

Evaluation of Organic Bracken Control on Archaeological Features at Ingram Farm, Ingram, Northumberland

Project Report – Year 4



View over Ingram Farm looking North East from Plots 5 and 6.

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Executive Summary

This document reports on the findings from a one year project extension of the Ingram Farm Bracken Project, funded by English Heritage and undertaken by Archaeological Research Services Ltd. The first three years of this project were funded by Natural England as part of a Higher Level Stewardship Agreement. The principal aim of the project has been the assessment, by controlled experiment, of non-chemical techniques of bracken control, including assessment of their physical impact and cost effectiveness. This information will be used to inform the future conservation management of archaeological remains on farmland in HLS and the new Countryside Stewardship scheme, and the payments made to farmers for bracken control. It will also inform future English Heritage advice on bracken management.

The experiment was set up at Ingram Farm in the Cheviot Hills in Northumberland, an area where extensive bracken stands have developed since grazing pressure was reduced, and where these are now thought to be causing significant damage to archaeological features. It used a split plot design to assess the impact of two stocking treatments and two mechanical methods of bracken control, with controls for both and two replicates of each treatment combination. Six plots of bracken-dominated vegetation, each 1 ha in size, were set out in spring 2011. They were positioned on site to take account of local factors such as the shape of the ground, the slope, the size of the areas available and the coverage of bracken. The plots were each divided into three sub-plots. After baseline recording in July 2011 the treatments were applied and monitoring carried out in July 2012 and July 2013. This initial three-year project was extended for a further year, with monitoring in July 2014, in order to continue monitoring the effects of differing bracken treatment options, whilst the project partners developed a proposal for a another phase of works.

All the plots were open to low intensity hill grazing by cattle and sheep. Two were fenced in order to pen large numbers of sheep for short periods. Another two were used for cattle foddering, while the remaining two were left with no stock treatment. Within each plot, the bracken in one sub-plot was cut in August each year, and in another sub-plot it was bashed. The third sub-plot was left with no mechanical treatment to act as a control. The objective of all the treatments was to reduce the density and vigour of the bracken and promote the development of a grassy sward that might be less damaging to the underlying archaeology.

A grid of nine partly-buried stones was set out in each sub-plot and the movement of the stones has been monitored year -on-year. The results suggest that the stocking regime has more of an impact on the archaeology than either of the mechanical bracken treatments, and that the intensive trampling treatments did significant and rapid damage. Cattle trampling was the most destructive. The mechanical treatments actually appear to decrease disturbance to the stone grids, presumably by increasing grass growth around the stones which can act as an anchor to hold the remains in-situ. Bracken cutting appeared to cause the least disturbance to the stone grids, however, this was not a statistically significant result. During the course of the study, however, a flail mower hit an upstanding boulder during the bracken cutting, smashing a large fragment of stone off the boulder and causing damage to the machinery. The presence of upstanding stone features (i.e. on settlement sites or where there are shaped stone features) therefore needs to be taken into account when making judgements as to whether cutting is an appropriate treatment.

Monitoring of the vegetation, by quadrat recording and other measurements, was carried out prior to treatment and again in July 2012, 2013 and 2014. The results after just two years of treatment were presented in the report dated December 2013, but further time was needed to detect a consistent vegetation response so this aspect of the recording was repeated in 2014. Three years is too short a time to detect long term ecological responses, but the results so far, after three years of treatment, suggest that both the stocking treatments have been unsuccessful as methods of bracken control, but that cutting, and to a lesser extent bashing, have had a significant impact on the bracken stands at Ingram Farm. Sheep penning in particular should be avoided as a treatment as it results in increased bracken growth and a loss of species richness.

The stone movement data also leads to the conclusion that normal hill grazing in combination with bracken cutting is the best option for organic bracken control. However, further monitoring is needed to determine how long this annual treatment would have to be continued to have a long term effect. Until the number of living

bracken shoots declines as well as their eventual cover and height, the effect of the treatment may be very short term and the bracken would soon recover if they ceased.

A new water supply for Ingram Farm was installed within the area used for the sheep stocking treatment in June/July 2014. The sheep stocking treatment has not been carried out since installation. Should a new phase of works be devised, this will need to address the issue of the sheep stocking treatment and the break in continuous data collection that will be caused.

1. INTRODUCTION, AIMS AND OBJECTIVES

1.1 The principal aim of the project has been the assessment, by controlled experiment, of non-chemical techniques of bracken control. This has included assessment of their physical impact and cost effectiveness. This information will be used to inform the future conservation management of archaeological remains on farmland in HLS and the payments made to farmers for bracken control. This evidence base will enable farmers and Natural England to fund and undertake the most efficient and effective bracken control methods, funded correctly, and with an understanding of their potential impacts both ecologically and archaeologically.

The experiment has monitored:

- effectiveness of each technique or combination of techniques.
- ecological impact of each technique or combination of techniques.
- cost of each technique or combination of techniques.
- archaeological impact of each technique or combination of techniques.

1.2 The preliminary results of the Year 1-3 archaeological and vegetation monitoring of treatment were presented in the final project report (Scott *et al* 2013). Following review of this report it was agreed that the treatments and monitoring should be extended for another year. This report details the results of the Year 4 monitoring exercise.

2. METHODS

2.1 Experiment Set-up

2.1.1 The experiment used a split plot design to assess the impact of two stocking treatments, intensive trampling by cattle and sheep, and two mechanical methods of bracken control, cutting and bashing, with controls for both and with two replicates of each treatment combination.

2.1.2 Six plots of bracken-dominated vegetation, each 1 ha in size, were set out in spring 2011 on Ewe Hill, Wether Hill, and on the slope above Fawdon Dean. They were positioned on site to take account of local factors such as the shape of the ground, the slope, the size of the areas available and the coverage of bracken (Figure 1). Wether Hill and Fawdon Dean are part of the same 190 ha grazing unit, but Ewe Hill is a separate stocking regime.

2.1.3 All the plots were open to low intensity hill grazing. Two were fenced so they could be used to pen large numbers of sheep for short periods. Another two were used for cattle foddering, while the remaining two were left with no stock treatment:

- Plots 1 and 2 on Ewe Hill - no stock treatment: open to hill grazing by Scottish Blackface sheep, at 1.91 ewe ha⁻¹ (in summer running with their lambs).
- Plots 3 and 4 on Wether Hill - sheep treatment: fenced to pen 50-150 ewes for 1-2 days at a time, approximately four times a year. Otherwise open to hill grazing by Scottish Blackface sheep, at 2.1 ewe ha⁻¹ (running with their lambs April-September), and in winter also by Aberdeen Angus cattle at 0.26 cattle ha⁻¹
- Plots 5 and 6 on Wether Hill above Fawdon Dean - cattle treatment: used for cattle foddering December-March, with two round bales of hay put out each day in the upper part, where the ground is flatter and accessible from the track, and rolled out, to encourage the cattle to congregate in that area. Ring feeders were not used. Also open to

hill grazing by Scottish Blackface sheep, at 2.1 ewe ha⁻¹ (running with their lambs April-September), and in winter also by Aberdeen Angus cattle at 0.26 cattle ha⁻¹.

2.1.4 Each plot was divided into three sub-plots (Figures 2, 3 and 4). Within each plot, the bracken in one sub-plot was cut with a tractor-pulled topper in August each year, and in another sub-plot it was bashed with a quad-towed bracken basher, also in August each year. In Year 4 bashing was carried out twice. The third sub-plot was left with no mechanical treatment to act as a control. The objective of all the stocking and mechanical treatments was to reduce the density and vigour of the bracken and promote the replacement of a dense stand of bracken by a grassy sward that might be less damaging to the archaeology.

2.1.5 A Magellan MobileMapper CX with post-processing hardware kit has been used to set out all fixed survey points, as well as the plots and their sub-divisions. The plots have been located as depicted in Figure 1 and centred as close as possible to the original centroid coordinates shown in Table 1.

| Plot | X | Y |
|------|-------------|-------------|
| 1 | 400931.3542 | 615531.8305 |
| 2 | 401056.5918 | 615614.3868 |
| 3 | 401556.7323 | 615145.2590 |
| 4 | 401621.1609 | 614982.3543 |
| 5 | 401635.5135 | 614506.2958 |
| 6 | 401579.9704 | 614423.1396 |

Table 1. Centroid coordinates of Bracken Treatment Areas

2.1.6 Fencing and setting out: only the two plots subject to intensive sheep trampling were fenced. The fencing consisted of post and pig netting fencing with posts 3m apart and topped by a strand of barbed wire. There was a new gate in each of these plots to allow them to be opened to grazing with the rest of the fell. All other plots (and the divisions within the plots) were marked by posts at each corner of each sub-plot, a total of eight posts. All posts were driven to a maximum depth of 2 feet. All setting out of posts and survey pegs took care to avoid extant archaeological features and was supervised by a qualified archaeologist.

2.1.7 Ten fixed survey control stations, marked with standard survey ground markers, were set out during the Year 1 set up using GPS to locate them to real-world coordinates (Figures 2, 3 and 4). These survey stations were used to undertake all the Year 4 survey measurements of the archaeological control markers and transects. The coordinates of these stations are shown in the Table 2.

| Station | X | Y | Z |
|---------|------------|------------|---------|
| 1 | 400926.800 | 615564.500 | 208.580 |
| 2 | 401112.200 | 615519.300 | 174.380 |
| 3 | 401632.600 | 615017.800 | 247.280 |
| 4 | 401704.400 | 615063.600 | 226.710 |
| 5 | 401545.500 | 614445.200 | 272.870 |
| 6 | 401620.400 | 614391.700 | 249.840 |
| 7 | 401680.500 | 614826.000 | 249.890 |
| 8 | 401667.700 | 615117.600 | 230.160 |
| 9 | 401593.700 | 615213.900 | 220.600 |
| 10 | 401520.600 | 615196.200 | 231.990 |

Table 2. Coordinates of fixed survey stations.

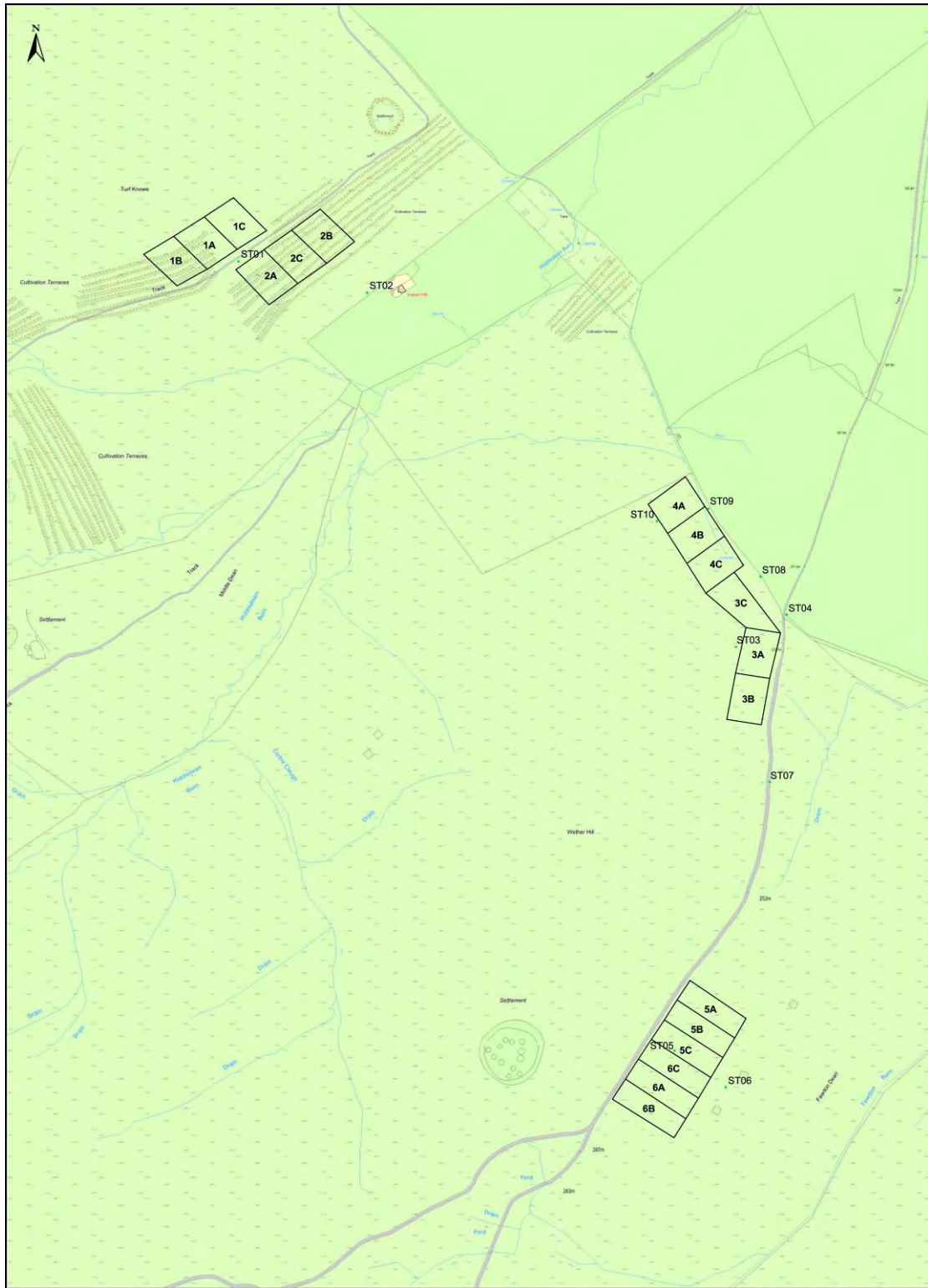


Figure 1: Site plan showing plots, sub-plots and station locations.

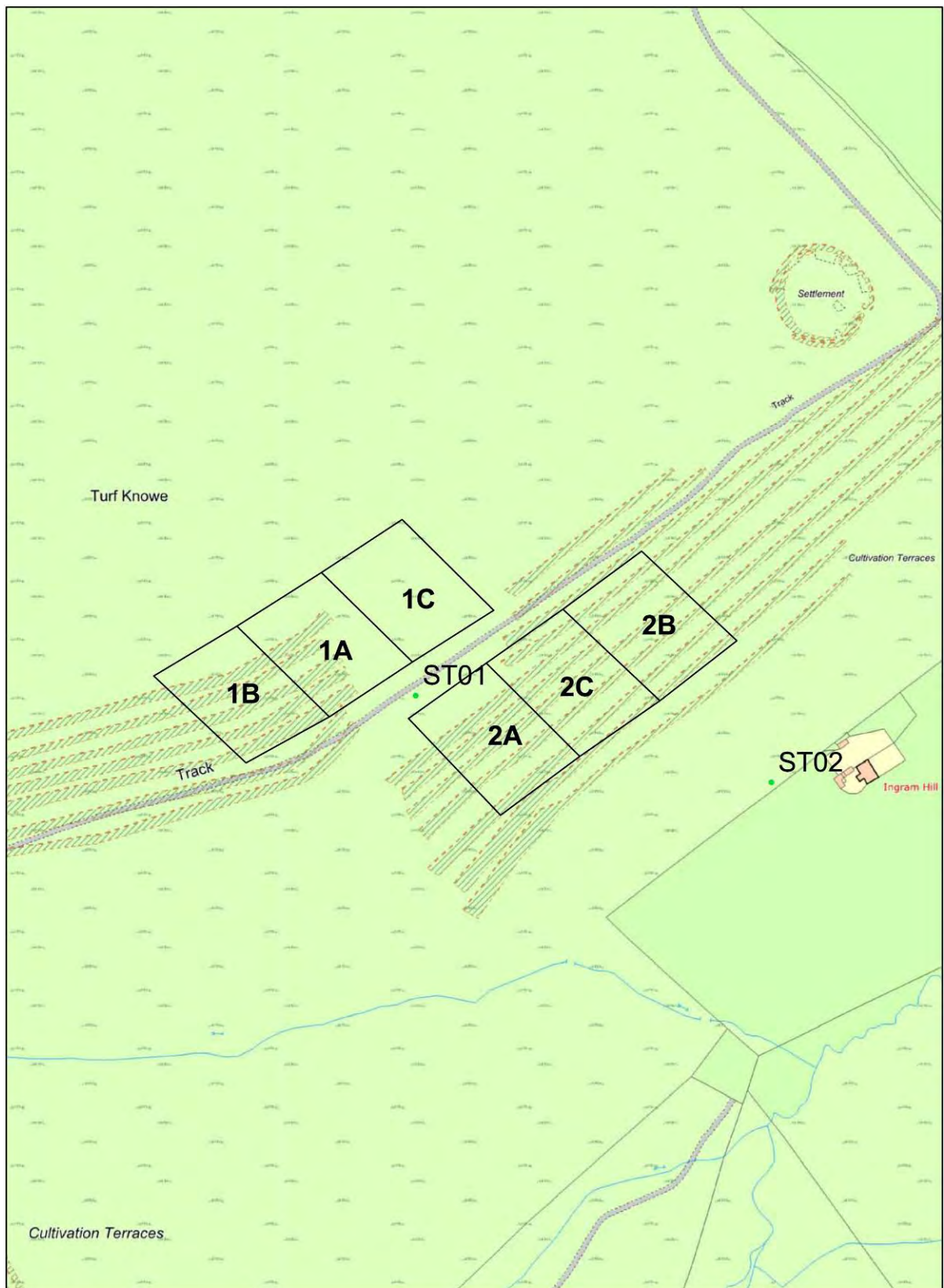


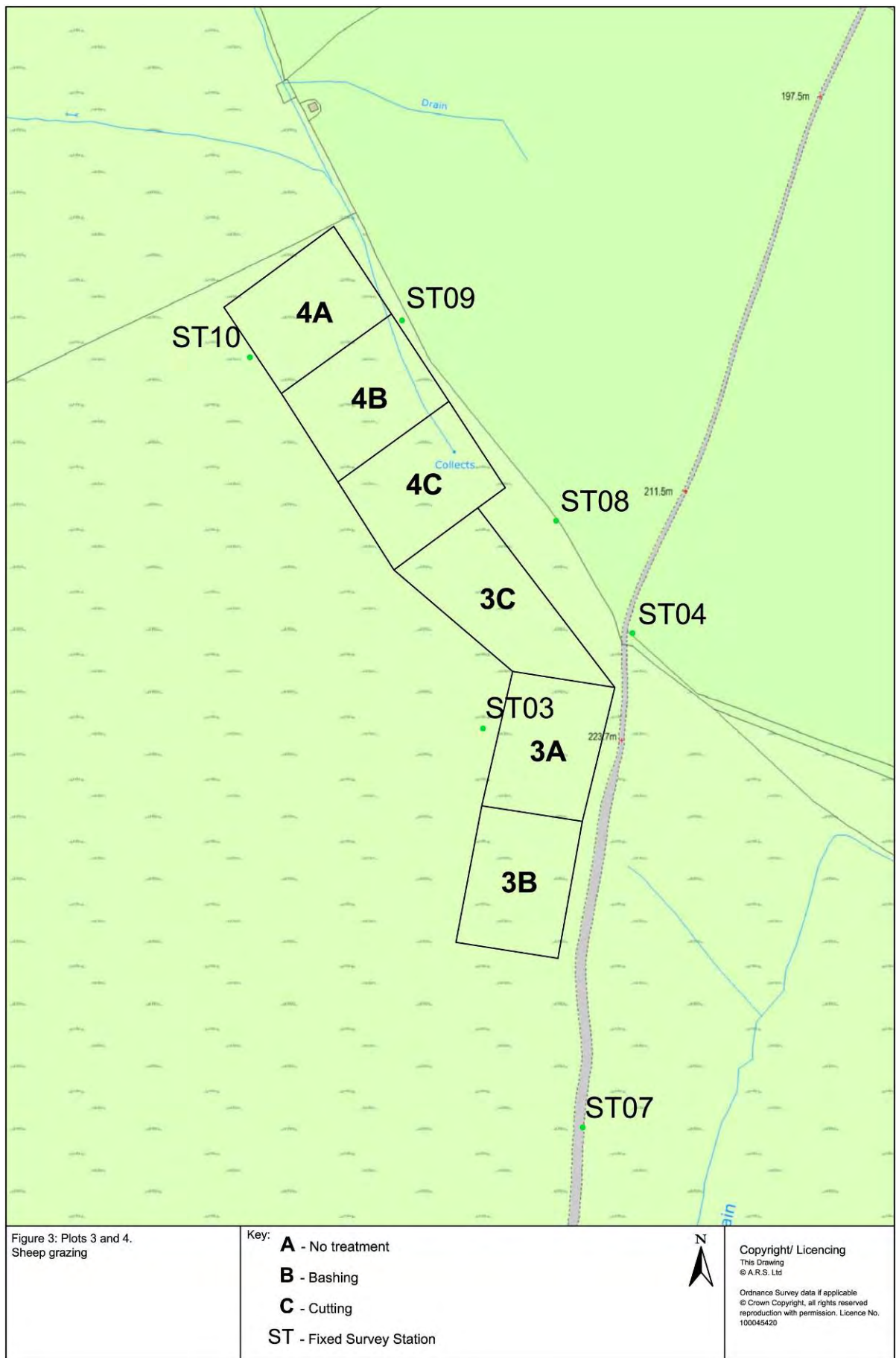
Figure 2: Plots 1 and 2.
No stock treatment

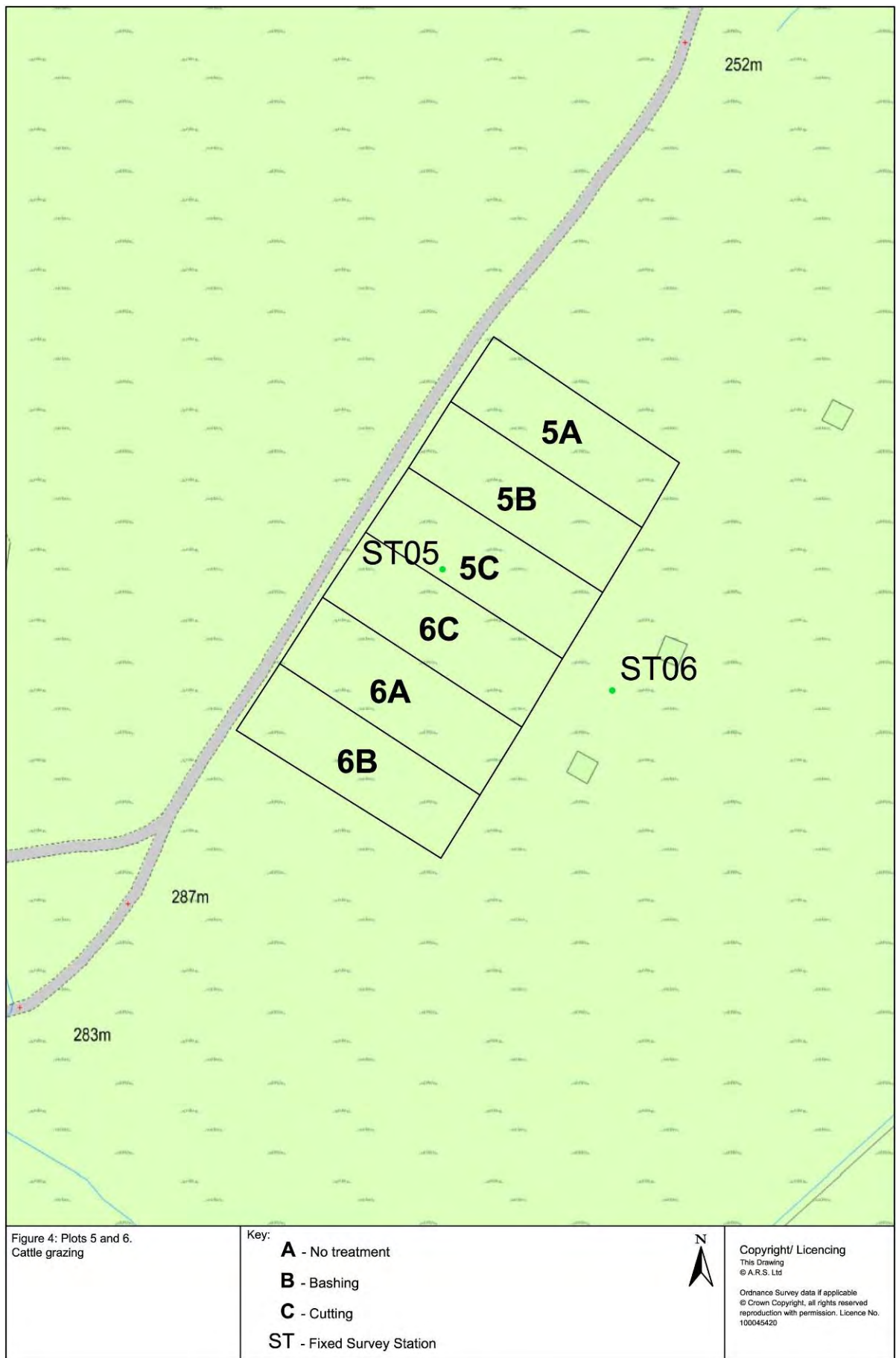
Key:

- A** - No treatment
- B** - Bashing
- C** - Cutting
- ST** - Fixed Survey Station



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2.2 Archaeological Measurements

2.2.1 In each of the three sub-divisions of each plot nine stones, each painted white, were placed in a grid, 1m apart, and buried in the ground during the Year 1 set up. The stone grids were intended to mimic buried archaeological features and the purpose of measuring their locations year on year was to be able to measure the effect that the various treatments had on their positions and condition. They were buried so that they protruded between 50 and 80 mm in a regular grid and their initial positions were surveyed by total station. The stones were roughly 200 mm by 100 mm in size and were buried in hand-dug pits using a small trowel by a qualified archaeologist. The pits were dug only large enough to accommodate the stone, and backfilled immediately with the spoil. The stones were brightly painted with white weather resistant paint and remained identifiably different to any in-situ stone (Figure 5).

2.2.2 The vegetation, within which the stone grids were sited at the start of the study, was as typical of the wider plots themselves as possible, and was as follows:

| Plot | Sub-plot | Vegetation |
|------|----------|------------------------------------|
| 1 | A | Dense bracken |
| 1 | B | Dense bracken |
| 1 | C | Medium bracken |
| 2 | A | Dense bracken |
| 2 | B | Thinner bracken with grassy spaces |
| 2 | C | Dense bracken |
| 3 | A | Dense bracken |
| 3 | B | Dense bracken |
| 3 | C | Dense bracken |
| 4 | A | Medium bracken |
| 4 | B | Dense bracken |
| 4 | C | Dense bracken |
| 5 | A | Medium bracken |
| 5 | B | Medium bracken |
| 5 | C | Medium bracken |
| 6 | A | Medium bracken |
| 6 | B | Medium bracken |
| 6 | C | Medium bracken |

Table 3: Description of bracken cover within each plot and sub-plot at the beginning of the experiment.



Figure 5: Stone Grid, photographed during the Year 1 set up (cleared partially to show stone positioning).

2.2.3 All datasets have been fully geo-referenced and integrated with ESRI ArcGIS software.

2.2.4 Following the survey, a statistical analysis of the level of movement within the stone grids was conducted. The method employed for the statistical analysis involved measuring the distance moved by each stone within each sub-plot using the survey data obtained in the field. As the individual stones were not numbered, the shortest possible distance moved was taken as the measurement of stone movement.

2.2.5 For those stones that could not be located at the time of survey, a representative value of stone movement was used. This was set at 2m which was considered to be a reasonable distance at which the stones could be lost amongst the bracken.

2.2.6 One of the stone grids, in Plot 4A, was damaged by a quad bike in Year 1, so for this plot the equivalent value from Plot 3A is used instead.

2.2.7 Due to the fact that the stones were not individually marked, it was not possible to track the movement of each stone. As a result, the stones were assumed to have moved the shortest distance, and measurements were taken accordingly.

2.2.8 This data was analysed by split plot ANOVA of the total distance moved over three years for each grid.

2.3 Vegetation monitoring methods

2.3.1 *Sampling strategy*

2.3.1.1 The vegetation in the plots was examined as soon as they were set up in 2011, and then recorded in detail in the baseline (Year 1) recording. Significant variation between plots,

within plots and even within sub-plots was apparent, and this had to be taken into account in designing the sampling strategy and data analysis. The variation is described in detail in section 3.2.

2.3.1.2 Five 1x1m quadrats were recorded within each sub-plot. It is good practice in vegetation recording to record at three or more random positions, but that approach is only valid within a homogenous stand. In this case, the strong trend of increasing bracken dominance down slope made it necessary to record quadrats at regular intervals within a 10m wide belt transect running down the centre of each sub-plot. The distance between quadrats varies with plot size and shape, to ensure that the five samples record the full range of variation down slope.

2.3.1.3 The belt transect was used to ensure that the full range of variation within each sub-plot was sampled, but avoiding any edge effects such as the wrong mechanical treatment. Some inaccuracy in locating the edges of the sub-plots is inevitable in this terrain, so it was estimated that edge effects could extend in for at least 5m.

2.3.1.4 Locating the sub-plots during monitoring was also difficult. The GPS coordinates of the corner posts were not available until after the baseline monitoring was done and the posts were often not visible above the bracken or were hidden by the slope of the hill. By Year 3 the corner posts had been removed and the transects had to be located solely by hand held GPS. GPS accuracy at times was no better than $\pm 6m$ so it was not practical to relocate fixed quadrats in the bracken accurately. Instead it was accepted that the quadrat positions would vary slightly from year to year although every effort was made to keep them at the same altitude and within the belt transects. This approach had the advantage of avoiding trampling the same positions and routes each year, which could have created paths that would be followed by sheep and cattle and lead to preferential grazing and trampling. The stone grids were avoided for the same reason, and also any paths, sheep scrapes, and in plots 3-4 the areas where the bracken has not yet colonised.

2.3.2 Data recorded

2.3.2.1 In each quadrat the data recorded was as follows:

- **Percentage cover** of each vascular plant and bryophyte present. In accordance with accepted good practice, cover of more than 5% was estimated to the nearest 5% and cover of less than 1% was recorded as 1%. The DOMIN scale was not used in this case because more accurate estimates of high cover species such as bracken and the grasses were required.
- **Bracken shoots** – the number of living shoots arising within the quadrat
- **Bracken vigour** - estimated on a 10-point scale. This is a subjective measure based on a visual assessment of the overall (rather than maximum) stand height and condition, and it is difficult to maintain consistency from year to year. The scale is as follows:

| <u>Vigour</u> | <u>Condition</u> | <u>Cover</u> | <u>Height</u> | <u>Shoot density</u> |
|---------------|--------------------|--------------|---------------|----------------------|
| 1 | Poor or very young | 5-20% | 25-50 cm | 1-30 |
| 2 | Poor or young | 10-50% | 35-60 cm | 5-50 |
| 3 | Poor or young | 25-70% | 45-70 cm | 10-55 |
| 4 | Moderate | 40-90% | 50-75 cm | 15-55 |
| 5 | Moderate | 55-95% | 55-85 cm | 15-65 |
| 6 | Moderate | 70-95% | 60-90 cm | 15-70 |
| 7 | Good | 75-100% | 65-100 cm | 15-70 |
| 8 | Good | 85-100% | 70-115 cm | 15-70 |

| | | | | |
|----|------|---------|------------|-------|
| 9 | Good | 90-100% | 80-130 cm | 15-70 |
| 10 | Good | 98-100% | 100-175 cm | 15-70 |

- **Bracken frond height** – the maximum height of the stand at this point, taken as the mean of the three tallest fronds arising within the quadrat, each measured to the nearest cm.
- **Litter cover** - the proportion of the ground with visible litter cover. This proved very difficult to estimate in disturbed and grassy areas.
- **Litter depth** - the mean of three measurements taken by probe at random points within the quadrat, measured to the nearest cm.
- **Disturbed ground** - percentage cover of visually disturbed ground within 5m of the quadrat. This is very difficult to estimate accurately in a dense grassy or bracken stand and the figures are approximate.
- **Bare ground** - percentage cover of bare ground within the quadrat.
- **Stones** - percentage cover of exposed stones within the quadrat.

This raw data for all four years is held in a spreadsheet and included here as Appendix 7.

2.3.2.2 These measurements were summarised for each sub-plot to even out the variation between quadrat sampling points, so that the response of each sub-plot to treatments could be assessed as a whole. This was done by taking the means of the values for each quadrat.

2.3.2.3 For plots 5 and 6 the cattle foddering treatment had only affected the flatter land at the top of the slope and livestock were avoiding the dense bracken on the steep lower slope, so for these were summarised separately, taking the top two quadrats as representing the foddering treatment, and the lower three as the slope below, in effect another control similar to plots 1 and 2. This was done so that the effect of foddering would not be masked, and for consistency with the analysis of stone movement data as the stone grids were only positioned on the upper slope where cattle were encouraged to congregate.

2.3.2.4 These measurements were summarised for the individual quadrats, and then the means taken for each sub-plot and treatment combination to facilitate statistical analysis. Derived data includes:

- **Species richness** – the number of plant species, including ferns and bryophytes, recorded.
- **Vegetation cover** - the sum of all the percentage cover values for individual species, including bracken. As the vegetation is strongly layered, with a grassy understorey and sometimes also a bryophyte layer beneath the bracken, this figure is usually considerably more than 100% in this habitat. Normalising this to 100% would in effect reduce the cover of each individual species and so distort the analysis, so this is not done unless the statistical method used requires it.
- **Understorey cover** – the sum of all the percentage cover values for individual species, excluding bracken. Although this figure is rather less in this habitat than the total cover, the understorey is often layered and so this value may also exceed 100%.
- **Litter volume** – litter depth x cover.
- **NVC scores** – the vegetation data is reduced to single values that can be analysed by comparison with defined plant communities in the National Vegetation Classification. These values are Tablefit scores, on a scale of 0-100 with 100 being a perfect fit.

2.3.2.5 The summary vegetation data for each sub-plot is presented in Appendix 1, and the other measurements in Appendix 2.

2.3.3 National Vegetation Classification

2.3.3.1 The botanical data is summarised by measuring its fit to the standard plant communities defined in the National Vegetation Classification (Rodwell, J. (1990-2000) British Plant Communities CUP).

2.3.3.2 **Bracken.** Upland stands of bracken are assigned to an acid grassland community, **U20 *Pteridium aquilinum* – *Galium saxatile* community.** This has three sub-communities:

U20a *Anthoxanthum odoratum* sub-community – bracken stands with a grassy sward beneath, consisting of common bent *Agrostis capillaris*, sheep's fescue *Festuca ovina*, sweet vernal-grass *Anthoxanthum odoratum*, yorkshire fog *Holcus lanatus*, heath bedstraw *Galium saxatile*, tormentil *Potentilla erecta*, sorrel *Rumex acetosa*, and violet *Viola riviniana*, and the mosses *Rhytidiadelphus squarrosus*, *Hypnum jutlandicum* and *Pseudoscleropodium purum*. Bluebell *Hyacinthoides non-scripta* and wood anemone *Anemone nemorosa* may also be present.

U20b *Vaccinium myrtillus*–*Dicranum scoparium* sub-community – a heathy form.

U20c species-poor sub-community – tall dense stands of bracken, species-poor with a deep litter layer.

The older bracken stands at Ingram are U20c, while the younger stands that are still invading grassland are U20a. U20b does not occur at Ingram. The target for the treatments is to replace the U20c stands with U20a, and then with open grassland.

2.3.3.3 **Grassland.** Grassland areas close to the plots were assessed to determine the locally dominant grassland communities which might be expected to extend into the treated plots over time if the treatments are successful in reducing the bracken. They were found to be acid grassland communities:

U1e *Festuca ovina* - *Agrostis capillaris* - *Rumex acetosella* grassland, *Galium saxatile*- *Potentilla erecta* sub-community – a low, tufted, patchy sward of sheep's fescue *Festuca ovina*, early hair-grass *Aira praecox* and common bent *Agrostis capillaris*, with scattered sheep's sorrel *Rumex acetosella*, tormentil *Potentilla erecta*, heath bedstraw *Galium saxatile*, and a variety of mosses. At Ingram this occurs in small patches on dry soils, often associated with paths and sheep scrapes.

U4b *Festuca ovina* - *Agrostis capillaris* - *Galium saxatile* grassland, *Holcus lanatus*-*Trifolium repens* sub-community – short grazed turf of sheep's fescue *Festuca ovina*, common bent *Agrostis capillaris*, sweet vernal-grass *Anthoxanthum odoratum*, with heath bedstraw *Galium saxatile*, tormentil *Potentilla erecta*, white clover *Trifolium repens*, yarrow *Achillea millefolium*, mouse ear *Cerastium fontanum*, and a variety of other forbs. This grassland is common on freely drained, grazed hill slopes, and occurs widely in the cheviots.

U5 *Nardus stricta* - *Galium saxatile* grassland – pale swards of mat-grass *Nardus stricta*, common bent *Agrostis capillaris*, sheep's fescue *Festuca ovina*, tormentil *Potentilla erecta* and heath bedstraw *Galium saxatile*. It is common on the upper slopes in this area but within the experiment only occurs in small patches in the upper parts of some of the plots.

On Ingram Farm, the usual successor to bracken stands that had been repeatedly cut or bashed was U4b, so this was used as the target vegetation in the NVC analysis.

2.3.3.4 The fit to the standard NVC communities was calculated from the mean vegetation data for each sub-plot using the software Tablefit and TablMany (Hill, M.O., 2011)). These give a “goodness of fit” score on a 100 point scale, calculated from the following:

- compositional satisfaction – are the expected species present?
- mean constancy – are the constant species of this community present?
- dominance satisfaction - are the expected dominants common?
- weighted mean constancy – dominance constancy

The Tablefit manual advises that this goodness of fit is can be assessed against the following ranges: 70-100 Very Good, 50-69 Good, 40-49 Fair, 30-39 Poor, 01-29 Very Poor. However, in the north of England the species composition of plant communities is often different to that in the original NVC samples, so the goodness of fit scores can be lower than might be expected.

2.3.4 Statistical analysis

2.3.4.1 Direct comparisons between plots and sub-plots are distorted by the initial differences between the vegetation of the plots, with some bracken stands being more mature than others, so instead the statistical data analysis compares the vegetation and other measurements after three years of treatment (Year 4) with the baseline (Year 1) for the same sub-plot. Again, this analysis uses the mean data derived from the quadrats to exclude the variation between individual quadrat sampling points.

2.3.4.2 This analysis has been carried out on the various measures of bracken vigour and grassland development, using the mean values for each sub-plot. Values analysed include:

- bracken cover, height, shoot number and vigour
- understorey cover
- species richness
- fit to NVC communities U4b, U20a and U20c.

2.3.4.3 The analysis of variance (ANOVA) was carried out using a General Linear Model (GLM) in Minitab v17, with Tukey pairwise comparisons to test the significance of differences. This significance is highlighted in the results by the use of asterisks, with highly significant differences having three ***, significant differences having two **, and differences of low significance having one *.

2.3.5 Multivariate analysis

2.3.5.1 Ordination analysis is a method for analysing complex data such as the species composition of vegetation, and the graphs produced provide a simple visual representation of the differences between samples. It can be particularly effective in showing changes over time.

2.3.5.2 The analysis was carried out using Canoco for Windows v. 4.56 and CanoDraw for Windows (both ter Braak, C.J.O. and Smilauer, P. [1997-2009]). Detrended Correspondence Analysis (DCA) was performed first to determine whether linear or unimodal methods would be more appropriate and confirmed that linear methods should be used. As an unconstrained ordination was required the method selected was Principal Components Analysis (PCA).

2.3.5.3 Two datasets were analysed, both comprising the summary vegetation and measurement data for each sub-plot and treatment combination:

- a) 2014 (Year 4) only – 24 samples
- b) data for each year – 96 samples

2.3.5.4 PCA requires positive values for the ordination so the differences between Year 4 and the baseline Year 1 could not be used. The initial variation between plots when the experiment was set up is therefore not excluded and must be taken into account when interpreting the results.

2.3.5.5 Active values included in the ordination are:

- bracken cover, height, shoot density and vigour
- cover of each other species recorded in the quadrats
- litter volume (cover x depth)
- disturbed ground, bare ground and stone

2.3.5.6 PCA is an indirect gradient analysis so the axes are unconstrained by the treatments, but the treatments, species richness and fit to NVC communities are shown on the graphs and positioned relative to the active variables. Although all plant and bryophyte species are included in the ordination, only those with more than one occurrence and a weighting >5% in the analysis are shown.

3. STONE GRIDS

3.1 The results of the stone grid location recording has shown that there has been at least a small degree of movement on each of the 18 stone grids since the Year 1 set up. This varies considerably between plots and, in some instances, between sub-plots within the same plot. In all cases, inaccuracies caused by surveying error and weather conditions must also be taken into consideration.

3.1.1 The Year 4 stone survey was conducted around a month earlier than previous surveys, as agreed in the Year 4 project setup. It was therefore undertaken when the bracken cover was less dense than in previous years and this resulted in the project team being able to locate a number of stones which had been reported as lost in previous year's surveys.

3.2 Plot 1 (no stock treatment but open to normal hill grazing) – Sub-Plot A (no treatment), Sub-plot B (bracken bashing) and Sub-plot C (bracken cutting)

3.2.1 In Plot 1 minimal stone movement was noted in Years 2 and 3 and this trend largely continued in Year 4. As the survey data shows all stones to have shifted slightly *en masse*, it would appear that this movement more likely relates to survey error, rather than true stone disturbance. One stone in Sub-plot A could not be located at the time of the Year 3 survey, and a further two stones in Sub-plot A were missing by the time of the Year 4 survey. Despite these losses the remaining stones are in more or less their original positions.

3.3 Plot 2 (no stock treatment but open to normal hill grazing) – Sub-Plot A (no treatment), Sub-plot B (bracken bashing) and Sub-plot C (bracken cutting)

3.3.1. In Years 2 and 3, the measurements from Plot 2 showed similar results to those from Plot 1, although a greater degree of downslope movement was noted in Sub-plots A and C in Year 3 than in the previous year. In Year 4 minimal stone movement was observed and that which is apparent is more likely due to survey error than real-life movement. The downslope movement noted in Sub-plots A and C over the previous years of the survey

appear to a lesser degree in Year 4. One stone in each of Sub-plots A and C could not be located at the time of the Year 3 survey, and a further stone was missing from Sub-plot C in the Year 4 survey.

3.4 Plot 3 (open to normal hill grazing plus intensive sheep trampling) – Sub-Plot A (no treatment), Sub-plot B (bracken bashing) and Sub-plot C (bracken cutting)

3.4.1 In Year 2 the stone grids from Plot 3 exhibited very little movement and the small amount of movement that had occurred was likely to be attributable to survey error, rather than true stone disturbance. In Year 3, Sub-plots A and C showed a higher degree of more random movement, in a general slightly down-slope direction. This higher degree of disturbance was not shown in the Year 4 data with the stones remaining largely in their Year 3 positions. Sub-plot A showed the highest level of disturbance to the original grid layout. In Years 2 and 3, four stones across sub-plots A and C could not be located, however in the Year 4 survey one stone previously reported as missing in Sub-plot 3A was re-discovered and a further stone was missing from Sub-plot 3C. Sub-plot 3B retains all of its stones largely in their original locations.

3.4.2 The findings for Plot 3 in Year 4 highlighted a problem with the reported results from the previous two years. The Year 4 survey was carried out at an earlier stage in the growing season than in previous years and the lower levels of bracken cover meant that stones that were previously reported as missing were re-discovered in Year 4. These stones must have been in, or near to, these locations in the previous two years, but were hidden amongst the bracken. This invalidates previously reported data on stone movement for Sub-plot 3A.

3.5 Plot 4 (open to normal hill grazing plus intensive sheep trampling) – Sub-Plot A (no treatment), Sub-plot B (bracken bashing) and Sub-plot C (bracken cutting)

3.5.1 In Year 2 the stones of Sub-plot 4B and 4C were found to have moved very little, if at all, however a total of six stones could not be located at the time of the Year 2 survey across the three sub-plots. Sub-plot A showed considerable disturbance and only five of the original nine stones remained, each one being out of its original position. In Year 3 this trend continued in Sub-plot 4A, where a further stone was missing and all stones were located at a considerable distance to the west of their original location. In contrast, the stones of Sub-plots B and C moved very little, generally in a northerly direction.

3.5.2 In Year 4, two stones were re-discovered in Sub-plot 4A, meaning that only three stones were missing from that sub-plot. This information invalidates previously reported data on stone movement for Sub-plot 4A. Aside from this, the stones in Plot 4 appear to have moved very little during Year 4 across all sub-plots. This lack of movement confirms a suspicion held during previous years that, particularly in Sub-plot 4A, the stone grids have previously been disturbed by the quad bike used to move the sheep. This particular sub-plot lies at the end of the sheep pen, near the gate and has an old track running through it. It is therefore something of a focal point for the quad bike movement. Although the presence of the quad bike is a necessary feature of the sheep stoking treatment, the results for Sub-plot 4A are skewed by their location within the field.

3.5.3 One stone in Sub-plot 4C has moved further than all of the others across Years 1-4.

3.6 Plot 5 (open to normal hill grazing plus cattle foddering) – Sub-Plot A (no treatment), Sub-plot B (bracken bashing) and Sub-plot C (bracken cutting)

3.6.1 In Year 2 each of the three stone grids in Plot 5 showed signs of considerable movement or disturbance, the majority of which had occurred in a down-slope direction. In Sub-plot C, one stone could not be located. In Year 3 this trend continued with the stones generally moving slightly further down-slope in all three sub-plots. There were stones missing from all sub-plots, but most particularly from Sub-plot A, which retained only five of its original nine stones. There were eight stones in total that could not be located at the time of the Year 3 survey.

3.6.2 In Year 4 the stone loss from Sub-plot 5A continued as a further two stones could not be located at the time of the survey. This leaves only three stones remaining in this Sub-plot. In Sub-plot 5B one stone was re-discovered in Year 4. This information invalidates previously reported data on stone movement for Sub-plot 5B. One further stone was missing in Sub-plot 5C. Aside from stone loss, the pattern of stone movement continued the downslope trend noted in previous years.

3.7 Plot 6 (open to normal hill grazing plus cattle foddering) – Sub-Plot A (no treatment), Sub-plot B (bracken bashing) and Sub-plot C (bracken cutting)

3.7.1 In Plot 6 the Year 4 survey significantly changed the results of the previous year's survey as all nine stones were identified in Sub-plots 6A and 6B where previously several missing stones had been reported. The results of Sub-plot 6C were also altered by the re-discovery of one stone, leaving three missing stones in this sub-plot over the course of the experiment.

3.7.2 Aside from missing stones, over the course of the experiment the stones in Plot 6 have exhibited the highest degree of disturbance to the original grid pattern, with movement generally in a downslope direction. In Year 2 the stone grids in Plot 6 exhibited the greatest amount of disturbance across all six plots, generally in a down-slope direction. Only Sub-plot 6C exhibited limited movement, but it also had the highest number of missing stones.

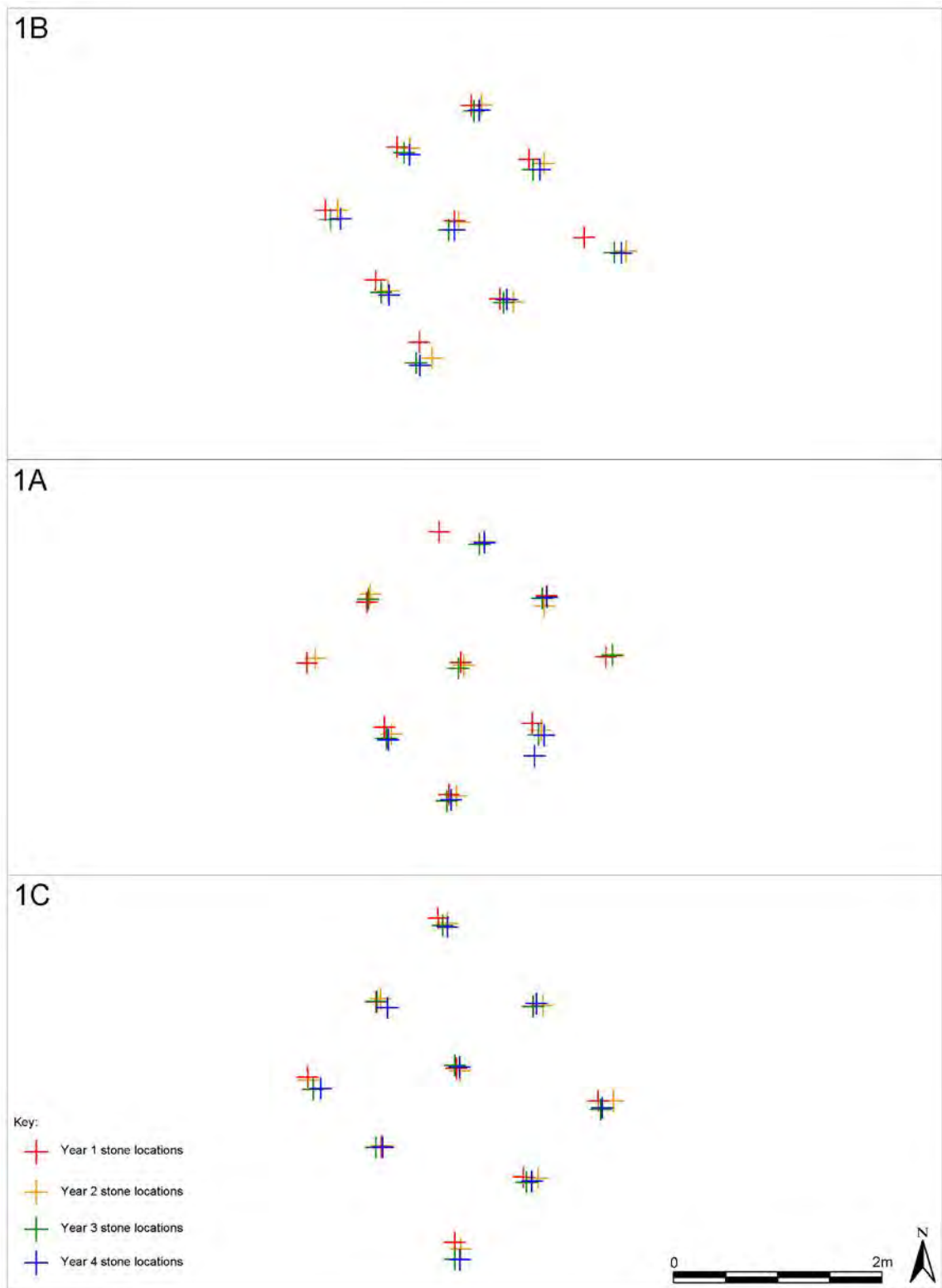


Figure 6: Stone locations in Plot 1 from Years 1-4.

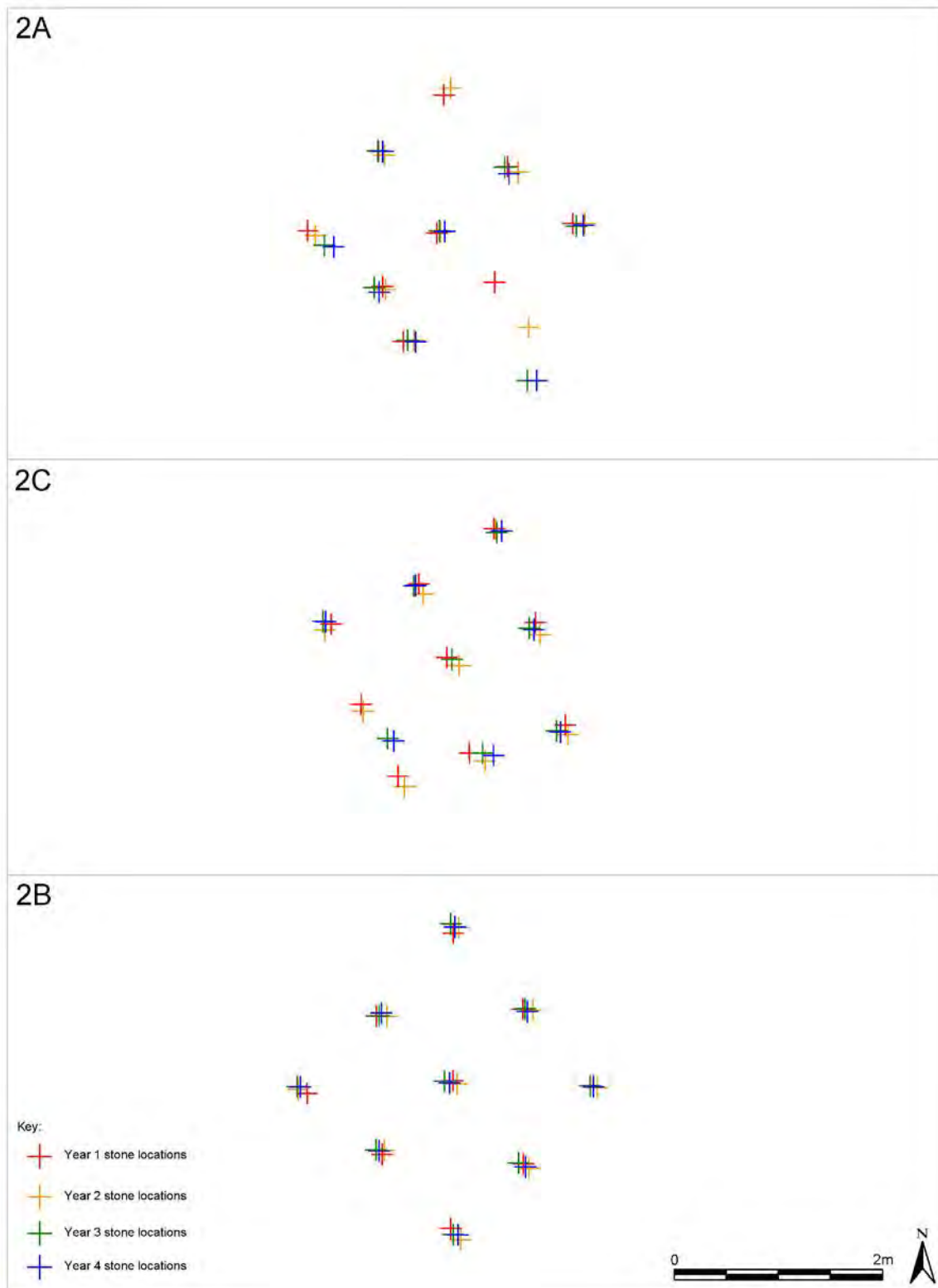


Figure 7: Stone locations in Plot 2 from Years 1-4.

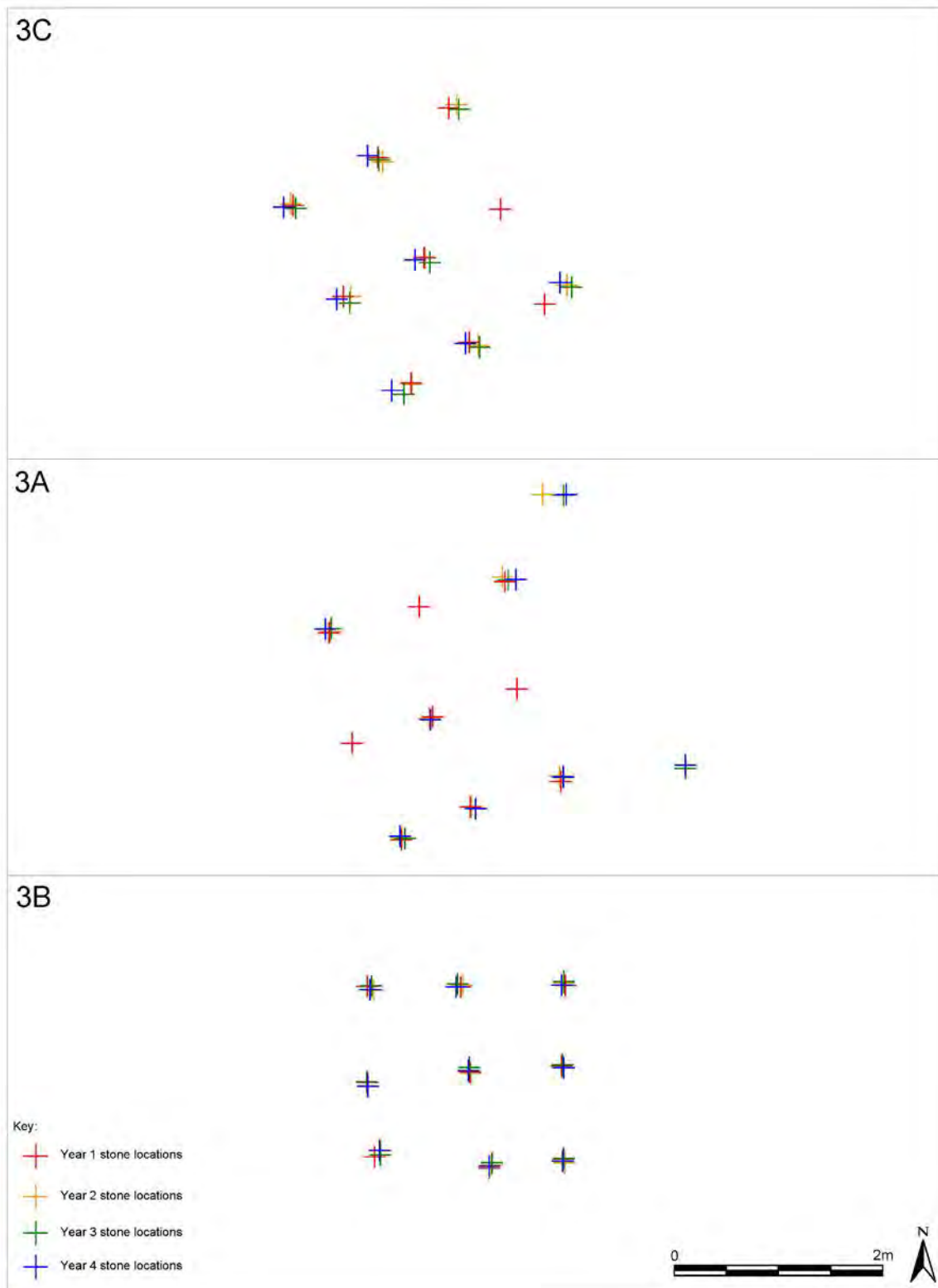


Figure 8: Stone locations in Plot 3 from Years 1-4.

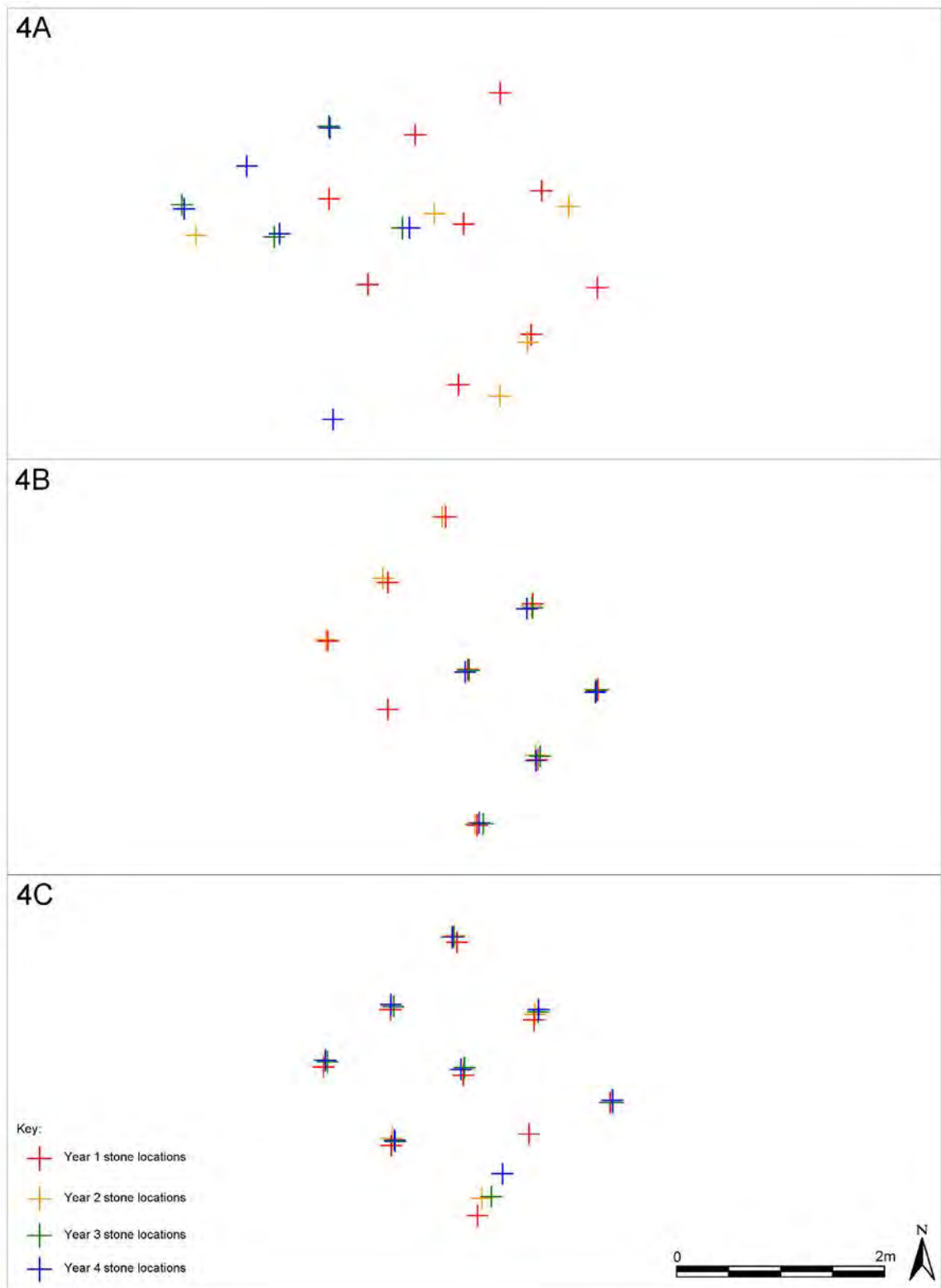


Figure 9: Stone locations in Plot 4 from Years 1-4.

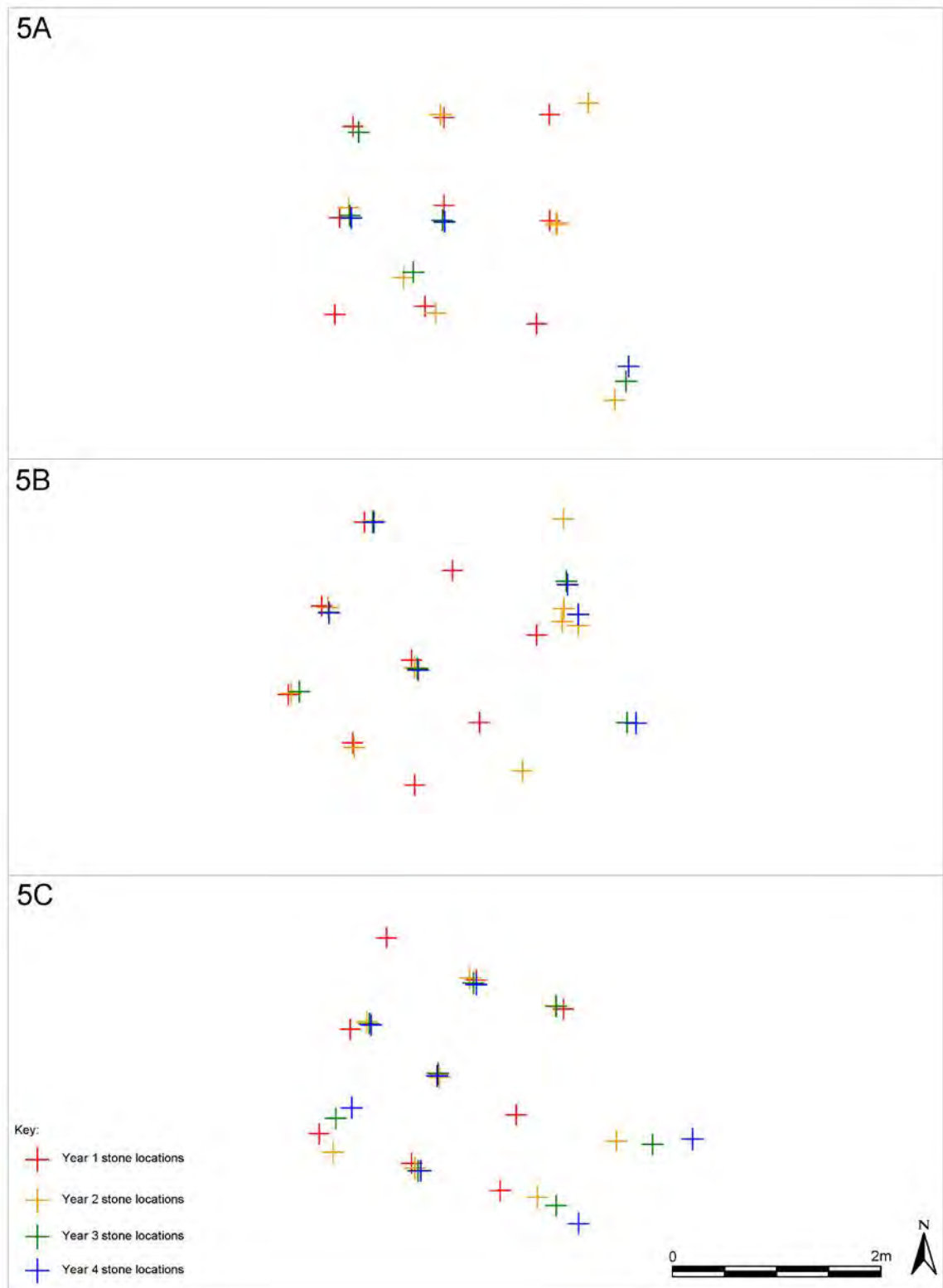


Figure 10: Stone locations in Plot 5 from Years 1-4.

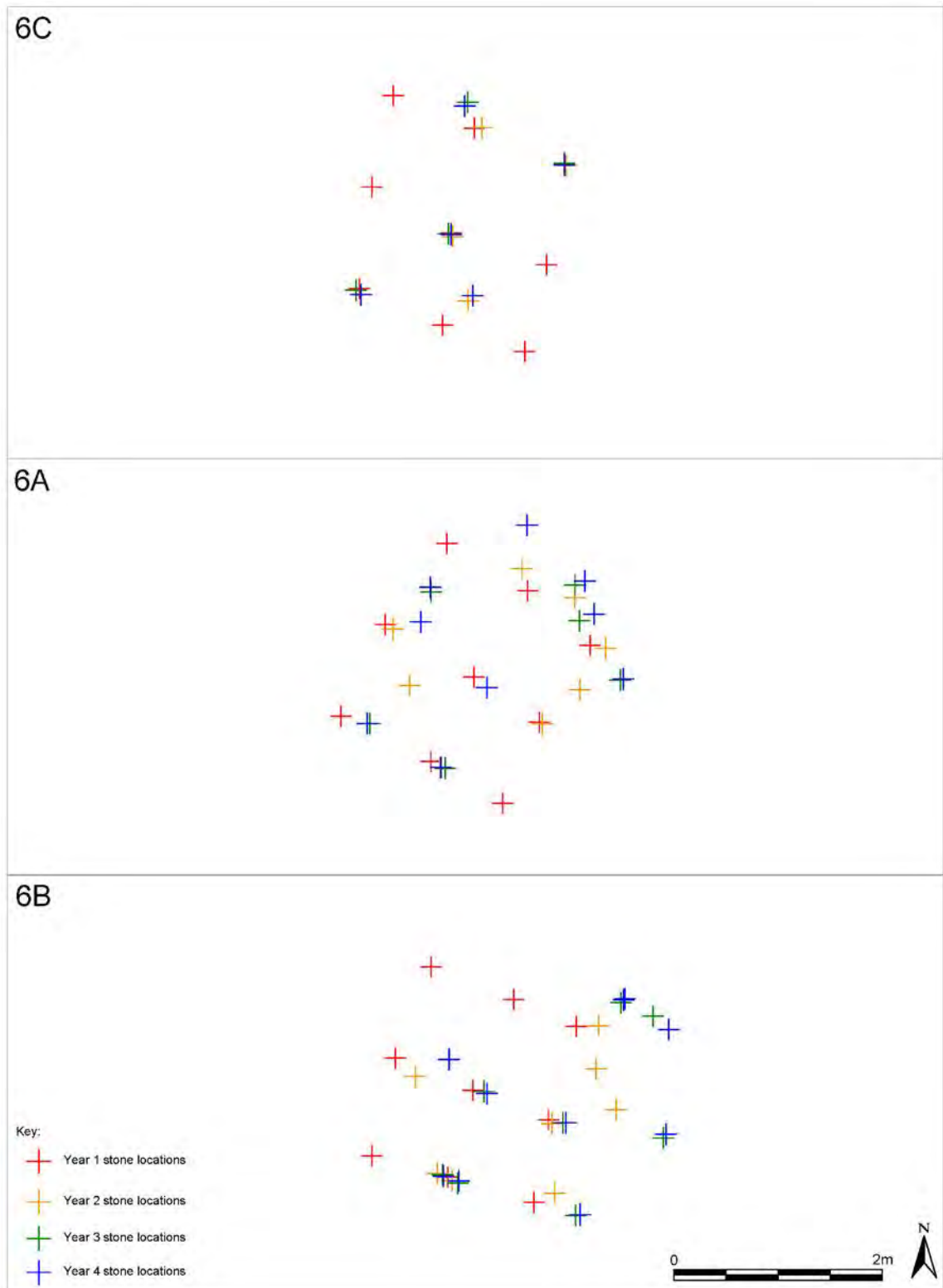


Figure 11: Stone locations in Plot 6 from Years 1-4.

3.8 Discussion

3.8.1 The results presented above show that there are differing levels of stone grid disturbance across the differing stock treatments.

3.8.2 Plots 1 and 2 have had no intensive stock trampling and show the least amount of stone grid disturbance, trending towards a down-slope and westerly movement. A total of six stones were missing across the two plots by Year 4. Of the different mechanical bracken treatments within these plots, the control sub-plots showed the greatest degree of disturbance. This observation may be explained by the increasing grassiness of the cut and, to a lesser degree, the bashed sub-plots, where the grass prevents erosion and holds the stones in place, but further monitoring is needed to test this.

3.8.3 Plots 3 and 4 have been subject to intense trampling by sheep for short periods over the past two years. They showed a higher level of stone grid disturbance than in Plots 1 and 2, trending towards a down-slope and westerly movement. This suggests that intensive sheep trampling increases the disturbance to partially-buried remains over normal hill grazing. A total of eleven stones were missing across the two plots by Year 4. Of the differing mechanical bracken treatments carried out, all the sub-plots showed a degree of disturbance, with the control Sub-plot 4A and the bashed Sub-plot 4B showing the greatest amount of disturbance with three stones and four stones missing by Year 4 respectively. Of these two, however, there was clearly more disturbance to the original grid pattern in the control Sub-plot 4A which was damaged by a quad bike between Years 2 and 3. The lesser degree of disturbance noted in the cut sub-plots may again be explained by the increasing grassiness of the cut plots, where the grass prevents erosion and holds the stones in place, but further monitoring is needed to test this.

3.8.4 Plots 5 and 6 have been subject to intensive trampling by cattle around foddering points and showed the highest degree of stone grid disturbance, trending towards a downslope movement. The disturbance was marginally greater than that caused by sheep trampling, but that result may be distorted by the one very disturbed grid in Plot 4 discussed above. A total of fourteen stones were missing across the two plots and one stone was broken in two. The majority of the remaining stones had moved a considerable distance from their original locations. Of the differing mechanical bracken treatments the sub-plots all showed a similarly high degree of disturbance, however there is a perceivable difference between the level of disturbance in the cut sub-plots, which show lesser disturbance to the original grid pattern than the control or bashed sub-plots.

3.8.5 It should be noted that during the course of the study, a flail mower hit an upstanding boulder during the bracken cutting, smashing a large fragment of stone off the boulder and causing damage to the machinery. This had an effect on the costs of the treatment. The presence of upstanding stone features (i.e. on settlement sites or where there are shaped stone features) therefore needs to be taken into account when making judgements as to whether cutting is an appropriate treatment. The damage to the machinery and the rock may have been avoided in this instance if a chain flail rather than a blade had been used to undertake the cutting treatment.

3.8.6 The results of the visual analysis of stone grid movement after Year 4 therefore point towards non-intensive stocking as being the least destructive form of livestock treatment on sensitive archaeological remains, followed by sheep grazing, with the highest degree of disturbance noted in the plots subjected to cattle foddering. Additionally the mechanical bracken treatments employed point towards bracken cutting as being the least destructive

form of mechanical treatment, followed by bracken bashing, with the highest degree of disturbance noted in the sub-plots without any form of mechanical bracken treatment.

3.8.7 A statistical analysis of stone grid disturbance has also been produced and is included in Section 4.

4. STATISTICAL ANALYSIS OF STONE MOVEMENT

4.1 Introduction

4.1.1 The Year 3 final report included a statistical assessment of stone movement as a means to provide a more robust, objective measure of stone movement than the simpler visual inspection. This statistical assessment has been continued in Year 4; however the re-discovery of stones that had previously been reported as missing necessitated a recalculation of the stone movement data. The results of the statistical analysis previously reported should be discarded and the following sections taken as the most reliable measure of stone movement throughout the course of the four year experiment to date.

4.2 Results

4.2.1 The results for each sub-plot are shown in Table 5.

| Plot | Stocking treatment | Mechanical treatment | Distance moved Year 2 (m) | Distance moved Year 3 (m) | Distance moved Year 4 (m) | Total distance moved in three years (m) | Mean distance per stone (m) |
|------|--------------------|----------------------|---------------------------|---------------------------|---------------------------|---|-----------------------------|
| 1 | O none | A none | 0.45 | 2 | 5 | 7.45 | 2.48 |
| 1 | O none | B bash | 0.63 | 0.16 | 0.07 | 0.86 | 0.29 |
| 1 | O none | C cut | 0 | 0.15 | 0 | 0.15 | 0.05 |
| 2 | O none | A none | 0.55 | 2.51 | 0.11 | 3.17 | 1.06 |
| 2 | O none | B bash | 0 | 0 | 0 | 0 | 0.00 |
| 2 | O none | C cut | 0 | 2.36 | 2.15 | 4.51 | 1.50 |
| 3 | S sheep | A none | 3.65 | 2.1 | 0.1 | 0 | 0.00 |
| 3 | S sheep | B bash | 0 | 0 | 0 | 0 | 0.00 |
| 3 | S sheep | C cut | 2.28 | 0.1 | 2.2 | 4.58 | 1.53 |
| 4 | S sheep | A none | 9.45 | 5.75 | 4.45 | 19.65 | 6.55 |
| 4 | S sheep | B bash | 2 | 6 | 0 | 8 | 2.67 |
| 4 | S sheep | C cut | 2.18 | 0.05 | 0.25 | 2.48 | 0.83 |
| 5 | C cattle | A none | 2.26 | 8.5 | 4.2 | 14.96 | 4.99 |
| 5 | C cattle | B bash | 3.88 | 5.45 | 2.15 | 11.48 | 3.83 |
| 5 | C cattle | C cut | 3.58 | 0.88 | 2.85 | 7.31 | 2.44 |
| 6 | C cattle | A none | 4.15 | 1.85 | 1.5 | 7.5 | 2.50 |
| 6 | C cattle | B bash | 5.77 | 2.96 | 0.2 | 8.93 | 2.98 |
| 6 | C cattle | C cut | 8.34 | 0.25 | 0.09 | 8.68 | 2.89 |

Table 4: Stone movement per sub-plot

4.2.2 This data is summarised below (Table 6 and Figure 12).

| Bracken treatments | A no mechanical treatment | B bashing | C cutting | |
|------------------------------------|------------------------------------|-----------------------|---------------------|----------------------|
| O no intensive stocking | 5.31 (3.17-7.45) | 0.43 (0-0.86) | 2.33 (0.15-4.51) | 2.69 (0-7.45) |
| S intensive sheep trampling | 9.85 (5.85-13.85) | 4.00 (0-8.00) | 3.53 (2.48-4.58) | 5.79 (0-13.85) |
| C cattle foddering | 11.23 (7.50-14.96) | 10.21 (8.93-11.48) | 8.00 (7.31-8.68) | 9.81 (7.31-14.96) |
| | 8.80 (3.17-14.96) | 4.88 (0-11.48) | 4.62 (0.15-8.68) | |

Table 5: Mean values and range for each treatment and treatment combination

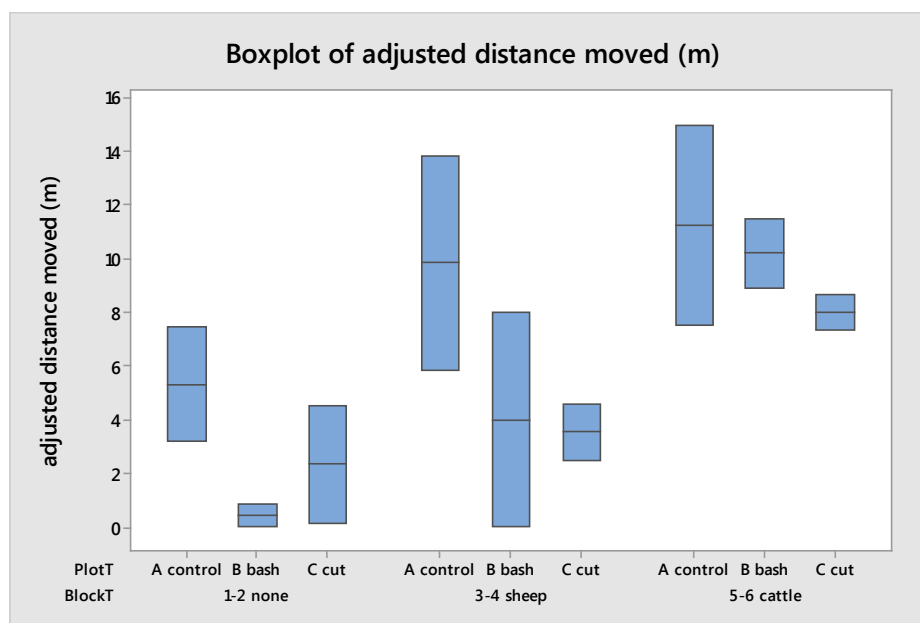


Figure 12: Boxplot of stone movements (Year 4 compared to Year 1)

4.2.3 The high values for the control Sub-plots 3A and 4A may be partly due to disturbance by the quad bike used to move the sheep. The most extreme value, 9.45m for Sub-plot 4A in year 1, is anomalous and has been excluded from the analysis. The equivalent measurement from Sub-plot 3A in Year 1 is used instead. Sub-plot 4A lies at the end of the sheep pen, near the gate and has an old track running through it. It is therefore something of a focal point for quad bike access. Although the presence of the quad bike is a necessary feature of the sheep stocking treatment, the results for Sub-plot 4A were skewed by their location within the field, over and above the normal level of quad bike movement expected.

4.2.4 Disturbance appears to be greatest in the cattle trampled plots and least in the plots with no stocking treatment. The disturbance to the cattle trampled grids is considerable, 9.81m over three years, or on average nearly 1.1m per stone in the grids.

4.2.5 The differences between the mechanical treatments are less clear, but there seems to have been greatest disturbance in the control plots in all three stocking treatments, with no obvious pattern of difference between the cut and bashed plots.

4.3 Statistical analysis

4.3.1 The results of the ANOVA are shown in Table 7. This analysis looks at the plot and sub-plot treatments together, and also any interactions between them.

4.3.2 The only significant difference is between the cattle foddering areas, where stone movement is greater, and the control plots with no stocking treatment, but the significance is low ($p=0.023$). The sheep treatment is intermediate and not significantly different to either of the others.

4.3.3 No significant differences are found between the mechanical treatments, or between any of the treatment combinations (Figure 13).

| Source | DF | Adj SS | Adj MS | F | p |
|----------------------------|----|--------|--------|------|-------|
| Stocking | 2 | 152.92 | 76.459 | 5.87 | 0.023 |
| Mechanical | 2 | 65.76 | 32.879 | 2.52 | 0.135 |
| Stocking*Mechanical | 4 | 18.97 | 4.742 | 0.36 | 0.828 |
| Error | 9 | 117.25 | 13.028 | | |
| total | 17 | 354.90 | | | |

| | | Mean | Group |
|------------------------------|---|-------|-------|
| Stocking treatments | | | |
| O None | O | 2.69 | b |
| S Sheep | S | 5.79 | ab |
| C Cattle | C | 9.81 | a |
| Mechanical treatments | | | |
| A control | A | 8.80 | a |
| B bash | B | 4.88 | a |
| C cut | C | 4.62 | a |
| Interactions | | | |
| C cattle x A control | | 11.23 | a |
| C cattle x B bash | | 10.21 | a |
| S sheep x A control | | 9.85 | a |
| C cattle x C cut | | 8.00 | a |
| O none x A control | | 5.31 | a |
| S sheep x B bash | | 4.00 | a |
| S sheep x C cut | | 3.53 | a |
| O none x C cut | | 2.33 | a |
| O none x B bash | | 0.43 | a |

Table 6: ANOVA of stone movement data

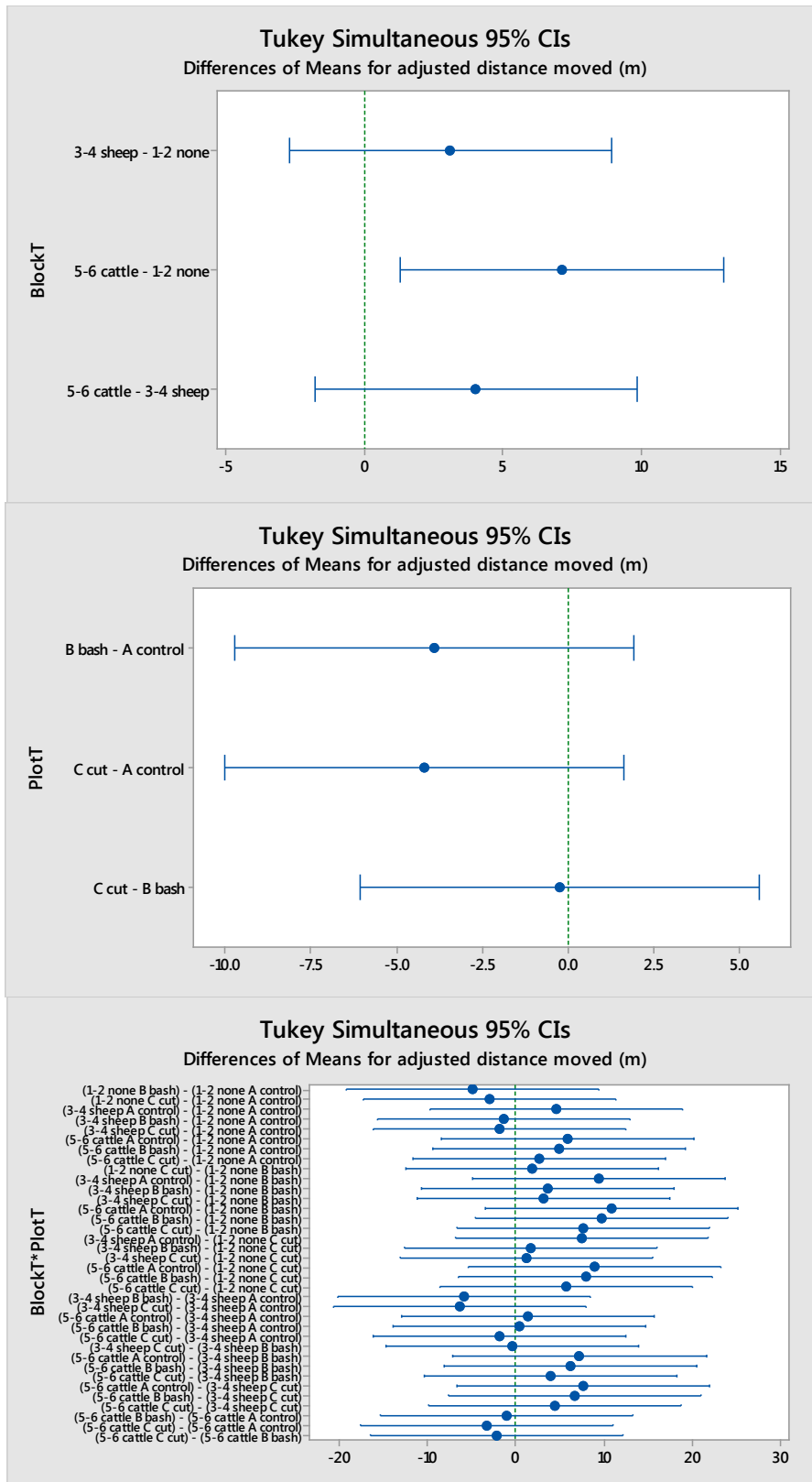


Figure 13: Plots of 95% confidence intervals. Means are only significantly different if the confidence interval includes zero.

4.3.4 The analysis was repeated using square-root transformed data to reduce the residuals, but the results were much the same and there was still no significant difference between mechanical treatments or interactions.

4.4 Discussion

4.4.1 Disturbance to the stone grids is significantly greater in the areas of cattle foddering, which is not surprising as the cattle congregate here for long periods during the winter months when there is no bracken to protect the surface from trampling. Poaching of the ground was apparent in these areas during the vegetation survey, although the grassland vegetation generally recovered by mid-summer.

4.4.2 The extent of the stone movement in these plots, nearly 1.1m per stone on average over three years, implies that there could be considerable damage to surface or partly buried archaeology, and supports the view that cattle foddering is not an appropriate management technique on sensitive archaeological sites.

4.4.3 The analysis after two years suggested that there was a significant difference between the effects of the mechanical treatments, but unexpectedly the disturbance was greatest in the controls and least in the cut sub-plots. This was not supported by signs of disturbance on the ground, and there may have been some distortion of the results by the pattern of movement of the quad bikes in some of the sheep-trampled sub-plots (plots 3-4), tending to cause repeated damage to the control plots while largely avoiding the others. Now after three years of treatment the difference is no longer significant.

4.4.4 The apparently greater disturbance to the control plots may be due to the increasing grassiness of the cut and bashed plots found in the vegetation survey, with the grass roots in the surface soil helping to hold the stones in place. Under dense bracken there is little or no understorey and often a dense layer of loose litter that may be easily disrupted by surface water flows in heavy rain, and by livestock and machinery. This would support the view that a grassy sward is more protective to surface and partly buried archaeological remains than bracken.

4.4.5 Analysis of individual stone movements, rather than a total figure for each stone grid, might give a higher significance to some of these differences, but this could not be done as the stones were not individually identified.

5. VEGETATION SURVEY

5.1 Introduction

5.1.1 To make this section easier to read, the results and discussion of each item are presented together, with an overview of the success of each treatment in controlling the bracken at the end.

5.1.2 Four aspects are considered:

- Baseline variability between and within plots
- Changes year on year
- Analysis of changes after three years of treatment
- Multivariate analysis

5.1.3 These are analysed by plot treatment and sub-plot treatment:

Plot treatment - the stocking regime applied to each of the six plots in the study

- None: Plots 1-2 on Ewe Hill, with no stocking treatment but open to the hill grazing
- Sheep: Plots 3-4 on Wether Hill, with intensive sheep stocking for short periods but otherwise open to the hill grazing

- Cattle: the upper part of Plots 5-6 above Fawdon Dean, with intensive cattle foddering
- Slope: the lower part of Plots 5-6 above Fawdon Dean, where the steep slope seems to be avoided by the cattle which only congregate in the upper part.

Sub-Plot treatment - the mechanical treatments each applied to one sub-plot in each plot:

- Control, with no treatment
- Bashed once a year
- Cut once a year

5.2 Baseline variability between and within plots

5.2.1 Types of variation found

5.2.1.1 The variation between plots and within the plots has been discussed in previous reports but is reviewed again here as it must be considered when interpreting the results of the experiment.

5.2.1.2 Several problems were apparent from the baseline recording in 2011:

- a) The vegetation in the six plots was not comparable. The bracken stands have different histories of grazing and bracken control, and so are of varying maturities and at different stages in the succession from grassland to bracken. Plots 2, 5 and 6 all showed signs of past bracken control along the top of the slope, with lower bracken vigour, a sparse litter layer and a grassy understorey with frequent sweet vernal-grass *Anthoxanthum odoratum*, common bent *Agrostis capillaris* and smooth meadow-grass *Poa pratensis*. In Plot 1 past bracken control had been along the track at the bottom of the slope and at the eastern end. This variation resulted in measurable differences in bracken vigour and dominance, the ground flora and the depth of litter. It can also be expected to be associated with other differences that are more difficult to measure, such as nutrient levels and the soil microbial and fungal flora which determines its capacity for nutrient cycling and whether suitable mycorrhizae are present to support a rapid change in the vegetation in response to treatment.
- b) Most of the stands appeared to be expanding. The older parts have the most vigorous bracken, with a deep litter layer and a sparse understorey of heath bedstraw *Galium saxatile*, yorkshire fog *Holcus lanatus* and creeping soft-grass *Holcus mollis*. In Plots 1 and 2 this also includes foxglove *Digitalis purpurea* and heath groundsel *Senecio sylvatica*. In most of the plots the older parts of the stand are towards the bottom of the slope, but in Plot 3 this is more complicated.
- c) There was variation within some of the plots, along the contour of the hill, so that the sub-plots subject to different mechanical bracken treatments within each plot were not identical prior to treatment.
- d) Most obvious on site, there was also variation downslope as the bracken gets significantly more dense and vigorous as water availability and nutrient levels increase.
- e) Where cultivation terraces are present (particularly Plots 2 and 3) there is a repeated change of slope from flat to steep. Livestock tend to stay on the flat parts so these are more trampled with a more open stand and a grassy understorey. The bracken on the steep slopes between terraces is often more vigorous with no understorey.

5.2.1.3 This variation is illustrated by the boxplot of bracken height in the baseline year, prior to treatment, showing the mean heights of the stand by position down slope for the three plot treatments (Figure 14). All the stands are on hillsides, but the slope and position on the hill varies. Samples were recorded at five points evenly spaced along a belt transect through the centre of each plot (adjusted in Plots 3 and 4 where the bracken stand did not extend to the edges of the irregularly shaped stand), with position 1 at the top and position 5 at the bottom. There was a significant increase in bracken height down slope in Plots 1-2 (Ewe Hill) and 5-6 (Fawdon Dene), but the less mature stand in Plots 3-4 (Wether Hill) had shorter bracken overall, and this was tallest at the top and bottom of the slope.

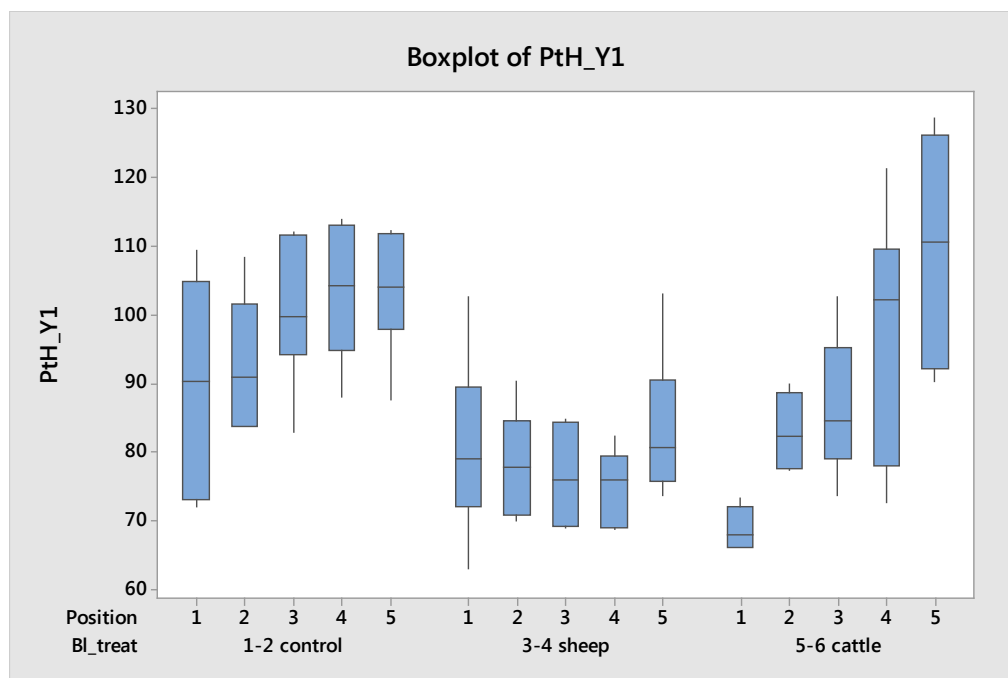


Figure 14. Bracken height prior to treatment (baseline Year 1), by position down slope.

5.2.1.4 This variability has persisted throughout the duration of the experiment, as can be seen from the equivalent graph for Year 4 (Figure 15). This includes the control, bashed and cut sub-plots within each plot, so all the plots now include the shorter stands resulting from cutting and bashing. Despite this, the trend towards taller bracken down slope is clear for all three plot treatments and the bracken in the control plots on Ewe Hill is now considerably taller than it was.

5.2.1.5 There is much less variation between the control, cut and bashed sub-plots in the plots that also had sheep and cattle trampling.

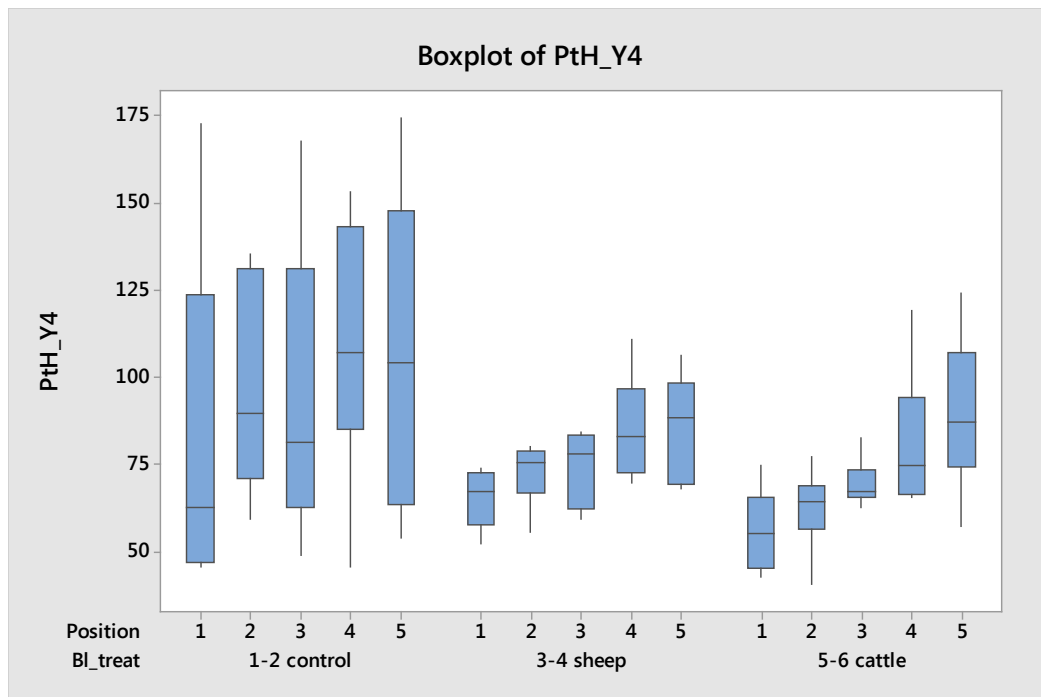


Figure 15. Bracken height after three years of treatment (Year 4), by position down slope.

5.2.2 Plot Descriptions

5.2.2.1 To assist in the interpretation of subsequent results the plots were described as part of the baseline recording:

Plot 1 - a mature stand of bracken above the track on Ewe Hill. The western and central sub-plots were a good fit to the species-poor bracken community U20c throughout. In places the litter layer was up to 10 cm deep and there was either no ground flora or just a few large plants of foxglove *Digitalis purpurea* and heath groundsel *Senecio sylvatica*. The eastern end had less vigorous bracken and a grassy understorey and the bracken appeared to have been treated in the past, so parts of this area were closer to the grassier U20a bracken community with patches of U1 and U4 grassland.

Plot 2 - a mature stand of bracken on cultivation terraces below the track on Ewe Hill. The vegetation was U20c throughout except at the top of the slope where the bracken was less vigorous and appeared to have been treated. Here the understorey was more grassy and closer to U20a. The bracken was tall and vigorous at the bottom of the slope. In places the litter layer was up to 13 cm deep with very little ground flora. Elsewhere the ground layer was dominated by creeping soft grass *Holcus mollis*, with frequent heath groundsel and foxglove.

Plot 3 - on the shoulder of Wether Hill, now fenced for intensive sheep grazing. The bracken appeared to be still colonising the hillside and the plots included some areas of grassland and rushes, as well as two grassy tracks. The transects had to be angled and shortened to stay within the bracken. The bracken was shorter and less vigorous than in the other plots, and the litter layer was no more than 4 cm deep. The bracken stand was the more species rich U20a form throughout, with affinities to U4b acid grassland, and heath bedstraw *Galium saxatile* and tormentil *Potentilla erecta* were frequent throughout. The ground layer changed down slope, being closer to U4b at the top but with Yorkshire fog *Holcus lanatus* and creeping soft grass *Holcus mollis* dominating further down.

Plot 4 - contiguous with Plot 3, following the track round the hill, and with a similar flora and zonation. The bracken community was U20a throughout but with affinities to U1 and U4 acid grasslands.

Plot 5 - a mature stand of bracken on the slope above Fawdon Dean, crossed by a grid of tracks that are now being colonised by bracken. The bracken stands were mostly U20a with affinities to various U1, U4 and U5 grassland communities, but U20c where the bracken was most vigorous at the bottom of the slope and the litter layer was up to 8 cm deep. Heath bedstraw *Galium saxatile* was abundant at the top of slope.

Plot 6 - contiguous with Plot 5, with the same vegetation and zonation but a more shallow litter layer.

5.3 Changes Year on Year

5.3.1 The Year 4 project extension was needed to confirm that the trends suggested after Year 3 were a genuine response to the treatments and not due to other factors such as climate variability and the date of recording.

5.3.2 Recording dates have varied but in most years the monitoring was timed to take place when the bracken was nearly at its full height for the year. This stage in the growing season is reached at different times depending on the weather that year, so it is difficult to plan and the requirement to fit in with the archaeological survey in the first three years imposed some constraints. In 2013 we were asked to do the survey two weeks earlier than usual to make the data available for a Natural England site visit later in July.

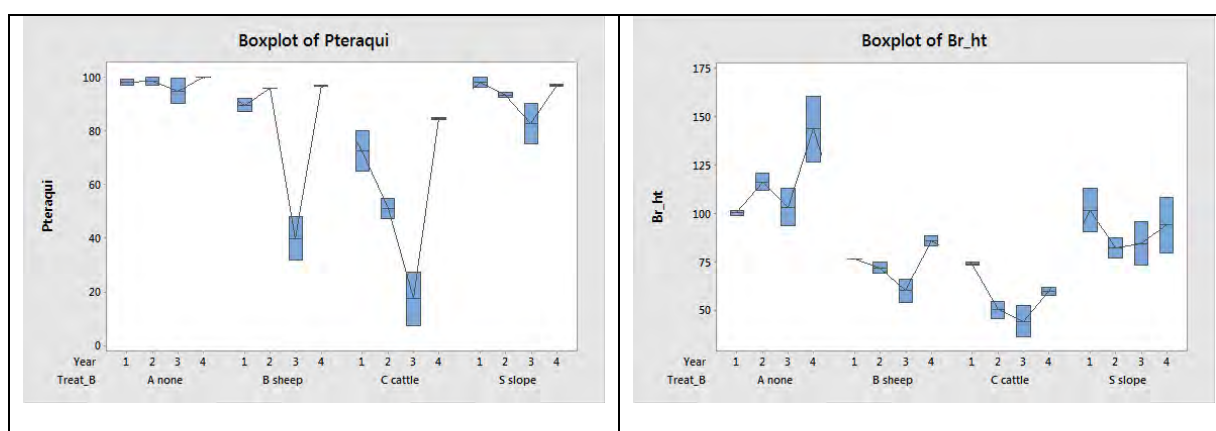
Baseline Year 1 21-23rd July 2011

Year 2 16-20th July 2012

Year 3 2-9th July 2013

Year 4 16-18th July 2014

5.3.3 The effects of the earlier recording in 2013 can be seen in the following graphs of data from the control sub-plots (those not cut or bashed) in each plot treatment (Figure 16). The greatest effect is seen in the figures for bracken cover and hence the fit to NVC community U20c, and also bracken height. From this it is apparent that the 2013 results should be discarded and the results of the experiment reassessed from the 2014 data. This is done in the following section.



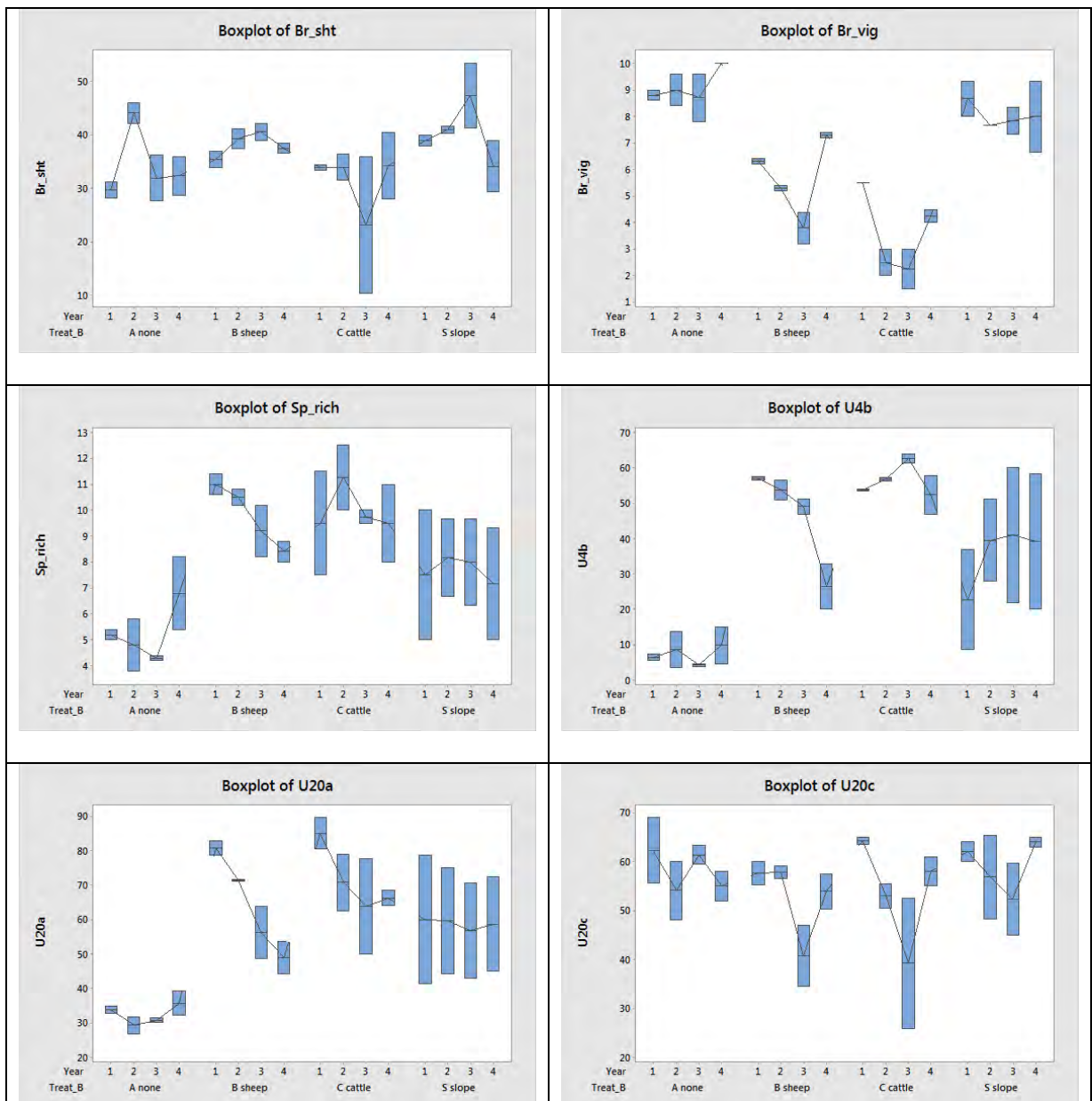


Figure 16. Year on year variation in the control sub-plots (not cut or bashed) in each livestock (plot) treatment

5.3.4 As well as the anomalies in the 2013 recording these graphs also show some interesting trends in the controls, and hence in the vegetation overall. Surprisingly the fit to the grassier bracken community, U20a, has fallen steadily over time in the plots with cattle and sheep trampling, and in the sheep plots the fit to U4b and species richness have also fallen. This may be associated with the lower levels of grazing and trampling throughout the year now that plots 3 and 4 are fenced off.

5.3.5 Bracken height and vigour have increased steadily in the controls that are open to the hill but otherwise untreated. This may be a result of the warm weather and lack of frosts in recent years as these stands are already mature and well established.

5.4 Analysis of Changes After Three Years of Treatment

5.4.1 For this analysis the results are analysed as the change after three years of treatment (Year 4 – Year 1), to exclude distortions due to the variability between plots when the experiment was set up. The results are summarised for the four plot treatments

- Plots 1-2 – control** (open to the hill with occasional sheep and cattle)
- Plots 3-4 – sheep** (intensive trampling for short periods, otherwise open to the hill)
- Plots 5-6 – cattle** foddering (the top two sampling points of each transect)
- Plots 5-6 – slope** below cattle feeding areas (the lower three sampling points of each transect)

5.4.2 In Plots 5-6 the cattle seem to avoid the steep slope below the flatter foddering areas close to the track along the top, so the lower slope is considered separately and would be expected to show a similar response to the untreated Plots 1-2.

5.4.3 Plots 3-4 are fenced to pen the sheep in when required, and although the gate is left open at other times, there is little sign of cattle entering the area and only the occasional sheep when it is open to the hill. For the first year of treatment the gate was kept closed.

5.4.4 The analysis of variance was assessed using a General Linear Model (GLM), with Tukey pairwise comparisons to determine which differences are significant. The results of these are denoted by letters, groups that share a letter are not significantly different while those that do not share a letter are significantly different.

5.4.5 Bracken Cover

5.4.5.1 Bracken cover is measured as a visual estimate of the percent cover of the bracken canopy in each 1x1m quadrat. This is subjective and there is a possibility of observer differences from year to year. The objective of the treatments is to reduce bracken cover, to allow grassland to expand into the gaps and beneath.

5.4.5.2 There has been a small increase in bracken cover in the sheep plots, and a decrease overall in the plots with no stocking treatment, and this difference is highly significant (Table 7).

5.4.5.3 The response of bracken to the sub-plot treatments is apparent on site, with an increase in cover in the control sub-plots, no change in the bashed sub-plots, and a highly significant decrease in the cut sub-plots (Table 7).

| | F | p |
|---------------------|-------|-------------|
| Plot treatments | 8.70 | < 0.001 *** |
| Sub-plot treatments | 22.07 | < 0.001 *** |
| Interactions | 5.12 | < 0.001 *** |

Table 7. ANOVA of bracken cover change after 3 years of treatment (Year 4 – Year 1)

5.4.5.4 The largest increases were in the control sub-plots in the sheep and cattle plots where nutrient input is not being offset by cutting or bashing (Table 8, Figure 17). The greatest decreases were in the cut sub-plots in the plots with no treatment and with cattle foddering, but these are partly offset in the overall figures by increases in the cut sub-plots in the sheep trampled plots and on the slope below the cattle foddering area.

| Plot treatment | | | Combination | | |
|--------------------|--------|-----|------------------|--------|-----|
| None | -13.43 | b | None x Control | 2.00 | a b |
| Sheep | 4.47 | a | Sheep x Control | 7.30 | a |
| Cattle | -3.50 | a b | Cattle x Control | 12.00 | a |
| Slope | -5.17 | a b | Slope x Control | -1.00 | a b |
| Sub-plot treatment | | | None x Bashed | -3.20 | a b |
| Control | 4.50 | a | Sheep x Bashed | 1.50 | a b |
| Bashed | -0.13 | a | Cattle x Bashed | 2.50 | a b |
| Cut | -17.83 | b | Slope x Bashed | 0.50 | a b |
| | | | None x Cut | -39.10 | c |
| | | | Sheep x Cut | 4.60 | a |
| | | | Cattle x Cut | -25.00 | b c |
| | | | Slope x Cut | 15.00 | a b |

Table 8. Mean change in bracken cover after 3 years of treatment (Year 4 – Year 1), and differences if significant

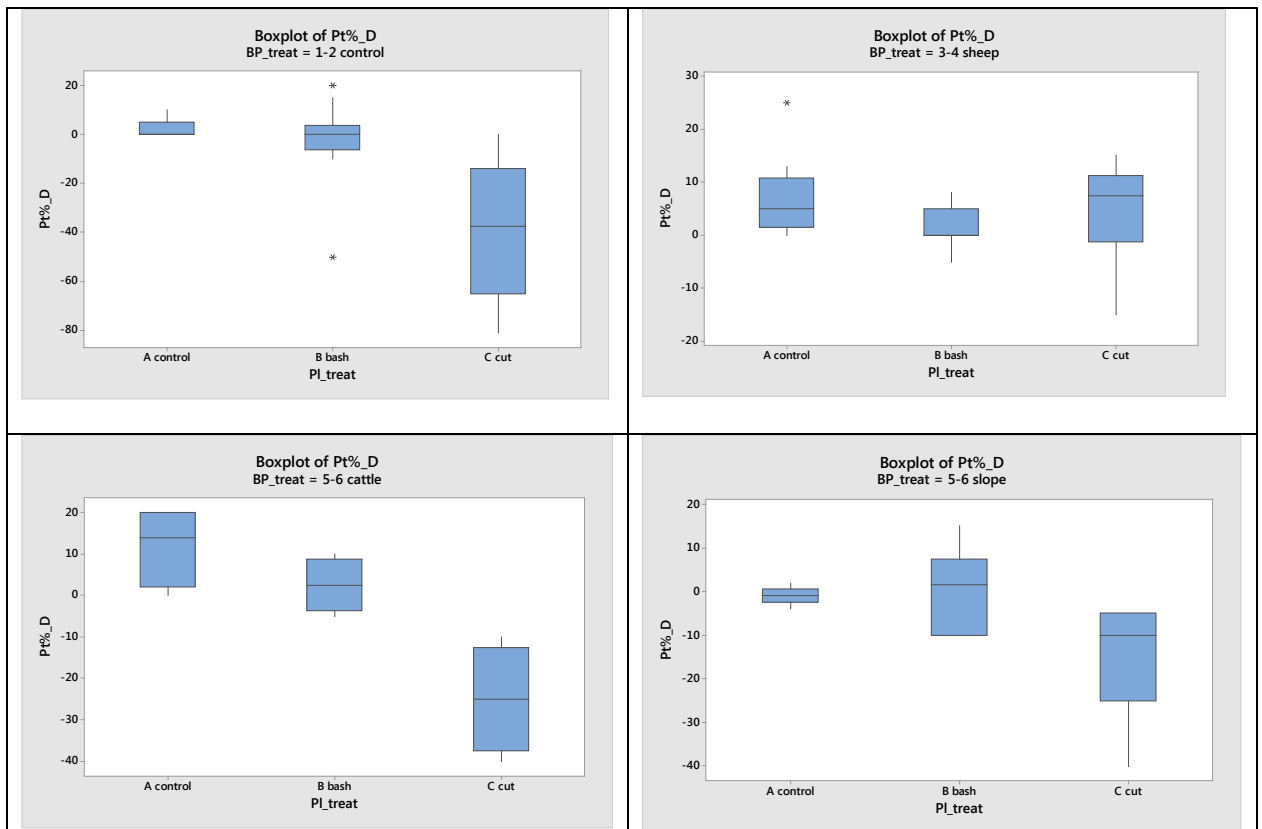


Figure 17. Change in bracken cover after 3 years of treatment (Year 4 – Year 1), by livestock (plot) and mechanical (sub-plot) treatment

5.4.6 Bracken Height

5.4.6.1 Bracken height is measured as the mean of the three tallest shoots arising from each quadrat. The treatments are intended to reduce bracken height, as well as cover and density.

5.4.6.2 There has been little change overall in the plots with no stocking treatment and with sheep, but there has been a considerable decrease in bracken height in the cattle plots and on the slope below them (Table 9). This difference is significant, but the reasons for it are unclear.

5.4.6.3 There is also a significant difference between all three mechanical (sub-plot) treatments, with an increase in bracken height in the control sub-plots overall, a decrease in the bashed sub-plots, and a much greater decrease in the cut sub-plots (Table 9).

| | F | p |
|---------------------|-------|-------------|
| Plot treatments | 6.92 | < 0.001 *** |
| Sub-plot treatments | 29.87 | < 0.001 *** |
| Interactions | 9.63 | < 0.001 *** |

Table 9. ANOVA of bracken cover change after 3 years of treatment (Year 4 – Year 1)

5.4.6.4 The greatest increase was in the sub-plots with no stocking or mechanical treatment, and the changes in the other treatment combinations should be considered relative to this (Table 10, Figure 18). There was a smaller increase in the sheep control sub-plots. Otherwise most of the sub-plots have shown a decrease in bracken height, with the greatest decrease in the cut sub-plots with no stocking treatment and the cut sub-plots on the slope on Fawdon Dean.

| Plot treatment | | | Combination | | |
|--------------------|--------|---|------------------|--------|---------|
| None | -0.20 | a | None x Control | 43.40 | a |
| Sheep | -2.11 | a | Sheep x Control | 9.60 | b |
| Cattle | -16.72 | b | Cattle x Control | -14.17 | b c d e |
| Slope | -17.83 | b | Slope x Control | -7.67 | b c d |
| Sub-plot treatment | | | None x Bashed | -6.00 | b c |
| Control | 14.24 | a | Sheep x Bashed | -7.87 | b c d |
| Bashed | -8.17 | b | Cattle x Bashed | -11.42 | b c d e |
| Cut | -25.78 | c | Slope x Bashed | -10.11 | b c d e |
| | | | None x Cut | -38.00 | e |
| | | | Sheep x Cut | -8.07 | b c d |
| | | | Cattle x Cut | -24.58 | c d e |
| | | | Slope x Cut | -35.72 | d e |

Table 10. Mean change in bracken height after 3 years of treatment (Year 4 – Year 1), and differences if significant

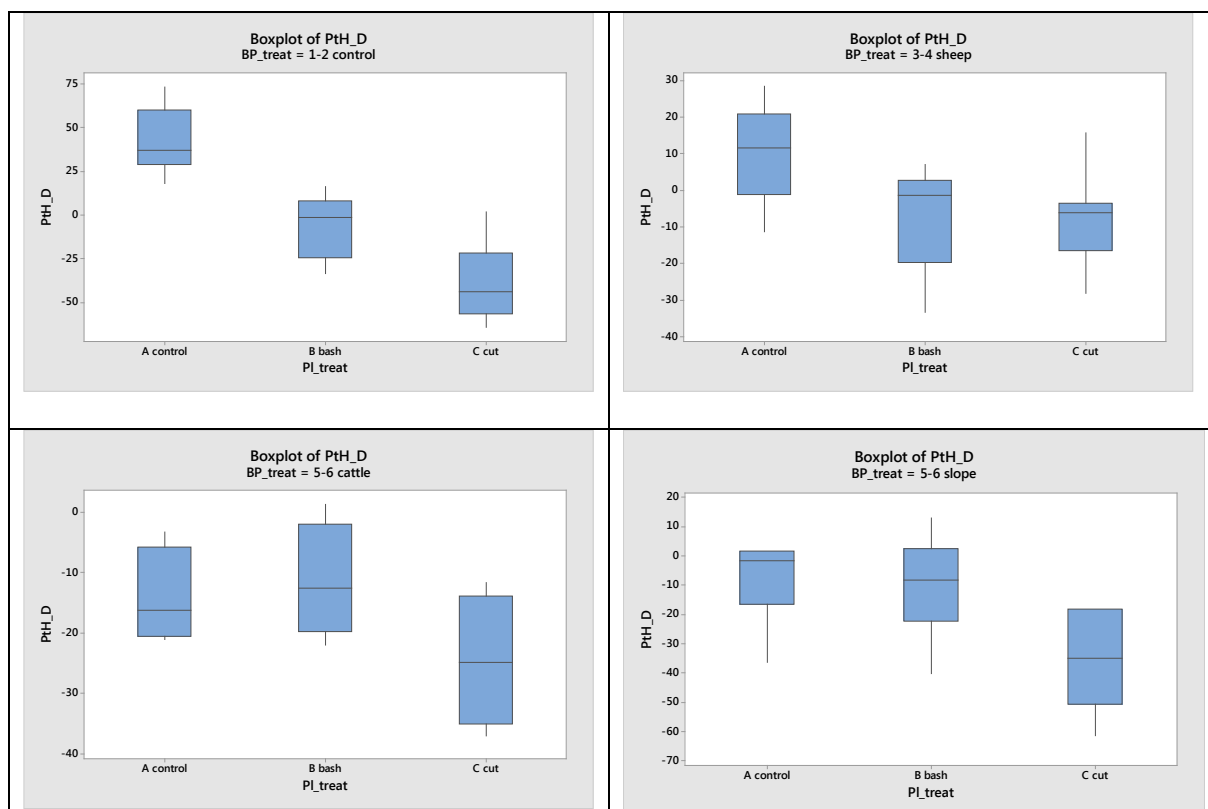


Figure 18. Change in bracken height after 3 years of treatment (Year 4 – Year 1), by livestock (plot) and mechanical (sub-plot) treatment

5.4.7 Bracken Shoot Density

5.4.7.1 Bracken shoot density is measured by counting the number of living shoots arising in each quadrat. The aim of the treatments is to reduce shoot density and hence competition, allowing grassland to develop between the plants.

5.4.7.2 There is considerable variation in bracken shoot density between and within plots, with local responses to trampling and frost damage year on year.

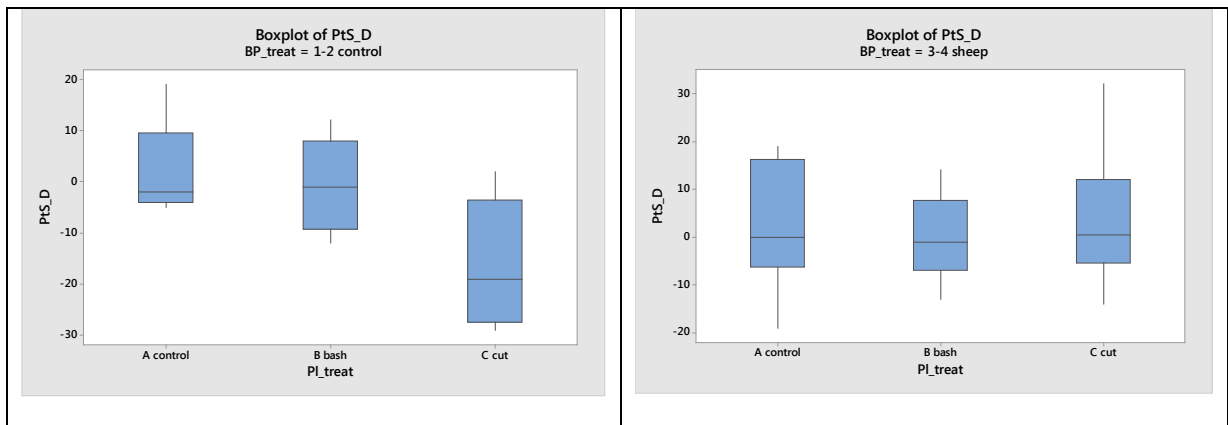
5.4.7.3 The differences between plot treatments and between sub-plot treatments are not significant overall, but there are significant differences between some of the treatment combinations. The greatest increase in density is in the cut sub-plots in the sheep and cattle plots, and the greatest decrease in the cut sub-plots in the untreated and slope plots (Table 11, Table 12, Figure 19).

| | F | p |
|---------------------|------|---------|
| Plot treatments | 2.82 | 0.044 * |
| Sub-plot treatments | 1.18 | 0.313 |
| Interactions | 2.61 | 0.024 * |

Table 11. ANOVA of bracken shoot density change after 3 years of treatment (Year 4 – Year 1)

| Plot treatment | | Combination | |
|--------------------|-------|------------------|------------|
| None | -4.70 | None x Control | 2.70 a |
| Sheep | 1.93 | Sheep x Control | 2.00 a |
| Cattle | 1.75 | Cattle x Control | 0.25 a b |
| Slope | -5.39 | Slope x Control | -4.83 a b |
| Sub-plot treatment | | None x Bashed | -0.40 a b |
| Control | 0.63 | Sheep x Bashed | -0.20 a b |
| Bashed | -0.43 | Cattle x Bashed | -0.75 a b |
| Cut | -5.50 | Slope x Bashed | -0.67 a b |
| | | None x Cut | -16.40 b |
| | | Sheep x Cut | 4.00 a |
| | | Cattle x Cut | 5.75 a b |
| | | Slope x Cut | -10.67 a b |

Table 12. Mean change in bracken shoot density after 3 years of treatment (Year 4 – Year 1), and differences if significant



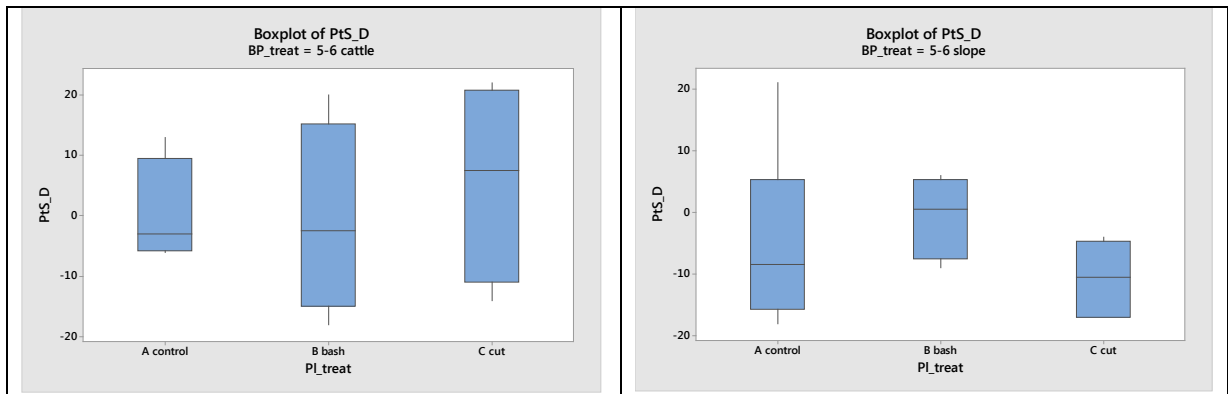


Figure 19. Change in bracken shoot density after 3 years of treatment (Year 4 – Year 1), by livestock (plot) and mechanical (sub-plot) treatment

5.4.8 Bracken vigour

5.4.8.1 Bracken vigour is a visual assessment against a 10 point scale, taking account of the condition of the plants as well as height, cover and density. It is subjective and vulnerable to observer differences from one year to the next. The treatments are intended to reduce all aspects of bracken vigour.

5.4.8.2 Overall vigour was recorded as having decreased in all the plot treatments, with the least change in the sheep plots and the greatest decrease on the slope on Fawdon Dean, but these differences are only just significant (Table 13).

5.4.8.3 The difference between sub-plot treatments is highly significant, with little change in the control sub-plots, a decrease in the bashed sub-plots and a greater decrease in the cut sub-plots (Table 13, Table 14, Figure 20).

| | F | p |
|---------------------|-------|-------------|
| Plot treatments | 3.91 | 0.012 * |
| Sub-plot treatments | 28.92 | < 0.001 *** |
| Interactions | 3.65 | 0.003 ** |

Table 13. ANOVA of bracken vigour change after 3 years of treatment (Year 4 – Year 1)

| Plot treatment | | | Combination | | |
|--------------------|-------|-----|------------------|-------|---------|
| None | -1.43 | a b | None x Control | 1.20 | a |
| Sheep | -0.57 | a | Sheep x Control | 1.00 | a |
| Cattle | -1.83 | a b | Cattle x Control | -1.25 | a b c |
| Slope | -2.11 | b | Slope x Control | -0.67 | a b |
| Sub-plot treatment | | | None x Bashed | -0.80 | a b |
| Control | 0.43 | a | Sheep x Bashed | -1.20 | a b |
| Bashed | -1.10 | b | Cattle x Bashed | -1.50 | a b c d |
| Cut | -3.33 | c | Slope x Bashed | -1.17 | a b |
| | | | None x Cut | -4.70 | d |
| | | | Sheep x Cut | -1.50 | b |
| | | | Cattle x Cut | -2.75 | b c d |
| | | | Slope x Cut | -4.50 | c d |

Table 14. Mean change in bracken vigour after 3 years of treatment (Year 4 – Year 1), and differences if significant

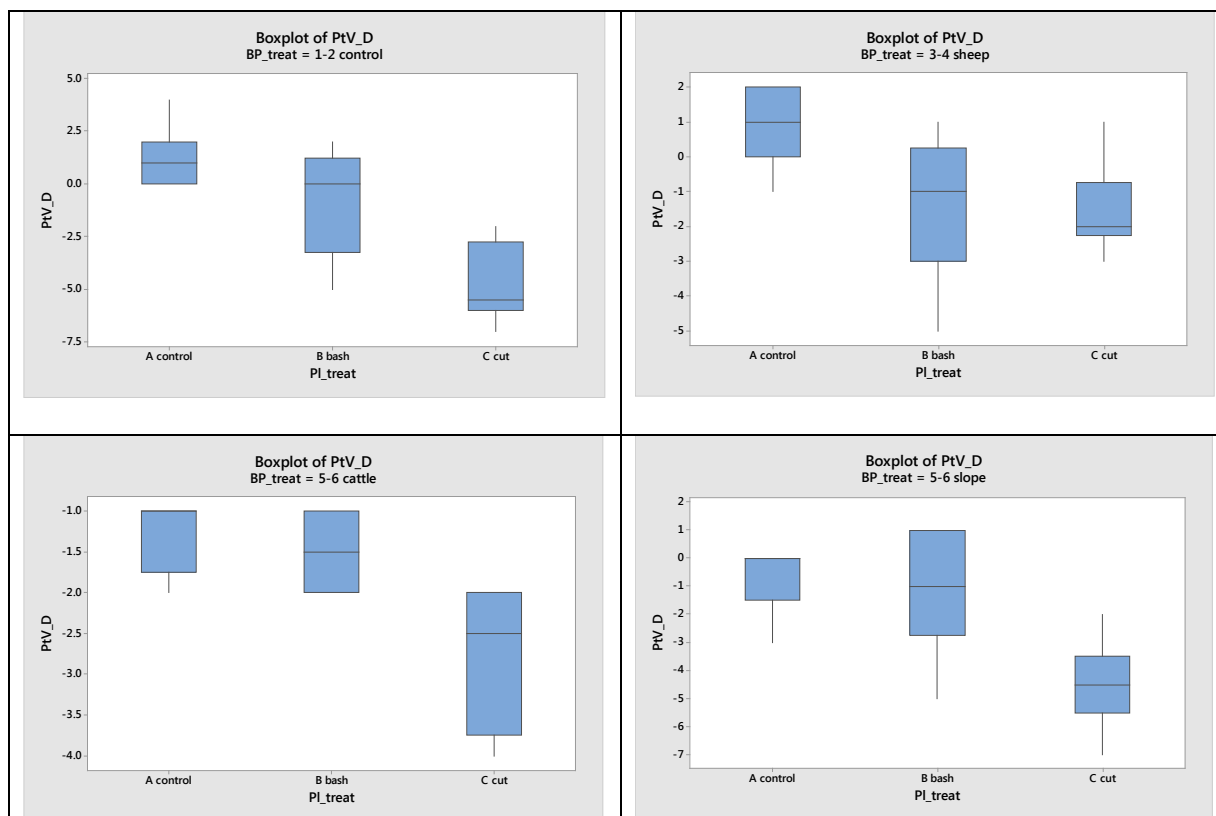


Figure 20. Change in bracken vigour after 3 years of treatment (Year 4 – Year 1), by livestock (plot) and mechanical (sub-plot) treatment

5.4.9 Species Richness

5.4.9.1 Species richness is measured as the count of vascular plant and bryophyte species found in each quadrat. The replacement of bracken by grassland is likely to increase species richness in time, but some species will be lost as well as gained and both processes are likely to take much longer than the three years of this experiment.

5.4.9.2 The only significant difference so far is between two of the plot treatments, where there has been an overall increase in species richness in the plots with no stocking treatment and a slight decrease in the plots with sheep Table 15, Table 16, Figure 21).

| | F | p |
|---------------------|------|-------------|
| Plot treatments | 13.3 | < 0.001 *** |
| Sub-plot treatments | 2.37 | 0.100 |
| Interactions | 1.31 | 0.262 |

Table 15. ANOVA of change in species richness after 3 years of treatment (Year 4 – Year 1)

| Plot treatment | | | Combination | |
|--------------------|-------|-----|------------------|-------|
| None | 2.70 | a | None x Control | 1.60 |
| Sheep | -1.60 | c | Sheep x Control | -2.60 |
| Cattle | 0.83 | a b | Cattle x Control | 0.00 |
| Slope | 0.39 | b c | Slope x Control | -0.33 |
| Sub-plot treatment | | | None x Bashed | 4.50 |
| Control | -0.40 | | Sheep x Bashed | -1.80 |
| Bashed | 1.10 | | Cattle x Bashed | 0.00 |
| Cut | 0.97 | | Slope x Bashed | -0.50 |
| | | | None x Cut | 2.00 |
| | | | Sheep x Cut | -0.40 |
| | | | Cattle x Cut | 2.50 |
| | | | Slope x Cut | 0.67 |

Table 16. Mean change in species richness after 3 years of treatment (Year 4 – Year 1), and differences if significant

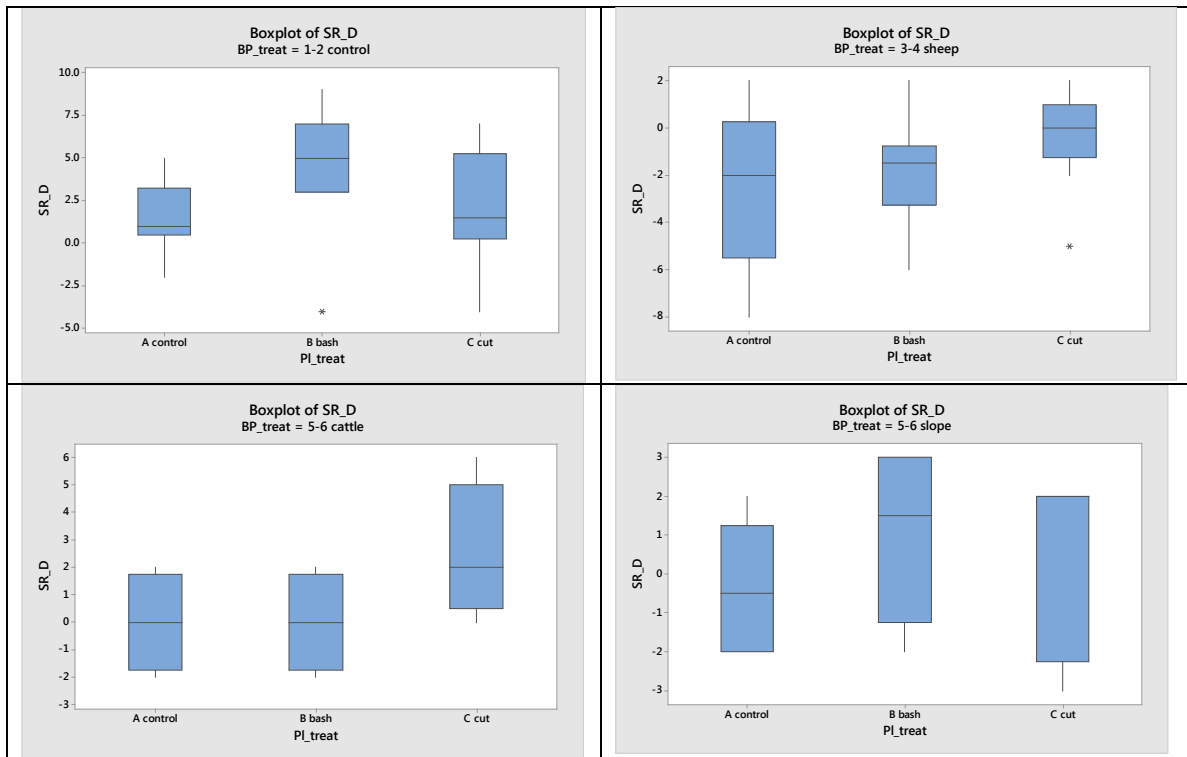


Figure 21. Change in species richness after 3 years of treatment (Year 4 – Year 1), by livestock (plot) and mechanical (sub-plot) treatment

5.4.10 Understorey Cover

5.4.10.1 Understorey cover is the sum of the percentage cover recorded for all species other than bracken in each 1x1m quadrat. As the minimum cover recorded for each species is 1%, when some may only be present as one small plant, this figure is often overstated, especially in species rich quadrats. The replacement of dense bracken stands by grassland should result in a considerable increase in cover of other species, but this can be complicated by rapid changes in the extent of the bracken understorey of creeping soft-grass *Holcus mollis*.

5.4.10.2 There is a highly significant difference between livestock treatments, with little change in the sheep and slope plots, a considerable increase in understorey cover in the plots with no stocking treatment, and a considerable decrease in the plots with cattle (Table 17).

5.4.10.3 The differences between mechanical treatments are less significant, but there is some decrease overall in the control sub-plots and an increase in the bashed and cut sub-plots (Table 17, Table 18, Figure 22). The greatest increase is in the bashed and cut sub-plots of the plots with no stocking treatment, while the greatest decrease is in the control and cut sub-plots of the cattle plots, but there is considerable variation within the sub-plots and these differences are not statistically significant.

| | F | p |
|---------------------|-------|-------------|
| Plot treatments | 11.84 | < 0.001 *** |
| Sub-plot treatments | 6.58 | 0.002 ** |
| Interactions | 1.39 | 0.230 |

Table 17. ANOVA of understorey cover change after 3 years of treatment (Year 4 – Year 1)

| Plot treatment | | | Combination | | |
|--------------------|--------|---|------------------|--------|--|
| None | 31.56 | a | None x Control | -6.30 | |
| Sheep | -3.10 | b | Sheep x Control | -11.50 | |
| Cattle | -34.60 | c | Cattle x Control | -45.80 | |
| Slope | 1.67 | b | Slope x Control | -20.20 | |
| Sub-plot treatment | | | None x Bashed | 54.10 | |
| Control | -16.07 | b | Sheep x Bashed | -3.30 | |
| Bashed | 13.50 | a | Cattle x Bashed | -24.50 | |
| Cut | 18.20 | a | Slope x Bashed | -0.80 | |
| | | | None x Cut | 46.90 | |
| | | | Sheep x Cut | 5.50 | |
| | | | Cattle x Cut | -33.50 | |
| | | | Slope x Cut | 26.00 | |

Table 18. Mean change in understorey cover after 3 years of treatment (Year 4 – Year 1), and differences if significant

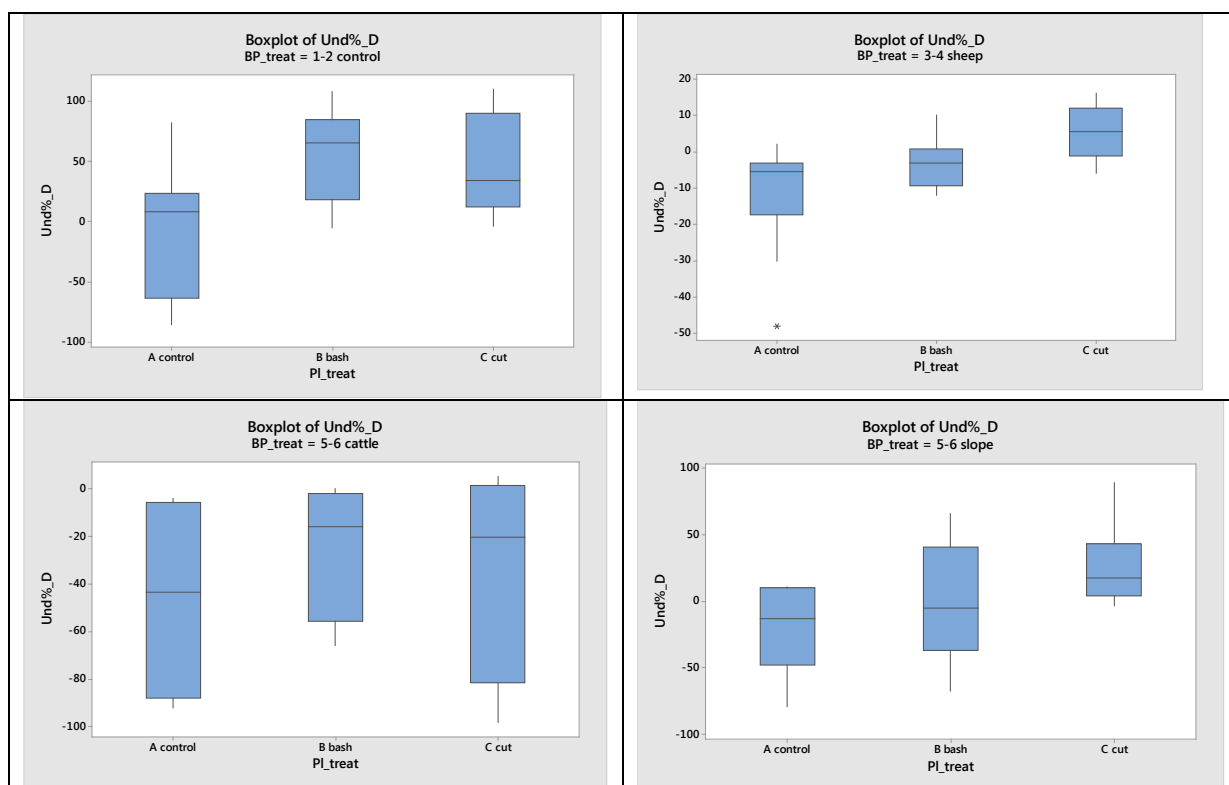


Figure 22. Change in understorey cover after 3 years of treatment (Year 4 – Year 1), by livestock (plot) and mechanical (sub-plot) treatment

5.4.11 Fit to NVC Community U4b

5.4.11.1 NVC community U4b is the grassland community commonly found in the upland fringes of Northumberland, and is the target of bracken control methods in this area. Ecological changes on the scale of the replacement of bracken by open hill grassland is a slow process and likely to take much longer than the three years of this experiment, however some increase in U4b score is an indication of successful treatment.

5.4.11.2 Overall there has been an increase in fit to U4b that corresponds to a trend towards grassiness in all the sub-plots except those in the sheep plots (Table 19). The reason for the lack of response in the sheep plots may be the reduction in hill grazing since they were fenced, even though the gate has been left open over the last year or two. The increase in fit to U4b in the plots with no stocking treatment is greatest, and may reflect the greater response of this mature bracken stand to cutting and bashing. The increase is smaller in the cattle plots, and there has been a considerable decrease in the sheep plots.

5.4.11.3 The differences between sub-plot treatments and the combinations of plot and sub-plot treatments are only just significant, with the greatest increase in fit to U4b in the cut and bashed sub-plots of the plots with no stocking treatment, and the greatest decrease in all the sub-plots of the sheep plots (Table 19, Table 20, Figure 23).

| | F | p |
|---------------------|-------|-------------|
| Plot treatments | 37.33 | < 0.001 *** |
| Sub-plot treatments | 3.72 | 0.029 * |
| Interactions | 2.73 | 0.019 * |

Table 19. ANOVA of change in fit to U4b after 3 years of treatment (Year 4 – Year 1)

| Plot treatment | | | Combination | | |
|--------------------|--------|-----|------------------|--------|-----|
| None | 16.30 | a | None x Control | 3.40 | a b |
| Sheep | -18.30 | c | Sheep x Control | -30.60 | c |
| Cattle | 3.58 | b | Cattle x Control | -1.25 | a b |
| Slope | 9.33 | a b | Slope x Control | 16.50 | a |
| Sub-plot treatment | | | None x Bashed | 22.80 | a |
| Control | -5.93 | b | Sheep x Bashed | -14.40 | b c |
| Bashed | 4.73 | a b | Cattle x Bashed | 4.75 | a b |
| Cut | 6.23 | a | Slope x Bashed | 6.50 | a b |
| | | | None x Cut | 22.70 | a |
| | | | Sheep x Cut | -9.90 | b |
| | | | Cattle x Cut | 7.25 | a b |
| | | | Slope x Cut | 5.00 | a b |

Table 20. Mean change in fit to U4b after 3 years of treatment (Year 4 – Year 1), and differences if significant

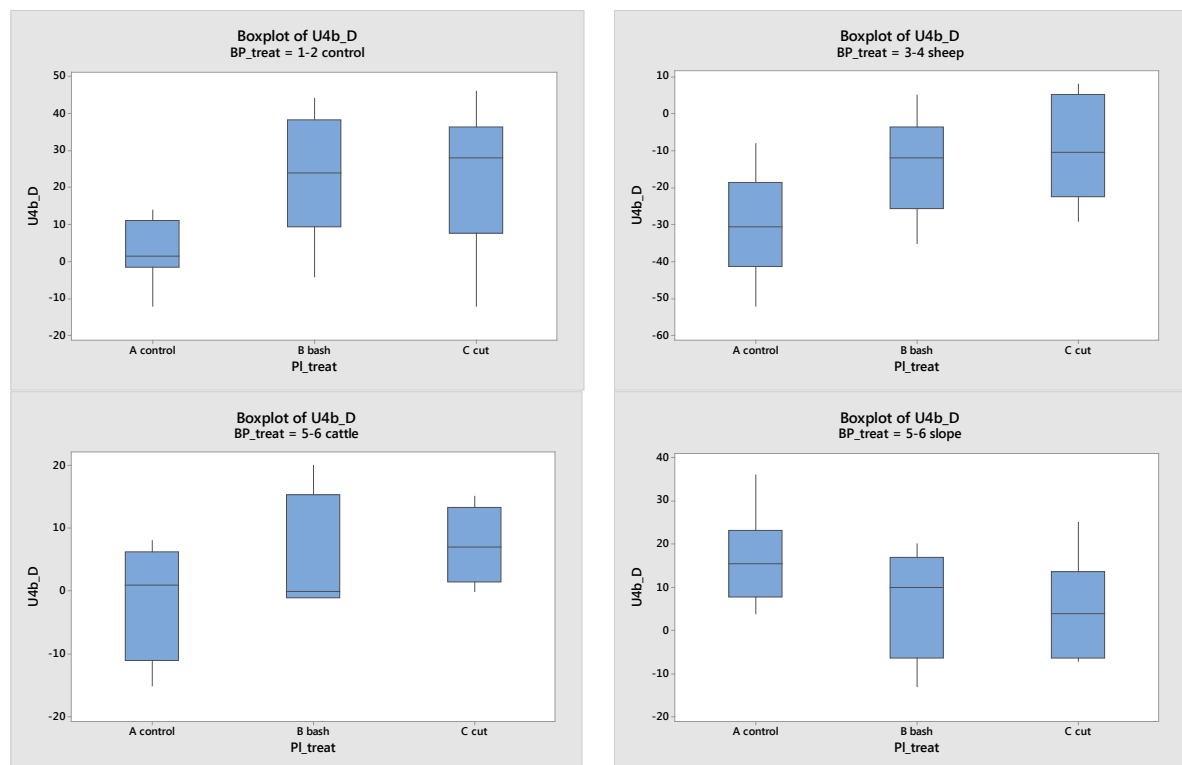


Figure 23. Change in fit to U4a after 3 years of treatment (Year 4 – Year 1), by livestock (plot) and mechanical (sub-plot) treatment

5.4.12 Fit to NVC Community U20a

5.4.12.1 U20a is the grassiest bracken stand community, and when bracken control is successful it is often transitional to U4b grassland. Successful bracken control should therefore increase the fit to U20a, but this response is slow and may take longer to show in some stands than the duration of this experiment allows.

5.4.12.2 There is a highly significant difference between livestock treatments, with the untreated and slope plots showing no change or a slight increase, but the sheep and cattle plots showing a significant decrease (Table 21, Table 22, Figure 24). The overall reduction in fit in the control sub-plots is also significant, compared to the bashed and cut sub-plots where the reduction has been much less. However, there is considerable variation in U20a scores down the transects within sub-plots (Appendix 7) and none of the differences between treatment combinations are themselves significant.

| | F | p |
|---------------------|-------|-------------|
| Plot treatments | 27.40 | < 0.001 *** |
| Sub-plot treatments | 5.29 | 0.007 ** |
| Interactions | 1.42 | 0.216 |

Table 21. ANOVA of bracken cover change after 3 years of treatment (Year 4 – Year 1)

| Plot treatment | | | Combination | |
|--------------------|--------|---|------------------|--------|
| None | 7.97 | a | None x Control | 1.90 |
| Sheep | -18.93 | b | Sheep x Control | -31.80 |
| Cattle | -13.67 | b | Cattle x Control | -18.75 |
| Slope | -0.39 | a | Slope x Control | -1.33 |
| Sub-plot treatment | | | None x Bashed | 15.50 |
| Control | -12.73 | b | Sheep x Bashed | -13.80 |
| Bashed | -0.87 | a | Cattle x Bashed | -10.00 |
| Cut | -3.07 | a | Slope x Bashed | -0.50 |
| | | | None x Cut | 6.50 |
| | | | Sheep x Cut | -11.20 |
| | | | Cattle x Cut | -12.25 |
| | | | Slope x Cut | 0.67 |

Table 22. Mean change in fit to U20a after 3 years of treatment (Year 4 – Year 1), and differences if significant

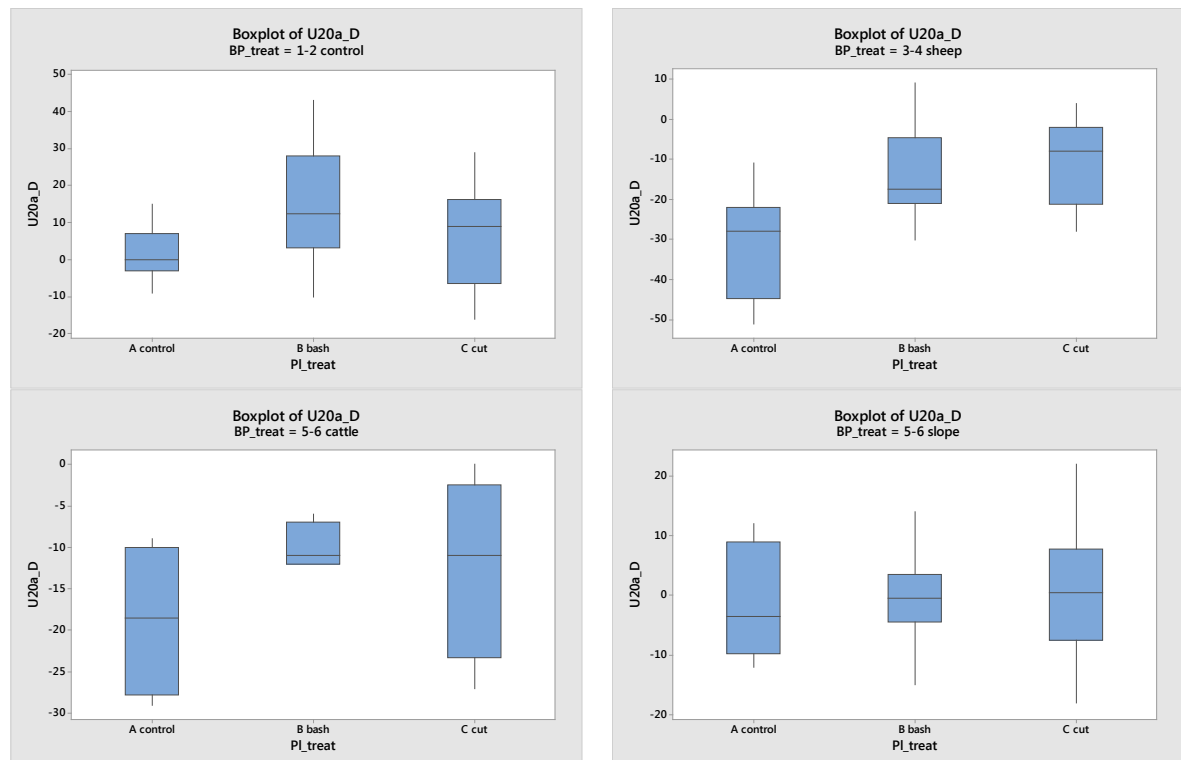


Figure 24. Change in fit to U20a after 3 years of treatment (Year 4 – Year 1), by livestock (plot) and mechanical (sub-plot) treatment

5.4.13 Fit to NVC Community U20c

5.4.13.1 NVC community U20c is the dense, mature bracken stand found throughout the cheviots. It is species poor but has a sparse understorey, often including creeping soft-grass

Holcus mollis, foxglove *Digitalis purpurea*, and heath groundsel *Senecio sylvatica*. The gradual replacement of dense bracken by grassland should result in a decrease in fit to U20c.

5.4.13.2 There has been a general trend towards a reduced fit to U20c throughout the experiment, with the only significant differences so far between livestock treatments where the greatest decrease has been in the plots without any stock treatment (Table 23, Table 24, Figure 25). This was the most mature bracken stand when the experiment was set up and so may be responding more quickly to the mechanical treatments, but the decrease in fit has also occurred in the control sub-plots suggesting that climate or some other factor is also involved.

| | F | P |
|---------------------|------|-------------|
| Plot treatments | 7.41 | < 0.001 *** |
| Sub-plot treatments | 3.03 | 0.054 |
| Interactions | 0.95 | 0.462 |

Table 23. ANOVA of bracken cover change after 3 years of treatment (Year 4 – Year 1)

| Plot treatment | | | Combination | | |
|---------------------------|--------|-----|------------------|--------|--|
| None | -12.80 | b | None x Control | -7.30 | |
| Sheep | -2.37 | a | Sheep x Control | -3.70 | |
| Cattle | -6.00 | a b | Cattle x Control | 6.25 | |
| Slope | -0.06 | a | Slope x Control | 2.00 | |
| Sub-plot treatment | | | None x Bashed | -11.10 | |
| Control | -4.10 | | Sheep x Bashed | -1.50 | |
| Bashed | -3.83 | | Cattle x Bashed | -0.50 | |
| Cut | -9.67 | | Slope x Bashed | 2.17 | |
| | | | None x Cut | -20.00 | |
| | | | Sheep x Cut | -1.50 | |
| | | | Cattle x Cut | -11.25 | |
| | | | Slope x Cut | -4.33 | |

Table 24. Mean change in fit to U20c after 3 years of treatment (Year 4 – Year 1), and differences if significant

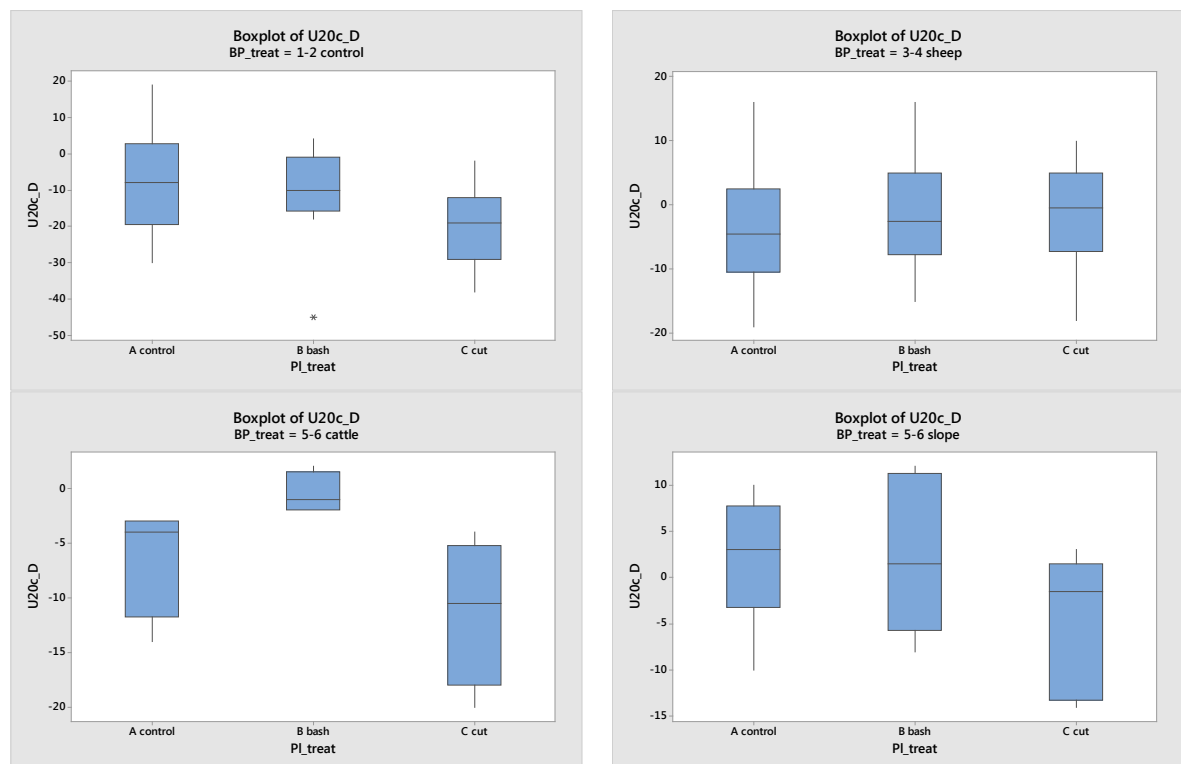


Figure 25. Change in fit to U20c after 3 years of treatment (Year 4 – Year 1), by livestock (plot) and mechanical (sub-plot) treatment

5.5 Multivariate Analysis

5.5.1 Introduction

5.5.1.1 This analysis is done using the vegetation data and other measurements, summarised by sub-plot. Preliminary investigation confirmed that the vegetation shows a linear, rather than unimodal, response to the treatments and so Principal Components Analysis (PCA), a linear method of indirect gradient analysis has been used. This is an unconstrained ordination method, in which the treatments and years of the experiment are shown in the sub-plots but do not constrain the ordination.

5.5.2 PCA of Year 4 Results

5.5.2.1 This analysis uses only the Year 4 data, and so does not compensate for the differences between and within plots and sub-plots found in the baseline recording.

5.5.2.1 The cumulative variance of the species data explained by the model is good, with 57.7% explained by the primary axis and another 19.7% by the second axis.

| Axes | 1 | 2 | 3 | 4 | Total variance |
|-----------------------------------|-------|-------|-------|-------|----------------|
| Eigenvalues: | 0.577 | 0.197 | 0.088 | 0.057 | 1.000 |
| Species-environment correlations: | 0.968 | 0.946 | 0.773 | 0.814 | |
| Cumulative percentage variance | | | | | |
| of species data: | 57.7 | 77.4 | 86.2 | 91.9 | |
| of species-environment relation: | 63.0 | 83.5 | 89.7 | 94.1 | |
| Sum of all eigenvalues | | | | | 1.000 |
| Sum of all canonical eigenvalues | | | | | 0.858 |

5.5.2.3 The treatments, summary and derived data are shown below (Figure 26). This shows a strong association between both bracken cutting and cattle foddering and higher species richness, understorey cover, and fit to NVC communities U4b and U20a. At the other end of the scale is a similarly strong association between the controls with no treatment and high bracken cover, height and vigour, and also a deep litter layer and the presence of exposed stones.

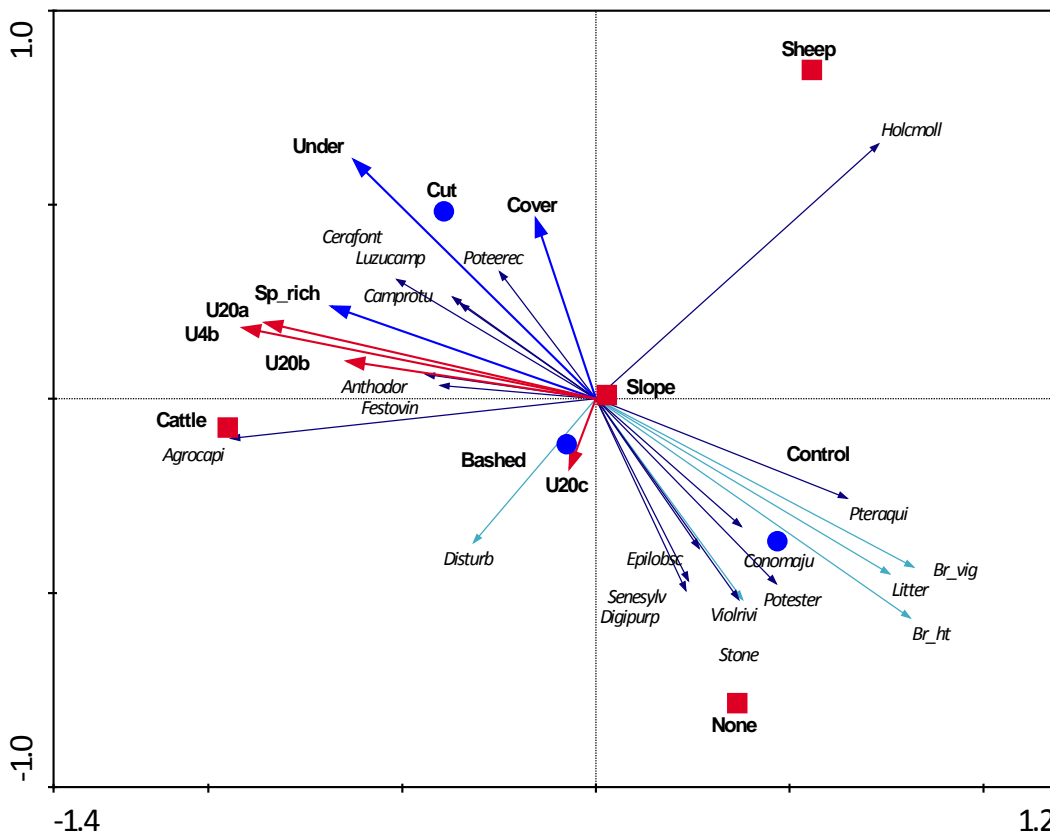


Figure 26. PCA showing treatments, summary data and selected species for Year 4 only

5.5.2.4 Grouping the samples by plot treatment (Figure 27) shows the similarity between samples from the control and slope plot treatments, neither of which have any livestock treatment other than being open to hill grazing, and the difference between these, the cattle treatment and the sheep treatment. The variation within these plot treatments is due partly to the mechanical sub-plot treatments, and partly to the variation between the stands of bracken from the beginning of the project.

5.5.3.5 Grouping the same samples by mechanical sub-plot treatment (Figure 28) again shows a gradient from cut to bashed and then control sub-plots, with the cut sub-plots most closely associated with high species richness and the NVC communities U4b and U20a, and the control sub-plots most closely associated with high bracken cover, shoot number, height and vigour, a deep litter layer, and NVC community U20c.

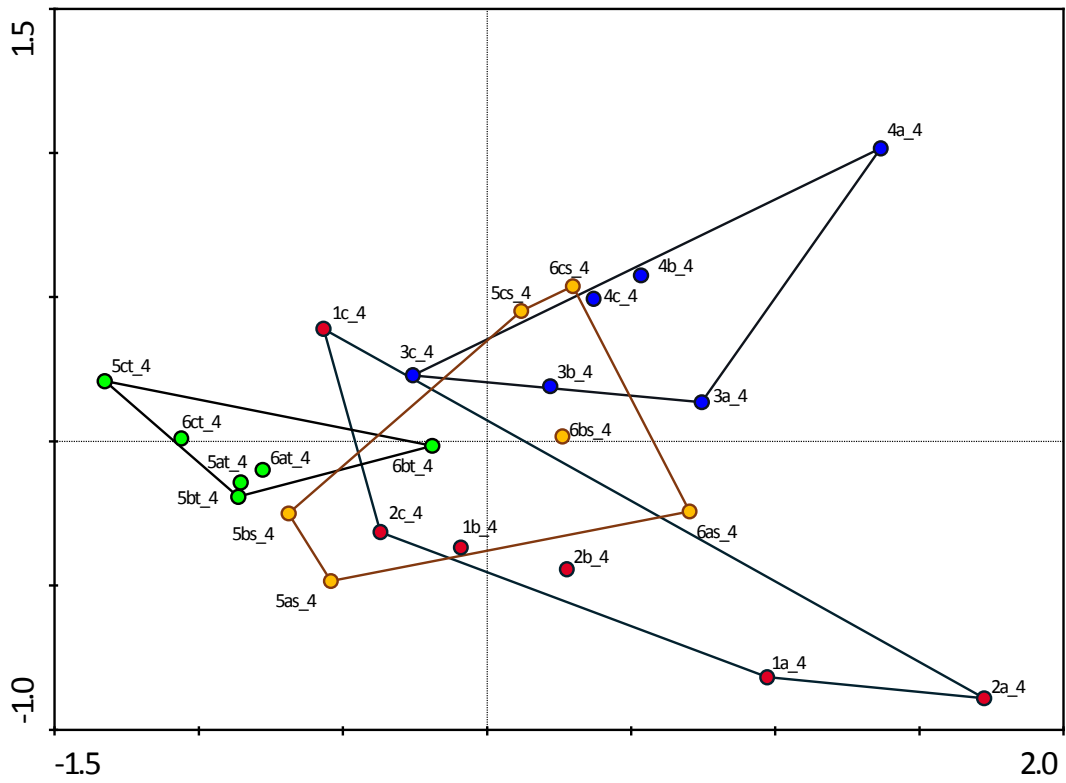


Figure 27. PCA showing samples for Year 4 only, classified by livestock (plot) treatment. Red – control, blue – sheep, green – cattle, yellow – slope.

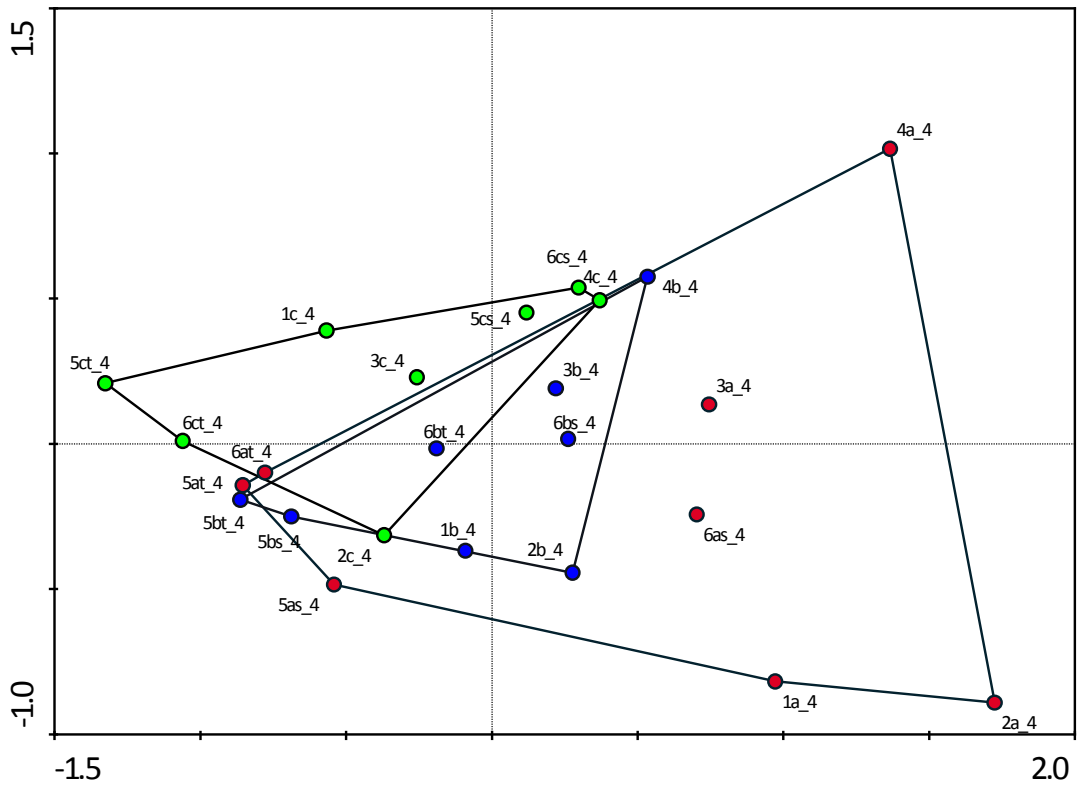


Figure 28. PCA showing samples for Year 4 only, classified by mechanical (sub-plot) treatment. Red – control, blue – bashed green – cut.

5.5.3 PCA of Results from all Four Years

5.5.3.1 In this analysis the baseline data, recorded before any treatments commenced, is all classified as controls with no stock treatment and no mechanical treatment. The results after treatment include data from Years 2, 3 and 4.

5.5.3.2 The fit to the model is poor, partly due to the inclusion of anomalous data from Year 3 when the recording was done at an earlier stage in the growing season, but despite this the primary axis explains 44.8% of the species data and 58% of the species-environment relation.

| <u>Axes</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>4</u> | <u>Total variance</u> |
|-----------------------------------|----------|----------|----------|----------|-----------------------|
| Eigenvalues : | 0.448 | 0.177 | 0.099 | 0.091 | 1.000 |
| Species-environment correlations: | 0.975 | 0.838 | 0.665 | 0.836 | |
| Cumulative percentage variance | | | | | |
| of species data : | 44.8 | 62.5 | 72.4 | 81.5 | |
| of species-environment relation: | 58.0 | 75.0 | 81.0 | 89.7 | |
| Sum of all eigenvalues | | | | | 1.000 |
| Sum of all canonical eigenvalues | | | | | 0.734 |

5.5.3.3 The plot of treatments, summary data and measurements (Figure 29) shows slightly different results to the analysis for Year 4 only, and the primary or x-axis is reversed. This separates dense bracken stands on the left from grassier stands on the right. The dense stands, with high bracken cover, height, vigour and shoot density, a deep litter layer and a good fit to U20c are associated with the controls with no stock or mechanical treatments. The grassier stands, with bare and disturbed ground, exposed stone, high species richness and a good fit to U4b are associated most strongly with the cutting treatment.

5.5.3.4 The cattle treatment is separated from slope and sheep on the 2nd or y-axis, with the cattle plots having a better fit to U20a and U4b, a higher species richness and more extensive understorey. This is not supported by the statistical analysis of change (5.4.9.3) and is probably the result of the past cutting of the strip now used for cattle foddering, so that it was already grassy and relatively forb-rich before the experiment began.

5.5.3.5 The mechanical treatments are distributed along the primary axis, from controls to bashed and then cut along the trend from dense to grassy bracken stands.

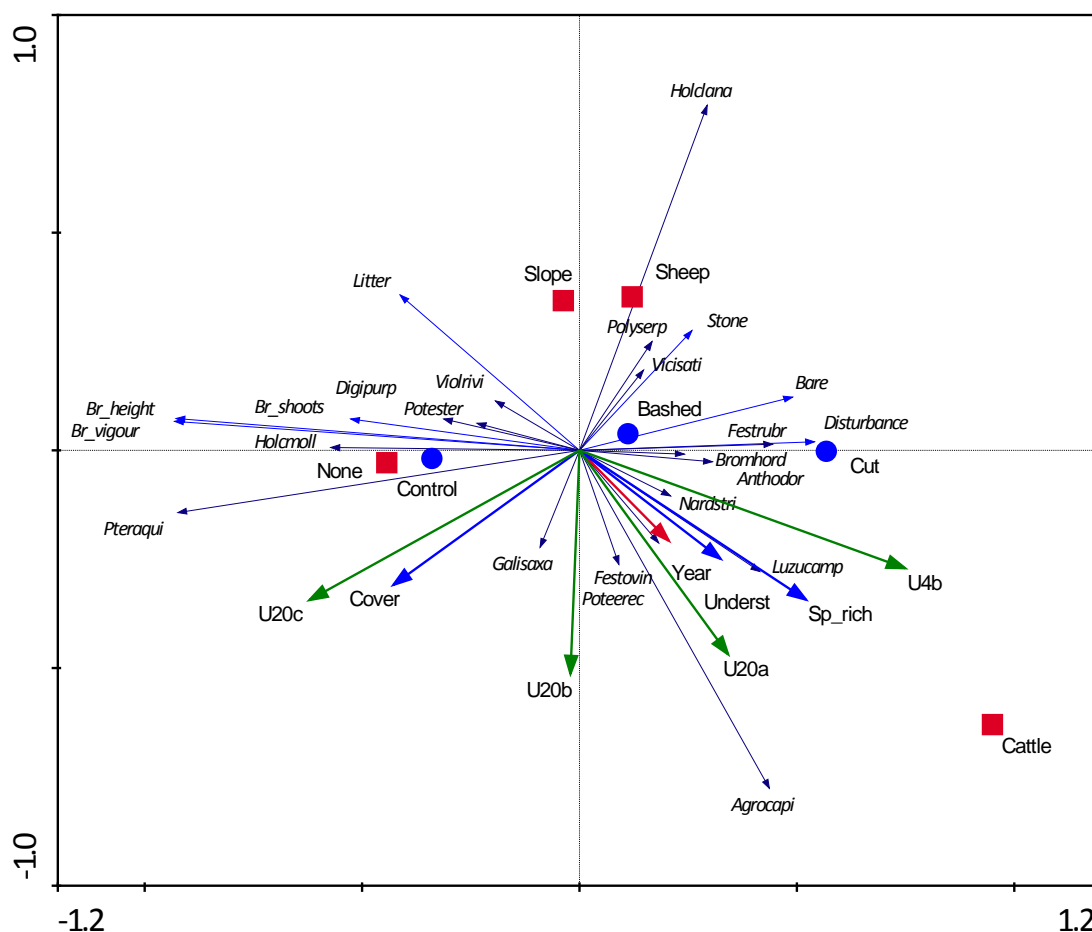


Figure 29. PCA showing treatments, summary data and selected species for Years 1-4

5.5.3.6 Classifying the samples by livestock treatment (Figure 30) shows considerable overlap between them, but the cattle plots are distributed towards the lower right quadrant associated with a good fit to U20a and U4b and an extensive understorey. The scatter within each group is due partly to the inclusion of control, bashed and cut sub-plots within the plot treatments, and also to the variation between bracken stands from the beginning of the experiment.

5.5.3.7 Similarly the plot of samples classified by mechanical treatment (Figure 31) shows considerable overlap but with the control sub-plots concentrated towards the left side, where they are associated with high bracken cover, height, shoot number and vigour and with a good fit to U20c, and the cut sub-plots at the other end of the primary axis where they are associated with a grassier sward and a good fit to U20a and U4b.

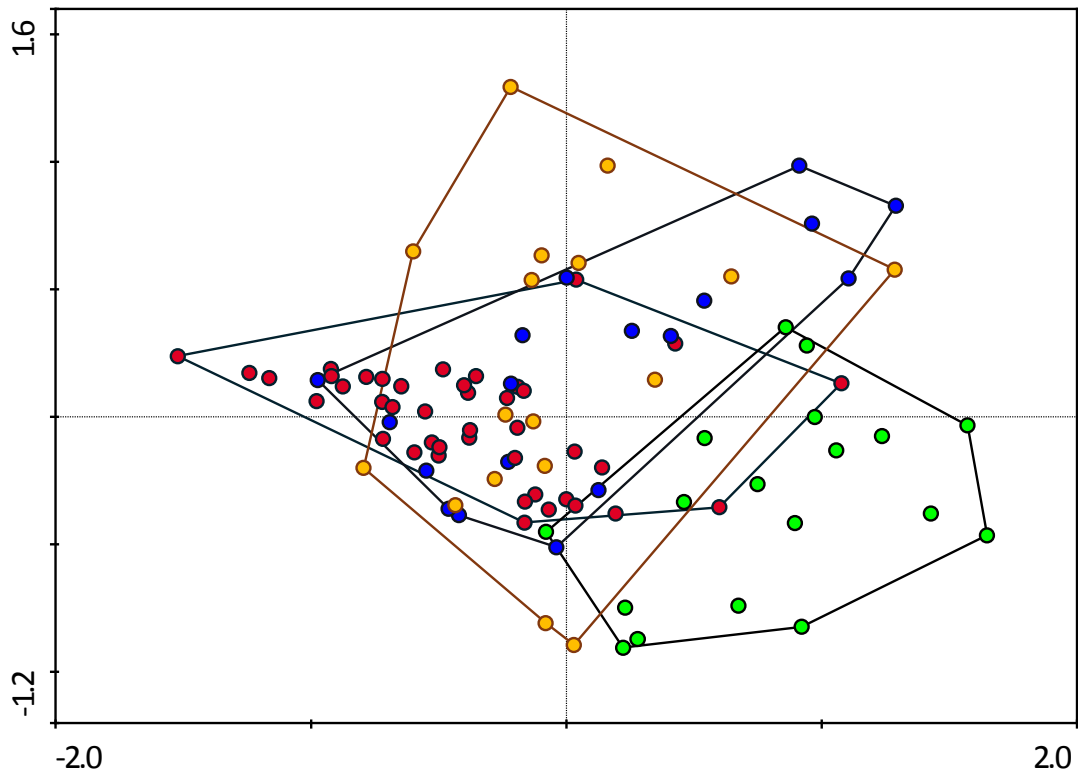


Figure 30. PCA showing samples for Years 1-4, classified by livestock (plot) treatment.
Red – control, blue – sheep, green – cattle, yellow – slope.

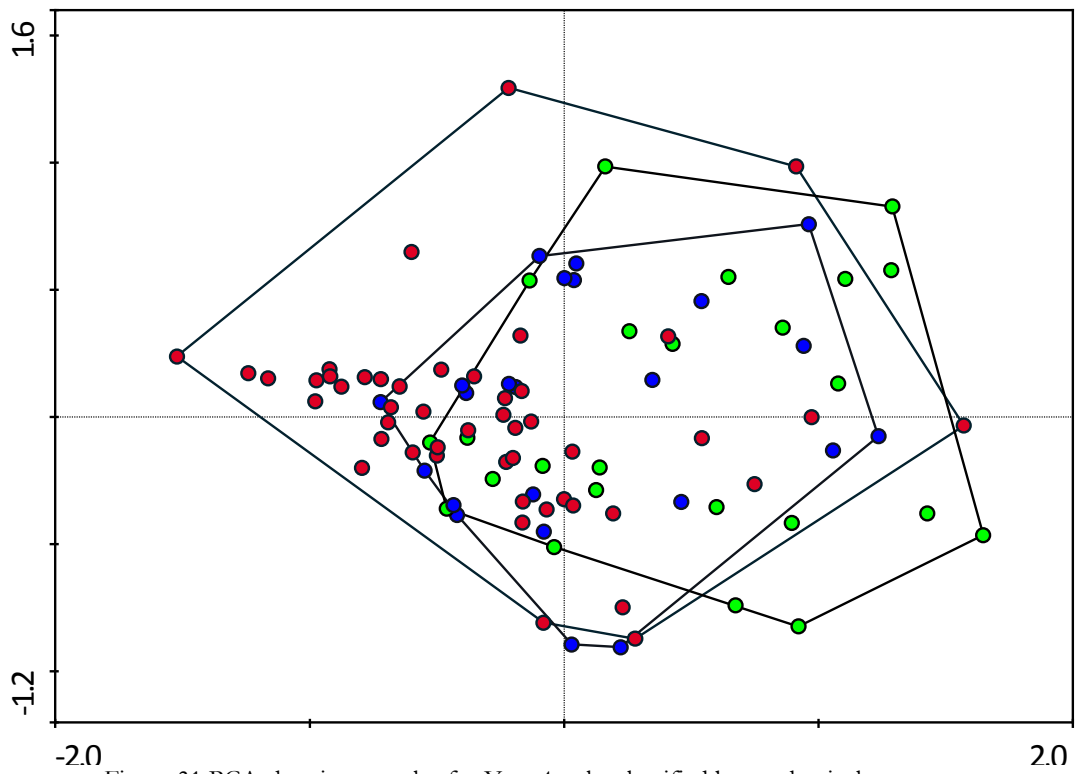


Figure 31 PCA showing samples for Year 4 only, classified by mechanical treatment.
Red – control, blue – bashed green – cut.

5.6 Summary and discussion of results

5.6.1 The following tables (Table 25) summarise the statistical analysis of changes since the baseline survey in Year 1, highlighting trends towards the target grassland vegetation which may be a response to the livestock and mechanical treatments.

5.6.2 Of the livestock (plot) treatments, the most successful has been having no stock treatment. Cattle foddering has also had a weakly positive result but this is complicated by previous cutting of the strip where the cattle congregate, so that the bracken stand on that parts of that slope is less mature than further down the slope. It is too soon to say whether the treatment itself has had a positive effect.

5.6.3 Sheep penning has had a negative influence. This appears to be genuine and may be due to a combination of nutrient input during times of high sheep numbers and the lower levels of hill grazing for the rest of the year as a result of fencing.

5.6.4 Of the mechanical (sub-plot) treatments, cutting has clearly been the most successful in initiating a trend from dense bracken stands towards grassland, although this is not yet reflected in the U20a and U20c scores. Bashing has produced a weaker response; with a negative trend overall in the controls.

| | Target trend | Livestock (plot) treatment | | | |
|-----------------------|--------------|----------------------------|--------------|---------------|--------------|
| | | 1-2 none | 3-4 sheep | 5-6 cattle | 5-6 slope |
| bracken cover (%) | Decrease | -13.43 | 4.47 | -3.50 | -5.17 |
| bracken height (cm) | Decrease | -0.20 | -2.11 | -16.72 | -17.83 |
| bracken shoots (n) | Decrease | -4.70 | 1.93 | 1.75 | -5.39 |
| bracken vigour (1-10) | Decrease | -1.43 | -0.57 | -1.83 | -2.11 |
| understorey cover (%) | Increase | 31.56 | -3.10 | -34.60 | 1.67 |
| species richness (n) | Increase | 2.70 | -1.60 | 0.83 | 0.39 |
| U4b (score) | Increase | 16.30 | -18.30 | 3.58 | 9.33 |
| U20a (score) | Increase | 7.97 | -18.93 | -13.67 | -0.39 |
| U20c (score) | Decrease | -12.80 | -2.37 | -6.00 | -0.06 |

| | Target trend | Mechanical (sub-plot) treatments | | |
|-----------------------|--------------|----------------------------------|----------|--------|
| | | A control | B bashed | C cut |
| bracken cover (%) | decrease | 4.50 | -0.13 | -17.83 |
| bracken height (cm) | decrease | 14.24 | -8.17 | -25.78 |
| bracken shoots (n) | decrease | 0.63 | -0.43 | -5.50 |
| bracken vigour (1-10) | decrease | 0.43 | -1.10 | -3.33 |
| understorey cover (%) | Increase | -16.07 | 13.50 | 18.20 |
| species richness (n) | Increase | -0.40 | 1.10 | 0.97 |
| U4b (score) | Increase | -5.93 | 4.73 | 6.23 |
| U20a (score) | Increase | -12.73 | -0.87 | -3.07 |
| U20c (score) | decrease | -4.10 | -3.83 | -9.67 |

Table 25. Summary of statistical analysis of change over three years of treatment, highlighting successful responses. Orange – successful response to treatment, pale orange – weak response, grey – negative response.

5.6.5 Three years is too short a time to detect long term ecological responses, but the results so far suggest that both the stocking treatments have been unsuccessful as methods of bracken control, but that cutting, and to a lesser extent bashing, have had a significant

impact on the bracken stands at Ingram Farm. Sheep penning in particular should be avoided as a treatment as it results in increased bracken growth and a loss of species richness.

5.6.6 Further monitoring is needed to determine how long the annual cutting would have to be continued to have a long term effect. Until the number of living bracken shoots declines as well as their cover and height, the effect of the treatment may be very short term and the bracken would soon recover if they ceased.

6. FINANCIAL DATA

6.1 Financial data has been collected by the Wilsons and harvested for each year by Archaeological Research Services Ltd using a standard form, which can be either paper or digital. The financial data for Year 4 is shown in Table 26. There have been no capital investments this year as all necessary equipment has been purchased in previous years.

6.2 Year 4 – Financial Information

| Sub-Plot | Treatment Description | Capital Investment Incurred (£) | Running Costs Year 4 (£) | Other benefits and notes |
|----------|------------------------|---------------------------------|--------------------------|---|
| 1a | No stock, no treatment | 0 | 0 | |
| 1b | No stock, bashing | 0 | 16.30 | |
| 1c | No stock, cutting | 0 | 33.93 | |
| 2a | No stock, no treatment | 0 | 0 | |
| 2b | No stock, bashing | 0 | 16.30 | |
| 2c | No stock, cutting | 0 | 33.93 | |
| 3a | Sheep, no treatment | 0 | 8.00 | |
| 3b | Sheep, bashing | 0 | 24.30 | |
| 3c | Sheep, cutting | 0 | 41.93 | |
| 4a | Sheep, no treatment | 0 | 8.00 | |
| 4b | Sheep, bashing | 0 | 24.30 | |
| 4c | Sheep, cutting | 0 | 41.93 | |
| 5a | Cattle, no treatment | 0 | 0 | Cattle feeding costs were £20 per day but need to feed cattle anyway. |
| 5b | Cattle, bashing | 0 | 16.30 | |
| 5c | Cattle, cutting | 0 | 33.93 | |
| 6a | Cattle, no treatment | 0 | 0 | |
| 6b | Cattle, bashing | 0 | 16.30 | |
| 6c | Cattle, cutting | 0 | 33.93 | |

Table 26. Year 4 Financial Information

6.3 The Wilson’s have noted that a new water supply for the farm was installed within the area used for the sheep stocking treatment in June/July 2014. The sheep stocking treatment has not been carried out since installation. Although this has likely not affected the Year 4 data (due to the dates when monitoring took place), it does mean that should a further monitoring project be devised, this will need to address the issue of the sheep stocking treatment and the break in continuous data collection that will be caused.

7. DISCUSSION

7.1 Visual inspection of the stone grids has allowed some conclusions to be drawn regarding the effects of differing stock treatments on partly-buried remains. The greatest disturbance occurred in those plots where there was more intensive trampling by livestock, and in particular those where cattle foddering was carried out on or close to the grids. Across those two plots a total of sixteen stones were missing and one stone was broken in two by Year 4. The majority of the remaining stones had moved a considerable distance from their original locations, trending towards a downslope movement. This high level of disturbance in the cattle foddering areas was confirmed by the statistical analysis of stone movements, with the level of disturbance in the cattle foddering plots being the only stock treatment to demonstrate a statistically significant difference to the control.

7.2 The results of the mechanical bracken treatments employed point towards bracken cutting as being the least destructive form of mechanical treatment in areas with sensitive archaeological remains, with the control sub-plots being the most destructive to buried remains. This is likely due to the increased grassiness of plots which have been subjected to mechanical treatment, as opposed to those which have not. The increased grassiness perhaps serves to anchor buried features in place.

7.3 Intensive sheep grazing and bracken bashing demonstrated intermediate results with regards to disturbance to archaeological features.

7.4 The results of the ecological monitoring so far suggest that both the stocking treatments have been unsuccessful as methods of bracken control, but that cutting, and to a lesser extent bashing, have had a significant impact on the bracken stands at Ingram Farm. Sheep penning in particular should be avoided as a treatment as it results in increased bracken growth and a loss of species richness. Further monitoring is needed to determine how long the annual cutting would have to be continued to have a long term effect. Until the number of living bracken shoots declines as well as their eventual cover and height, the effect of the treatment may be very short term and the bracken would soon recover if they ceased.

7.5 At this point of the experiment, the potentially competing priorities of reducing the bracken cover and protecting sensitive archaeological remains appear to be moving in tandem, with both forms of observation pointing towards no stocking treatment and bracken cutting as being the most effective and least damaging form of bracken control. Further monitoring will confirm whether this trend continues in the longer term and whether once the bracken is down to a certain level whether sheep or cattle grazing could then benefit the bracken control as these different treatments have started from a position of high level infestation at the outset.

7.6 Over the course of the experiment significant disturbance has been noted in a number of the stone grids laid out in Year 1. Several grids now have missing stones, with one stone grid only retaining three stones of its original nine. Should the experiment be continued it is suggested that all stone grids are renewed immediately following the next round of monitoring, so that this can continue to be used as a measure of disturbance to archaeological remains.

7.7 A research project application to investigate prehistoric cultivation terraces at a European-wide scale has been made by Prof Tony Brown (Southampton University) supported by Dr Clive Waddington with a view to undertaking some further work on cultivation terraces in Northumberland, and ideally those at Ingram Farm where previous

preliminary work was undertaken on the terraces with high level bracken cover close to the existing survey areas. This project could also look at aspects of below ground impact of bracken to archaeological remains as part of any new or continuation of this bracken monitoring project.

8. PROGRESS

| <i>Task (see also Gantt Chart)</i> | <i>Performed by:</i> | <i>Date deliverable</i> |
|--|--|--|
| Project Initiation, planning and meeting, creation of a MORPHE Compliant Project Design, Scheduled Monument Consent | Clive Waddington and Chris Scott | Complete |
| Literature Review | Janet Simkin and Robert Shiel | Complete |
| Reporting and Consultation from/ as part of Literature Review | Chris Scott | Complete |
| Taking Measurements (Ecology, Archaeology, Financial) | Chris Scott and Philippa Cockburn | Year 1 baseline survey and set-out complete |
| | Janet Simkin and Robert Shiel | Year 2 survey complete |
| | | Year 3 survey complete |
| Final Report Production, consultation process on report | Chris Scott, Clive Waddington | Complete |
| Final reporting | Janet Simkin, Robert Shiel and Chris Scott | Complete |
| Year 4 Interim Project – Taking Measurements (Ecology, Archaeology, Financial) | Chris Scott Janet Simkin Gillian Eadie | Complete |
| Year 4 Interim Project – Final Report Production | Gillian Eadie Janet Simkin Chris Scott | Complete |

9. REFERENCES

Frodsham, P. and C. Waddington (2004), The Breamish Valley Archaeological Project, 1994-2002, in P. Frodsham (ed.) *Archaeology in Northumberland National Park*, York, CBA Report 136: 171-89.

Rodwell, J. 1990-2000. *British Plant Communities vols 1-5*. Cambridge, Cambridge University Press.

Scott, C., Knight, D., Shiel, R. and J. Simkin. 2011. *Evaluation of Organic Bracken Control on Archaeological Features at Ingram Farm, Ingram, Northumberland: Interim Project Report – Year 1*. Archaeological Research Services Ltd., Unpublished Report.

Scott, C., Cockburn, P., Shiel, R. and J. Simkin. 2012. *Evaluation of Organic Bracken Control on Archaeological Features at Ingram Farm, Ingram, Northumberland: Interim Project Report – Year 2*. Archaeological Research Services Ltd., Unpublished Report.

Scott, C., Simkin, J.M., Shiel, R., and Eadie, G. 2013. *Evaluation of Organic Bracken Control on Archaeological Features at Ingram Farm, Ingram, Northumberland, Final Project Report – Year 3*. Archaeological Research Services Ltd., Unpublished Report.

Appendix 1 Botanical data for Years 1-4

This is the summary vegetation data for each sub-plot as used in the NVC and multivariate analyses, derived as the means of the quadrats sampled within each sub-plot and treatment combination (Appendix 7).

Year 1 (2011)

| Sample | 1b_1 | 1a_1 | 1c_1 | 2a_1 | 2c_1 | 2b_1 | 3c_1 | 3a_1 | 3b_1 | 4a_1 | 4b_1 | 4c_1 | 5ct_1 | 5cs_1 | 5bt_1 | 5bs_1 | 5at_1 | 5as_1 | 6bt_1 | 6bs_1 | 6at_1 | 6as_1 | 6ct_1 | 6cs_1 |
|------------------------------|------|------|------|------|------|-------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| <i>Pteridium aquilinum</i> | 88.0 | 97.0 | 97.0 | 99.0 | 98.0 | 100.0 | 85.0 | 87.0 | 95.6 | 92.0 | 96.0 | 87.0 | 75.0 | 100.0 | 90.0 | 96.7 | 80.0 | 100.0 | 75.0 | 88.3 | 65.0 | 96.0 | 80.0 | 96.7 |
| <i>Agrostis canina</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Agrostis capillaris</i> | 1.0 | 0.4 | 19.0 | 1.2 | 10.4 | 4.2 | 20.0 | 39.0 | 30.4 | 41.0 | 34.0 | 25.4 | 15.0 | 8.3 | 35.0 | 16.7 | 30.0 | 15.0 | 40.0 | 20.0 | 35.0 | | 30.0 | 20.0 |
| <i>Agrostis stolonifera</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Anthoxanthum odoratum</i> | 1.0 | 0.8 | 2.0 | 0.8 | 0.4 | 1.0 | 23.6 | 29.0 | 12.0 | 7.0 | 9.0 | 8.0 | 22.5 | 5.0 | 17.5 | 6.0 | 15.0 | 15.7 | 17.5 | 13.7 | 10.0 | 1.7 | 32.5 | 13.3 |
| <i>Bromus hordeceus</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Carex binervis</i> | | | | | 0.2 | | 0.4 | 0.2 | | | | | | 0.3 | | | | 1.7 | | | | | | |
| <i>Carex pilulifera</i> | | | | | | | | | | | | | | | | | | | | 0.7 | | | | |
| <i>Dactylis glomerata</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Danthonia decumbens</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Deschampsia cespitosa</i> | 0.4 | | 0.6 | | | | | 6.0 | | | | | | | | 5.0 | | | | | | | | 1.7 |
| <i>Deschampsia flexuosa</i> | 0.4 | | | | 0.2 | | | | | 1.2 | 0.2 | | | | | | 4.0 | 1.7 | | | | | | |
| <i>Festuca ovina</i> | | 0.8 | 10.8 | 0.8 | 0.4 | 5.0 | 6.4 | 10.2 | 8.0 | 2.2 | 0.2 | 0.4 | 52.5 | 13.3 | 32.5 | 8.3 | 30.0 | 36.7 | 0.5 | 2.7 | 40.0 | 1.7 | 25.0 | 3.3 |
| <i>Festuca rubra</i> | | | | | | | | | | 0.4 | 2.4 | 7.0 | | | | | | | | | | | | |
| <i>Holcus lanatus</i> | | | | 0.4 | | 2.0 | 8.4 | 1.0 | 18.0 | 19.0 | 29.6 | 22.8 | | 15.0 | 1.0 | 10.0 | 1.5 | | | | 1.3 | | | 0.3 |
| <i>Holcus mollis</i> | 2.2 | 0.4 | 7.2 | 44.0 | 7.0 | 38.0 | 11.4 | | 12.0 | 19.0 | 13.6 | 13.0 | | 15.0 | 2.0 | 13.3 | 1.5 | 0.3 | 27.5 | 43.3 | | 83.3 | | 23.3 |
| <i>Juncus effusus</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Luzula campestris</i> | | | | | | | | 0.4 | 0.2 | 0.4 | 0.2 | 0.2 | 0.5 | | | | | 0.3 | 0.5 | 0.3 | | | 0.5 | |
| <i>Luzula multiflora</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Molinia caerulea</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Nardus stricta</i> | | | | | | | | | | | | | | | | | 6.5 | 0.7 | | | | | | |
| <i>Poa annua</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Poa pratensis</i> | | 14.8 | 15.4 | 1.6 | 1.4 | 10.0 | 27.6 | 10.6 | 19.0 | 7.6 | 7.6 | 13.8 | 7.5 | 13.3 | 7.5 | 15.7 | 10.0 | 18.3 | 15.5 | 14.3 | 12.5 | 8.3 | 12.5 | 6.7 |
| <i>Trisetum flavescens</i> | | | | | | | | | | | | | | | | | | | | | | | | |

| Sample | 1b_1 | 1a_1 | 1c_1 | 2a_1 | 2c_1 | 2b_1 | 3c_1 | 3a_1 | 3b_1 | 4a_1 | 4b_1 | 4c_1 | 5ct_1 | 5cs_1 | 5bt_1 | 5bs_1 | 5at_1 | 5as_1 | 6bt_1 | 6bs_1 | 6at_1 | 6as_1 | 6ct_1 | 6cs_1 |
|----------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| <i>Achillea millefolium</i> | | | | | | 0.2 | | | | | | | | | | | | | | | | | | |
| <i>Campanula rotundifolia</i> | | 0.2 | 0.4 | | 0.0 | | 0.6 | 0.6 | | 0.2 | 0.4 | | 2.0 | 1.0 | | 1.3 | | 0.3 | 1.0 | 0.3 | | 1.0 | 1.0 | 1.0 |
| <i>Cerastium fontanum</i> | | | | | | | 0.6 | 0.6 | | 0.2 | | | | | | | | | 0.5 | | | | | 1.7 |
| <i>Chamaerion angustifolium</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Cirsium palustre</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Cirsium vulgare</i> | | | | 2.0 | | | | | | | 1.8 | | | | | | | | | | | | | |
| <i>Conopodium majus</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Digitalis purpurea</i> | 5.4 | 10.2 | 7.4 | 2.6 | 2.6 | 0.8 | | | | | | | | | | | | | | | | | | |
| <i>Epilobium obscurum</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Euphrasia officinalis</i> | | | | | | | | | | 0.2 | | | | | | | | | | | | | | |
| <i>Galeopsis tetrabit</i> | | | | | 0.4 | | | | | | | | | | | | | | | | | | | |
| <i>Galium aparine</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Galium saxatile</i> | 1.8 | 16.6 | 18.6 | | 2.2 | 0.2 | 14.4 | 8.6 | 8.6 | 9.2 | 0.8 | 8.6 | 23.0 | 33.3 | 41.5 | 15.0 | 42.5 | 15.0 | 11.0 | 18.7 | 42.5 | 10.3 | 45.0 | 0.7 |
| <i>Galium verum</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Hyacinthoides non-scripta</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Lathyrus linifolius</i> | | | | | | | | 0.2 | 0.2 | 0.6 | | | | | | | | | 0.5 | | | | | |
| <i>Linum catharticum</i> | | | | | | | 0.2 | | | | | | | | | | | | | | | | | |
| <i>Oxalis acetosella</i> | | | | | 0.8 | | | | | | 1.6 | 1.8 | | | | | | | | | | | | |
| <i>Plantago lanceolata</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Polygala serpyllifolia</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Potentilla erecta</i> | | | | | 0.6 | 0.2 | 2.4 | 1.4 | 0.8 | 1.0 | 1.4 | 1.2 | 2.0 | 1.0 | 3.0 | | 1.0 | 1.7 | | 2.0 | | 2.0 | 0.7 | |
| <i>Potentilla sterilis</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Prunella vulgaris</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Ranunculus acris</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Ranunculus repens</i> | | | 0.2 | | | 0.2 | | | | | | | | | | | | | | | | | | |
| <i>Rumex acetosa</i> | 0.4 | | 2.8 | | 0.2 | | 0.2 | 2.4 | 0.2 | 1.0 | 0.8 | 1.2 | 2.0 | | | | | 0.3 | 0.5 | | 0.5 | 0.3 | 0.5 | 1.0 |
| <i>Rumex acetosella</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Senecio sylvatica</i> | 9.4 | 2.2 | 0.2 | 2.0 | 2.6 | 0.6 | | | | | | | | | | | | | | | | | | |
| <i>Senecio vulgaris</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Stellaria holostea</i> | 0.2 | 0.0 | | | 0.2 | | | | | | | | | | | | | | | 0.3 | | | | 1.7 |
| <i>Taraxacum officinale</i> | | | | | | | | | | | | | | | | | | | | | | | | |

| Sample | 1b_1 | 1a_1 | 1c_1 | 2a_1 | 2c_1 | 2b_1 | 3c_1 | 3a_1 | 3b_1 | 4a_1 | 4b_1 | 4c_1 | 5ct_1 | 5cs_1 | 5bt_1 | 5bs_1 | 5at_1 | 5as_1 | 6bt_1 | 6bs_1 | 6at_1 | 6as_1 | 6ct_1 | 6cs_1 | |
|-----------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|
| <i>Teucrium scorodonia</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Trifolium repens</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Urtica dioica</i> | | | 1.6 | | | 4.0 | | | | | | | | | | | | | | | | | | | |
| <i>Vaccinium myrtillus</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Veronica chamaedrys</i> | | | | | 0.4 | | | | | 0.4 | | | | | | | | | | | | | | | |
| <i>Veronica officinalis</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Vicia sativa</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Vicia sepium</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Viola riviniana</i> | | | 0.2 | | 0.4 | 0.4 | | | | 0.6 | | | | | | | | | | | | | | 0.3 | |
| <i>Brachythecium rutabulum</i> | 0.2 | | | | 0.2 | | | | | | | | | | | | | | | | | | | | |
| <i>Dicranum scoparium</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Hylocomium splendens</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Hypnum cupressiforme</i> | | | | | | | | | | | | | | | | | | | | | | | | 0.3 | |
| <i>Lophocolea bidentata</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Lophozia ventricosa</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Plagiothecium undulatum</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Pleurozium schreberi</i> | | | | | | | 0.2 | | | | | | | | | | | | | | | | | | |
| <i>Pseudoscleropodium purum</i> | | | 0.2 | | | | 0.2 | 0.2 | | 0.2 | | | | | 0.5 | | 1.0 | 0.3 | | | | | 1.0 | | |
| <i>Rhytidiadelphus loreus</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Rhytidiadelphus squarrosus</i> | | | 0.2 | | | | 2.4 | 1.6 | 1.2 | 5.4 | 1.2 | 6.0 | 2.5 | 10.3 | 3.0 | 1.3 | 5.0 | 4.0 | 4.5 | 6.3 | 14.5 | 1.7 | 10.5 | 1.0 | |

Year 2 (2012)

| Sample | 1b_2 | 1a_2 | 1c_2 | 2a_2 | 2c_2 | 2b_2 | 3c_2 | 3a_2 | 3b_2 | 4a_2 | 4b_2 | 4c_2 | 5ct_2 | 5cs_2 | 5bt_2 | 5bs_2 | 5at_2 | 5as_2 | 6bt_2 | 6bs_2 | 6at_2 | 6as_2 | 6ct_2 | 6cs_2 | |
|------------------------------|------|------|------|-------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|
| <i>Pteridium aquilinum</i> | 93.0 | 97.0 | 94.0 | 100.0 | 94.0 | 97.0 | 76.0 | 95.6 | 93.0 | 95.8 | 89.0 | 77.0 | 42.5 | 71.7 | 62.5 | 86.7 | 55.0 | 94.3 | 40.0 | 80.0 | 47.5 | 92.3 | 37.5 | 81.7 | |
| <i>Agrostis canina</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Agrostis capillaris</i> | 3.2 | 2.0 | 17.0 | 0.6 | 20.6 | 7.2 | 38.2 | 31.0 | 24.0 | 23.2 | 24.0 | 31.0 | 50.0 | | 42.5 | 10.0 | 27.5 | 21.7 | 35.0 | 16.7 | 37.5 | 0.3 | 20.0 | 11.7 | |
| <i>Agrostis stolonifera</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Anthoxanthum odoratum</i> | 1.2 | 4.0 | 10.0 | | 1.4 | 5.0 | 15.0 | 11.0 | 3.8 | 7.2 | 3.0 | 11.0 | 12.5 | | 10.0 | 11.7 | 16.0 | 14.7 | 15.0 | 8.3 | 5.0 | 1.0 | 22.5 | 3.3 | |
| <i>Bromus hordeaceus</i> | | | | | | | | | | | | | | | | | | | | | | | | | |

| Sample | 1b_2 | 1a_2 | 1c_2 | 2a_2 | 2c_2 | 2b_2 | 3c_2 | 3a_2 | 3b_2 | 4a_2 | 4b_2 | 4c_2 | 5ct_2 | 5cs_2 | 5bt_2 | 5bs_2 | 5at_2 | 5as_2 | 6bt_2 | 6bs_2 | 6at_2 | 6as_2 | 6ct_2 | 6cs_2 | |
|---------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----|
| <i>Carex binervis</i> | 0.2 | 0.2 | | | | | | | | | | | | | | | 0.5 | 1.3 | | | | | | | |
| <i>Carex pilulifera</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Dactylis glomerata</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Danthonia decumbens</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Deschampsia cespitosa</i> | 0.2 | | 1.6 | 0.4 | | | | 1.4 | | | | | | | | | | | | | | | | | |
| <i>Deschampsia flexuosa</i> | | | | | | | 0.4 | | 4.0 | | | | 3.0 | 0.3 | 1.0 | 0.3 | 2.5 | 3.3 | | 0.3 | 1.5 | | | | |
| <i>Festuca ovina</i> | | | | | | | 4.2 | 1.4 | 3.2 | 0.6 | | 0.4 | 9.0 | | 13.0 | | 26.5 | | | 0.7 | | | 3.0 | | |
| <i>Festuca rubra</i> | 8.2 | 2.6 | 19.4 | | 3.0 | 1.0 | 4.4 | 0.2 | | 1.2 | 1.8 | 1.0 | | | 1.0 | 1.0 | 1.0 | 6.3 | 5.0 | 3.0 | 22.0 | 0.7 | 2.5 | 1.7 | |
| <i>Holcus lanatus</i> | | | 0.4 | | | | 4.0 | 9.0 | 24.6 | 40.0 | 56.0 | 45.0 | 1.0 | 66.7 | 2.5 | 50.0 | 7.5 | 15.0 | 37.5 | 10.0 | | 90.0 | 30.0 | 41.7 | |
| <i>Holcus mollis</i> | | | 19.0 | 39.0 | 12.0 | 13.2 | 24.4 | 2.8 | 12.0 | 15.0 | 10.6 | 7.4 | | 5.0 | | 15.0 | | | | 0.3 | | 0.3 | | 23.3 | |
| <i>Juncus effusus</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Luzula campestris</i> | | | | | | | 0.8 | | | 0.2 | 0.2 | 0.6 | 3.5 | | 2.0 | 0.7 | 0.5 | | | 0.3 | 2.0 | | 0.5 | | |
| <i>Luzula multiflora</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Molinia caerulea</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Nardus stricta</i> | | | | | | | | | | | | | | | | | | 3.0 | | | 0.3 | | | | |
| <i>Poa annua</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Poa pratensis</i> | 1.4 | 19.0 | 16.0 | 41.0 | 12.0 | 26.4 | 4.8 | 30.0 | 10.0 | 7.6 | 2.6 | 2.4 | 17.5 | 15.3 | 4.0 | 6.7 | 10.0 | 10.3 | 7.5 | 26.7 | 27.5 | 5.0 | 17.5 | 16.7 | |
| <i>Trisetum flavescens</i> | | | | 0.2 | | 0.2 | | | | | | | | | | | | 0.5 | | | | | | | |
| <i>Achillea millefolium</i> | | | | | | | | | | 0.2 | | | | | | | | | | | | | | | |
| <i>Campanula rotundifolia</i> | | | 0.2 | | | | | | | 0.2 | 0.2 | | 0.5 | 0.3 | | 2.7 | | | | | 1.0 | 1.0 | 1.0 | 0.5 | 1.0 |
| <i>Cerastium fontanum</i> | | | | | | | 0.6 | 0.2 | 0.2 | 0.2 | 0.4 | | | | | | | | 0.5 | | 0.5 | 0.7 | | 0.3 | |
| <i>Chamaerion angustifolium</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Cirsium palustre</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Cirsium vulgare</i> | 0.6 | | 0.4 | | | | | 0.4 | | | 0.4 | 0.2 | | | | | | | | | | | | | |
| <i>Conopodium majus</i> | | | | | 0.2 | 0.2 | 0.2 | 0.4 | | | 0.2 | | | | | | | | | | | | | 0.3 | |
| <i>Digitalis purpurea</i> | 2.0 | 4.2 | 1.2 | 2.4 | 1.6 | 2.6 | | | | | | | | | | | | | | | | | | | |
| <i>Epilobium obscurum</i> | | | 0.2 | | | | | | | | | | | | | | | | | | | | | | |
| <i>Euphrasia officinalis</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Galeopsis tetrahit</i> | | | | 0.2 | 0.2 | | | | | | | | | | | | | | | | | | | | |
| <i>Galium aparine</i> | | | | 0.2 | | | | | | | | | | | | | | | | | | | | | |
| <i>Galium saxatile</i> | 0.2 | | | 0.2 | 0.6 | | 7.4 | 1.2 | 4.4 | 5.8 | 0.6 | 2.4 | 4.5 | 21.7 | 5.5 | 13.7 | 2.5 | 22.3 | 1.5 | 6.3 | 3.0 | 0.3 | 10.5 | 3.7 | |

| Sample | 1b_2 | 1a_2 | 1c_2 | 2a_2 | 2c_2 | 2b_2 | 3c_2 | 3a_2 | 3b_2 | 4a_2 | 4b_2 | 4c_2 | 5ct_2 | 5cs_2 | 5bt_2 | 5bs_2 | 5at_2 | 5as_2 | 6bt_2 | 6bs_2 | 6at_2 | 6as_2 | 6ct_2 | 6cs_2 | |
|----------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----|
| <i>Galium verum</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Hyacinthoides non-scripta</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Lathyrus linifolius</i> | | | | | 0.2 | | | | | 0.2 | | | | | 0.5 | | | 0.7 | | | 0.5 | | | | |
| <i>Linum catharticum</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Oxalis acetosella</i> | | | | | 4.0 | | | | | | | 2.2 | | | | | | | | | | | | | |
| <i>Plantago lanceolata</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Polygala serpyllifolia</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Potentilla erecta</i> | | | 0.6 | | 0.4 | 0.4 | 4.0 | 5.8 | 2.6 | 0.6 | 2.2 | 2.6 | 8.0 | 1.0 | 3.0 | 0.7 | 1.5 | 8.0 | | 2.7 | | | | 0.3 | |
| <i>Potentilla sterilis</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Prunella vulgaris</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Ranunculus acris</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Ranunculus repens</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Rumex acetosa</i> | 0.6 | 0.4 | 1.4 | | | | 0.8 | 1.0 | 0.2 | 4.6 | 1.0 | 0.6 | 0.5 | | | 0.3 | 1.0 | | 0.5 | 1.0 | 0.5 | | | | |
| <i>Rumex acetosella</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Senecio sylvatica</i> | | | | | 0.4 | 1.2 | | | | | | | | | | | | | | | | | | | |
| <i>Senecio vulgaris</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Stellaria holostea</i> | | | | | | | | | | | | | | | | | | | | | | | | | 0.3 |
| <i>Taraxacum officinale</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Teucrium scorodonia</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Trifolium repens</i> | | | | | | | | | | 0.2 | | | | | | | | | | | | | | | |
| <i>Urtica dioica</i> | | | | | 0.2 | 0.2 | 0.2 | | | | | | | | | | | | | | | | | | |
| <i>Vaccinium myrtillus</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Veronica chamaedrys</i> | | | | | | 0.6 | 0.2 | | | | 0.2 | | | | | | | | | | | | | | 0.7 |
| <i>Veronica officinalis</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Vicia sativa</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Vicia sepium</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Viola riviniana</i> | | | 2.0 | | 0.8 | 0.2 | 0.4 | | | | | | | | | | | | | | | | 0.3 | | |
| <i>Brachythecium rutabulum</i> | | | | | | | | 0.2 | | | | | | | | | | | | | | | | | |
| <i>Dicranum scoparium</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Hylocomium splendens</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Hypnum cupressiforme</i> | | | | | | | | | | | | | | | | | | | | | | | | | |

| Sample | 1b_2 | 1a_2 | 1c_2 | 2a_2 | 2c_2 | 2b_2 | 3c_2 | 3a_2 | 3b_2 | 4a_2 | 4b_2 | 4c_2 | 5ct_2 | 5cs_2 | 5bt_2 | 5bs_2 | 5at_2 | 5as_2 | 6bt_2 | 6bs_2 | 6at_2 | 6as_2 | 6ct_2 | 6cs_2 | |
|-----------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|
| <i>Lophocolea bidentata</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Lophozia ventricosa</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Plagiothecium undulatum</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Pleurozium schreberi</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Pseudoscleropodium purum</i> | | | | 0.2 | | | | 0.2 | | | | | | | | | 0.5 | 0.3 | | | | 0.3 | | 0.3 | |
| <i>Rhytidiadelphus loreus</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Rhytidiadelphus squarrosus</i> | | 0.2 | | | | 0.4 | 3.2 | 0.8 | 0.8 | 2.8 | 1.2 | 2.6 | 2.0 | 0.7 | 1.5 | 0.7 | 3.0 | 1.3 | 2.5 | 4.7 | 4.0 | 0.3 | 5.0 | 1.0 | |

Year 3 (2013)

| Sample | 1b_3 | 1a_3 | 1c_3 | 2a_3 | 2c_3 | 2b_3 | 3c_3 | 3a_3 | 3b_3 | 4a_3 | 4b_3 | 4c_3 | 5ct | 5cs | 5bt | 5bs | 5at | 5as_3 | 6bt_3 | 6bs_3 | 6at_3 | 6as_3 | 6ct_3 | 6cs_3 | |
|------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|--|
| <i>Pteridium aquilinum</i> | 84.0 | 90.0 | 25.6 | 99.6 | 54.0 | 83.0 | 20.0 | 48.0 | 51.0 | 32.0 | 34.0 | 10.8 | 6.5 | 14.3 | 44.0 | 83.3 | 7.5 | 90.0 | 13.5 | 65.0 | 27.5 | 75.0 | 12.5 | 55.0 | |
| <i>Agrostis canina</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Agrostis capillaris</i> | 4.4 | | 27.4 | 0.4 | 9.8 | 8.8 | 12.2 | 9.0 | 7.0 | 13.0 | 16.0 | 13.2 | 62.5 | 20.3 | 35.0 | 13.3 | 35.0 | 20.0 | 42.5 | 32.0 | 25.0 | 1.3 | 55.0 | 28.3 | |
| <i>Agrostis stolonifera</i> | | | | | 0.2 | | | | | | | | | | | | | | | | | | | | |
| <i>Anthoxanthum odoratum</i> | 2.0 | 2.4 | 6.8 | 0.2 | 4.4 | 4.2 | 25.4 | 28.0 | 9.2 | 7.8 | 3.2 | 14.8 | 4.0 | 2.3 | 3.5 | 10.7 | 11.0 | 20.0 | 17.5 | 16.7 | 8.5 | 1.3 | 2.5 | 6.7 | |
| <i>Bromus hordeceus</i> | | | | | | | | | | | | | | | | | 0.5 | | | | | | | | |
| <i>Carex binervis</i> | | 0.2 | 0.2 | | 3.2 | 0.2 | | | | | | | | | 0.5 | 0.3 | | 0.3 | | | | | | | |
| <i>Carex pilulifera</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Dactylis glomerata</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Danthonia decumbens</i> | | | | | | | | | | | | | | | | | | 3.0 | | | | | | | |
| <i>Deschampsia cespitosa</i> | | | | | | | 3.2 | | 6.0 | | | | | | | | | | | | | | | | |
| <i>Deschampsia flexuosa</i> | 0.6 | | 0.4 | | | | 0.4 | 3.2 | 4.6 | 0.2 | 0.2 | 4.2 | | | 0.5 | 0.7 | | 3.3 | | 0.3 | | | | | |
| <i>Festuca ovina</i> | 4.8 | | 1.2 | | | 0.4 | | 1.4 | 10.6 | | | 2.2 | 8.5 | 0.3 | 12.5 | 1.0 | 6.5 | 1.0 | 15.0 | 6.7 | 40.0 | 0.3 | 16.5 | 6.7 | |
| <i>Festuca rubra</i> | | | 23.0 | | 1.0 | 2.2 | 26.0 | 1.0 | 4.2 | 1.2 | 15.6 | 6.4 | 20.0 | 20.0 | 32.5 | 7.0 | 2.5 | 6.3 | | | | | | | |
| <i>Holcus lanatus</i> | 0.2 | | 15.0 | 0.4 | 14.4 | 39.2 | 30.0 | 14.8 | 26.0 | 67.0 | 54.0 | 52.0 | 0.5 | 41.7 | 7.5 | 49.0 | 7.5 | 9.3 | 11.5 | 28.3 | 5.5 | 33.3 | 2.0 | 55.0 | |
| <i>Holcus mollis</i> | 0.8 | 0.4 | | 18.4 | | 2.4 | | | | 2.6 | 0.4 | 0.2 | | | | 10.0 | | | | 15.0 | 2.5 | 60.0 | | 1.7 | |
| <i>Juncus effusus</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Luzula campestris</i> | | | 0.2 | | | | | 0.6 | | | 0.2 | 0.4 | 1.0 | 0.3 | 0.5 | | | 0.3 | 1.5 | 0.3 | 0.5 | | 0.5 | 0.7 | |
| <i>Luzula multiflora</i> | | | | | | | | | 0.2 | | | | | | | | | | | | | | | | |

| Sample | 1b_3 | 1a_3 | 1c_3 | 2a_3 | 2c_3 | 2b_3 | 3c_3 | 3a_3 | 3b_3 | 4a_3 | 4b_3 | 4c_3 | 5ct | 5cs | 5bt | 5bs | 5at | 5as_3 | 6bt_3 | 6bs_3 | 6at_3 | 6as_3 | 6ct_3 | 6cs_3 | |
|----------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|-----|------|-----|-----|------|-------|-------|-------|-------|-------|-------|-------|--|
| <i>Molinia caerulea</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Nardus stricta</i> | | | | | | | | | 2.0 | | | 2.0 | | | 2.5 | | 2.5 | | | | | | | | |
| <i>Poa annua</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Poa pratensis</i> | 2.0 | 0.2 | 18.6 | 0.4 | 17.8 | 9.6 | 1.6 | 25.6 | 11.4 | 0.8 | 6.0 | 1.8 | 1.5 | 16.0 | 7.5 | 5.7 | 27.5 | 36.7 | 1.5 | 1.3 | 5.0 | 2.7 | 1.0 | 1.3 | |
| <i>Trisetum flavescens</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Achillea millefolium</i> | | | | | | | | | 0.2 | | | | | | | | | | | | | | | | |
| <i>Campanula rotundifolia</i> | | 0.2 | 1.2 | | | 0.4 | 0.2 | | | | | | | 0.3 | | 0.3 | | | 0.5 | 0.7 | | 1.0 | 1.0 | 0.7 | |
| <i>Cerastium fontanum</i> | | | | | | | 0.4 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | | | | | | | | | 0.5 | 1.0 | 1.0 | 0.7 | |
| <i>Chamaerion angustifolium</i> | 0.4 | 0.2 | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Cirsium palustre</i> | | | | | | | | | | | 0.2 | | | | | | | | | | | | | | |
| <i>Cirsium vulgare</i> | 0.4 | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Conopodium majus</i> | | | 0.2 | | 0.2 | 0.4 | 0.2 | 0.6 | 0.4 | | 0.2 | | | 0.3 | | | | | | 0.5 | | | | | |
| <i>Digitalis purpurea</i> | 3.6 | 3.0 | | 0.8 | 5.0 | 0.4 | | | | | | | | | | | | | | | | | | | |
| <i>Epilobium obscurum</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Euphrasia officinalis</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Galeopsis tetrabit</i> | | | | | 0.2 | 0.2 | | | | | | | | | | | | | | | | | | | |
| <i>Galium aparine</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Galium saxatile</i> | | | | | 0.2 | | 1.4 | 0.4 | 1.2 | 0.2 | 0.2 | 0.4 | 3.0 | 3.3 | 2.0 | 1.3 | | 1.0 | 1.0 | 0.7 | 1.5 | 0.3 | 2.0 | 0.7 | |
| <i>Galium verum</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Hyacinthoides non-scripta</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Lathyrus linifolius</i> | | | | | | | | | 0.2 | 0.2 | | | | | | | | | | | | | | | |
| <i>Linum catharticum</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Oxalis acetosella</i> | | | | | | | | | | | | 0.8 | | | | | | | | | | | | | |
| <i>Plantago lanceolata</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Polygala serpyllifolia</i> | | | | | | | | 0.2 | 0.2 | 0.2 | | | | | | | | | | | | | | | |
| <i>Potentilla erecta</i> | | | | | 0.4 | 0.4 | 0.8 | 1.2 | 1.2 | 0.2 | 0.6 | 1.0 | 1.0 | | 0.5 | | 1.0 | 1.0 | 0.5 | 0.7 | 0.5 | | 0.5 | 0.3 | |
| <i>Potentilla sterilis</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Prunella vulgaris</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Ranunculus acris</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Ranunculus repens</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Rumex acetosa</i> | 0.8 | 0.4 | 0.6 | | | | 0.4 | 0.8 | 0.4 | 0.6 | 0.8 | | | 0.3 | 0.5 | | | 0.3 | 0.5 | 0.7 | | | 0.5 | 0.3 | |

| Sample | 1b_3 | 1a_3 | 1c_3 | 2a_3 | 2c_3 | 2b_3 | 3c_3 | 3a_3 | 3b_3 | 4a_3 | 4b_3 | 4c_3 | 5ct | 5cs | 5bt | 5bs | 5at | 5as_3 | 6bt_3 | 6bs_3 | 6at_3 | 6as_3 | 6ct_3 | 6cs_3 | |
|-----------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|-----|-----|-----|-----|-----|-------|-------|-------|-------|-------|-------|-------|-----|
| <i>Rumex acetosella</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Senecia sylvatica</i> | 8.0 | 8.2 | | 2.2 | 1.6 | 0.8 | | | | | | | | | | | | | | | | | | | |
| <i>Senecio vulgaris</i> | | | | | 0.2 | | | | | | | | | | | | | | | | | | | | |
| <i>Stellaria holostea</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Taraxacum officinale</i> | | | | | | | | | | | | 0.2 | | | | | | | | | | | | | |
| <i>Teucrium scorodonia</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Trifolium repens</i> | | | | | | | | | | | 0.4 | 0.2 | | | | | | | | | | | | | |
| <i>Urtica dioica</i> | 0.2 | | 0.2 | | 0.4 | 0.2 | | | | | | | | | | | | | | | | | | | 0.3 |
| <i>Vaccinium myrtillus</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Veronica chamaedrys</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Veronica officinalis</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Vicia sativa</i> | | | | | | | | | | | 0.2 | | | | | | | | | | | | | | |
| <i>Vicia sepium</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Viola riviniana</i> | | | 0.4 | 0.4 | 2.0 | 0.8 | | | | | | | | | | | | | | | | | | | |
| <i>Brachythecium rutabulum</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Dicranum scoparium</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Hylocomium splendens</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Hypnum cupressiforme</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Lophocolea bidentata</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Lophozia ventricosa</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Plagiothecium undulatum</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Pleurozium schreberi</i> | | | 0.2 | | | | | | | | 0.2 | | | | | | | | | | | | | | 0.2 |
| <i>Pseudoscleropodium purum</i> | | | | | | | | | | | 0.2 | | | | | | | | | | | | | | 0.3 |
| <i>Rhytidiadelphus loreus</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Rhytidiadelphus squarrosus</i> | | | | | | | 2.4 | 1.4 | 6.4 | 1.6 | 0.8 | 1.4 | 1.5 | 0.7 | 1.0 | 0.3 | | 2.7 | 1.5 | 0.7 | 1.0 | 0.7 | 1.0 | 1.0 | |

Year 4 (2014)

| Sample | 1b_4 | 1a_4 | 1c_4 | 2a_4 | 2c_4 | 2b_4 | 3c_4 | 3a_4 | 3b_4 | 4a_4 | 4b_4 | 4c_4 | 5ct_4 | 5cs_4 | 5bt_4 | 5bs_4 | 5at_4 | 5as_4 | 6bt_4 | 6bs_4 | 6at_4 | 6as_4 | 6ct_4 | 6cs_4 |
|---------------------------------|------|-------|------|-------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| <i>Pteridium aquilinum</i> | 84.0 | 100.0 | 50.0 | 100.0 | 83.0 | 97.6 | 86.0 | 97.0 | 97.6 | 96.6 | 97.0 | 95.2 | 50.0 | 76.7 | 90.0 | 94.3 | 84.0 | 97.3 | 80.0 | 91.7 | 85.0 | 96.7 | 55.0 | 83.3 |
| <i>Agrostis canina</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Agrostis capillaris</i> | 35.0 | 10.8 | 46.0 | 1.0 | 48.0 | 31.2 | 54.0 | 11.2 | 38.4 | 1.0 | 29.2 | 39.2 | 80.0 | 23.3 | 80.0 | 78.3 | 80.0 | 73.3 | 50.0 | 40.0 | 67.5 | 32.0 | 75.0 | 30.7 |
| <i>Agrostis stolonifera</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Anthoxanthum odoratum</i> | 3.4 | 0.4 | 8.6 | | 7.6 | 2.4 | 4.8 | 5.0 | 4.6 | 1.0 | 0.4 | 2.0 | 2.5 | 2.3 | 3.0 | 2.0 | 7.5 | 4.0 | 7.5 | 2.0 | 0.5 | | 2.5 | 2.0 |
| <i>Bromus hordeceus</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Carex binervis</i> | 2.0 | 0.2 | 0.4 | | | 0.6 | | | | | | | | | | | | | | | | | | |
| <i>Carex pilulifera</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Dactylis glomerata</i> | | | | | | 0.2 | | | | | | | | | | | | | | | | | | |
| <i>Danthonia decumbens</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Deschampsia cespitosa</i> | 6.0 | | 0.2 | | | 0.2 | | | | | | | | | | | | | | | | | | |
| <i>Deschampsia flexuosa</i> | 9.2 | | 17.2 | | 8.0 | 2.0 | 0.2 | | 1.0 | 0.2 | | | | | | | 0.5 | | | | | | | |
| <i>Festuca ovina</i> | 4.8 | 0.6 | 4.0 | | | 1.0 | 3.0 | | 4.0 | | | 0.6 | 3.0 | | 2.5 | | | | | | 2.0 | | 2.0 | |
| <i>Festuca rubra</i> | 1.2 | | 2.6 | 0.2 | 0.2 | | 3.4 | 6.6 | 3.2 | 1.0 | 2.6 | 1.2 | 3.5 | 4.7 | 5.0 | 5.3 | 3.5 | 12.0 | 3.5 | 2.0 | 1.0 | 1.0 | 2.5 | 3.7 |
| <i>Holcus lanatus</i> | 0.6 | 1.0 | 0.6 | | 19.8 | 27.2 | 3.2 | | | | 1.8 | 0.4 | | | 0.5 | 1.3 | | 0.3 | 1.0 | 0.3 | | 1.7 | | 0.7 |
| <i>Holcus mollis</i> | 0.4 | 12.0 | 20.0 | 35.6 | 0.4 | 11.4 | 26.0 | 38.0 | 35.0 | 92.0 | 57.0 | 54.2 | | 33.3 | 2.0 | 5.7 | 5.0 | | 17.5 | 31.7 | | 35.7 | | 48.3 |
| <i>Juncus effusus</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Luzula campestris</i> | | | 0.2 | | | | | 0.6 | 0.2 | 0.2 | | | 2.0 | 0.7 | 0.5 | 0.3 | 0.5 | | | 0.7 | 0.5 | | | 0.7 |
| <i>Luzula multiflora</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Molinia caerulea</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Nardus stricta</i> | | | | | | | | | 0.4 | | | | | | | | 4.0 | | | | | | | |
| <i>Poa annua</i> | | | | 0.2 | 6.6 | 9.4 | | | | | | | | | | | | | | | | | | |
| <i>Poa pratensis</i> | 35.0 | 12.6 | 5.6 | | | | 6.2 | 38.0 | 12.2 | 2.0 | 4.6 | 2.6 | 8.0 | 36.7 | 7.0 | 10.0 | 1.5 | 11.0 | 20.0 | 2.3 | 25.0 | 1.7 | 16.5 | 13.3 |
| <i>Trisetum flavescens</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Achillea millefolium</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Campanula rotundifolia</i> | | | 1.4 | | 0.2 | 0.4 | 0.2 | | | | 0.2 | 0.2 | 1.5 | 0.7 | | 1.3 | | 0.3 | 0.5 | 1.0 | | | | 1.0 |
| <i>Cerastium fontanum</i> | 0.2 | | 0.8 | | | | 0.4 | | | 0.2 | 0.2 | 0.2 | 1.0 | | | | 0.5 | 0.3 | 0.5 | | | 0.5 | 0.3 | |
| <i>Chamaerion angustifolium</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Cirsium palustre</i> | | | | | | | | 0.2 | | | | 0.6 | | | | | | | | | | | | |

| Sample | 1b_4 | 1a_4 | 1c_4 | 2a_4 | 2c_4 | 2b_4 | 3c_4 | 3a_4 | 3b_4 | 4a_4 | 4b_4 | 4c_4 | 5ct_4 | 5cs_4 | 5bt_4 | 5bs_4 | 5at_4 | 5as_4 | 6bt_4 | 6bs_4 | 6at_4 | 6as_4 | 6ct_4 | 6cs_4 | |
|----------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|
| <i>Cirsium vulgare</i> | | 0.2 | 0.2 | 0.2 | 0.4 | 0.6 | | 0.2 | 0.2 | | 0.2 | | | | | | | | | | | | | 0.5 | |
| <i>Conopodium majus</i> | | 0.2 | | 0.2 | 0.2 | 0.4 | 0.2 | 0.4 | 0.2 | | | | | | | | | | | | | | | | |
| <i>Digitalis purpurea</i> | 1.0 | 4.8 | 0.8 | 0.8 | 3.0 | 0.8 | | | | | | | | | | | | | | | | | | 0.3 | |
| <i>Epilobium obscurum</i> | | 0.2 | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Euphrasia officinalis</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Galeopsis tetrahit</i> | | | | | 0.2 | | | | | | | | | | | | | | | | | | | | |
| <i>Galium aparine</i> | | | | | | 0.2 | | | | | | | | | | | | | | | | | | 0.3 | |
| <i>Galium saxatile</i> | 0.4 | | 0.2 | | 0.2 | 0.4 | 3.8 | 0.4 | 9.6 | 1.4 | 1.4 | | 11.0 | 21.0 | 8.0 | 20.0 | 0.5 | 1.7 | 1.5 | 5.7 | 5.0 | 0.7 | 0.5 | 11.7 | |
| <i>Galium verum</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Hyacinthoides non-scripta</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Lathyrus linifolius</i> | | | | | | | | | | 0.2 | | | 1.0 | | | | | | 0.5 | | | | | | |
| <i>Linum catharticum</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Oxalis acetosella</i> | | | | | | | | | | | | 1.6 | | | | | | | | | | | | | |
| <i>Plantago lanceolata</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Polygala serpyllifolia</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Potentilla erecta</i> | 1.0 | | 0.4 | | 0.4 | 1.8 | 1.4 | 0.8 | 0.6 | 0.6 | 0.8 | 3.0 | 1.0 | 4.0 | 2.0 | 2.0 | 1.0 | 1.3 | | 1.0 | 0.5 | | 2.0 | 2.0 | |
| <i>Potentilla sterilis</i> | | | | 0.4 | | 0.2 | | | | | | | | | | | | | | | | | | | |
| <i>Prunella vulgaris</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Ranunculus acris</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Ranunculus repens</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Rumex acetosa</i> | 1.0 | 0.2 | 1.8 | | 0.6 | 0.6 | 0.2 | 0.4 | | 0.2 | 0.2 | 0.8 | 0.5 | | | | | | | 0.3 | | | 2.5 | 0.3 | |
| <i>Rumex acetosella</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Senecio sylvatica</i> | 0.2 | 3.8 | 0.8 | 0.6 | 1.2 | 0.2 | | | | | | | | | | | | 0.5 | | | | | | | |
| <i>Senecio vulgaris</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Stellaria holostea</i> | | 0.2 | 0.2 | | | | | | | 0.2 | | | | | | | | | | | 0.3 | | | 1.0 | |
| <i>Taraxacum officinale</i> | | | | | | 0.2 | | | | | | | | | | | | | | | | | | | |
| <i>Teucrium scorodonia</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Trifolium repens</i> | | | | | | 1.0 | | | | | 0.4 | | | | | | | 1.5 | 0.5 | | 0.5 | | 0.5 | | |
| <i>Urtica dioica</i> | | | | | | 1.8 | | | | | | | | | | | | | | | | | | | |
| <i>Vaccinium myrtillus</i> | | | | | | | | | | | | 0.2 | | | | | | | | | | | | | |
| <i>Veronica chamaedrys</i> | | | | | 0.2 | 0.2 | | | | | | | | | 0.3 | | | 0.3 | | | | | | 0.5 | |

| Sample | 1b_4 | 1a_4 | 1c_4 | 2a_4 | 2c_4 | 2b_4 | 3c_4 | 3a_4 | 3b_4 | 4a_4 | 4b_4 | 4c_4 | 5ct_4 | 5cs_4 | 5bt_4 | 5bs_4 | 5at_4 | 5as_4 | 6bt_4 | 6bs_4 | 6at_4 | 6as_4 | 6ct_4 | 6cs_4 | |
|-----------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----|
| <i>Veronica officinalis</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Vicia sativa</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Vicia sepium</i> | | | | | | | | | | 0.4 | | | | | | | | | | | | | | | |
| <i>Viola riviniana</i> | | 0.6 | 0.6 | 1.0 | 0.4 | 1.0 | | | | | | | | | | | | | | | | | | | |
| <i>Brachythecium rutabulum</i> | | 0.2 | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Dicranum scoparium</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Hylocomium splendens</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Hypnum cupressiforme</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Lophocolea bidentata</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Lophozia ventricosa</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Plagiothecium undulatum</i> | | | | 0.2 | | | | | | | | | | | | | | | | | | | | | |
| <i>Pleurozium schreberi</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Pseudoscleropodium purum</i> | 0.2 | 0.2 | | 0.2 | | | 0.2 | 0.2 | | | | | | | | | | | | | | 0.3 | | | |
| <i>Rhytidiadelphus loreus</i> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Rhytidiadelphus squarrosus</i> | 0.2 | 0.2 | 1.0 | 0.2 | | 0.2 | 15.8 | 1.8 | 1.4 | 1.0 | 0.8 | 8.0 | 1.0 | 1.0 | | | 0.3 | 1.5 | 2.0 | 0.5 | 0.7 | 1.0 | 0.3 | 1.5 | 0.7 |

Appendix 2 Measurements and derived data for Years 1-4

This is the data for each sub-plot and treatment combination, as used in the analyses, and represents the means of quadrats (see Appendix 7).

Year 1 (2011)

| Sample | 1b_1 | 1a_1 | 1c_1 | 2a_1 | 2c_1 | 2b_1 | 3c_1 | 3a_1 | 3b_1 | 4a_1 | 4b_1 | 4c_1 | 5ct_1 | 5cs_1 | 5bt_1 | 5bs_1 | 5at_1 | 5as_1 | 6bt_1 | 6bs_1 | 6at_1 | 6as_1 | 6ct_1 | 6cs_1 | | |
|--------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|-------|--------|-------|--------|-------|--------|-------|--------|-------|--------|-------|--|--|
| Plot | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | | |
| Plot treatment | A | A | A | A | A | A | B | B | B | B | B | B | C | S | C | S | C | S | C | S | C | S | C | S | | |
| Sub-plot treatment | none | none | none | none | none | none | sheep | sheep | sheep | sheep | sheep | sheep | cattle | slope | cattle | slope | cattle | slope | cattle | slope | cattle | slope | cattle | slope | | |
| Sub plot | 1b | 1a | 1c | 2a | 2c | 2b | 3c | 3a | 3b | 4a | 4b | 4c | 5c | 5c | 5b | 5b | 5a | 5a | 6b | 6b | 6a | 6a | 6c | 6c | | |
| Year | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| Derived data | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Vegetation cover (%) | 110.4 | 143.4 | 183.8 | 154.4 | 128.6 | 166.8 | 203.8 | 199.2 | 206.2 | 207.8 | 201.8 | 196.4 | 204.5 | 216.0 | 233.5 | 189.3 | 228.0 | 212.0 | 194.5 | 212.3 | 220.0 | 204.3 | 240.5 | 173.7 | | |
| Understorey cover (%) | 22.4 | 46.4 | 86.8 | 55.4 | 30.6 | 66.8 | 118.8 | 112.2 | 110.6 | 115.8 | 105.8 | 109.4 | 129.5 | 116.0 | 143.5 | 92.7 | 148.0 | 112.0 | 119.5 | 124.0 | 155.0 | 108.3 | 160.5 | 77.0 | | |
| Species richness | 5.8 | 5.0 | 8.8 | 5.4 | 7.2 | 5.2 | 10.8 | 10.6 | 8.8 | 11.4 | 11.2 | 9.2 | 9.0 | 8.3 | 9.5 | 8.3 | 11.5 | 10.0 | 10.5 | 9.7 | 7.5 | 5.0 | 10.0 | 10.3 | | |
| NVC_U4b score | 7.0 | 5.6 | 27.4 | 7.4 | 10.6 | 14.0 | 57.4 | 57.6 | 47.4 | 56.8 | 56.4 | 53.4 | 49.5 | 32.7 | 57.0 | 41.3 | 53.5 | 37.0 | 48.0 | 39.7 | 54.0 | 8.7 | 56.5 | 36.0 | | |
| NVC_U20a score | 37.4 | 35.0 | 61.6 | 32.8 | 42.8 | 39.8 | 83.0 | 82.8 | 74.0 | 78.6 | 70.6 | 71.0 | 86.0 | 66.3 | 89.0 | 76.0 | 89.5 | 78.7 | 76.0 | 74.3 | 80.5 | 41.3 | 91.0 | 63.0 | | |
| NVC_U20b score | 43.0 | 42.8 | 57.0 | 37.2 | 44.0 | 41.2 | 65.6 | 65.4 | 64.4 | 59.4 | 48.6 | 53.8 | 71.0 | 55.7 | 75.5 | 59.3 | 77.5 | 70.0 | 53.0 | 59.3 | 69.0 | 42.3 | 74.0 | 53.0 | | |
| NVC_U20c score | 67.0 | 69.0 | 63.8 | 55.6 | 67.2 | 57.4 | 58.8 | 60.0 | 65.4 | 55.2 | 50.6 | 57.6 | 68.0 | 64.7 | 68.5 | 63.3 | 63.5 | 64.0 | 52.5 | 58.7 | 65.0 | 60.0 | 65.0 | 56.0 | | |
| Recorded data (means) | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bracken cover % | 88.0 | 97.0 | 97.0 | 99.0 | 98.0 | 100.0 | 85.0 | 87.0 | 95.6 | 92.0 | 96.0 | 87.0 | 75.0 | 100.0 | 90.0 | 96.7 | 80.0 | 100.0 | 75.0 | 88.3 | 65.0 | 96.0 | 80.0 | 96.7 | | |
| Bracken shoots | 19.6 | 28.2 | 33.4 | 31.2 | 33.8 | 29.2 | 34.0 | 37.0 | 35.2 | 34.0 | 44.0 | 36.0 | 29.0 | 37.7 | 37.0 | 37.3 | 33.5 | 40.0 | 43.0 | 33.7 | 34.5 | 38.0 | 31.0 | 38.3 | | |
| Bracken vigour | 6.4 | 8.6 | 8.0 | 9.0 | 8.8 | 9.0 | 6.2 | 6.2 | 8.0 | 6.4 | 7.2 | 6.6 | 5.5 | 9.0 | 5.5 | 8.0 | 5.5 | 8.0 | 6.5 | 7.3 | 5.5 | 9.3 | 5.5 | 8.3 | | |
| Bracken frond height (cm) | 84.6 | 99.3 | 98.9 | 101.7 | 102.1 | 101.7 | 77.5 | 76.5 | 88.4 | 76.9 | 76.2 | 77.3 | 74.7 | 102.1 | 78.7 | 93.7 | 73.3 | 90.9 | 81.7 | 83.0 | 75.0 | 113.1 | 72.0 | 104.1 | | |
| Litter cover x depth | 6.4 | 5.8 | 2.8 | 4.0 | 9.0 | 3.6 | 1.0 | 1.1 | 1.8 | 1.1 | 1.7 | 1.6 | 0.8 | 2.3 | 0.7 | 3.7 | 1.4 | 2.6 | 0.7 | 1.3 | 1.3 | 3.0 | 0.6 | 1.8 | | |
| Disturbed ground within 5m (%) | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bare ground (%) | | 0.2 | | | | 0.2 | 1.0 | 1.4 | | | 0.2 | 3.2 | | | | | | | | | | | | | | |
| Stone (%) | | 0.2 | | | | | | | | | | | | | | | | | | | | | | | | |

Year 2 (2012)

| Sample | 1b_2 | 1a_2 | 1c_2 | 2a_2 | 2c_2 | 2b_2 | 3c_2 | 3a_2 | 3b_2 | 4a_2 | 4b_2 | 4c_2 | 5ct_2 | 5cs_2 | 5bt_2 | 5bs_2 | 5at_2 | 5as_2 | 6bt_2 | 6bs_2 | 6at_2 | 6as_2 | 6ct_2 | 6cs_2 |
|--------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|-------|--------|-------|--------|-------|--------|-------|--------|-------|--------|-------|
| Plot | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 |
| Plot treatment | A | A | A | A | A | A | B | B | B | B | B | B | C | S | C | S | C | S | C | S | C | S | C | S |
| | none | none | none | none | none | none | sheep | sheep | sheep | sheep | sheep | sheep | cattle | slope | cattle | slope | cattle | slope | cattle | slope | cattle | slope | cattle | slope |
| Sub-plot treatment | B | A | C | A | C | B | C | A | B | A | B | C | C | C | B | B | A | A | B | B | A | A | C | C |
| | bash | none | cut | none | cut | bash | cut | none | bash | none | bash | cut | cut | cut | bash | bash | none | none | bash | bash | none | none | cut | cut |
| Sub plot | 1b | 1a | 1c | 2a | 2c | 2b | 3c | 3a | 3b | 4a | 4b | 4c | 5c | 5c | 5b | 5b | 5a | 5a | 6b | 6b | 6a | 6a | 6c | 6c |
| Year | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Derived data | | | | | | | | | | | | | | | | | | | | | | | | |
| Vegetation cover (%) | 110.8 | 130.2 | 182.8 | 185.8 | 152.4 | 154.4 | 188.4 | 192.6 | 182.8 | 205.6 | 193.6 | 186.4 | 154.5 | 182.7 | 149.0 | 200.0 | 159.0 | 199.7 | 145.0 | 162.3 | 152.5 | 192.7 | 149.5 | 188.0 |
| Understorey cover (%) | 17.8 | 33.2 | 88.8 | 85.8 | 58.4 | 57.4 | 112.4 | 97.0 | 89.8 | 109.8 | 104.6 | 109.4 | 112.0 | 111.0 | 86.5 | 113.3 | 104.0 | 105.3 | 105.0 | 82.3 | 105.0 | 100.3 | 112.0 | 106.3 |
| Species richness | 4.8 | 3.8 | 6.8 | 5.8 | 6.6 | 6.0 | 10.2 | 10.2 | 8.8 | 10.8 | 9.8 | 10.2 | 11.0 | 6.3 | 11.0 | 11.0 | 12.5 | 9.7 | 8.5 | 11.3 | 10.0 | 6.7 | 8.0 | 9.3 |
| NVC_U4b score | 14.8 | 13.8 | 33.8 | 3.6 | 20.4 | 17.0 | 55.8 | 51.0 | 45.4 | 56.8 | 51.2 | 52.6 | 61.5 | 21.7 | 60.5 | 54.0 | 57.5 | 51.3 | 76.0 | 54.3 | 56.5 | 28.0 | 59.5 | 45.7 |
| NVC_U20a score | 34.8 | 31.8 | 44.0 | 26.8 | 39.8 | 40.0 | 76.6 | 71.0 | 72.4 | 71.6 | 59.2 | 70.4 | 88.5 | 50.7 | 85.0 | 73.3 | 79.0 | 75.0 | 64.5 | 72.7 | 62.5 | 44.3 | 71.0 | 61.0 |
| NVC_U20b score | 40.6 | 37.4 | 35.8 | 31.2 | 39.0 | 39.8 | 62.2 | 56.0 | 61.4 | 53.2 | 41.8 | 54.6 | 68.5 | 45.7 | 69.0 | 49.3 | 67.5 | 61.0 | 42.5 | 56.3 | 46.0 | 36.0 | 51.5 | 47.3 |
| NVC_U20c score | 64.6 | 60.0 | 46.0 | 48.2 | 57.2 | 58.2 | 59.8 | 59.2 | 65.6 | 56.6 | 51.6 | 57.0 | 58.0 | 63.7 | 63.5 | 53.3 | 55.5 | 65.3 | 41.5 | 60.7 | 50.5 | 48.3 | 53.0 | 56.3 |
| Recorded data (means) | | | | | | | | | | | | | | | | | | | | | | | | |
| Bracken cover % | 93.0 | 97.0 | 94.0 | 100.0 | 94.0 | 97.0 | 76.0 | 95.6 | 93.0 | 95.8 | 89.0 | 77.0 | 42.5 | 71.7 | 62.5 | 86.7 | 55.0 | 94.3 | 40.0 | 80.0 | 47.5 | 92.3 | 37.5 | 81.7 |
| Bracken shoots | 34.2 | 42.2 | 27.2 | 46.0 | 36.0 | 31.8 | 32.4 | 41.2 | 50.2 | 37.4 | 35.4 | 35.0 | 26.0 | 29.3 | 23.0 | 42.7 | 36.5 | 40.3 | 28.5 | 42.3 | 31.5 | 41.7 | 22.0 | 45.0 |
| Bracken vigour | 6.4 | 8.4 | 5.8 | 9.6 | 6.6 | 7.4 | 2.6 | 5.2 | 6.4 | 5.4 | 4.8 | 4.0 | 1.5 | 4.3 | 2.5 | 5.7 | 3.0 | 7.7 | 2.5 | 4.3 | 2.0 | 7.7 | 2.0 | 4.7 |
| Bracken frond height (cm) | 83.4 | 112.1 | 80.3 | 121.2 | 94.3 | 103.6 | 59.0 | 74.9 | 71.4 | 69.5 | 68.5 | 60.8 | 43.8 | 68.4 | 59.5 | 69.2 | 54.7 | 77.3 | 46.5 | 66.8 | 46.2 | 87.7 | 49.3 | 71.4 |
| Litter cover x depth | 8.1 | 6.3 | 1.0 | 3.0 | 3.4 | 2.5 | 1.5 | 2.6 | 1.6 | 1.3 | 1.9 | 1.1 | 0.5 | 1.4 | 2.3 | 1.7 | 0.5 | 3.7 | 0.2 | 1.3 | 0.8 | 4.7 | 0.6 | 1.7 |
| Disturbed ground within 5m (%) | | 0.4 | | 0.2 | 0.2 | 0.6 | 0.2 | 0.2 | 0.4 | 0.4 | 0.4 | 0.4 | 3.0 | | 2.0 | 1.0 | 3.0 | | 5.5 | 0.3 | 3.5 | 0.3 | 2.0 | |
| Bare ground (%) | | 5.0 | | 0.2 | 0.6 | 1.8 | 0.4 | 0.4 | 0.6 | 2.0 | 0.8 | 0.8 | 3.0 | 0.3 | 2.0 | 2.0 | 3.0 | | 3.0 | 3.3 | 5.0 | 0.7 | 3.0 | |
| Stone (%) | | 0.2 | | | | | | | | 0.2 | | | | | | | | | | | | | | |

Year 3 (2013)

| Sample | 1b_3 | 1a_3 | 1c_3 | 2a_3 | 2c_3 | 2b_3 | 3c_3 | 3a_3 | 3b_3 | 4a_3 | 4b_3 | 4c_3 | 5ct | 5cs | 5bt | 5bs | 5at | 5as_3 | 6bt_3 | 6bs_3 | 6at_3 | 6as_3 | 6ct_3 | 6cs_3 |
|--------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|-------|--------|-------|--------|-------|--------|-------|--------|-------|--------|-------|
| Plot | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 |
| Plot treatment | A | A | A | A | A | A | B | B | B | B | B | B | C | S | C | S | C | S | C | S | C | S | C | S |
| | none | none | none | none | none | none | sheep | sheep | sheep | sheep | sheep | sheep | cattle | slope | cattle | slope | cattle | slope | cattle | slope | cattle | slope | cattle | slope |
| Sub-plot treatment | B | A | C | A | C | B | C | A | B | A | B | C | C | C | B | B | A | A | B | B | A | A | C | C |
| | bash | none | cut | none | cut | bash | cut | none | bash | none | bash | cut | cut | cut | bash | bash | none | none | bash | bash | none | none | cut | cut |
| Sub plot | 1b | 1a | 1c | 2a | 2c | 2b | 3c | 3a | 3b | 4a | 4b | 4c | 5c | 5c | 5b | 5b | 5a | 5a | 6b | 6b | 6a | 6a | 6c | 6c |
| Year | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Derived data | | | | | | | | | | | | | | | | | | | | | | | | |
| Vegetation cover (%) | 112.2 | 105.2 | 121.2 | 122.8 | 115.0 | 154.0 | 124.6 | 136.4 | 142.8 | 127.8 | 133.2 | 112.2 | 110.0 | 120.3 | 150.5 | 183.3 | 104.5 | 192.3 | 107.5 | 169.3 | 118.0 | 177.0 | 96.0 | 159.0 |
| Understorey cover (%) | 28.2 | 15.2 | 95.6 | 23.2 | 61.0 | 71.0 | 104.6 | 88.4 | 91.8 | 95.8 | 99.2 | 101.4 | 103.5 | 106.0 | 106.5 | 100.0 | 97.0 | 102.3 | 94.0 | 104.3 | 90.5 | 102.0 | 83.5 | 104.0 |
| Species richness | 5.8 | 4.4 | 8.6 | 4.2 | 8.0 | 8.2 | 9.8 | 10.2 | 9.8 | 8.2 | 9.0 | 9.4 | 10.5 | 7.3 | 12.0 | 9.3 | 9.5 | 9.7 | 11.0 | 9.3 | 10.0 | 6.3 | 11.0 | 10.7 |
| NVC_U4b score | 14.4 | 4.0 | 53.8 | 4.6 | 28.0 | 29.2 | 64.0 | 51.4 | 40.6 | 47.0 | 57.8 | 52.2 | 67.0 | 48.7 | 69.0 | 44.7 | 61.5 | 60.3 | 70.5 | 52.0 | 64.0 | 22.0 | 62.0 | 57.3 |
| NVC_U20a score | 38.2 | 30.2 | 41.4 | 31.4 | 42.8 | 44.6 | 56.6 | 63.8 | 61.8 | 48.8 | 51.4 | 50.6 | 64.0 | 44.3 | 66.0 | 55.7 | 50.0 | 70.7 | 72.5 | 68.3 | 77.5 | 43.0 | 67.5 | 65.3 |
| NVC_U20b score | 42.2 | 37.4 | 24.0 | 37.2 | 34.2 | 36.0 | 37.8 | 51.4 | 57.6 | 30.8 | 31.8 | 33.0 | 42.0 | 24.7 | 52.5 | 44.7 | 29.5 | 56.3 | 45.0 | 51.0 | 60.5 | 35.0 | 44.0 | 45.7 |
| NVC_U20c score | 57.2 | 59.4 | 26.4 | 63.4 | 48.6 | 49.8 | 37.6 | 47.0 | 52.8 | 34.6 | 37.4 | 28.8 | 36.5 | 29.0 | 43.5 | 53.7 | 26.0 | 59.7 | 37.5 | 49.3 | 52.5 | 45.0 | 39.0 | 43.7 |
| Recorded data (means) | | | | | | | | | | | | | | | | | | | | | | | | |
| Bracken cover % | 84.0 | 90.0 | 25.6 | 99.6 | 54.0 | 83.0 | 20.0 | 48.0 | 51.0 | 32.0 | 34.0 | 10.8 | 6.5 | 14.3 | 44.0 | 83.3 | 7.5 | 90.0 | 13.5 | 65.0 | 27.5 | 75.0 | 12.5 | 55.0 |
| Bracken shoots | 28.2 | 27.8 | 18.0 | 36.2 | 23.2 | 26.4 | 29.4 | 42.2 | 39.4 | 39.0 | 24.6 | 19.0 | 9.0 | 12.0 | 26.0 | 37.0 | 10.5 | 41.3 | 31.0 | 36.7 | 36.0 | 53.3 | 10.5 | 29.0 |
| Bracken vigour | 6.4 | 7.8 | 2.2 | 9.6 | 3.6 | 4.8 | 1.6 | 4.4 | 3.0 | 3.2 | 2.4 | 1.8 | 1.5 | 2.0 | 2.0 | 5.7 | 1.5 | 7.3 | 2.5 | 5.0 | 3.0 | 8.3 | 1.5 | 4.0 |
| Bracken frond height (cm) | 76.1 | 93.9 | 48.1 | 113.1 | 62.7 | 67.7 | 45.1 | 66.5 | 54.4 | 54.2 | 48.7 | 44.8 | 32.8 | 42.6 | 37.2 | 65.6 | 36.7 | 73.4 | 47.2 | 58.7 | 52.5 | 96.1 | 36.2 | 55.8 |
| Litter cover x depth | 3.2 | 6.2 | 0.3 | 7.3 | 2.0 | 2.1 | 2.4 | 2.5 | 2.4 | 2.9 | 2.7 | 2.7 | 1.4 | 1.9 | 1.9 | 1.8 | 2.2 | 4.1 | 4.6 | 3.2 | 3.3 | 6.2 | 2.0 | 2.9 |
| Disturbed ground within 5m (%) | 3.4 | 1.8 | 19.0 | 1.2 | 14.0 | 2.0 | 1.0 | 2.2 | 6.0 | 12.0 | 5.0 | 5.6 | 29.5 | 5.7 | 45.0 | 0.7 | 70.0 | 10.3 | 10.5 | | 37.5 | 1.7 | 10.0 | 1.7 |
| Bare ground (%) | 6.4 | 2.0 | 2.2 | 1.0 | 3.0 | 7.4 | 0.4 | 2.8 | 5.4 | 3.8 | 3.8 | 2.0 | 7.5 | 2.0 | 11.0 | 1.3 | 11.0 | 10.7 | 0.5 | | 4.5 | 0.7 | 6.0 | |
| Stone (%) | 1.0 | 0.6 | 1.0 | 0.2 | 0.4 | 1.2 | | 0.2 | | 0.4 | 0.6 | | 0.5 | 1.0 | 0.5 | 0.3 | 0.5 | 0.3 | | | | | | |

Year 4 (2014)

| Sample | 1b_4 | 1a_4 | 1c_4 | 2a_4 | 2c_4 | 2b_4 | 3c_4 | 3a_4 | 3b_4 | 4a_4 | 4b_4 | 4c_4 | 5ct_4 | 5cs_4 | 5bt_4 | 5bs_4 | 5at_4 | 5as_4 | 6bt_4 | 6bs_4 | 6at_4 | 6as_4 | 6ct_4 | 6cs_4 |
|--------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|-------|--------|-------|--------|-------|--------|-------|--------|-------|--------|-------|
| Plot | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 |
| Plot treatment | A | A | A | A | A | A | B | B | B | B | B | B | C | S | C | S | C | S | C | S | C | S | C | S |
| | none | none | none | none | none | none | sheep | sheep | sheep | sheep | sheep | sheep | cattle | slope | cattle | slope | cattle | slope | cattle | slope | cattle | slope | cattle | slope |
| Sub-plot treatment | B | A | C | A | C | B | C | A | B | A | B | C | C | C | B | B | A | A | B | B | A | A | C | C |
| | bash | none | cut | none | cut | bash | cut | none | bash | none | bash | cut | cut | cut | bash | bash | none | none | bash | bash | none | none | cut | cut |
| Sub plot | 1b | 1a | 1c | 2a | 2c | 2b | 3c | 3a | 3b | 4a | 4b | 4c | 5c | 5c | 5b | 5b | 5a | 5a | 6b | 6b | 6a | 6a | 6c | 6c |
| Year | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| Derived data | | | | | | | | | | | | | | | | | | | | | | | | |
| Vegetation cover (%) | 185.8 | 148.4 | 163.6 | 140.8 | 164.4 | 193.2 | 209.0 | 200.8 | 208.6 | 197.8 | 195.8 | 211.4 | 166.0 | 204.7 | 200.5 | 221.3 | 192.0 | 204.0 | 183.5 | 179.7 | 188.5 | 170.0 | 162.0 | 200.3 |
| Understorey cover (%) | 101.8 | 48.4 | 113.6 | 40.8 | 97.6 | 95.6 | 123.0 | 103.8 | 111.0 | 101.2 | 98.8 | 116.2 | 116.0 | 128.0 | 110.5 | 127.0 | 108.0 | 106.7 | 103.5 | 88.0 | 103.5 | 73.3 | 107.0 | 117.0 |
| Species richness | 8.6 | 8.2 | 11.4 | 5.4 | 8.6 | 11.4 | 9.8 | 8.8 | 8.4 | 8.0 | 8.0 | 9.4 | 13.0 | 8.7 | 9.5 | 10.7 | 11.0 | 9.3 | 10.5 | 9.3 | 8.0 | 5.0 | 11.0 | 11.0 |
| NVC_U4b score | 39.6 | 15.2 | 48.4 | 4.6 | 35.0 | 27.0 | 54.8 | 33.0 | 40.0 | 20.2 | 35.0 | 36.2 | 61.0 | 36.7 | 57.0 | 54.7 | 58.0 | 58.3 | 57.5 | 39.3 | 47.0 | 20.3 | 59.5 | 42.0 |
| NVC_U20a score | 57.8 | 39.4 | 61.6 | 32.2 | 55.8 | 50.0 | 71.6 | 53.6 | 68.2 | 44.2 | 48.8 | 59.4 | 81.0 | 67.3 | 78.0 | 80.3 | 68.5 | 72.3 | 67.0 | 69.0 | 64.0 | 45.0 | 71.5 | 63.3 |
| NVC_U20b score | 49.2 | 36.6 | 38.4 | 38.6 | 40.4 | 41.0 | 58.0 | 45.4 | 60.6 | 44.8 | 37.0 | 51.8 | 62.0 | 50.7 | 62.5 | 54.7 | 54.0 | 58.7 | 45.0 | 52.0 | 53.5 | 42.7 | 57.5 | 44.7 |
| NVC_U20c score | 53.8 | 52.0 | 35.6 | 58.0 | 50.2 | 48.4 | 57.8 | 50.4 | 64.6 | 57.4 | 48.4 | 54.8 | 56.0 | 61.3 | 68.5 | 62.7 | 55.0 | 65.0 | 51.5 | 63.7 | 61.0 | 63.0 | 54.5 | 50.7 |
| Recorded data (means) | | | | | | | | | | | | | | | | | | | | | | | | |
| Bracken cover % | 84.0 | 100.0 | 50.0 | 100.0 | 66.8 | 97.6 | 86.0 | 97.0 | 97.6 | 96.6 | 97.0 | 95.2 | 50.0 | 76.7 | 90.0 | 94.3 | 84.0 | 97.3 | 80.0 | 91.7 | 85.0 | 96.7 | 55.0 | 83.3 |
| Bracken shoots | 23.6 | 28.8 | 13.6 | 36.0 | 20.8 | 24.4 | 45.0 | 36.6 | 36.6 | 38.4 | 42.2 | 33.0 | 33.0 | 23.0 | 28.5 | 31.0 | 28.0 | 29.3 | 50.0 | 38.7 | 40.5 | 39.0 | 38.5 | 31.7 |
| Bracken vigour | 6.6 | 10.0 | 2.6 | 10.0 | 4.8 | 7.2 | 4.2 | 7.4 | 6.4 | 7.2 | 6.4 | 5.6 | 2.0 | 3.3 | 3.5 | 5.0 | 4.0 | 6.7 | 5.5 | 8.0 | 4.5 | 9.3 | 3.5 | 5.0 |
| Bracken frond height (cm) | 82.4 | 127.1 | 53.1 | 160.7 | 71.9 | 91.9 | 64.5 | 88.9 | 76.1 | 83.6 | 72.7 | 74.1 | 41.7 | 64.6 | 61.7 | 70.6 | 62.0 | 80.0 | 75.8 | 85.9 | 58.0 | 108.7 | 55.8 | 70.2 |
| Litter cover x depth | 2.1 | 6.5 | 0.7 | 6.2 | 1.2 | 1.9 | 1.9 | 3.4 | 3.5 | 1.5 | 1.7 | 2.3 | 0.5 | 0.8 | 0.3 | 0.4 | 0.3 | 0.8 | 1.2 | 1.7 | 0.3 | 3.2 | 0.5 | 0.4 |
| Disturbed ground within 5m (%) | | 1.8 | 0.8 | 0.2 | 2.0 | 0.4 | | 0.4 | 0.2 | | | | 1.0 | | 1.0 | 0.3 | 0.5 | | | | 1.0 | | 1.0 | |
| Bare ground (%) | | 0.4 | | 0.2 | | 0.4 | | 0.6 | 0.6 | | | | 0.5 | | 2.5 | 1.0 | | | | | | | | |
| Stone (%) | | 0.2 | | 0.2 | | 0.4 | | | | | | | | | | | | | | | | | | |

Appendix 3 Difference data (Year 4 – Year 1)

| ID | 1b | 1a | 1c | 2a | 2c | 2b | 3c | 3a | 3b | 4a | 4b | 4c | 5ct | 5cs | 5bt | 5bs | 5at | 5as | 6bt | 6bs | 6at | 6as | 6ct | 6cs |
|--------------------------------|-------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|--------|-------|--------|-------|--------|-------|--------|-------|--------|-------|--------|-------|
| Plot | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 6 |
| Plot treatment | A | A | A | A | A | A | B | B | B | B | B | B | C | S | C | S | C | S | C | S | C | S | C | S |
| Sub-plot treatment | none | none | none | none | none | none | sheep | sheep | sheep | sheep | sheep | sheep | cattle | slope | cattle | slope | cattle | slope | cattle | slope | cattle | slope | cattle | slope |
| Sub-plot | B | A | C | A | C | B | C | A | B | A | B | C | C | C | B | B | A | A | B | B | A | A | C | C |
| Sub-plot treatment | bash | none | cut | none | cut | bash | cut | none | bash | none | bash | cut | cut | cut | bash | bash | none | none | bash | bash | none | none | cut | cut |
| Sub-plot | 1b | 1a | 1c | 2a | 2c | 2b | 3c | 3a | 3b | 4a | 4b | 4c | 5c | 5c | 5b | 5b | 5a | 5a | 6b | 6b | 6a | 6a | 6c | 6c |
| Vegetation cover (%) | 75.4 | 5.0 | -20.2 | -13.6 | 35.8 | 26.4 | 5.2 | 1.6 | 2.4 | -10.0 | -6.0 | 15.0 | -38.5 | -11.3 | -33.0 | 32.0 | -36.0 | -8.0 | -11.0 | -32.7 | -31.5 | -34.3 | -78.5 | 26.7 |
| Understorey cover (%) | 79.4 | 2.0 | 26.8 | -14.6 | 67.0 | 28.8 | 4.2 | -8.4 | 0.4 | -14.6 | -7.0 | 6.8 | -13.5 | 12.0 | -33.0 | 34.3 | -40.0 | -5.3 | -16.0 | -36.0 | -51.5 | -35.0 | -53.5 | 40.0 |
| Species richness | 2.8 | 3.2 | 2.6 | 0.0 | 1.4 | 6.2 | -1.0 | -1.8 | -0.4 | -3.4 | -3.2 | 0.2 | 4.0 | 0.3 | 0 | 2.3 | -0.5 | -0.7 | 0.0 | -0.3 | 0.5 | 0.0 | 1.0 | 0.7 |
| NVC_U4b score | 32.6 | 9.6 | 21.0 | -2.8 | 24.4 | 13.0 | -2.6 | -24.6 | -7.4 | -36.6 | -21.4 | -17.2 | 11.5 | 4.0 | 0 | 13.3 | 4.5 | 21.3 | 9.5 | -0.3 | -7.0 | 11.7 | 3.0 | 6.0 |
| NVC_U20a score | 20.4 | 4.4 | 0.0 | -0.6 | 13.0 | 10.2 | -11.4 | -29.2 | -5.8 | -34.4 | -21.8 | -11.6 | -5.0 | 1.0 | -11.0 | 4.3 | -21.0 | -6.3 | -9.0 | -5.3 | -16.5 | 3.7 | -19.5 | 0.3 |
| NVC_U20b score | 6.2 | -6.2 | -18.6 | 1.4 | -3.6 | -0.2 | -7.6 | -20.0 | -3.8 | -14.6 | -11.6 | -2.0 | -9.0 | -5.0 | -13.0 | -4.7 | -23.5 | -11.3 | -8.0 | -7.3 | -15.5 | 0.3 | -16.5 | -8.3 |
| NVC_U20c score | -13.2 | -17.0 | -28.2 | 2.4 | -17.0 | -9.0 | -1.0 | -9.6 | -0.8 | 2.2 | -2.2 | -2.8 | -12.0 | -3.3 | 0 | -0.7 | -8.5 | 1.0 | -1.0 | 5.0 | -4.0 | 3.0 | -10.5 | -5.3 |
| Bracken shoots | 4.0 | 0.6 | -19.8 | 4.8 | -13.0 | -4.8 | 11.0 | -0.4 | 1.4 | 4.4 | -1.8 | -3.0 | 4.0 | -14.7 | -8.5 | -6.3 | -5.5 | -10.7 | 7.0 | 5.0 | 6.0 | 1.0 | 7.5 | -6.7 |
| Bracken vigour (1-10) | 0.2 | 1.4 | -5.4 | 1.0 | -4.0 | -1.8 | -2.0 | 1.2 | -1.6 | 0.8 | -0.8 | -1.0 | -3.5 | -5.7 | -2.0 | -3.0 | -1.5 | -1.3 | -1.0 | 0.7 | -1.0 | 0.0 | -2.0 | -3.3 |
| Bracken frond height (cm) | -2.2 | 27.7 | -45.7 | 59.1 | -30.3 | -9.8 | -13.0 | 12.5 | -12.3 | 6.7 | -3.5 | -3.1 | -33.0 | -37.6 | -17.0 | -23.1 | -11.3 | -10.9 | -5.8 | 2.9 | -17.0 | -4.4 | -16.2 | -33.9 |
| Litter cover x depth | -4.3 | 0.7 | -2.1 | 2.2 | -7.8 | -1.7 | 0.9 | 2.3 | 1.7 | 0.4 | -0.1 | 0.6 | -0.3 | -1.6 | -0.3 | -3.2 | -1.1 | -1.9 | 0.5 | 0.3 | -1.0 | 0.2 | -0.1 | -1.4 |
| Disturbed ground within 5m (%) | 0 | 1.8 | 0.8 | 0.2 | 2.0 | 0.4 | 0 | 0.4 | 0.2 | 0 | 0 | 0 | 1.0 | 0 | 1.0 | 0.3 | 0.5 | 0 | 0 | 0 | 1.0 | 0 | 1.0 | 0 |
| Bare ground (%) | 0 | 0.2 | 0 | 0.2 | 0 | 0.2 | -1.0 | -0.8 | 0.6 | 0 | -0.2 | -3.2 | 0.5 | 0 | 2.5 | 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Stone (%) | 0 | 0 | 0 | 0.2 | 0 | 0.4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bracken cover | -4.0 | 3.0 | -47.0 | 1.0 | -15.0 | -2.4 | 1.0 | 10.0 | 2.0 | 4.6 | 1.0 | 8.2 | -25.0 | -23.3 | 0 | -2.3 | 4.0 | -2.7 | 5.0 | 3.3 | 20.0 | 0.7 | -25.0 | -13.3 |

Appendix 4. Risk Log

| Risk No | Description | Probability | Impact | Countermeasures | Estimated time/cost | Owner | Date last reviewed |
|----------------|--|--------------------|---------------|---|----------------------------|----------------------|---------------------------|
| 1 | Project overrun | Low | Medium | Ensure Gantt chart adhered to. Good communication | Minimal | Project Executive | |
| 2 | Lack of access due to bad Weather | low | High | Time of year and ability to shift timings | Minimal | Project Executive | |
| 3 | Illness to key members of project team | Low-medium | low | With the project being delivered by a team of individuals there is cover if one person is ill | Minimal | Project Executive | |
| 4 | Failure in computer equipment/loss due to fire/theft leading to loss of Data | Low | Low | Ensure all computers are properly and regularly backed up | Minimal | Project Executive | |
| 5 | Members of project team leave | Low | Low | Back up staff available and several individuals who can plug any gaps | Minimal | Project Executive | |
| 6 | Project funding | Medium | High | Discuss routes for further funding beyond 2014 | Unknown | Commissioning Client | |

Appendix 5. Issues Log

| No. | Description | Raised by | Date raised | Resolution | Date last updated | Status | Priority |
|-----|--|-------------|-------------|--|-------------------|----------|----------|
| 1 | Project Overrun | Chris Scott | 11/11/14 | Project Extension applied for and granted | | Resolved | High |
| 2 | Sheep Stocking treatment unable to be carried out since June/July 2014 | Ross Wilson | August 2014 | Does not affect Year 4 monitoring. Will need to be considered in developing any further phases of work | Nov. 2014 | Ongoing | High |

Appendix 6. Product Descriptions

Product Description

| | |
|---|---|
| Product Number | 1 |
| Product title | Submission of Project Summary |
| Purpose of the product | For use of EH Website |
| Composition | 150-300 word project summary |
| Derived from | Previous Project documentation and Project Design documentation |
| Format and Presentation | Word document |
| Allocated to | Project Executive |
| Quality Criteria and method | In accordance with Archaeological Research Services Ltd policy |
| Person responsible for quality assurance | Project Executive |
| Person responsible for approval | Project Executive |
| Planned Completion date | Complete |

| | |
|---|---|
| Product Number | 2 |
| Product title | Completion of project, Submission of Project Report, Attendance at close of project meeting |
| Purpose of the product | Provide a record and assessment of data collected in Year 4 |
| Composition | Project report document |
| Derived from | On site work |
| Format and Presentation | Word document |
| Allocated to | All |
| Quality Criteria and method | In accordance with standard procedure of Archaeological Research Services Ltd |
| Person responsible for quality assurance | Project Executive |
| Person responsible for approval | Project Executive |
| Planned Completion date | Project report complete. Meeting will be scheduled following review of project report. |

Appendix 7 Full Botanical and bracken dataset for Years 1-4

This is the raw data for each quadrat, which was summarised by sub-plot and treatment combination for analysis as shown in Appendices 1 and 2.

| Quadrat ID | 1b-1 | 1b-2 | 1b-3 | 1b-4 | 1b-5 | 1a-1 | 1a-2 | 1a-3 | 1a-4 | 1a-5 | 1c-1 | 1c-2 | 1c-3 | 1c-4 | 1c-5 | 2a-1 | 2a-2 | 2a-3 | 2a-4 | 2a-5 | 2c-1 | 2c-2 | 2c-3 | 2c-4 | 2c-5 | 2b-1 | 2b-2 | |
|--------------------------------|------|------|------|------|------|------|------|-------|-------|-------|-------|------|------|------|-------|-------|------|-------|------|-------|-------|------|------|-------|-------|------|-------|------|
| Plot | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | |
| Plot treatment | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A |
| | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none |
| Sub-plot | 1b | 1b | 1b | 1b | 1b | 1a | 1a | 1a | 1a | 1a | 1c | 1c | 1c | 1c | 1c | 2a | 2a | 2a | 2a | 2a | 2c | 2c | 2c | 2c | 2c | 2c | 2b | 2b |
| Sub-plot treatment | B | B | B | B | B | A | A | A | A | A | C | C | C | C | C | A | A | A | A | A | C | C | C | C | C | C | B | B |
| | bash | bash | bash | bash | bash | none | none | none | none | none | cut | cut | cut | cut | cut | none | none | none | none | none | cut | cut | cut | cut | cut | cut | bash | bash |
| Quadrat | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | |
| Year | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Measurements | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bracken shoots | 23 | 14 | 18 | 26 | 17 | 37 | 33 | 26 | 16 | 29 | 41 | 33 | 29 | 43 | 21 | 38 | 31 | 27 | 33 | 27 | 49 | 15 | 43 | 25 | 37 | 36 | 33 | |
| Bracken vigour (1-10) | 5 | 6 | 7 | 7 | 7 | 6 | 8 | 9 | 10 | 10 | 8 | 7 | 8 | 8 | 9 | 8 | 9 | 10 | 9 | 9 | 9 | 8 | 8 | 10 | 9 | 7 | 9 | |
| Bracken frond height (cm) | 78.3 | 86.0 | 83.0 | 88.0 | 87.7 | 73.3 | 99.3 | 101.0 | 110.7 | 112.3 | 109.3 | 83.7 | 98.3 | 98.0 | 105.0 | 102.3 | 96.0 | 111.7 | 97.0 | 101.3 | 103.3 | 83.7 | 98.0 | 114.0 | 111.7 | 72.0 | 108.3 | |
| Litter cover (%) | 100 | 100 | 100 | 100 | 100 | 20 | 100 | 100 | 100 | 100 | 100 | 80 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 80 | 100 | |
| Litter depth (cm) | 8.0 | 8.0 | 4.0 | 6.0 | 6.0 | 1.0 | 7.0 | 8.0 | 4.0 | 10.0 | 5.0 | 1.0 | 2.0 | 2.0 | 4.0 | 1.0 | 9.0 | 3.0 | 5.0 | 2.0 | 8.0 | 5.0 | 10.0 | 13.0 | 9.0 | 1.0 | 5.0 | |
| Litter volume | 8.0 | 8.0 | 4.0 | 6.0 | 6.0 | 0.2 | 7.0 | 8.0 | 4.0 | 10.0 | 5.0 | 0.8 | 2.0 | 2.0 | 4.0 | 1.0 | 9.0 | 3.0 | 5.0 | 2.0 | 8.0 | 5.0 | 10.0 | 13.0 | 9.0 | 0.8 | 5.0 | |
| Disturbed ground within 5m (%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bare ground (%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Stone (%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Derived data | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Vegetation cover (%) | 85 | 105 | 113 | 132 | 117 | 182 | 205 | 110 | 107 | 113 | 132 | 196 | 211 | 182 | 198 | 188 | 106 | 110 | 177 | 191 | 195 | 131 | 106 | 101 | 110 | 201 | 126 | |
| Understorey cover (%) | 5 | 25 | 18 | 32 | 32 | 92 | 105 | 15 | 7 | 13 | 32 | 96 | 121 | 87 | 98 | 88 | 11 | 10 | 77 | 91 | 95 | 41 | 6 | 1 | 10 | 101 | 26 | |
| Species richness | 5 | 5 | 5 | 4 | 10 | 9 | 5 | 4 | 3 | 4 | 9 | 8 | 7 | 10 | 10 | 8 | 4 | 3 | 7 | 5 | 12 | 12 | 6 | 2 | 4 | 9 | 5 | |
| NVC_U4b score | 7 | 6 | 11 | | 11 | 24 | 4 | | | | 16 | 31 | 25 | 40 | 25 | 16 | 4 | | 9 | 8 | 38 | 11 | 3 | | 1 | 47 | 3 | |
| NVC_U20a score | 40 | 31 | 43 | 21 | 52 | 55 | 40 | 32 | 24 | 24 | 49 | 61 | 65 | 78 | 55 | 39 | 33 | 23 | 36 | 33 | 69 | 56 | 39 | 25 | 25 | 70 | 32 | |
| NVC_U20b score | 48 | 37 | 43 | 34 | 53 | 52 | 45 | 46 | 36 | 35 | 55 | 64 | 61 | 61 | 44 | 37 | 40 | 36 | 40 | 33 | 47 | 51 | 49 | 38 | 35 | 64 | 38 | |
| NVC_U20c score | 87 | 61 | 64 | 57 | 66 | 59 | 76 | 82 | 67 | 61 | 64 | 64 | 75 | 62 | 54 | 46 | 61 | 66 | 53 | 52 | 51 | 67 | 85 | 71 | 62 | 68 | 55 | |
| Plant cover (%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Pteridium aquilinum</i> | 80 | 80 | 95 | 100 | 85 | 90 | 100 | 95 | 100 | 100 | 100 | 100 | 90 | 95 | 100 | 100 | 95 | 100 | 100 | 100 | 100 | 90 | 100 | 100 | 100 | 100 | 100 | |
| <i>Agrostis canina</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Agrostis capillaris</i> | 1 | 0.1 | 3 | | 1 | 2 | | | | | | 2 | 3 | 50 | 40 | | | | 1 | 5 | 50 | 2 | | | | 20 | | |
| <i>Agrostis stolonifera</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Anthoxanthum odoratum</i> | | | 1 | | 4 | 4 | | | | | 1 | 2 | 4 | 2 | 1 | 1 | 3 | | | | 2 | | | | | 2 | 1 | |
| <i>Bromus hordeceus</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Carex binervis</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Carex pilulifera</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Dactylis glomerata</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Danthonia decumbens</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Deschampsia cespitosa</i> | 1 | | | | 1 | | | | | | | | | 3 | | | | | | | | | | | | | | |
| <i>Deschampsia flexuosa</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Quadrat ID | 2b-3 | 2b-4 | 2b-5 | 3c-1 | 3c-2 | 3c-3 | 3c-4 | 3c-5 | 3a-1 | 3a-2 | 3a-3 | 3a-4 | 3a-5 | 3b-1 | 3b-2 | 3b-3 | 3b-4 | 3b-5 | 4a-1 | 4a-2 | 4a-3 | 4a-4 | 4a-5 | 4b-1 |
|--------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Plot | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 |
| Plot treatment | A | A | A | B | B | B | B | B | B | B | B | B | B | B | B | B | B | B | B | B | B | B | B | B |
| | none | none | none | sheep | sheep | sheep | sheep | sheep | sheep | sheep | sheep | sheep | sheep | sheep | sheep | sheep | sheep | sheep | sheep | sheep | sheep | sheep | sheep | sheep |
| Sub-plot | 2b | 2b | 2b | 3c | 3c | 3c | 3c | 3c | 3a | 3a | 3a | 3a | 3a | 3b | 3b | 3b | 3b | 3b | 4a | 4a | 4a | 4a | 4a | 4b |
| Sub-plot treatment | B | B | B | C | C | C | C | C | A | A | A | A | A | B | B | B | B | B | A | A | A | A | A | B |
| | bash | bash | bash | cut | cut | cut | cut | cut | none | none | none | none | none | bash | bash | bash | bash | bash | none | none | none | none | none | bash |
| Quadrat | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 |
| Year | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Measurements | | | | | | | | | | | | | | | | | | | | | | | | |
| Bracken shoots | 32 | 23 | 22 | 31 | 38 | 34 | 36 | 31 | 34 | 27 | 35 | 52 | 37 | 34 | 30 | 39 | 39 | 34 | 30 | 43 | 26 | 29 | 42 | 48 |
| Bracken vigour (1-10) | 10 | 10 | 9 | 5 | 5 | 8 | 7 | 6 | 4 | 5 | 7 | 7 | 8 | 10 | 7 | 7 | 7 | 9 | 7 | 7 | 6 | 6 | 6 | 7 |
| Bracken frond height (cm) | 112.0 | 112.7 | 103.3 | 80.0 | 71.0 | 84.7 | 78.3 | 73.7 | 63.0 | 70.0 | 80.7 | 82.3 | 86.3 | 102.7 | 78.3 | 84.3 | 73.7 | 103.0 | 85.0 | 82.7 | 71.3 | 69.0 | 76.3 | 75.0 |
| Litter cover (%) | 100 | 100 | 100 | 80 | 60 | 20 | 60 | 90 | 30 | 40 | 80 | 60 | 100 | 100 | 40 | 95 | 60 | 100 | 90 | 100 | 100 | 60 | 80 | 70 |
| Litter depth (cm) | 8.0 | 1.0 | 3.0 | 2.0 | 1.0 | 1.0 | 1.0 | 2.0 | 2.0 | 2.0 | 2.0 | 1.0 | 2.0 | 3.0 | 1.0 | 2.0 | 1.0 | 3.0 | 1.0 | 2.0 | 1.0 | 1.0 | 1.0 | 2.0 |
| Litter volume | 8.0 | 1.0 | 3.0 | 1.6 | 0.6 | 0.2 | 0.6 | 1.8 | 0.6 | 0.8 | 1.6 | 0.6 | 2.0 | 3.0 | 0.4 | 1.9 | 0.6 | 3.0 | 0.9 | 2.0 | 1.0 | 0.6 | 0.8 | 1.4 |
| Disturbed ground within 5m (%) | | | | | | | | | | | | | | | | | | | | | | | | |
| Bare ground (%) | | | | | | 5 | | | 2 | | 3 | | 2 | | | | | | | | | | | |
| Stone (%) | | | | | | | | | | | | | | | | | | | | | | | | |
| Derived data | | | | | | | | | | | | | | | | | | | | | | | | |
| Vegetation cover (%) | 184 | 123 | 200 | 185 | 186 | 240 | 207 | 201 | 198 | 193 | 205 | 196 | 204 | 203 | 227 | 197 | 201 | 203 | 193 | 207 | 195 | 206 | 238 | 201 |
| Understorey cover (%) | 84 | 23 | 100 | 110 | 116 | 150 | 112 | 106 | 133 | 108 | 110 | 106 | 104 | 103 | 132 | 107 | 106 | 105 | 103 | 117 | 105 | 111 | 143 | 111 |
| Species richness | 6 | 4 | 2 | 9 | 12 | 13 | 10 | 10 | 14 | 11 | 9 | 11 | 8 | 8 | 8 | 8 | 10 | 10 | 13 | 10 | 10 | 12 | 12 | 12 |
| NVC_U4b score | 20 | | | 54 | 66 | 65 | 56 | 46 | 68 | 48 | 59 | 63 | 50 | 53 | 53 | 43 | 47 | 41 | 61 | 60 | 53 | 52 | 58 | 55 |
| NVC_U20a score | 45 | 27 | 25 | 80 | 86 | 95 | 82 | 72 | 91 | 81 | 78 | 86 | 78 | 77 | 90 | 72 | 69 | 62 | 70 | 85 | 67 | 80 | 91 | 83 |
| NVC_U20b score | 37 | 35 | 32 | 71 | 63 | 72 | 66 | 56 | 65 | 72 | 67 | 61 | 62 | 70 | 75 | 69 | 58 | 50 | 59 | 66 | 44 | 59 | 69 | 65 |
| NVC_U20c score | 50 | 59 | 55 | 64 | 55 | 59 | 61 | 55 | 55 | 58 | 62 | 60 | 65 | 73 | 74 | 69 | 60 | 51 | 55 | 57 | 46 | 57 | 61 | 59 |
| Plant cover (%) | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Pteridium aquilinum</i> | 100 | 100 | 100 | 75 | 70 | 90 | 95 | 95 | 65 | 85 | 95 | 90 | 100 | 100 | 95 | 90 | 95 | 98 | 90 | 90 | 90 | 95 | 95 | 90 |
| <i>Agrostis canina</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Agrostis capillaris</i> | 1 | | | 35 | 20 | 30 | 10 | 5 | 35 | 20 | 55 | 35 | 50 | 80 | 60 | 10 | 2 | | 70 | 55 | 10 | 40 | 30 | 40 |
| <i>Agrostis stolonifera</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Anthoxanthum odoratum</i> | 2 | | | 20 | 30 | 40 | 20 | 8 | 45 | 30 | 10 | 40 | 20 | 10 | 10 | 15 | 15 | 10 | 10 | 10 | 5 | 5 | 5 | 20 |
| <i>Bromus hordeceus</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Carex binervis</i> | | | | 1 | | 1 | | | 1 | | | | | | | | | | | | | | | |
| <i>Carex pilulifera</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Dactylis glomerata</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Danthonia decumbens</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Deschampsia cespitosa</i> | | | | | | | | | | 30 | | | | | | | | | | | | | | |
| <i>Deschampsia flexuosa</i> | | | | | | | | | | | | | | | | | | | 2 | | | 2 | 2 | 1 |

| Quadrat ID | 2b-3 | 2b-4 | 2b-5 | 3c-1 | 3c-2 | 3c-3 | 3c-4 | 3c-5 | 3a-1 | 3a-2 | 3a-3 | 3a-4 | 3a-5 | 3b-1 | 3b-2 | 3b-3 | 3b-4 | 3b-5 | 4a-1 | 4a-2 | 4a-3 | 4a-4 | 4a-5 | 4b-1 |
|-----------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| <i>Stellaria holostea</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Taraxacum officinale</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Teucrium scorodonia</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Trifolium repens</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Urtica dioica</i> | | 20 | | | | | | | | | | | | | | | | | | | | | | |
| <i>Vaccinium myrtillus</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Veronica chamaedrys</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Veronica officinalis</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Vicia sativa</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Vicia sepium</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Viola riviniana</i> | | 2 | | | | | | | | | | | | | | | | | | | | | | |
| <i>Brachythecium rutabulum</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Dicranum scoparium</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Hylocomium splendens</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Hypnum cupressiforme</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Lophocolea bidentata</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Lophozia ventricosa</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Plagiothecium undulatum</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Pleurozium schreberi</i> | | | | | | | | | | 1 | | | | | | | | | | | | | | |
| <i>Pseudoscleropodium purum</i> | | | | | | 1 | | | | 1 | | | | | | | | | | 1 | | | | |
| <i>Rhytidiadelphus loreus</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Rhytidiadelphus squarrosus</i> | | | | 5 | 1 | 4 | 1 | 1 | 4 | | 4 | | | 3 | 1 | 1 | | 1 | 1 | 6 | 5 | 5 | 10 | 2 |

| Quadrat ID | 4b-2 | 4b-3 | 4b-4 | 4b-5 | 4c-1 | 4c-2 | 4c-3 | 4c-4 | 4c-5 | 5c-1 | 5c-2 | 5c-3 | 5c-4 | 5c-5 | 5b-1 | 5b-2 | 5b-3 | 5b-4 | 5b-5 | 5a-1 | 5a-2 | 5a-3 | 5a-4 | 5a-5 | 6b-1 | |
|--------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|------------|------------|------------|-------------|-------------|------------|------------|------------|-------------|-------------|------------|------------|------------|------------|-------------|
| Plot | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 6 |
| Plot treatment | B sheep | B sheep | B sheep | B sheep | B sheep | B sheep | B sheep | B sheep | B sheep | C cattle | C cattle | S slope | S slope | S slope | C cattle | C cattle | S slope | S slope | S slope | C cattle | C cattle | S slope | S slope | S slope | S slope | C cattle |
| Sub-plot | 4b | 4b | 4b | 4b | 4c | 4c | 4c | 4c | 4c | 5c | 5c | 5c | 5c | 5c | 5b | 5b | 5b | 5b | 5b | 5a | 5a | 5a | 5a | 5a | 5a | 6b |
| Sub-plot treatment | B bash | B bash | B bash | B bash | C cut | C cut | C cut | C cut | C cut | C cut | C cut | C cut | C cut | C cut | B bash | B bash | B bash | B bash | B bash | A none | A none | A none | A none | A none | A none | B bash |
| Quadrat | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | |
| Year | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Measurements | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bracken shoots | 44 | 45 | 56 | 27 | 37 | 30 | 41 | 38 | 34 | 22 | 36 | 36 | 37 | 40 | 47 | 27 | 35 | 50 | 27 | 35 | 32 | 37 | 40 | 43 | 55 | |
| Bracken vigour (1-10) | 8 | 6 | 7 | 8 | 6 | 8 | 6 | 6 | 7 | 5 | 6 | 8 | 9 | 10 | 5 | 6 | 7 | 9 | 8 | 5 | 6 | 8 | 7 | 9 | 6 | |
| Bracken frond height (cm) | 77.3 | 69.0 | 78.3 | 81.3 | 78.0 | 90.3 | 69.3 | 68.7 | 80.0 | 71.7 | 77.7 | 86.3 | 101.3 | 118.7 | 69.0 | 88.3 | 82.7 | 105.7 | 92.7 | 66.0 | 80.7 | 102.7 | 79.7 | 90.3 | 73.3 | |
| Litter cover (%) | 100 | 100 | 90 | 30 | 100 | 100 | 100 | 50 | 20 | 80 | 80 | 100 | 100 | 100 | 50 | 80 | 100 | 100 | 100 | 80 | 100 | 100 | 90 | 100 | 70 | |
| Litter depth (cm) | 2.0 | 4.0 | 1.0 | 1.0 | 1.0 | 3.0 | 3.0 | 2.0 | 1.0 | 1.0 | 1.0 | 1.0 | 2.0 | 4.0 | 1.0 | 1.0 | 3.0 | 6.0 | 2.0 | 1.0 | 2.0 | 3.0 | 1.0 | 4.0 | 1.0 | |
| Litter volume | 2.0 | 4.0 | 0.9 | 0.3 | 1.0 | 3.0 | 3.0 | 1.0 | 0.2 | 0.8 | 0.8 | 1.0 | 2.0 | 4.0 | 0.5 | 0.8 | 3.0 | 6.0 | 2.0 | 0.8 | 2.0 | 3.0 | 0.9 | 4.0 | 0.7 | |
| Disturbed ground within 5m (%) | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bare ground (%) | | | | | 1 | 15 | | | 1 | | | | | | | | | | | | | | | | | |
| Stone (%) | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Derived data | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Vegetation cover (%) | 202 | 202 | 206 | 198 | 210 | 205 | 201 | 180 | 186 | 212 | 197 | 218 | 224 | 206 | 271 | 196 | 211 | 151 | 206 | 256 | 200 | 202 | 218 | 216 | 193 | |
| Understorey cover (%) | 102 | 112 | 106 | 98 | 130 | 110 | 111 | 95 | 101 | 142 | 117 | 118 | 124 | 106 | 186 | 101 | 116 | 51 | 111 | 186 | 110 | 102 | 118 | 116 | 113 | |
| Species richness | 11 | 11 | 12 | 10 | 9 | 10 | 10 | 9 | 8 | 7 | 11 | 12 | 8 | 5 | 11 | 8 | 10 | 7 | 8 | 12 | 11 | 9 | 11 | 10 | 12 | |
| NVC_U4b score | 66 | 68 | 51 | 42 | 61 | 64 | 39 | 49 | 54 | 51 | 48 | 58 | 24 | 16 | 62 | 52 | 53 | 33 | 38 | 60 | 47 | 41 | 50 | 20 | 50 | |
| NVC_U20a score | 81 | 74 | 59 | 56 | 81 | 80 | 62 | 68 | 64 | 86 | 86 | 92 | 55 | 52 | 96 | 82 | 85 | 66 | 77 | 93 | 86 | 88 | 81 | 67 | 78 | |
| NVC_U20b score | 55 | 47 | 40 | 36 | 60 | 67 | 51 | 51 | 40 | 71 | 71 | 70 | 47 | 50 | 76 | 75 | 61 | 57 | 60 | 76 | 79 | 78 | 69 | 63 | 56 | |
| NVC_U20c score | 59 | 50 | 44 | 41 | 64 | 63 | 56 | 55 | 50 | 77 | 59 | 60 | 58 | 76 | 65 | 72 | 57 | 69 | 64 | 63 | 64 | 71 | 58 | 63 | 52 | |
| Plant cover (%) | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Pteridium aquilinum</i> | 100 | 90 | 100 | 100 | 80 | 95 | 90 | 85 | 85 | 70 | 80 | 100 | 100 | 100 | 85 | 95 | 95 | 100 | 95 | 70 | 90 | 100 | 100 | 100 | 80 | |
| <i>Agrostis canina</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Agrostis capillaris</i> | 50 | 65 | 5 | 10 | 30 | 40 | 1 | 41 | 15 | 20 | 10 | 25 | | | 40 | 30 | 10 | 15 | 25 | 45 | 15 | 5 | 40 | | 60 | |
| <i>Agrostis stolonifera</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Anthoxanthum odoratum</i> | 10 | 10 | 3 | 2 | 15 | 15 | 1 | 4 | 5 | 15 | 30 | 15 | | | 15 | 20 | 10 | 5 | 3 | 15 | 15 | 25 | 20 | 2 | 25 | |
| <i>Bromus hordeceus</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Carex binervis</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Carex pilulifera</i> | | | | | | | | | | | | 1 | | | | | | | | | | | 1 | 4 | | |
| <i>Dactylis glomerata</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Danthonia decumbens</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Deschampsia cespitosa</i> | | | | | | | | | | | | | | | | | | 15 | | | | | | | | |
| <i>Deschampsia flexuosa</i> | | | | | | | | | | | | | | | | | | | | 5 | 3 | | 5 | | | |

| Quadrat ID | 4b-2 | 4b-3 | 4b-4 | 4b-5 | 4c-1 | 4c-2 | 4c-3 | 4c-4 | 4c-5 | 5c-1 | 5c-2 | 5c-3 | 5c-4 | 5c-5 | 5b-1 | 5b-2 | 5b-3 | 5b-4 | 5b-5 | 5a-1 | 5a-2 | 5a-3 | 5a-4 | 5a-5 | 6b-1 | |
|-----------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|---|
| <i>Stellaria holostea</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Taraxacum officinale</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Teucrium scorodonia</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Trifolium repens</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Urtica dioica</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Vaccinium myrtillus</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Veronica chamaedrys</i> | | | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | |
| <i>Veronica officinalis</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Vicia sativa</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Vicia sepium</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Viola riviniana</i> | | | | 3 | | | | | | | | | | | | | | | | | | | | | | |
| <i>Brachythecium rutabulum</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Dicranum scoparium</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Hylocomium splendens</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Hypnum cupressiforme</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Lophocolea bidentata</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Lophozia ventricosa</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Plagiothecium undulatum</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Pleurozium schreberi</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Pseudoscleropodium purum</i> | | | | | | | | | | | | | | | 1 | | | | | | 2 | 1 | | | | |
| <i>Rhytidiadelphus loreus</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Rhytidiadelphus squarrosus</i> | 1 | 1 | 1 | 1 | 1 | 6 | 8 | 15 | | 5 | 10 | 20 | 1 | 5 | 1 | 3 | 1 | | | 6 | 4 | 2 | 10 | | | 5 |

| Quadrat ID | 6b-2 | 6b-3 | 6b-4 | 6b-5 | 6a-1 | 6a-2 | 6a-3 | 6a-4 | 6a-5 | 6c-1 | 6c-2 | 6c-3 | 6c-4 | 6c-5 |
|-----------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| <i>Stellaria holostea</i> | | | | 1 | | | | | | | | 4 | 1 | |
| <i>Taraxacum officinale</i> | | | | | | | | | | | | | | |
| <i>Teucrium scorodonia</i> | | | | | | | | | | | | | | |
| <i>Trifolium repens</i> | | | | | | | | | | | | | | |
| <i>Urtica dioica</i> | | | | | | | | | | | | | | |
| <i>Vaccinium myrtillus</i> | | | | | | | | | | | | | | |
| <i>Veronica chamaedrys</i> | | | | | | | | | | | | | | |
| <i>Veronica officinalis</i> | | | | | | | | | | | | | | |
| <i>Vicia sativa</i> | | | | | | | | | | | | | | |
| <i>Vicia sepium</i> | | | | | | | | | | | | | | |
| <i>Viola riviniana</i> | | | | | | | | | | | | | | 1 |
| <i>Brachythecium rutabulum</i> | | | | | | | | | | | | | | |
| <i>Dicranum scoparium</i> | | | | | | | | | | | | | | |
| <i>Hylocomium splendens</i> | | | | | | | | | | | | | | |
| <i>Hypnum cupressiforme</i> | | | | | | | | | | | | | | 1 |
| <i>Lophocolea bidentata</i> | | | | | | | | | | | | | | |
| <i>Lophozia ventricosa</i> | | | | | | | | | | | | | | |
| <i>Plagiothecium undulatum</i> | | | | | | | | | | | | | | |
| <i>Pleurozium schreberi</i> | | | | | | | | | | | | | | |
| <i>Pseudoscleropodium purum</i> | | | | | | | | | | 2 | | | | |
| <i>Rhytidiadelphus loreus</i> | | | | | | | | | | | | | | |
| <i>Rhytidiadelphus squarrosus</i> | 4 | 2 | 5 | 12 | 25 | 4 | 5 | | | 20 | 1 | 2 | 1 | |

| Quadrat ID | 1b-1 | 1b-2 | 1b-3 | 1b-4 | 1b-5 | 1a-1 | 1a-2 | 1a-3 | 1a-4 | 1a-5 | 1c-1 | 1c-2 | 1c-3 | 1c-4 | 1c-5 | 2a-1 | 2a-2 | 2a-3 | 2a-4 | 2a-5 | 2c-1 | 2c-2 | 2c-3 | 2c-4 | 2c-5 | 2b-1 | 2b-2 | |
|--------------------------------|------|------|------|------|------|------|-------|-------|-------|-------|------|------|------|------|------|-------|-------|-------|-------|-------|------|------|-------|-------|------|------|-------|----|
| Plot | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | |
| Plot treatment | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | |
| | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | |
| Sub-plot | 1b | 1b | 1b | 1b | 1b | 1a | 1a | 1a | 1a | 1a | 1c | 1c | 1c | 1c | 1c | 2a | 2a | 2a | 2a | 2a | 2c | 2c | 2c | 2c | 2c | 2b | 2b | |
| Sub-plot treatment | B | B | B | B | B | A | A | A | A | A | C | C | C | C | C | A | A | A | A | A | C | C | C | C | C | B | B | |
| | bash | bash | bash | bash | bash | none | none | none | none | none | cut | cut | cut | cut | cut | none | none | none | none | none | cut | cut | cut | cut | cut | cut | cut | |
| Quadrat | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | |
| Year | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | |
| Measurements | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bracken shoots | 18 | 47 | 28 | 39 | 39 | 36 | 48 | 24 | 48 | 55 | 27 | 24 | 32 | 24 | 29 | 35 | 45 | 44 | 58 | 48 | 20 | 39 | 49 | 56 | 16 | 24 | 39 | |
| Bracken vigour (1-10) | 7 | 5 | 6 | 7 | 7 | 7 | 9 | 8 | 9 | 9 | 6 | 5 | 5 | 6 | 7 | 9 | 9 | 10 | 10 | 10 | 5 | 7 | 8 | 7 | 6 | 5 | 7 | |
| Bracken frond height (cm) | 73.0 | 75.0 | 88.0 | 89.3 | 91.7 | 82.0 | 121.0 | 114.3 | 126.3 | 116.7 | 70.0 | 73.7 | 83.3 | 84.0 | 90.7 | 115.7 | 114.0 | 113.0 | 139.7 | 123.7 | 76.0 | 95.7 | 106.0 | 105.0 | 88.7 | 81.0 | 113.0 | |
| Litter cover (%) | 100 | 100 | 100 | 100 | 100 | 30 | 100 | 95 | 100 | 100 | 100 | 100 | 100 | 90 | 100 | 100 | 100 | 100 | 100 | 100 | 90 | 100 | 100 | 97 | 90 | 100 | 100 | |
| Litter depth (cm) | 5.3 | 7.7 | 6.0 | 9.0 | 12.7 | 0.7 | 10.3 | 10.3 | 6.0 | 5.3 | 1.0 | 1.0 | 1.3 | 1.0 | 1.0 | 3.3 | 1.7 | 4.3 | 3.3 | 2.3 | 1.0 | 2.0 | 6.7 | 4.3 | 3.7 | 1.3 | 1.3 | |
| Litter volume | 5.3 | 7.7 | 6.0 | 9.0 | 12.7 | 0.2 | 10.3 | 9.8 | 6.0 | 5.3 | 1.0 | 1.0 | 1.3 | 0.9 | 1.0 | 3.3 | 1.7 | 4.3 | 3.3 | 2.3 | 0.9 | 2.0 | 6.7 | 4.2 | 3.3 | 1.3 | 1.3 | |
| Disturbed ground within 5m (%) | | | | | | 1 | | | | | 1 | | | | | | | | | | | 1 | | | 1 | 1 | | |
| Bare ground (%) | | | | | | 20 | | | | | 5 | | | | | | | | | | | 1 | | | 3 | 3 | 2 | |
| Stone (%) | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | |
| Derived data | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Vegetation cover (%) | 102 | 107 | 97 | 91 | 157 | 169 | 101 | 180 | 101 | 100 | 194 | 189 | 190 | 186 | 155 | 188 | 174 | 198 | 180 | 189 | 181 | 179 | 103 | 118 | 181 | 198 | 166 | |
| Understorey cover (%) | 12 | 12 | 7 | 1 | 57 | 74 | 1 | 90 | 1 | 96 | | 92 | 95 | 96 | 65 | 88 | 74 | 98 | 80 | 89 | 101 | 79 | 3 | 18 | 91 | 103 | 66 | |
| Species richness | 6 | 6 | 3 | 2 | 7 | 8 | 2 | 6 | 2 | 1 | 7 | 7 | 7 | 6 | 7 | 6 | 6 | 6 | 3 | 8 | 9 | 10 | 3 | 6 | 5 | 7 | 4 | |
| NVC_U4b score | 21 | 12 | 2 | | 39 | 42 | 25 | | 2 | 47 | | 48 | 50 | 18 | 6 | 2 | 3 | 3 | 2 | 8 | 50 | 45 | 7 | | 45 | | 1 | |
| NVC_U20a score | 47 | 33 | 24 | 25 | 45 | 48 | 25 | 32 | 29 | 25 | 56 | 48 | 58 | 34 | 24 | 23 | 28 | 29 | 23 | 31 | 58 | 67 | 24 | 30 | 20 | 64 | 23 | |
| NVC_U20b score | 52 | 38 | 36 | 38 | 39 | 37 | 38 | 32 | 42 | 38 | 38 | 37 | 45 | 31 | 28 | 27 | 37 | 31 | 31 | 30 | 42 | 53 | 36 | 37 | 27 | 50 | 31 | |
| NVC_U20c score | 79 | 56 | 66 | 71 | 51 | 46 | 71 | 41 | 71 | 71 | 47 | 46 | 55 | 40 | 42 | 42 | 61 | 42 | 52 | 44 | 51 | 64 | 67 | 61 | 43 | 55 | 51 | |
| Plant cover (%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Pteridium aquilinum</i> | 90 | 95 | 90 | 90 | 100 | 95 | 100 | 90 | 100 | 100 | 98 | 97 | 95 | 90 | 90 | 100 | 100 | 100 | 100 | 100 | 80 | 100 | 100 | 100 | 90 | 95 | 100 | |
| <i>Agrostis canina</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Agrostis capillaris</i> | 1 | | | | 15 | 10 | | | | | | 50 | 25 | 10 | | | | | | | | | 3 | 60 | 40 | 3 | | 30 |
| <i>Agrostis stolonifera</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Anthoxanthum odoratum</i> | 1 | 1 | 4 | | 15 | 5 | | | 10 | | 5 | 30 | 5 | | | | | | | | | 5 | | 2 | | | 20 | |
| <i>Bromus hordeceus</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Carex binervis</i> | 1 | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | |
| <i>Carex pilulifera</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Dactylis glomerata</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Danthonia decumbens</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Deschampsia cespitosa</i> | 1 | | | | | | | | | | 8 | | | | | | | | | | 2 | | | | | | | |
| <i>Deschampsia flexuosa</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Quadrat ID | 2b-3 | 2b-4 | 2b-5 | 3c-1 | 3c-2 | 3c-3 | 3c-4 | 3c-5 | 3a-1 | 3a-2 | 3a-3 | 3a-4 | 3a-5 | 3b-1 | 3b-2 | 3b-3 | 3b-4 | 3b-5 | 4a-1 | 4a-2 | 4a-3 | 4a-4 | 4a-5 | 4b-1 |
|-----------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| <i>Stellaria holostea</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Taraxacum officinale</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Teucrium scorodonia</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Trifolium repens</i> | | | | | | | | | | | | | | | | | | | | | | | 1 | |
| <i>Urtica dioica</i> | | 1 | | | | | | | | | | | | | | | | | | | | | | |
| <i>Vaccinium myrtillus</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Veronica chamaedrys</i> | | | 1 | | | | | | | | | | | | | | | | | | | | | |
| <i>Veronica officinalis</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Vicia sativa</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Vicia sepium</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Viola riviniana</i> | | | 2 | | | | | | | | | | | | | | | | | | | | | |
| <i>Brachythecium rutabulum</i> | | | | | | | | | | | | 1 | | | | | | | | | | | | |
| <i>Dicranum scoparium</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Hylocomium splendens</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Hypnum cupressiforme</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Lophocolea bidentata</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Lophozia ventricosa</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Plagiothecium undulatum</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Pleurozium schreberi</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Pseudoscleropodium purum</i> | | | | | | | | | 1 | | | | | | | | | | | | | | | |
| <i>Rhytidiadelphus loreus</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Rhytidiadelphus squarrosus</i> | | | 1 | 3 | 1 | 6 | 2 | 4 | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | | 3 | 5 | | 4 | 2 | 2 |

| Quadrat ID | 4b-2 | 4b-3 | 4b-4 | 4b-5 | 4c-1 | 4c-2 | 4c-3 | 4c-4 | 4c-5 | 5c-1 | 5c-2 | 5c-3 | 5c-4 | 5c-5 | 5b-1 | 5b-2 | 5b-3 | 5b-4 | 5b-5 | 5a-1 | 5a-2 | 5a-3 | 5a-4 | 5a-5 | 6b-1 | |
|--------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|------------|------------|------------|-------------|-------------|------------|------------|------------|-------------|-------------|------------|------------|------------|-------------|-------------|
| Plot | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 6 |
| Plot treatment | B sheep | B sheep | B sheep | B sheep | B sheep | B sheep | B sheep | B sheep | B sheep | C cattle | C cattle | S slope | S slope | S slope | C cattle | C cattle | S slope | S slope | S slope | C cattle | C cattle | S slope | S slope | S slope | C cattle | C cattle |
| Sub-plot | 4b | 4b | 4b | 4b | 4c | 4c | 4c | 4c | 4c | 5c | 5c | 5c | 5c | 5c | 5b | 5b | 5b | 5b | 5b | 5a | 5a | 5a | 5a | 5a | 5a | 6b |
| Sub-plot treatment | B bash | B bash | B bash | B bash | C cut | C cut | C cut | C cut | C cut | C cut | C cut | C cut | C cut | C cut | B bash | B bash | B bash | B bash | B bash | A none | A none | A none | A none | A none | A none | B bash |
| Quadrat | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | |
| Year | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Measurements | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bracken shoots | 44 | 30 | 23 | 40 | 24 | 39 | 30 | 29 | 53 | 32 | 20 | 21 | 28 | 39 | 20 | 26 | 27 | 53 | 48 | 50 | 23 | 42 | 32 | 47 | 28 | |
| Bracken vigour (1-10) | 4 | 3 | 6 | 7 | 2 | 5 | 3 | 4 | 6 | 1 | 2 | 4 | 4 | 5 | 2 | 3 | 5 | 5 | 7 | 2 | 4 | 8 | 8 | 7 | 2 | |
| Bracken frond height (cm) | 63.0 | 57.7 | 74.3 | 82.0 | 54.3 | 65.7 | 48.7 | 62.7 | 72.7 | 39.7 | 48.0 | 73.0 | 58.7 | 73.7 | 55.0 | 64.0 | 66.3 | 66.3 | 75.0 | 52.0 | 57.3 | 83.0 | 71.7 | 77.3 | 49.7 | |
| Litter cover (%) | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 80 | 20 | 100 | 100 | 100 | 100 | 100 | 100 | 95 | 98 | 60 | 50 | 100 | 100 | 100 | 30 | |
| Litter depth (cm) | 2.0 | 0.7 | 3.0 | 1.7 | 0.3 | 0.7 | 0.7 | 1.3 | 2.3 | 1.0 | 1.0 | 1.3 | 1.3 | 1.7 | 2.0 | 2.7 | 1.3 | 1.7 | 2.3 | 1.3 | 0.3 | 4.7 | 3.0 | 3.3 | 0.3 | |
| Litter volume | 2.0 | 0.7 | 3.0 | 1.7 | 0.3 | 0.7 | 0.7 | 1.3 | 2.3 | 0.8 | 0.2 | 1.3 | 1.3 | 1.7 | 2.0 | 2.7 | 1.3 | 1.6 | 2.3 | 0.8 | 0.2 | 4.7 | 3.0 | 3.3 | 0.1 | |
| Disturbed ground within 5m (%) | 1 | | | | 1 | 1 | | | | 3 | 3 | | | | 3 | 1 | 1 | 1 | 1 | 3 | 3 | | | | 1 | |
| Bare ground (%) | 2 | | | | | 4 | | | | 3 | 3 | | 1 | | 3 | 1 | 2 | 2 | 2 | 3 | 3 | | | | 1 | |
| Stone (%) | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Derived data | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Vegetation cover (%) | 194 | 191 | 198 | 203 | 175 | 172 | 182 | 210 | 193 | 144 | 165 | 210 | 192 | 146 | 148 | 150 | 211 | 187 | 202 | 168 | 150 | 216 | 190 | 193 | 142 | |
| Understorey cover (%) | 104 | 111 | 103 | 103 | 105 | 112 | 112 | 115 | 103 | 114 | 110 | 130 | 127 | 76 | 108 | 65 | 131 | 102 | 107 | 108 | 100 | 118 | 100 | 98 | 102 | |
| Species richness | 11 | 13 | 6 | 8 | 8 | 10 | 11 | 10 | 12 | 12 | 10 | 8 | 6 | 5 | 12 | 10 | 12 | 12 | 9 | 15 | 10 | 9 | 10 | 10 | 8 | |
| NVC_U4b score | 75 | 61 | 14 | 39 | 53 | 62 | 54 | 47 | 47 | 65 | 58 | 24 | 23 | 18 | 74 | 47 | 59 | 64 | 39 | 53 | 62 | 58 | 59 | 37 | 74 | |
| NVC_U20a score | 74 | 62 | 28 | 55 | 75 | 81 | 69 | 57 | 70 | 91 | 86 | 60 | 50 | 42 | 86 | 84 | 86 | 77 | 57 | 79 | 79 | 78 | 71 | 76 | 61 | |
| NVC_U20b score | 50 | 39 | 27 | 41 | 61 | 59 | 51 | 45 | 57 | 68 | 69 | 47 | 49 | 41 | 63 | 75 | 54 | 55 | 39 | 70 | 65 | 65 | 56 | 62 | 38 | |
| NVC_U20c score | 58 | 52 | 41 | 52 | 67 | 59 | 54 | 49 | 56 | 55 | 61 | 60 | 65 | 66 | 56 | 71 | 55 | 56 | 49 | 52 | 59 | 65 | 58 | 73 | 36 | |
| Plant cover (%) | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Pteridium aquilinum</i> | 90 | 80 | 95 | 100 | 70 | 60 | 70 | 95 | 90 | 30 | 55 | 80 | 65 | 70 | 40 | 85 | 80 | 85 | 95 | 60 | 50 | 98 | 90 | 95 | 40 | |
| <i>Agrostis canina</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Agrostis capillaris</i> | 60 | 20 | | 10 | 80 | 60 | 5 | 5 | 5 | 50 | 50 | | | | 65 | 20 | 10 | 20 | | 5 | 50 | 50 | 5 | 10 | 30 | |
| <i>Agrostis stolonifera</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Anthoxanthum odoratum</i> | 10 | | | | 15 | 30 | 5 | 3 | 2 | 15 | 10 | | | | 15 | 5 | 20 | 5 | 10 | 12 | 20 | 4 | 30 | 10 | 20 | |
| <i>Bromus hordeceus</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Carex binervis</i> | | | | | | | | | | | | | | | | | | | | 1 | | | 1 | 3 | | |
| <i>Carex pilulifera</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Dactylis glomerata</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Danthonia decumbens</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Deschampsia cespitosa</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Deschampsia flexuosa</i> | | | | | | | | | | 6 | | | 1 | | | 2 | | 1 | | 5 | | | | 10 | | |

| Quadrat ID | 4b-2 | 4b-3 | 4b-4 | 4b-5 | 4c-1 | 4c-2 | 4c-3 | 4c-4 | 4c-5 | 5c-1 | 5c-2 | 5c-3 | 5c-4 | 5c-5 | 5b-1 | 5b-2 | 5b-3 | 5b-4 | 5b-5 | 5a-1 | 5a-2 | 5a-3 | 5a-4 | 5a-5 | 6b-1 | |
|-----------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|--|
| <i>Stellaria holostea</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Taraxacum officinale</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Teucrium scorodonia</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Trifolium repens</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Urtica dioica</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Vaccinium myrtillus</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Veronica chamaedrys</i> | | | 1 | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Veronica officinalis</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Vicia sativa</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Vicia sepium</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Viola riviniana</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Brachythecium rutabulum</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Dicranum scoparium</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Hylocomium splendens</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Hypnum cupressiforme</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Lophocolea bidentata</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Lophozia ventricosa</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Plagiothecium undulatum</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Pleurozium schreberi</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Pseudoscleropodium purum</i> | | | | | | | | | | | | | | | | | | | | | 1 | | 1 | | | |
| <i>Rhytidiadelphus loreus</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Rhytidiadelphus squarrosus</i> | | | | 4 | 2 | 1 | 3 | 6 | 1 | 2 | 2 | 1 | 1 | | 2 | 1 | 1 | 1 | | 5 | 1 | 3 | 1 | | 1 | |

| Quadrat ID | 6b-2 | 6b-3 | 6b-4 | 6b-5 | 6a-1 | 6a-2 | 6a-3 | 6a-4 | 6a-5 | 6c-1 | 6c-2 | 6c-3 | 6c-4 | 6c-5 |
|-----------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| <i>Stellaria holostea</i> | | | | | | | | | | | | | 1 | |
| <i>Taraxacum officinale</i> | | | | | | | | | | | | | | |
| <i>Teucrium scorodonia</i> | | | | | | | | | | | | | | |
| <i>Trifolium repens</i> | | | | | | | | | | | | | | |
| <i>Urtica dioica</i> | | | | | | | | | | | | | | |
| <i>Vaccinium myrtillus</i> | | | | | | | | | | | | | | |
| <i>Veronica chamaedrys</i> | | | | | | | | | | | | | 2 | |
| <i>Veronica officinalis</i> | | | | | | | | | | | | | | |
| <i>Vicia sativa</i> | | | | | | | | | | | | | | |
| <i>Vicia sepium</i> | | | | | | | | | | | | | | |
| <i>Viola riviniana</i> | | | | | | | 1 | | | | | | | |
| <i>Brachythecium rutabulum</i> | | | | | | | | | | | | | | |
| <i>Dicranum scoparium</i> | | | | | | | | | | | | | | |
| <i>Hylocomium splendens</i> | | | | | | | | | | | | | | |
| <i>Hypnum cupressiforme</i> | | | | | | | | | | | | | | |
| <i>Lophocolea bidentata</i> | | | | | | | | | | | | | | |
| <i>Lophozia ventricosa</i> | | | | | | | | | | | | | | |
| <i>Plagiothecium undulatum</i> | | | | | | | | | | | | | | |
| <i>Pleurozium schreberi</i> | | | | | | | | | | | | | | |
| <i>Pseudoscleropodium purum</i> | | | | | | | | | 1 | | | | | 1 |
| <i>Rhytidiadelphus loreus</i> | | | | | | | | | | | | | | |
| <i>Rhytidiadelphus squarrosus</i> | 4 | 1 | 3 | 10 | 8 | | | 1 | | 10 | | 1 | 1 | 1 |

| Quadrat ID | 2b-3 | 2b-4 | 2b-5 | 3c-1 | 3c-2 | 3c-3 | 3c-4 | 3c-5 | 3a-1 | 3a-2 | 3a-3 | 3a-4 | 3a-5 | 3b-1 | 3b-2 | 3b-3 | 3b-4 | 3b-5 | 4a-1 | 4a-2 | 4a-3 | 4a-4 | 4a-5 | 4b-1 |
|--------------------------------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Plot | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 |
| Plot treatment | A | A | A | B | B | B | B | B | B | B | B | B | B | B | B | B | B | B | B | B | B | B | B | B |
| | none | none | none | sheep | sheep | sheep | sheep | sheep | sheep | sheep | sheep | sheep | sheep | sheep | sheep | sheep | sheep | sheep | sheep | sheep | sheep | sheep | sheep | sheep |
| Sub-plot | 2b | 2b | 2b | 3c | 3c | 3c | 3c | 3c | 3a | 3a | 3a | 3a | 3a | 3b | 3b | 3b | 3b | 3b | 4a | 4a | 4a | 4a | 4a | 4b |
| Sub-plot treatment | B | B | B | C | C | C | C | C | A | A | A | A | A | B | B | B | B | B | A | A | A | A | A | B |
| | bash | bash | bash | cut | cut | cut | cut | cut | none | none | none | none | none | bash | bash | bash | bash | bash | none | none | none | none | none | bash |
| Quadrat | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 |
| Year | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Measurements | | | | | | | | | | | | | | | | | | | | | | | | |
| Bracken shoots | 30 | 17 | 34 | 22 | 29 | 28 | 33 | 35 | 38 | 26 | 30 | 70 | 47 | 23 | 44 | 52 | 37 | 41 | 26 | 34 | 32 | 54 | 49 | 24 |
| Bracken vigour (1-10) | 7 | 5 | 5 | 1 | 2 | 2 | 1 | 2 | 3 | 2 | 4 | 6 | 7 | 2 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 4 | 3 | 1 |
| Bracken frond height (cm) | 87.3 | 65.3 | 72.7 | 42.0 | 46.7 | 48.3 | 43.3 | 45.3 | 58.7 | 53.3 | 60.3 | 79.7 | 80.7 | 52.3 | 48.0 | 61.3 | 48.3 | 62.0 | 57.7 | 48.7 | 61.7 | 53.7 | 49.3 | 43.3 |
| Litter cover (%) | 70 | 10 | 100 | 100 | 96 | 100 | 100 | 98 | 90 | 80 | 95 | 98 | 100 | 90 | 100 | 100 | 95 | 60 | 98 | 95 | 95 | 98 | 96 | 90 |
| Litter depth (cm) | 6.3 | 1.0 | 1.3 | 2.3 | 3.0 | 1.7 | 2.7 | 2.7 | 2.3 | 2.3 | 2.3 | 2.3 | 4.0 | 2.7 | 1.7 | 2.3 | 4.7 | 1.7 | 2.3 | 4.3 | 2.0 | 4.7 | 1.7 | 3.7 |
| Litter volume | 4.4 | 0.1 | 1.3 | 2.3 | 2.9 | 1.7 | 2.7 | 2.6 | 2.1 | 1.9 | 2.2 | 2.3 | 4.0 | 2.4 | 1.7 | 2.3 | 4.4 | 1.0 | 2.3 | 4.1 | 1.9 | 4.6 | 1.6 | 3.3 |
| Disturbed ground within 5m (%) | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 5 | 1 | 1 | 1 | 4 | 10 | 3 | 5 | 8 | 5 | 10 | 20 | 10 | 15 | 10 |
| Bare ground (%) | 30 | 4 | | | | | 1 | 1 | 6 | 5 | 2 | 1 | | 3 | 1 | | 3 | 20 | 2 | 6 | 5 | 3 | 3 | 5 |
| Stone (%) | 4 | 1 | | | | | | | | | 1 | | | | | | | | 1 | | | 1 | | |
| Derived data | | | | | | | | | | | | | | | | | | | | | | | | |
| Vegetation cover (%) | 98 | 160 | 192 | 120 | 114 | 133 | 134 | 122 | 102 | 123 | 121 | 162 | 174 | 125 | 168 | 137 | 150 | 134 | 99 | 107 | 120 | 148 | 165 | 117 |
| Understorey cover (%) | 8 | 90 | 102 | 105 | 94 | 103 | 114 | 107 | 82 | 93 | 91 | 92 | 84 | 95 | 118 | 67 | 100 | 79 | 84 | 92 | 100 | 98 | 105 | 102 |
| Species richness | 7 | 9 | 8 | 9 | 10 | 10 | 10 | 10 | 10 | 11 | 10 | 10 | 10 | 10 | 11 | 10 | 9 | 9 | 9 | 9 | 6 | 8 | 9 | 12 |
| NVC_U4b score | 3 | 37 | 24 | 66 | 62 | 66 | 58 | 68 | 49 | 61 | 50 | 57 | 40 | 60 | 40 | 37 | 34 | 32 | 57 | 46 | 32 | 42 | 58 | 81 |
| NVC_U20a score | 32 | 53 | 37 | 62 | 47 | 69 | 55 | 50 | 67 | 74 | 57 | 66 | 55 | 68 | 82 | 71 | 50 | 38 | 46 | 49 | 41 | 52 | 56 | 53 |
| NVC_U20b score | 37 | 40 | 28 | 42 | 27 | 50 | 37 | 33 | 56 | 63 | 43 | 49 | 46 | 65 | 78 | 74 | 39 | 32 | 25 | 32 | 25 | 37 | 35 | 27 |
| NVC_U20c score | 62 | 51 | 43 | 41 | 26 | 47 | 40 | 34 | 49 | 52 | 39 | 47 | 48 | 49 | 58 | 65 | 51 | 41 | 23 | 36 | 29 | 47 | 38 | 25 |
| Plant cover (%) | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Pteridium aquilinum</i> | 90 | 70 | 90 | 15 | 20 | 30 | 20 | 15 | 20 | 30 | 30 | 70 | 90 | 30 | 50 | 70 | 50 | 55 | 15 | 15 | 20 | 50 | 60 | 15 |
| <i>Agrostis canina</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Agrostis capillaris</i> | 1 | 1 | 2 | 25 | 15 | 15 | 1 | 5 | 15 | 10 | 10 | 10 | | 20 | 10 | 5 | | | 45 | 3 | 1 | 1 | 15 | 15 |
| <i>Agrostis stolonifera</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Anthoxanthum odoratum</i> | | | | 50 | 15 | 40 | 2 | 20 | 25 | 25 | 30 | 40 | 20 | 5 | 15 | 20 | 2 | 4 | 30 | 4 | 1 | 3 | 1 | 10 |
| <i>Bromus hordeceus</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Carex binervis</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Carex pilulifera</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Dactylis glomerata</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Danthonia decumbens</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Deschampsia cespitosa</i> | | | | 1 | 15 | | | | | | | | | | | | 30 | | | | | | | |
| <i>Deschampsia flexuosa</i> | | | | | 1 | | | 1 | 5 | 5 | 1 | 1 | 4 | 2 | 20 | 1 | | | | 1 | | | | 1 |

| Quadrat ID | 2b-3 | 2b-4 | 2b-5 | 3c-1 | 3c-2 | 3c-3 | 3c-4 | 3c-5 | 3a-1 | 3a-2 | 3a-3 | 3a-4 | 3a-5 | 3b-1 | 3b-2 | 3b-3 | 3b-4 | 3b-5 | 4a-1 | 4a-2 | 4a-3 | 4a-4 | 4a-5 | 4b-1 |
|-----------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| <i>Stellaria holostea</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Taraxacum officinale</i> | | | 1 | | | | | | | | | | | | | | | | | | | | | |
| <i>Teucrium scorodonia</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Trifolium repens</i> | | | | | | | | | | | | | | | | | | | | | | | | 2 |
| <i>Urtica dioica</i> | 1 | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Vaccinium myrtillus</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Veronica chamaedrys</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Veronica officinalis</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Vicia sativa</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Vicia sepium</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Viola riviniana</i> | 1 | 2 | | | | | | | | | | | | | | | | | | | | | | |
| <i>Brachythecium rutabulum</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Dicranum scoparium</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Hylocomium splendens</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Hypnum cupressiforme</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Lophocolea bidentata</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Lophozia ventricosa</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Plagiothecium undulatum</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Pleurozium schreberi</i> | | | | | | | | | | | | | | 1 | | | | | | | | | | |
| <i>Pseudoscleropodium purum</i> | | | | | | | | | | | | | | | | 1 | | | | | | | | |
| <i>Rhytidiadelphus loreus</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Rhytidiadelphus squarrosus</i> | | | | 4 | 1 | 1 | 5 | 1 | 2 | 1 | 1 | 2 | 1 | 6 | 25 | 1 | | | 4 | 1 | 2 | | 1 | 1 |

| Quadrat ID | 4b-2 | 4b-3 | 4b-4 | 4b-5 | 4c-1 | 4c-2 | 4c-3 | 4c-4 | 4c-5 | 5c-1 | 5c-2 | 5c-3 | 5c-4 | 5c-5 | 5b-1 | 5b-2 | 5b-3 | 5b-4 | 5b-5 | 5a-1 | 5a-2 | 5a-3 | 5a-4 | 5a-5 | 6b-1 | |
|--------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|------------|------------|------------|-------------|-------------|------------|------------|------------|-------------|-------------|------------|------------|------------|-------------|----|
| Plot | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 6 | |
| Plot treatment | B sheep | B sheep | B sheep | B sheep | B sheep | B sheep | B sheep | B sheep | B sheep | C cattle | C cattle | S slope | S slope | S slope | C cattle | C cattle | S slope | S slope | S slope | C cattle | C cattle | S slope | S slope | S slope | C cattle | |
| Sub-plot | 4b | 4b | 4b | 4b | 4c | 4c | 4c | 4c | 4c | 5c | 5c | 5c | 5c | 5c | 5b | 5b | 5b | 5b | 5b | 5b | 5a | 5a | 5a | 5a | 5a | 6b |
| Sub-plot treatment | B bash | B bash | B bash | B bash | C cut | C cut | C cut | C cut | C cut | C cut | C cut | C cut | C cut | C cut | B bash | B bash | B bash | B bash | B bash | A none | A none | A none | A none | A none | B bash | |
| Quadrat | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | |
| Year | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | |
| Measurements | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bracken shoots | 18 | 26 | 31 | 24 | 17 | 23 | 13 | 18 | 24 | 8 | 10 | 20 | 9 | 7 | 9 | 43 | 33 | 38 | 40 | 12 | 9 | 40 | 44 | 40 | 37 | |
| Bracken vigour (1-10) | 2 | 2 | 3 | 4 | 1 | 2 | 2 | 2 | 2 | 1 | 2 | 3 | 1 | 2 | 1 | 3 | 5 | 5 | 7 | 1 | 2 | 7 | 7 | 8 | 3 | |
| Bracken frond height (cm) | 49.3 | 42.7 | 57.7 | 50.3 | 42.3 | 39.3 | 51.3 | 44.3 | 46.7 | 25.0 | 40.7 | 55.3 | 34.3 | 38.0 | 27.3 | 47.0 | 61.7 | 68.7 | 66.3 | 32.3 | 41.0 | 65.7 | 72.3 | 82.3 | 52.0 | |
| Litter cover (%) | 98 | 80 | 90 | 98 | 98 | 98 | 99 | 90 | 100 | 90 | 90 | 95 | 90 | 100 | 80 | 90 | 90 | 100 | 99 | 85 | 90 | 90 | 100 | 98 | 100 | |
| Litter depth (cm) | 1.7 | 1.3 | 3.3 | 4.7 | 4.7 | 1.3 | 2.0 | 2.3 | 3.7 | 1.7 | 1.3 | 1.7 | 1.7 | 2.7 | 1.7 | 2.7 | 1.7 | 1.3 | 2.7 | 2.7 | 2.3 | 2.0 | 4.0 | 6.7 | 5.3 | |
| Litter volume | 1.6 | 1.1 | 3.0 | 4.6 | 4.6 | 1.3 | 2.0 | 2.1 | 3.7 | 1.5 | 1.2 | 1.6 | 1.5 | 2.7 | 1.3 | 2.4 | 1.5 | 1.3 | 2.6 | 2.3 | 2.1 | 1.8 | 4.0 | 6.5 | 5.3 | |
| Disturbed ground within 5m (%) | 3 | 5 | 5 | 2 | 5 | 1 | 1 | 20 | 1 | 55 | 4 | 10 | 3 | 4 | 60 | 30 | 2 | | | 80 | 60 | 30 | | 1 | 20 | |
| Bare ground (%) | 1 | 3 | 8 | 2 | 2 | 1 | 1 | 6 | | 8 | 7 | 4 | 2 | | 12 | 10 | 3 | | 1 | 12 | 10 | 30 | | 2 | | |
| Stone (%) | | 1 | 2 | | | | | | | 1 | | 1 | 2 | | 1 | | | | 1 | 1 | | 1 | | | | |
| Derived data | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Vegetation cover (%) | 115 | 134 | 147 | 153 | 112 | 111 | 108 | 117 | 113 | 103 | 117 | 141 | 107 | 113 | 108 | 193 | 174 | 184 | 192 | 102 | 107 | 186 | 189 | 202 | 96 | |
| Understorey cover (%) | 100 | 104 | 87 | 103 | 102 | 99 | 103 | 102 | 101 | 100 | 107 | 116 | 99 | 103 | 100 | 113 | 94 | 104 | 102 | 97 | 97 | 96 | 104 | 107 | 81 | |
| Species richness | 7 | 10 | 7 | 9 | 11 | 9 | 9 | 6 | 12 | 11 | 10 | 10 | 5 | 7 | 13 | 11 | 10 | 8 | 10 | 11 | 8 | 8 | 12 | 9 | 11 | |
| NVC_U4b score | 58 | 68 | 49 | 33 | 47 | 68 | 45 | 25 | 76 | 73 | 61 | 66 | 25 | 55 | 78 | 60 | 56 | 23 | 55 | 73 | 50 | 58 | 76 | 47 | 67 | |
| NVC_U20a score | 43 | 65 | 49 | 47 | 69 | 60 | 37 | 30 | 57 | 63 | 65 | 67 | 25 | 41 | 54 | 78 | 64 | 37 | 66 | 51 | 49 | 70 | 84 | 58 | 70 | |
| NVC_U20b score | 23 | 38 | 34 | 37 | 60 | 37 | 19 | 21 | 28 | 38 | 46 | 47 | 9 | 18 | 32 | 73 | 54 | 31 | 49 | 25 | 34 | 53 | 62 | 54 | 43 | |
| NVC_U20c score | 32 | 38 | 43 | 49 | 38 | 39 | 20 | 24 | 23 | 31 | 42 | 45 | 22 | 20 | 25 | 62 | 55 | 50 | 56 | 21 | 31 | 66 | 56 | 57 | 37 | |
| Plant cover (%) | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Pteridium aquilinum</i> | 15 | 30 | 60 | 50 | 10 | 12 | 5 | 15 | 12 | 3 | 10 | 25 | 8 | 10 | 8 | 80 | 80 | 80 | 90 | 5 | 10 | 90 | 85 | 95 | 15 | |
| <i>Agrostis canina</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Agrostis capillaris</i> | 10 | 40 | 10 | 5 | 15 | 40 | 1 | | 10 | 40 | 85 | 30 | 1 | 30 | 25 | 45 | 5 | | 35 | 40 | 30 | 20 | 30 | 10 | 45 | |
| <i>Agrostis stolonifera</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Anthoxanthum odoratum</i> | 2 | 2 | 2 | | 40 | 20 | 2 | 2 | 10 | 4 | 4 | 6 | | 1 | 2 | 5 | 2 | | 30 | 20 | 2 | 10 | 30 | 20 | 15 | |
| <i>Bromus hordeceus</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Carex binervis</i> | | | | | | | | | | | | | | | 1 | | | | | 1 | | | | | 1 | |
| <i>Carex pilulifera</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Dactylis glomerata</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Danthonia decumbens</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Deschampsia cespitosa</i> | | | | | | | | | | | | | | | | | | | | | 6 | | | | | |
| <i>Deschampsia flexuosa</i> | | | | | 20 | | | 1 | | | | | | | | 1 | | | 2 | | | | | 10 | | |

| Quadrat ID | 4b-2 | 4b-3 | 4b-4 | 4b-5 | 4c-1 | 4c-2 | 4c-3 | 4c-4 | 4c-5 | 5c-1 | 5c-2 | 5c-3 | 5c-4 | 5c-5 | 5b-1 | 5b-2 | 5b-3 | 5b-4 | 5b-5 | 5a-1 | 5a-2 | 5a-3 | 5a-4 | 5a-5 | 6b-1 | |
|-----------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|---|
| <i>Stellaria holostea</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Taraxacum officinale</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Teucrium scorodonia</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Trifolium repens</i> | | | | | | | | | 1 | | | | | | | | | | | | | | | | | |
| <i>Urtica dioica</i> | | | | | | | | | | | | | | | | | | | 1 | | | | | | | |
| <i>Vaccinium myrtillus</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Veronica chamaedrys</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Veronica officinalis</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Vicia sativa</i> | | | | 1 | | | | | | | | | | | | | | | | | | | | | | |
| <i>Vicia sepium</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Viola riviniana</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Brachythecium rutabulum</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Dicranum scoparium</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Hylocomium splendens</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Hypnum cupressiforme</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Lophocolea bidentata</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Lophozia ventricosa</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Plagiothecium undulatum</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Pleurozium schreberi</i> | | | | | 1 | | | | | | | | | | | | | | | | | | | | | |
| <i>Pseudoscleropodium purum</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Rhytidiadelphus loreus</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Rhytidiadelphus squarrosus</i> | 2 | | | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 2 | 1 | | 1 | 1 | 1 | 1 | | | | | | | 3 | 5 | 1 |

| Quadrat ID | 6b-2 | 6b-3 | 6b-4 | 6b-5 | 6a-1 | 6a-2 | 6a-3 | 6a-4 | 6a-5 | 6c-1 | 6c-2 | 6c-3 | 6c-4 | 6c-5 |
|-----------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| <i>Stellaria holostea</i> | | | | | | | | | | | | | | |
| <i>Taraxacum officinale</i> | | | | | | | | | | | | | | |
| <i>Teucrium scorodonia</i> | | | | | | | | | | | | | | |
| <i>Trifolium repens</i> | | | | | | | | | | | | | | |
| <i>Urtica dioica</i> | | | | | | | | | | | | | | |
| <i>Vaccinium myrtillus</i> | | | | | | | | | | | | | | |
| <i>Veronica chamaedrys</i> | | | | | | | | | | | | | | |
| <i>Veronica officinalis</i> | | | | | | | | | | | | | | |
| <i>Vicia sativa</i> | | | | | | | | | | | | | | |
| <i>Vicia sepium</i> | | | | | | | | | | | | | | |
| <i>Viola riviniana</i> | | | | | | | | | | | | | | |
| <i>Brachythecium rutabulum</i> | | | | | | | | | | | | | | |
| <i>Dicranum scoparium</i> | | | | | | | | | | | | | | |
| <i>Hylocomium splendens</i> | | | | | | | | | | | | | | |
| <i>Hypnum cupressiforme</i> | | | | | | | | | | | | | | |
| <i>Lophocolea bidentata</i> | | | | | | | | | | | | | | |
| <i>Lophozia ventricosa</i> | | | | | | | | | | | | | | |
| <i>Plagiothecium undulatum</i> | | | | | | | | | | | | | | |
| <i>Pleurozium schreberi</i> | | | | | | | | | | | | | | |
| <i>Pseudoscleropodium purum</i> | | | | 1 | | | | | | | | | | |
| <i>Rhytidiadelphus loreus</i> | | | | | 1 | 1 | | | | 1 | 1 | 1 | 1 | 1 |
| <i>Rhytidiadelphus squarrosus</i> | 2 | 1 | | 1 | 1 | 1 | | | 1 | 1 | 1 | 1 | 1 | 1 |

| Quadrat ID | 1b-1 | 1b-2 | 1b-3 | 1b-4 | 1b-5 | 1a-1 | 1a-2 | 1a-3 | 1a-4 | 1a-5 | 1c-1 | 1c-2 | 1c-3 | 1c-4 | 1c-5 | 2a-1 | 2a-2 | 2a-3 | 2a-4 | 2a-5 | 2c-1 | 2c-2 | 2c-3 | 2c-4 | 2c-5 | 2b-1 | 2b-2 | | | | | | |
|--------------------------------|------|------|------|-------|------|-------|-------|-------|-------|-------|------|------|------|------|------|-------|-------|-------|-------|-------|------|------|------|------|------|------|------|------|----|---|---|--|--|
| Plot | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | | | | | |
| Plot treatment | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | A | | | | | |
| | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | none | | | | | |
| Sub-plot | 1b | 1b | 1b | 1b | 1b | 1a | 1a | 1a | 1a | 1a | 1c | 1c | 1c | 1c | 1c | 2a | 2a | 2a | 2a | 2a | 2c | 2c | 2c | 2c | 2c | 2c | 2b | 2b | | | | | |
| Sub-plot treatment | B | B | B | B | B | A | A | A | A | A | C | C | C | C | C | A | A | A | A | A | C | C | C | C | C | C | B | B | | | | | |
| | bash | bash | bash | bash | bash | none | none | none | none | none | cut | cut | cut | cut | cut | none | none | none | none | none | cut | cut | cut | cut | cut | cut | bash | bash | | | | | |
| Quadrat | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | | | | | | |
| Year | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | | | | | |
| Measurements | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bracken shoots | 13 | 26 | 25 | 26 | 28 | 34 | 29 | 22 | 35 | 24 | 12 | 13 | 11 | 16 | 16 | 36 | 29 | 38 | 42 | 35 | 20 | 17 | 20 | 26 | 21 | 24 | 31 | | | | | | |
| Bracken vigour (1-10) | 1 | 7 | 7 | 9 | 9 | 10 | 10 | 10 | 10 | 10 | 2 | 3 | 2 | 2 | 4 | 10 | 10 | 10 | 10 | 10 | 2 | 6 | 6 | 7 | 3 | 4 | 4 | | | | | | |
| Bracken frond height (cm) | 52.7 | 93.7 | 67.0 | 104.3 | 94.3 | 107.7 | 129.7 | 119.0 | 140.0 | 139.0 | 45.3 | 59.3 | 49.0 | 45.7 | 66.3 | 172.7 | 135.3 | 168.0 | 153.3 | 174.3 | 47.3 | 85.7 | 74.3 | 98.0 | 54.0 | 72.3 | 75.0 | | | | | | |
| Litter cover (%) | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | | | | | | |
| Litter depth (cm) | 1.0 | 2.7 | 2.7 | 2.3 | 1.7 | 2.7 | 8.3 | 3.3 | 7.3 | 11.0 | 1.3 | 0.7 | 0.3 | 0.3 | 0.7 | 7.3 | 4.0 | 10.0 | 6.0 | 3.7 | 0.7 | 4.0 | 0.3 | 0.7 | 0.3 | 0.7 | 0.7 | | | | | | |
| Litter volume | 1.0 | 2.7 | 2.7 | 2.3 | 1.7 | 2.7 | 8.3 | 3.3 | 7.3 | 11.0 | 1.3 | 0.7 | 0.3 | 0.3 | 0.7 | 7.3 | 4.0 | 10.0 | 6.0 | 3.7 | 0.7 | 4.0 | 0.3 | 0.7 | 0.3 | 0.7 | 0.7 | | | | | | |
| Disturbed ground within 5m (%) | | | | | | 2 | 5 | 1 | 1 | | | | | | 1 | 2 | 1 | | | | | | 1 | | | | | | 5 | 5 | | | |
| Bare ground (%) | | | | | | | | | | | 1 | 1 | | | | | | | | | | | 1 | | | | | | | | | | |
| Stone (%) | | | | | | 1 | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | |
| Derived data | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Vegetation cover (%) | 143 | 200 | 191 | 200 | 195 | 206 | 146 | 144 | 129 | 117 | 140 | 157 | 147 | 193 | 181 | 111 | 193 | 104 | 190 | 106 | 166 | 121 | 216 | 133 | 186 | 218 | 213 | | | | | | |
| Understorey cover (%) | 113 | 100 | 101 | 100 | 95 | 106 | 46 | 44 | 29 | 17 | 120 | 107 | 117 | 113 | 111 | 11 | 93 | 4 | 90 | 6 | 111 | 112 | 116 | 43 | 106 | 128 | 115 | | | | | | |
| Species richness | 10 | 12 | 8 | 7 | 6 | 14 | 8 | 5 | 6 | 8 | 12 | 10 | 13 | 11 | 11 | 6 | 5 | 4 | 8 | 4 | 8 | 10 | 7 | 7 | 11 | 16 | 14 | | | | | | |
| NVC_U4b score | 51 | 48 | 36 | 29 | 34 | 36 | 15 | 1 | 10 | 14 | 46 | 42 | 71 | 38 | 45 | 4 | 6 | | 8 | 5 | 26 | 46 | 44 | 32 | 27 | 55 | 40 | | | | | | |
| NVC_U20a score | 64 | 74 | 63 | 35 | 53 | 55 | 43 | 23 | 37 | 39 | 45 | 68 | 77 | 62 | 56 | 36 | 31 | 23 | 33 | 38 | 55 | 67 | 65 | 54 | 38 | 81 | 72 | | | | | | |
| NVC_U20b score | 45 | 68 | 57 | 30 | 46 | 45 | 34 | 32 | 36 | 36 | | 56 | 55 | 46 | 35 | 37 | 38 | 35 | 43 | 40 | 44 | 45 | 46 | 40 | 27 | 59 | 60 | | | | | | |
| NVC_U20c score | 42 | 63 | 62 | 45 | 57 | 41 | 52 | 52 | 58 | 57 | | 45 | 40 | 53 | 40 | 63 | 46 | 64 | 46 | 71 | 49 | 54 | 58 | 52 | 38 | 53 | 59 | | | | | | |
| Plant cover (%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Pteridium aquilinum</i> | 30 | 100 | 90 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 20 | 50 | 30 | 80 | 70 | 100 | 100 | 100 | 100 | 100 | 55 | 90 | 100 | 90 | 80 | 90 | 98 | | | | | | |
| <i>Agrostis canina</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Agrostis capillaris</i> | 45 | 60 | 20 | 10 | 40 | 30 | 20 | | 3 | 1 | 30 | 40 | 70 | 50 | 40 | 1 | | | | | | 1 | 60 | 75 | 85 | 15 | 5 | 70 | 80 | | | | |
| <i>Agrostis stolonifera</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Anthoxanthum odoratum</i> | 10 | 3 | 1 | | 3 | 2 | | | | | | 15 | 5 | 12 | 6 | 5 | | | | | | 6 | 20 | 4 | 8 | | 10 | 2 | | | | | |
| <i>Bromus hordeceus</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Carex binervis</i> | 4 | 2 | 4 | | | | | | 1 | | | | | | 1 | 1 | | | | | | | | | | | | | | | | | |
| <i>Carex pilulifera</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Dactylis glomerata</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Danthonia decumbens</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Deschampsia cespitosa</i> | | | | | | 30 | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | |
| <i>Deschampsia flexuosa</i> | 20 | 6 | | | | | | 20 | | | | | | 40 | 40 | 3 | 2 | 1 | | | | | | 40 | | | | | | 5 | 5 | | |

| Quadrat ID | 2b-3 | 2b-4 | 2b-5 | 3c-1 | 3c-2 | 3c-3 | 3c-4 | 3c-5 | 3a-1 | 3a-2 | 3a-3 | 3a-4 | 3a-5 | 3b-1 | 3b-2 | 3b-3 | 3b-4 | 3b-5 | 4a-1 | 4a-2 | 4a-3 | 4a-4 | 4a-5 | 4b-1 |
|--------------------------------|-----------|-----------|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Plot | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 |
| Plot treatment | A none | A none | A none | B sheep | B sheep | B sheep | B sheep | B sheep | B sheep | B sheep | B sheep | B sheep | B sheep | B sheep | B sheep | B sheep | B sheep | B sheep | B sheep | B sheep | B sheep | B sheep | B sheep | B sheep |
| Sub-plot | 2b | 2b | 2b | 3c | 3c | 3c | 3c | 3c | 3a | 3a | 3a | 3a | 3a | 3b | 3b | 3b | 3b | 3b | 4a | 4a | 4a | 4a | 4a | 4b |
| Sub-plot treatment | B bash | B bash | B bash | C cut | C cut | C cut | C cut | C cut | A none | A none | A none | A none | A none | B bash | B bash | B bash | B bash | B bash | A none | A none | A none | A none | A none | B bash |
| Quadrat | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 |
| Year | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| Measurements | | | | | | | | | | | | | | | | | | | | | | | | |
| Bracken shoots | 23 | 27 | 17 | 55 | 34 | 42 | 31 | 63 | 53 | 22 | 28 | 46 | 34 | 29 | 40 | 53 | 29 | 32 | 35 | 24 | 43 | 32 | 58 | 42 |
| Bracken vigour (1-10) | 8 | 10 | 10 | 3 | 3 | 5 | 5 | 5 | 5 | 7 | 7 | 9 | 9 | 5 | 6 | 7 | 8 | 6 | 6 | 7 | 7 | 8 | 8 | 4 |
| Bracken frond height (cm) | 88.3 | 110.0 | 113.7 | 52.0 | 55.7 | 73.7 | 73.3 | 68.0 | 64.3 | 80.0 | 83.3 | 110.7 | 106.3 | 69.7 | 78.3 | 82.3 | 80.7 | 69.7 | 73.7 | 74.3 | 84.3 | 92.0 | 93.7 | 59.7 |
| Litter cover (%) | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Litter depth (cm) | 0.7 | 7.0 | 0.3 | 2.3 | 1.0 | 2.3 | 1.7 | 2.0 | 3.7 | 5.3 | 2.7 | 2.0 | 3.3 | 3.0 | 3.7 | 3.7 | 2.3 | 4.7 | 0.7 | 1.3 | 1.3 | 1.7 | 2.3 | 0.7 |
| Litter volume | 0.7 | 7.0 | 0.3 | 2.3 | 1.0 | 2.3 | 1.7 | 2.0 | 3.7 | 5.3 | 2.7 | 2.0 | 3.3 | 3.0 | 3.7 | 3.7 | 2.3 | 4.7 | 0.7 | 1.3 | 1.3 | 1.7 | 2.3 | 0.7 |
| Disturbed ground within 5m (%) | | 1 | 1 | | | | | | 1 | 1 | | | | | 1 | | | | | | | | | |
| Bare ground (%) | | | 1 | | | | | | 2 | 1 | | | | | 3 | | | | | | | | | |
| Stone (%) | | 1 | 1 | | | | | | | | | | | | | | | | | | | | | |
| Derived data | | | | | | | | | | | | | | | | | | | | | | | | |
| Vegetation cover (%) | 197 | 143 | 195 | 194 | 190 | 247 | 207 | 207 | 193 | 201 | 204 | 200 | 206 | 208 | 227 | 201 | 204 | 203 | 198 | 194 | 197 | 205 | 195 | 197 |
| Understorey cover (%) | 97 | 43 | 95 | 109 | 110 | 152 | 127 | 117 | 103 | 103 | 107 | 100 | 106 | 113 | 132 | 103 | 104 | 103 | 100 | 104 | 102 | 105 | 95 | 102 |
| Species richness | 11 | 7 | 9 | 9 | 10 | 8 | 10 | 12 | 7 | 9 | 9 | 9 | 10 | 7 | 8 | 10 | 9 | 8 | 5 | 11 | 7 | 10 | 7 | 8 |
| NVC_U4b score | 16 | 14 | 10 | 60 | 71 | 55 | 34 | 54 | 23 | 31 | 51 | 29 | 31 | 51 | 49 | 48 | 19 | 33 | 9 | 33 | 13 | 27 | 19 | 47 |
| NVC_U20a score | 35 | 35 | 27 | 74 | 65 | 86 | 63 | 70 | 50 | 59 | 67 | 39 | 53 | 60 | 82 | 81 | 50 | 68 | 26 | 61 | 45 | 49 | 40 | 53 |
| NVC_U20b score | 27 | 34 | 25 | 59 | 47 | 75 | 58 | 51 | 40 | 46 | 56 | 37 | 48 | 53 | 71 | 74 | 47 | 58 | 33 | 51 | 51 | 49 | 40 | 34 |
| NVC_U20c score | 39 | 54 | 37 | 66 | 48 | 69 | 58 | 48 | 45 | 50 | 63 | 41 | 53 | 63 | 69 | 68 | 56 | 67 | 45 | 56 | 62 | 61 | 63 | 44 |
| Plant cover (%) | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Pteridium aquilinum</i> | 100 | 100 | 100 | 85 | 80 | 95 | 80 | 90 | 90 | 98 | 97 | 100 | 100 | 95 | 95 | 98 | 100 | 100 | 98 | 90 | 95 | 100 | 100 | 95 |
| <i>Agrostis canina</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Agrostis capillaris</i> | 5 | 1 | | 90 | 70 | 65 | 5 | 40 | 20 | 10 | 25 | 1 | | 75 | 30 | 70 | 2 | 15 | | 3 | | 1 | 1 | 25 |
| <i>Agrostis stolonifera</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Anthoxanthum odoratum</i> | | | | 2 | 5 | 10 | 2 | 5 | | 4 | 3 | 3 | 15 | 1 | 15 | 3 | 1 | 3 | | 4 | 1 | | | 1 |
| <i>Bromus hordeceus</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Carex binervis</i> | 2 | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Carex pilulifera</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Dactylis glomerata</i> | | | 1 | | | | | | | | | | | | | | | | | | | | | |
| <i>Danthonia decumbens</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Deschampsia cespitosa</i> | | 1 | | | | | | | | | | | | | | | | | | | | | | |
| <i>Deschampsia flexuosa</i> | | | | | | | 1 | | | | | | | 5 | | | | | | | 1 | | | |

| Quadrat ID | 2b-3 | 2b-4 | 2b-5 | 3c-1 | 3c-2 | 3c-3 | 3c-4 | 3c-5 | 3a-1 | 3a-2 | 3a-3 | 3a-4 | 3a-5 | 3b-1 | 3b-2 | 3b-3 | 3b-4 | 3b-5 | 4a-1 | 4a-2 | 4a-3 | 4a-4 | 4a-5 | 4b-1 |
|-----------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| <i>Stellaria holostea</i> | | | | | | | | | | | | | | | | | | | | | | 1 | | |
| <i>Taraxacum officinale</i> | | | 1 | | | | | | | | | | | | | | | | | | | | | |
| <i>Teucrium scorodonia</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Trifolium repens</i> | | | | | | | | | | | | | | | | | | | | | | | | 2 |
| <i>Urtica dioica</i> | 1 | | 8 | | | | | | | | | | | | | | | | | | | | | |
| <i>Vaccinium myrtillus</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Veronica chamaedrys</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Veronica officinalis</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Vicia sativa</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Vicia sepium</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Viola riviniana</i> | 1 | | 4 | | | | | | | | | | | | | | | | | | | | | |
| <i>Brachythecium rutabulum</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Dicranum scoparium</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Hylocomium splendens</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Hypnum cupressiforme</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Lophocolea bidentata</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Lophozia ventricosa</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Plagiothecium undulatum</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Pleurozium schreberi</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Pseudoscleropodium purum</i> | | | | | | | | 1 | 1 | | | | | | | | | | | | | | | |
| <i>Rhytidiadelphus loreus</i> | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Rhytidiadelphus squarrosus</i> | | | | 4 | 10 | 40 | 20 | 5 | 1 | 2 | 1 | 4 | 1 | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | | |

| Quadrat ID | 4b-2 | 4b-3 | 4b-4 | 4b-5 | 4c-1 | 4c-2 | 4c-3 | 4c-4 | 4c-5 | 5c-1 | 5c-2 | 5c-3 | 5c-4 | 5c-5 | 5b-1 | 5b-2 | 5b-3 | 5b-4 | 5b-5 | 5a-1 | 5a-2 | 5a-3 | 5a-4 | 5a-5 | 6b-1 | |
|--------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|------------|------------|------------|-------------|-------------|------------|------------|------------|-------------|-------------|------------|------------|------------|------------|-------------|
| Plot | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 6 |
| Plot treatment | B sheep | B sheep | B sheep | B sheep | B sheep | B sheep | B sheep | B sheep | B sheep | C cattle | C cattle | S slope | S slope | S slope | C cattle | C cattle | S slope | S slope | S slope | C cattle | C cattle | S slope | S slope | S slope | S slope | C cattle |
| Sub-plot | 4b | 4b | 4b | 4b | 4c | 4c | 4c | 4c | 4c | 5c | 5c | 5c | 5c | 5c | 5b | 5b | 5b | 5b | 5b | 5a | 5a | 5a | 5a | 5a | 5a | 6b |
| Sub-plot treatment | B bash | B bash | B bash | B bash | C cut | C cut | C cut | C cut | C cut | C cut | C cut | C cut | C cut | C cut | B bash | B bash | B bash | B bash | B bash | A none | A none | A none | A none | A none | A none | B bash |
| Quadrat | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | |
| Year | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| Measurements | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bracken shoots | 51 | 45 | 43 | 30 | 42 | 36 | 27 | 33 | 27 | 44 | 22 | 26 | 20 | 23 | 29 | 28 | 28 | 41 | 24 | 30 | 26 | 22 | 32 | 34 | 49 | |
| Bracken vigour (1-10) | 7 | 5 | 8 | 8 | 5 | 5 | 4 | 6 | 8 | 2 | 2 | 3 | 4 | 3 | 3 | 4 | 5 | 4 | 6 | 4 | 4 | 5 | 7 | 8 | 5 | |
| Bracken frond height (cm) | 76.7 | 59.3 | 85.3 | 82.7 | 72.0 | 70.3 | 63.0 | 69.7 | 95.7 | 42.7 | 40.7 | 68.3 | 68.0 | 57.3 | 57.0 | 66.3 | 66.3 | 65.7 | 79.7 | 62.7 | 61.3 | 66.3 | 81.3 | 92.3 | 74.7 | |
| Litter cover (%) | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | |
| Litter depth (cm) | 3.0 | 0.3 | 3.3 | 1.0 | 2.7 | 1.0 | 1.7 | 2.0 | 4.0 | 0.7 | 0.3 | 1.0 | 0.3 | 1.0 | 0.3 | 0.3 | 0.3 | 0.3 | 0.7 | 0.3 | 0.3 | 0.3 | 0.3 | 1.7 | 1.0 | |
| Litter volume | 3.0 | 0.3 | 3.3 | 1.0 | 2.7 | 1.0 | 1.7 | 2.0 | 4.0 | 0.7 | 0.3 | 1.0 | 0.3 | 1.0 | 0.3 | 0.3 | 0.3 | 0.3 | 0.7 | 0.3 | 0.3 | 0.3 | 0.3 | 1.7 | 1.0 | |
| Disturbed ground within 5m (%) | | | | | | | | | | 1 | 1 | | | | 1 | 1 | | | 1 | 1 | | | | | | |
| Bare ground (%) | | | | | | | | | | | 1 | | | | 3 | 2 | | | 3 | | | | | | | |
| Stone (%) | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Derived data | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Vegetation cover (%) | 192 | 190 | 199 | 201 | 236 | 204 | 204 | 204 | 209 | 170 | 162 | 200 | 220 | 194 | 210 | 191 | 244 | 207 | 213 | 180 | 204 | 208 | 203 | 201 | 185 | |
| Understorey cover (%) | 92 | 100 | 99 | 101 | 146 | 108 | 114 | 104 | 109 | 110 | 122 | 115 | 135 | 134 | 120 | 101 | 149 | 117 | 115 | 110 | 106 | 112 | 105 | 103 | 105 | |
| Species richness | 9 | 10 | 6 | 7 | 10 | 9 | 9 | 10 | 9 | 13 | 13 | 9 | 10 | 7 | 10 | 9 | 13 | 10 | 9 | 10 | 12 | 11 | 9 | 8 | 10 | |
| NVC_U4b score | 50 | 43 | 16 | 19 | 54 | 49 | 28 | 25 | 25 | 59 | 63 | 51 | 49 | 10 | 61 | 53 | 60 | 53 | 51 | 61 | 55 | 60 | 59 | 56 | 49 | |
| NVC_U20a score | 66 | 55 | 32 | 38 | 79 | 70 | 66 | 40 | 42 | 76 | 86 | 74 | 77 | 51 | 84 | 72 | 85 | 80 | 76 | 64 | 73 | 76 | 73 | 68 | 66 | |
| NVC_U20b score | 46 | 37 | 32 | 36 | 76 | 59 | 55 | 32 | 37 | 63 | 61 | 58 | 52 | 42 | 63 | 62 | 54 | 54 | 56 | 47 | 61 | 57 | 60 | 59 | 41 | |
| NVC_U20c score | 52 | 51 | 49 | 46 | 66 | 68 | 61 | 37 | 42 | 57 | 55 | 61 | 61 | 62 | 67 | 70 | 57 | 64 | 67 | 49 | 61 | 61 | 68 | 66 | 50 | |
| Plant cover (%) | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Pteridium aquilinum</i> | 100 | 90 | 100 | 100 | 90 | 96 | 90 | 100 | 100 | 60 | 40 | 85 | 85 | 60 | 90 | 90 | 95 | 90 | 98 | 70 | 98 | 96 | 98 | 98 | 80 | |
| <i>Agrostis canina</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Agrostis capillaris</i> | 40 | 70 | 1 | 10 | 90 | 95 | 10 | | 1 | 90 | 70 | 40 | 30 | | 80 | 80 | 65 | 85 | 85 | 85 | 75 | 90 | 90 | 40 | 20 | |
| <i>Agrostis stolonifera</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Anthoxanthum odoratum</i> | 1 | | | | 3 | 1 | 3 | 2 | 1 | 3 | 2 | 5 | 2 | | 3 | 3 | 1 | 1 | 4 | 5 | 10 | 5 | 3 | 4 | 10 | |
| <i>Bromus hordeceus</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Carex binervis</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Carex pilulifera</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Dactylis glomerata</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Danthonia decumbens</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Deschampsia cespitosa</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Deschampsia flexuosa</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Quadrat ID | 4b-2 | 4b-3 | 4b-4 | 4b-5 | 4c-1 | 4c-2 | 4c-3 | 4c-4 | 4c-5 | 5c-1 | 5c-2 | 5c-3 | 5c-4 | 5c-5 | 5b-1 | 5b-2 | 5b-3 | 5b-4 | 5b-5 | 5a-1 | 5a-2 | 5a-3 | 5a-4 | 5a-5 | 6b-1 | | |
|-----------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|--|--|
| <i>Stellaria holostea</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Taraxacum officinale</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Teucrium scorodonia</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Trifolium repens</i> | | | | | | | | | | | | | | | | | | | | | 3 | | | | | | |
| <i>Urtica dioica</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Vaccinium myrtillus</i> | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | |
| <i>Veronica chamaedrys</i> | | | | | | | | | | | | | 1 | | | | | | | | | | 1 | | | | |
| <i>Veronica officinalis</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Vicia sativa</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Vicia sepium</i> | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Viola riviniana</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Brachythecium rutabulum</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Dicranum scoparium</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Hylocomium splendens</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Hypnum cupressiforme</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Lophocolea bidentata</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Lophozia ventricosa</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Plagiothecium undulatum</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Pleurozium schreberi</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Pseudoscleropodium purum</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Rhytidiadelphus loreus</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <i>Rhytidiadelphus squarrosus</i> | 1 | | | 3 | 30 | 2 | 5 | 1 | 2 | 1 | 1 | 3 | | | | | 1 | | | | 1 | 2 | 4 | 1 | 1 | | |

| Quadrat ID | 6b-2 | 6b-3 | 6b-4 | 6b-5 | 6a-1 | 6a-2 | 6a-3 | 6a-4 | 6a-5 | 6c-1 | 6c-2 | 6c-3 | 6c-4 | 6c-5 |
|-----------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| <i>Stellaria holostea</i> | | | | 1 | | | | | | | | 3 | | |
| <i>Taraxacum officinale</i> | | | | | | | | | | | | | | |
| <i>Teucrium scorodonia</i> | | | | | | | | | | | | | | |
| <i>Trifolium repens</i> | 1 | | | | 1 | | | | | 1 | | | | |
| <i>Urtica dioica</i> | | | | | | | | | | | | | | |
| <i>Vaccinium myrtillus</i> | | | | | | | | | | | | | | |
| <i>Veronica chamaedrys</i> | | | | | | | | | | 1 | | | | |
| <i>Veronica officinalis</i> | | | | | | | | | | | | | | |
| <i>Vicia sativa</i> | | | | | | | | | | | | | | |
| <i>Vicia sepium</i> | | | | | | | | | | | | | | |
| <i>Viola riviniana</i> | | | | | | | | | | | | | | |
| <i>Brachythecium rutabulum</i> | | | | | | | | | | | | | | |
| <i>Dicranum scoparium</i> | | | | | | | | | | | | | | |
| <i>Hylocomium splendens</i> | | | | | | | | | | | | | | |
| <i>Hypnum cupressiforme</i> | | | | | | | | | | | | | | |
| <i>Lophocolea bidentata</i> | | | | | | | | | | | | | | |
| <i>Lophozia ventricosa</i> | | | | | | | | | | | | | | |
| <i>Plagiothecium undulatum</i> | | | | | | | | | | | | | | |
| <i>Pleurozium schreberi</i> | | | | | | | | | | | | | | |
| <i>Pseudoscleropodium purum</i> | | | | | | | | 1 | | | | | | |
| <i>Rhytidiadelphus loreus</i> | | | | | | | | | | | | | | |
| <i>Rhytidiadelphus squarrosus</i> | 1 | 1 | 1 | | 1 | 1 | 1 | | | 1 | 2 | 1 | 1 | |