure 3.39. Plot A9 on 21 May 2015. Scene matches Photo A9.3 of Rothero (2006).

Figure 3.40. Plot A9 on 21 May 2015. Scene matches Photo A9.4 of Rothero (2006).

3.2.18 Plot A10

Grid reference: Eastern patch: NO18347.93450; western patch: NO18334.93460
Species: *Athalamia hyalina*
2005: Two small patches, both about 10cm in diameter.
2009: No significant change.
2015: Figure 3.36 and 3.37. Decline. Western patch lost due to rock slippage. Eastern patch still present. Vegetation structure is very similar to October 2005. Rock slippages have greatly altered the terrain in the eastern part of the plot.

Figure 3.41. Plot A10 (eastern) on 22 May 2015. Colony lost due to rock slippage. Scene matches Photo A10.5 of Rothero (2006).

Figure 3.42. Plot A10 (western) on 22 May 2015. Scene matches Photo A10.7 of Rothero (2006).

3.3 Additional photographic locations

3.3.1 Athalamia hyalina

Figure 3.43. New location for Athalamia hyalina *(NO19034.93019). Two hand-sized patches.*

Figure 3.44. New location for Athalamia hyalina *(NO18884.93165), close to Plot A6. One small patch.*

3.3.2 Schistidium trichodon

Figure 3.45. Location of Schistidium trichodon *(NO18688.93504).*

3.4 Site attributes and targets

Site: **Craig Leek SSSI**
Feature: Bryophyte assemblage
Report Category: Non-vascular plants
Site Feature ID: 15365

Visit Date: 20-22 May 2015

Guidance: CSM Guidance - Bryophytes & Lichens, JNCC
Guidance Version: July 2005
Attibute Set: Bryophyte assemblage: Basic montane cliffs (Special habitat 26)
Notes:

Attribute	Mandatory	Standard Target	Site-specific Target	Site-specific Method	Target Result	Target Met
No loss of important bryophyte species and communities	No	Presence of threatened species as outlined in site report			Most of the nationally rare and scarce species were refound and eleven further such species were added to the site list. However, *Tortula leucostoma* was again not found and its habitat has continued to decline.	No
		No significant change in important byrophytes in fixed quadrates/reference photos			A significant decline in *Athalamia* is evident and, as with the last monitoring visit, no plants of *Tortula leucostoma* were found	No
		Presence of indicator species outlined in site report			Indicator species of calcareous crags were present	Yes
Niche availability	Yes	No loss in area of rock outcrop			No loss of area of rock outcrop but further increase in shading from birch regeneration	No
Negative indicators: disturbance	Yes	No evidence of grazing (this is copied from previous assessment and is inappropriate for this site)	Moderate grazing pressure (new site-specific target)		Moderate grazing pressure appears to be essential for restoring and maintaining the bryophyte interest. There continues to be light deer	No

					grazing, but this is clearly insufficient, with continued loss of exposed soil habitat and expansion of grassy turf plus rapid development of birch scrub.	
		No obvious evidence of abrasion			No evidence of abrasion	Yes

Guidance: CSM Guidance - Bryophytes & Lichens, JNCC
Guidance Version: July 2005
Attibute Set: Bryophyte assemblage: Montane flushes (Special habitat 10)
Notes:

Attribute	Mandatory	Standard Target	Site-specific Target	Site-specific Method	Target Result	Target Met
No loss of important bryophyte species and communities	No	Presence of threatened species as outlined in site report			Most species of interest in flushes were seen and new important species were discovered	Yes
		No significant change in important byrophytes in fixed quadrates/refernce photos			no monitoring sites in the flushes	n/a
		Presence of indicator species outlined in site report			all indicator species present	Yes
Water quality	No	95% of montane flushes/springs running with cool clear water			All springs and flushes had clear running water	Yes
Water movement	No	All flushes and springs showing water movement			All flushes had water movement	Yes

Vegetation structure	No	No encroachment by scrub			No monitoring plots have been established in flushes and so this target is difficult to judge. However, the flushes appeared to be in good condition with little scrub associated.	Yes
		Some open areas present			Open stony flushes are locally frequent	Yes
Negative indicators: disturbance	No	All flushes or springs free from excessive trampling or poaching			No poaching or trampling seen	Yes

Guidance: CSM Guidance - Bryophytes & Lichens, JNCC
Guidance Version: July 2005
Attibute Set: Bryophyte assemblage: Scree (Special habitat 20)
Notes:

Attribute	Mandatory	Standard Target	Site-specific Target	Site-specific Method	Target Result	Target Met
No loss of important bryophyte species and communities	No	Presence of threatened species as outlined in site report			Most target species in the scree areas were seen	Yes
		No significant change in important byrophytes in fixed quadrates/refernce photos			No stands of Tortula leucostoma were found	No
		Presence of indicator species outlined in site report			All indicator species of the calcareous scree were seen	Yes

Niche availability	No	No loss of area of block scree supporting feature of interest			Further areas of scree are being colonised by birch and this has led to a decline in habitat quality, with corresponding declines in some important species	No
Negative indicators: fire	No	No evidence of burning			No evidence of recent burning	Yes
Negative indicators: disturbance	No	No disturbance observable in the form of abrasion or damage to the vegetation			No evidence of damage	Yes

3.5 Pressures

Pressures	Comments
1. Agricultural operations	
2. Burning	
3. Development with planning permission	
4. Dumping/spreading/storage of materials	
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	A large decline in the rabbit population was noted between 2005 and 2009. It hasn't recovered, with very little evidence of rabbits seen in 2015, limited to a few scattered burrows within the general region of Plot T6. The only other grazing appears to be low-level deer activity. As a result, vegetation succession has continued. Birch scrub and grassland cover (Molinia/Festuca) has increased at the expense of exposed soil habitat, the latter being a key niche for many of the notable species.
17. Inter-specific competition	
18. Maintenance activities carried on site by an organisation	
19. Mineral extraction	
20. Natural event	
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	
31. Statutory undertaker	
32. Tourism & recreation	
33. Trampling	
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	
40. Water Dependant Pressure- point source pollution	
41. Plant pests and diseases: *Phytophthora ramorum/kernoviae* on Blaeberry of heathland and woodland habitats	
42. Plant pests and diseases: *Phytophthora austrocedrae* on Juniper (Juniper dieback)	
43. Plant pests and diseases: *Dothistroma septosporum* on conifers *(*Dothistroma needle blight, or Red-band needle blight)	
44. Plant pests and diseases: *Phytophthora ramorum/kernoviae* on Rhododendron, Larch http://tinyurl.com/d6wbe8a, other hosts	
45. Plant pests and diseases: Alder dieback (Including *Phytophthora alni* and other causes)	
46. Plant pests and diseases: Heather beetle	
47. Plant pests and diseases: Other/unidentified suspected pest/pathogen	

3.6 Condition assessment

Unfavourable – Declining.

3.7 Management notes

Open soil, especially thin soil over limestone exposures, is a key niche for many of the species of conservation importance, including *Tortula leucostoma* and *Athalamia hyalina*. Photographs of monitoring plots clearly indicate that this habitat continues to decline across the site as a result of vegetation succession, though frost-heaving helps to maintain the niche in some plots. During the previous bryophyte condition assessment, Rothero (2009) noted the rapid development of birch scrub and that the driver for this change must be the reduction in grazing, the most obvious difference since 1996 being the lack of rabbits. During the present survey grazing appeared to be limited to a very small and isolated rabbit population plus light deer grazing. It seems that restoring, or at least maintaining, the frequency of open soil, and hence the key bryophyte interest, requires a significant increase in grazing animals. The hand-clearance of scrub, without an improvement in grazing pressure, would not be a suitable management option.

3.8 Site check recommendations

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

- Plots A3-A8 and T3-T6 (i.e. ten plots in total), which supported the largest populations of *Tortula leucostoma* and *Athalamia hyalina* in 2005, possess frequent open soil exposures over limestone and no significant birch growth shading the rock outcrops.
- Evidence of moderate grazing pressure.
- Vegetation structure similar to reference photographs in Rothero (2006).

4. REFERENCES

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ANNEX 1: SPECIES INVENTORY

MARCHANTIOPHYTA
MARCHANTIALES
Cleveaceae
Clevea (Athalamia) hyalina
Marchantiaceae
Preissia quadrata
METZGERIALES
Aneuraceae
Aneura pinguis
Riccardia latifrons
Pelliaceae
Pellia endiviifolia
JUNGERMANNIALES
Lophoziaceae
Barbilophozia barbata
Barbilophozia floerkei
Barbilophozia hatcheri
Lophozia longidens
Lophozia sudetica
Leiocolea badensis
Leiocolea bantriensis
Leiocolea collaris
Tritomaria quinquedentata
Jungermanniaceae
Jungermannia borealis
Nardia scalaris
Gymnomitriaceae
Marsupella emarginata
Marsupella emarginata var. emarginata
Plagiochilaceae
Plagiochila porelloides
Scapaniaceae
Scapania aspera
Scapania compacta
Scapania gymnostomophila
Cephaloziellaceae
Cephaloziella divaricata
Cephaloziaceae
Cephalozia lunulifolia
Lepidoziaceae
Kurzia pauciflora
Calypogeiaceae
Calypogeia muelleriana
Radulaceae
Radula complanata
Frullaniaceae
Frullania tamarisci
BRYOPHYTA
SPHAGNALES
Sphagnaceae
Sphagnum denticulatum
Sphagnum capillifolium
Sphagnum contortum
Sphagnum cuspidatum
Sphagnum inundatum
Sphagnum papillosum
Sphagnum subnitens
Sphagnum subnitens subsp. subnitens
ANDREAEALES
Andreaeaceae
Andreaea rupestris
POLYTRICHALES
Polytrichaceae
Atrichum undulatum
Atrichum undulatum var. undulatum
Pogonatum urnigerum
Polytrichum commune
Polytrichum commune var. commune
Polytrichum formosum
Polytrichum piliferum
ENCALYPTALES
Encalyptaceae
Encalypta ciliata
Encalypta streptocarpa
Encalypta vulgaris
GRIMMIALES
Grimmiaceae
Grimmia funalis
Grimmia hartmanii
Grimmia montana
Grimmia pulvinata
Grimmia ramondii
Grimmia trichophylla
Racomitrium aciculare
Racomitrium aquaticum
Racomitrium canescens
Racomitrium elongatum
Racomitrium ericoides
Racomitrium fasciculare
Racomitrium heterostichum
Racomitrium lanuginosum
Racomitrium sudeticum
Schistidium crassipilum
Schistidium papillosum
Schistidium robustum
Schistidium trichodon
Seligeriaceae
Blindia acuta
Seligeria pusilla
DICRANALES
Fissidentaceae
Fissidens dubius
Fissidens viridulus
Ditrichaceae
Ceratodon purpureus
Distichium capillaceum
Ditrichum flexicaule
Ditrichum gracile
Rhabdoweisiaceae
Amphidium lapponicum

Amphidium mougeotii
Dichodontium pellucidum
Kiaeria blyttii
Rhabdoweisia fugax
Dicranaceae
Dicranella grevilleana
Dicranella varia
Dicranum fuscescens
Dicranum scoparium
Leucobryaceae
Campylopus flexuosus
Campylopus introflexus
POTTIALES
Pottiaceae
Gymnostomum aeruginosum
Hymenostylium recurvirostrum
Hymenostylium recurvirostrum var. recurvirostrum
Tortella bambergeri
Tortella tortuosa
Trichostomum brachydontium
Trichostomum crispulum
Weissia brachycarpa
Weissia brachycarpa var. obliqua
Weissia controversa
Weissia controversa var. controversa
Barbula unguiculata
Bryoerythrophyllum ferruginascens
Bryoerythrophyllum recurvirostrum
Didymodon fallax
Didymodon ferrugineus
Didymodon insulanus
Didymodon rigidulus
Microbryum curvicollum
Pseudocrossidium hornschuchianum
Pseudocrossidium revolutum
Pterygoneurum ovatum
Stegonia latifolia
Syntrichia ruralis
Syntrichia ruralis var. ruralis
Tortula lanceola
Tortula subulata
ORTHOTRICHALES
Orthotrichaceae
Orthotrichum affine
Orthotrichum rupestre
Orthotrichum stramineum
Orthotrichum striatum
HEDWIGIALES
Hedwigiaceae
Hedwigia stellata
BRYALES
Bartramiaceae
Bartramia ithyphylla
Philonotis fontana
Bryaceae
Anomobryum concinnatum
Bryum alpinum

Bryum archangelicum
Bryum capillare
Bryum elegans
Bryum pallens
Bryum pseudotriquetrum
Bryum rubens
Plagiobryum zieri
Mielichhoferiaceae
Pohlia cruda
Pohlia melanodon
Pohlia nutans
Mniaceae
Mnium hornum
Plagiomniaceae
Plagiomnium elatum
Aulacomniaceae
Aulacomnium palustre
HYPNALES
Amblystegiaceae
Amblystegium serpens
Amblystegium serpens var. serpens
Campylium protensum
Campylium stellatum
Cratoneuron filicinum
Hygrohypnum luridum
Palustriella commutata
Palustriella falcata
Sanionia uncinata
Calliergonaceae
Scorpidium cossonii
Scorpidium revolvens
Scorpidium scorpioides
Leskeaceae
Pseudoleskeella catenulata
Thuidiaceae
Thuidium tamariscinum
Brachytheciaceae
Pseudoscleropodium purum
Eurhynchium striatum
Kindbergia praelonga
Brachythecium rivulare
Eurhynchiastrum pulchellum
Homalothecium lutescens
Homalothecium sericeum
Hypnaceae
Calliergonella cuspidata
Ctenidium molluscum
Ctenidium molluscum var. molluscum
Hypnum andoi
Hypnum cupressiforme
Hypnum cupressiforme var. cupressiforme
Hypnum cupressiforme var. lacunosum
Hypnum jutlandicum
Ptilium crista-castrensis
Pterigynandraceae
Pterigynandrum filiforme
Hylocomiaceae
Hylocomium splendens

Pleurozium schreberi
Rhytidiadelphus loreus
Rhytidiadelphus squarrosus
Rhytidiadelphus triquetrus
Plagiotheciaceae
Orthothecium intricatum
Plagiothecium undulatum
Pseudotaxiphyllum elegans
Leucodontaceae

Leucodon sciuroides
Leucodon sciuroides var. sciuroides
Neckeraceae
Neckera complanata
Lembophyllaceae
Isothecium myosuroides
Isothecium myosuroides var. myosuroides
Anomodontaceae
Anomodon viticulosus

ANNEX 2: GPS LOCATIONS OF NOTABLE SPECIES

Species	GR
Anomobryum concinnatum	NO1917793065
Athalamia hyalina	NO1833493464
Athalamia hyalina	NO1864993475
Athalamia hyalina	NO1865393475
Athalamia hyalina	NO1865493480
Athalamia hyalina	NO1865593471
Athalamia hyalina	NO1865693475
Athalamia hyalina	NO1865793481
Athalamia hyalina	NO1866093481
Athalamia hyalina	NO1866293483
Athalamia hyalina	NO1866293485
Athalamia hyalina	NO1866493482
Athalamia hyalina	NO1866793487
Athalamia hyalina	NO1866793494
Athalamia hyalina	NO1867093479
Athalamia hyalina	NO1867693479
Athalamia hyalina	NO1882093225
Athalamia hyalina	NO1882293243
Athalamia hyalina	NO1882793226
Athalamia hyalina	NO1884393265
Athalamia hyalina	NO1884493268
Athalamia hyalina	NO1884493269
Athalamia hyalina	NO1888493165
Athalamia hyalina	NO1888893160
Athalamia hyalina	NO1889293162
Athalamia hyalina	NO1903493019
Athalamia hyalina	NO1894192912
Athalamia hyalina	NO1893092910
Athalamia hyalina	NO1893893160
Athalamia hyalina	NO1882193087
Eurhynchiastrum pulchellum	NO1893792916
Grimmia montana	NO1885192836

Species	GR
Grimmia montana	NO1919793088
Jungermannia borealis	NO1903493019
Jungermannia borealis	NO1914093041
Kiaeria blyttii	NO1899493165
Microbryum curvicollum	NO1898292975
Microbryum curvicollum	NO1901892954
Pseudoleskeella catenulata	NO1910193022
Pterigynandrum filiforme	NO1894292912
Pterygoneurum ovatum	NO1910793031
Racomitrium canescens	NO1906692995
Scapania gymnostomophila	NO1903493019
Schistidium papillosum	NO1917893086
Schistidium trichodon	NO1868893504
Seligeria pusilla	NO1891792904
Seligeria pusilla	NO1919893099
Stegonia latifolia	NO1893792922
Stegonia latifolia	NO1894692925
Stegonia latifolia	NO1894692931
Stegonia latifolia	NO1896393177
Stegonia latifolia	NO1900392959
Stegonia latifolia	NO1901892954
Stegonia latifolia	NO1905192984
Stegonia latifolia	NO1907392991
Stegonia latifolia	NO1908993006
Stegonia latifolia	NO1909993021
Stegonia latifolia	NO1910393025
Stegonia latifolia	NO1910593026
Stegonia latifolia	NO1910893035
Stegonia latifolia	NO1910993031
Stegonia latifolia	NO1894992918
Tortella bambergeri	NO1943493089

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