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.

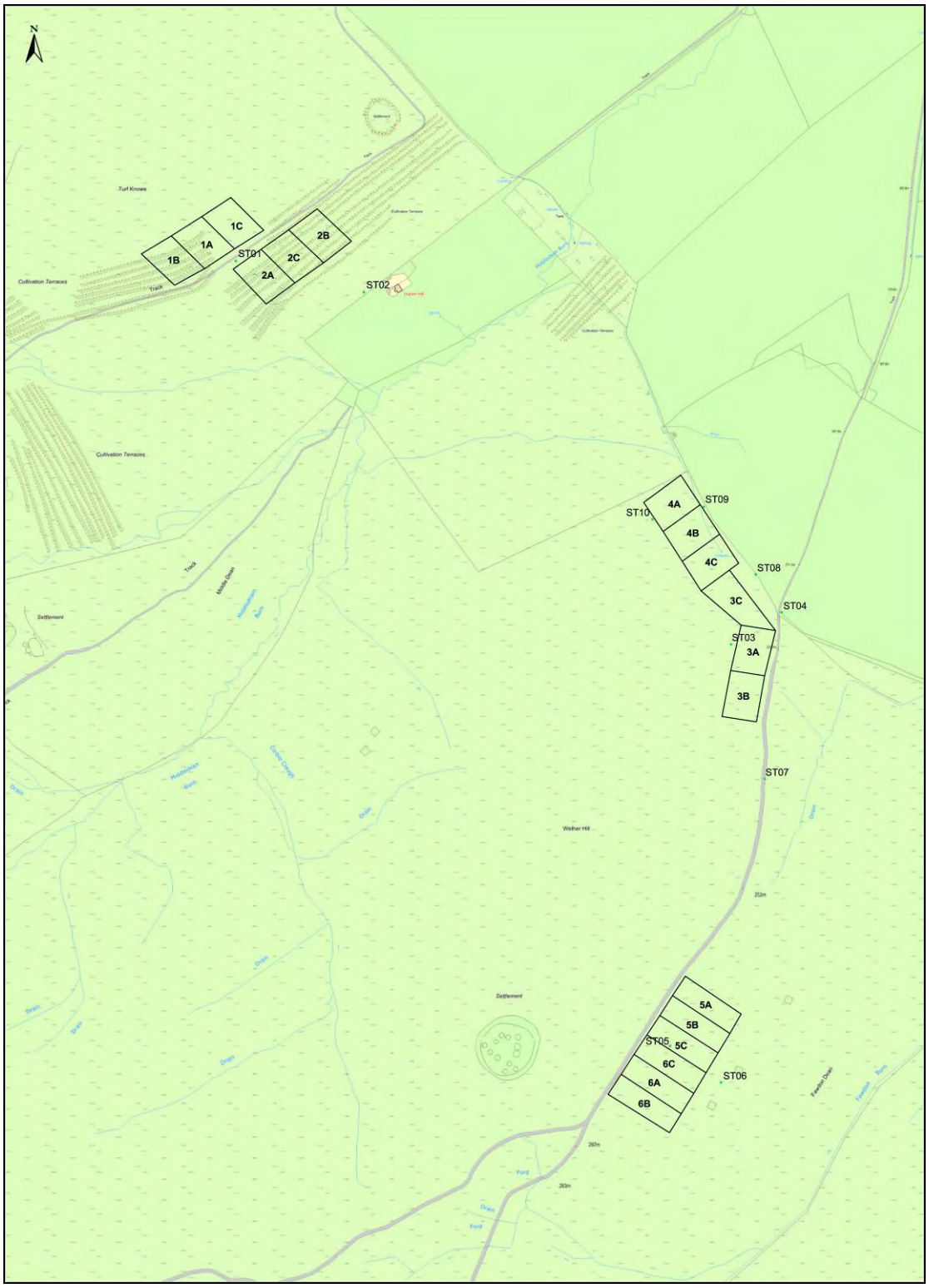
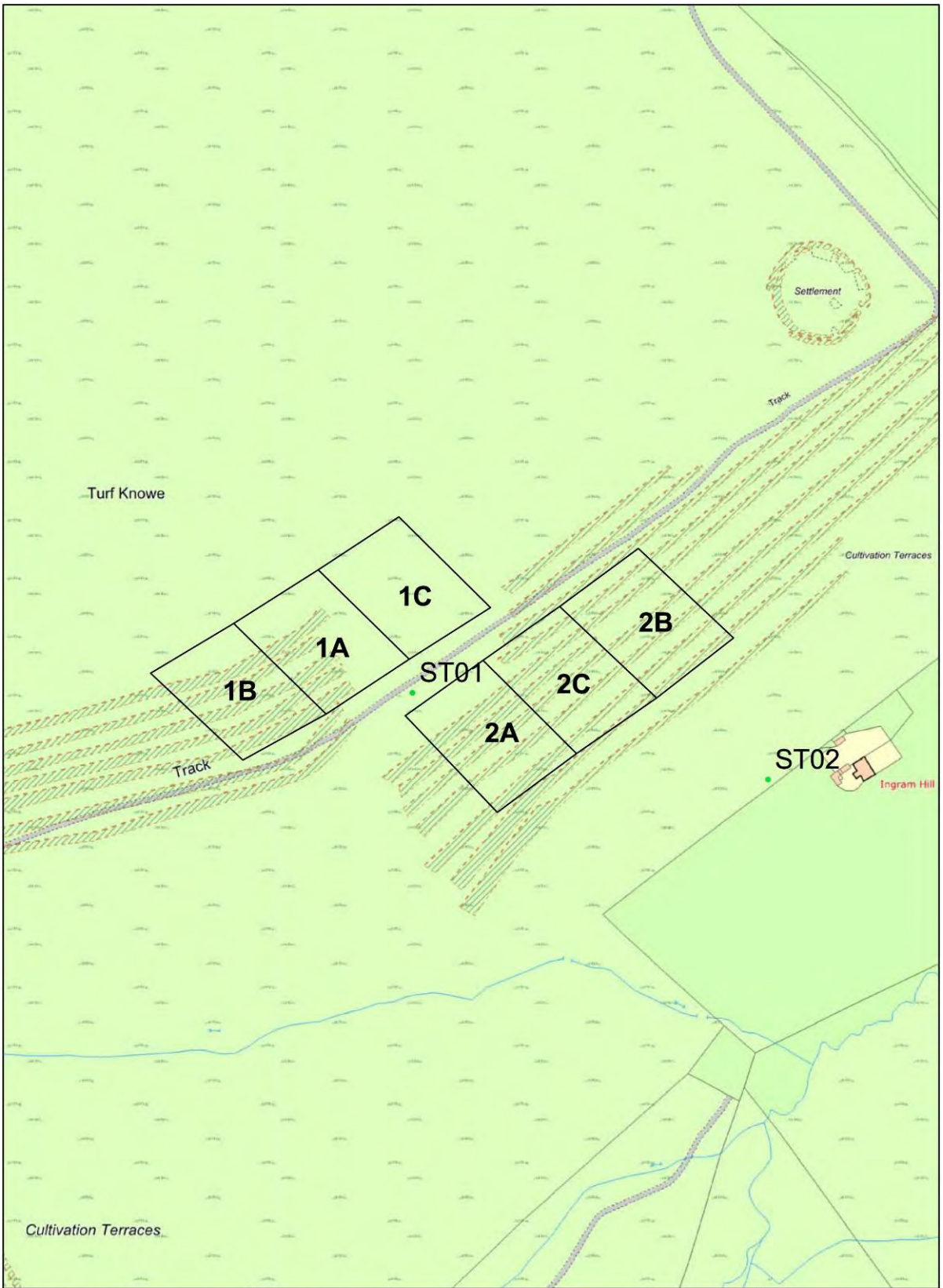


Figure 1: Site plan showing plots, sub-plots and station locations.


Settlement
Track
Turf Knowe
Cultivation Terraces
1C
1A
1B
2B
2C
2A
ST01
ST02
Track
Ingram Hill
Cultivation Terraces
Figure 2: Plots 1 and 2.
No stock treatment
Key:
A - No treatment
B - Bashing
C - Cutting
ST - Fixed Survey Station
N
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This Drawing
© A.R.S. Ltd
Ordnance Survey data if applicable
© Crown Copyright, all rights reserved
reproduction with permission. Licence No.
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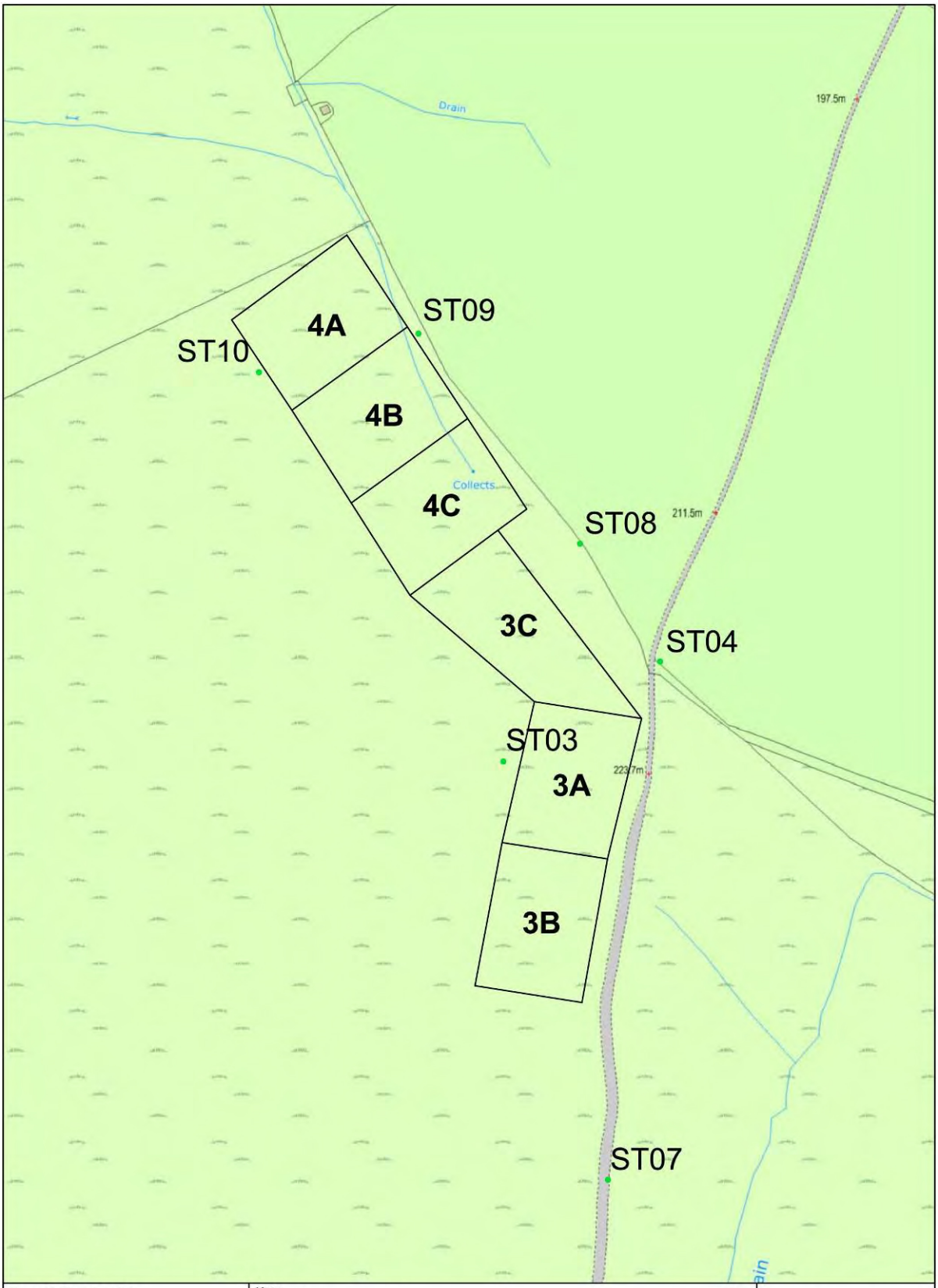


Figure 3: Plots 3 and 4.
Sheep grazing

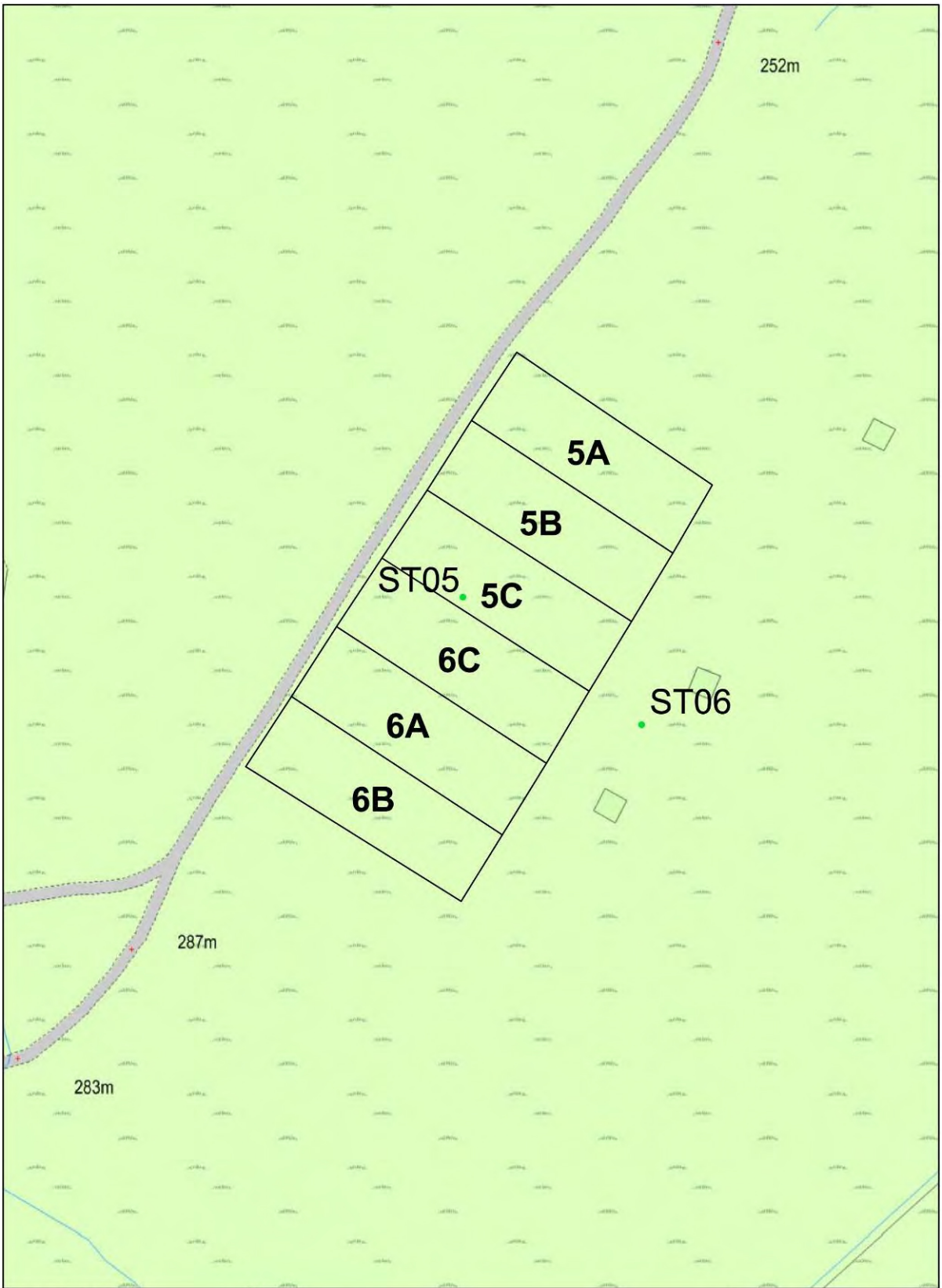


Figure 4: Plots 5 and 6.
Cattle grazing

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

N

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 ±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:

Vigour	Condition	Cover	Height	Shoot density
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 be 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 Brak, C.J.O. and Smilaer, 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.

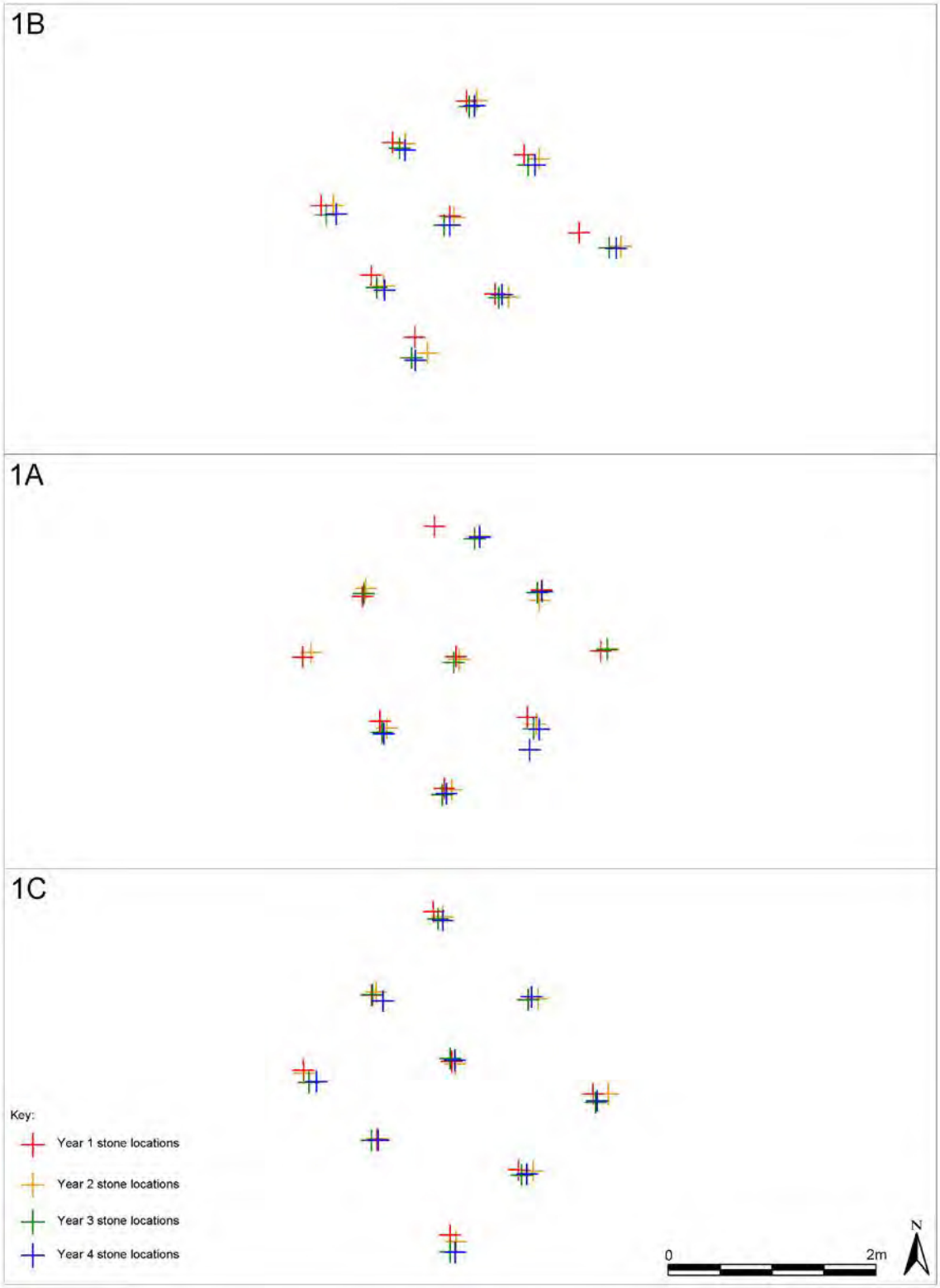


Figure 6: Stone locations in Plot 1 from Years 1-4.

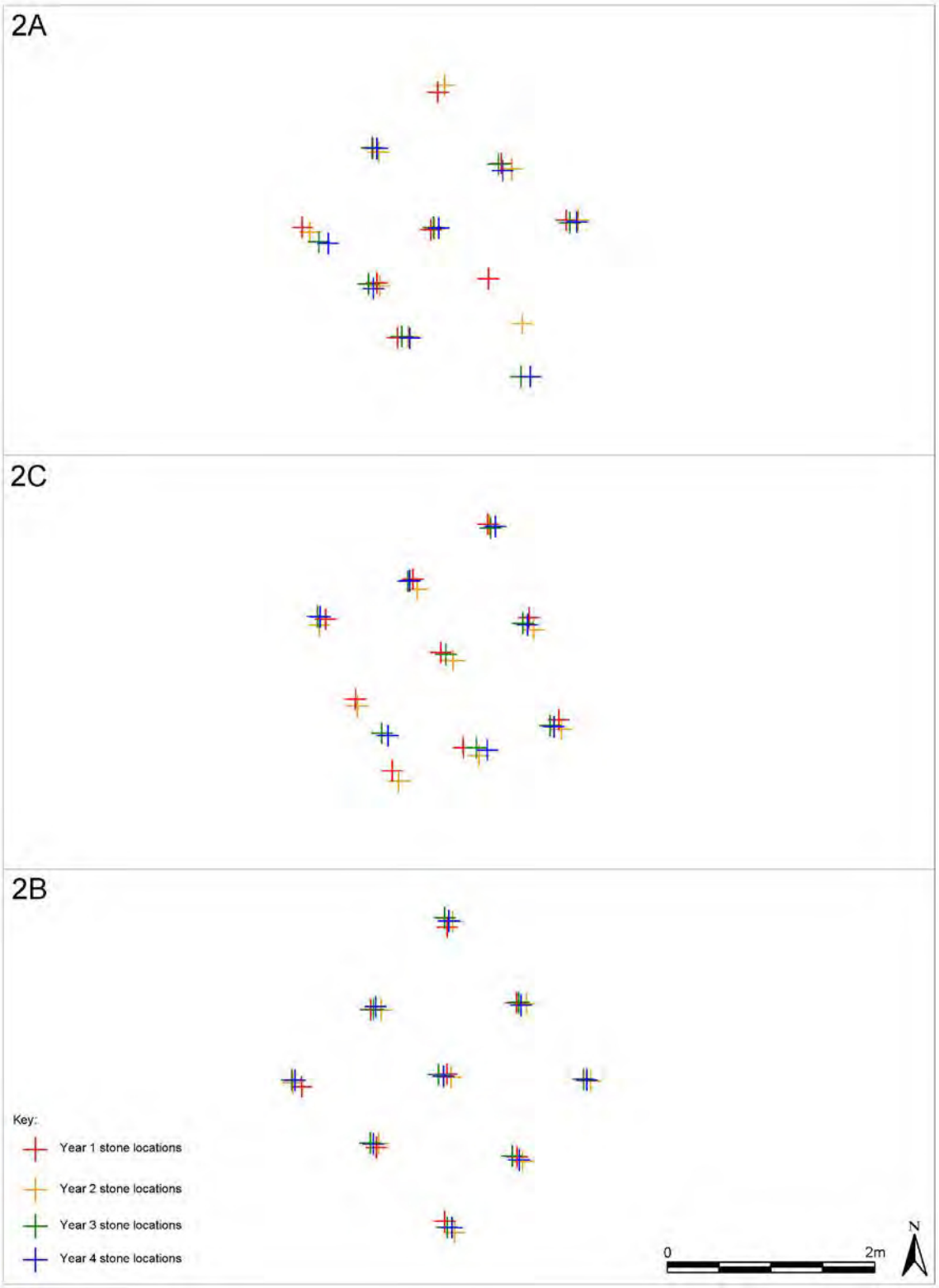


Figure 7: Stone locations in Plot 2 from Years 1-4.

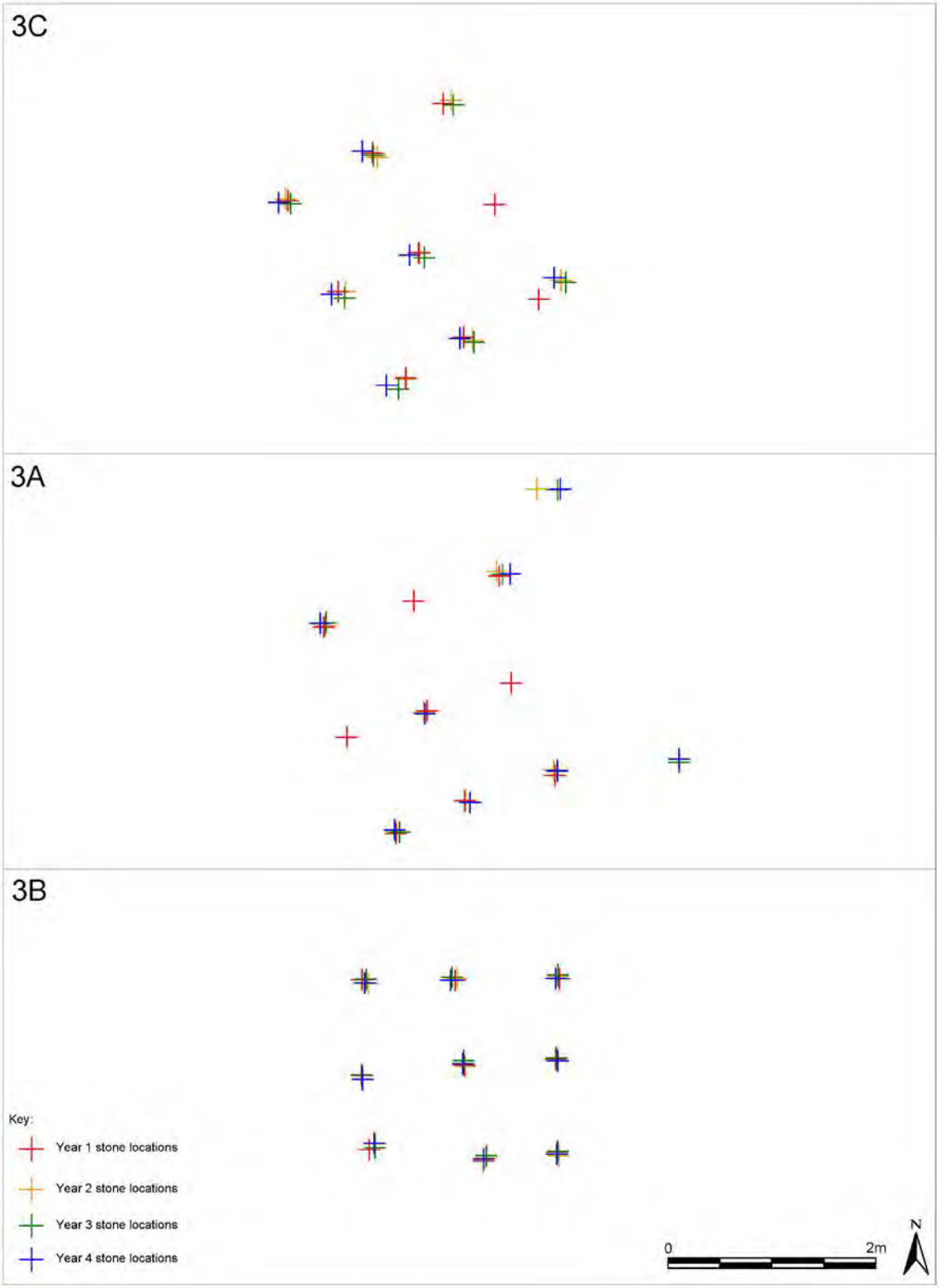


Figure 8: Stone locations in Plot 3 from Years 1-4.

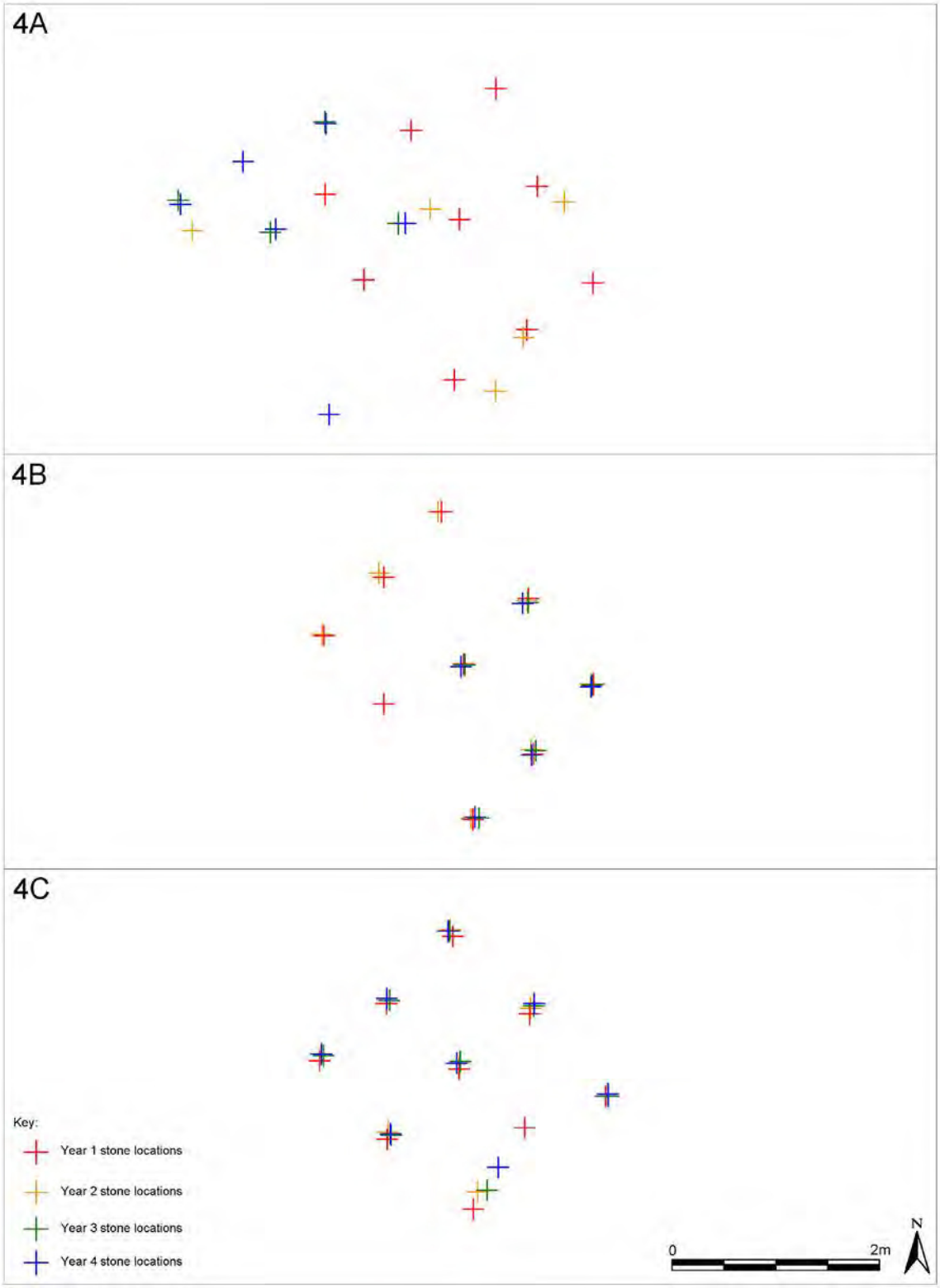


Figure 9: Stone locations in Plot 4 from Years 1-4.

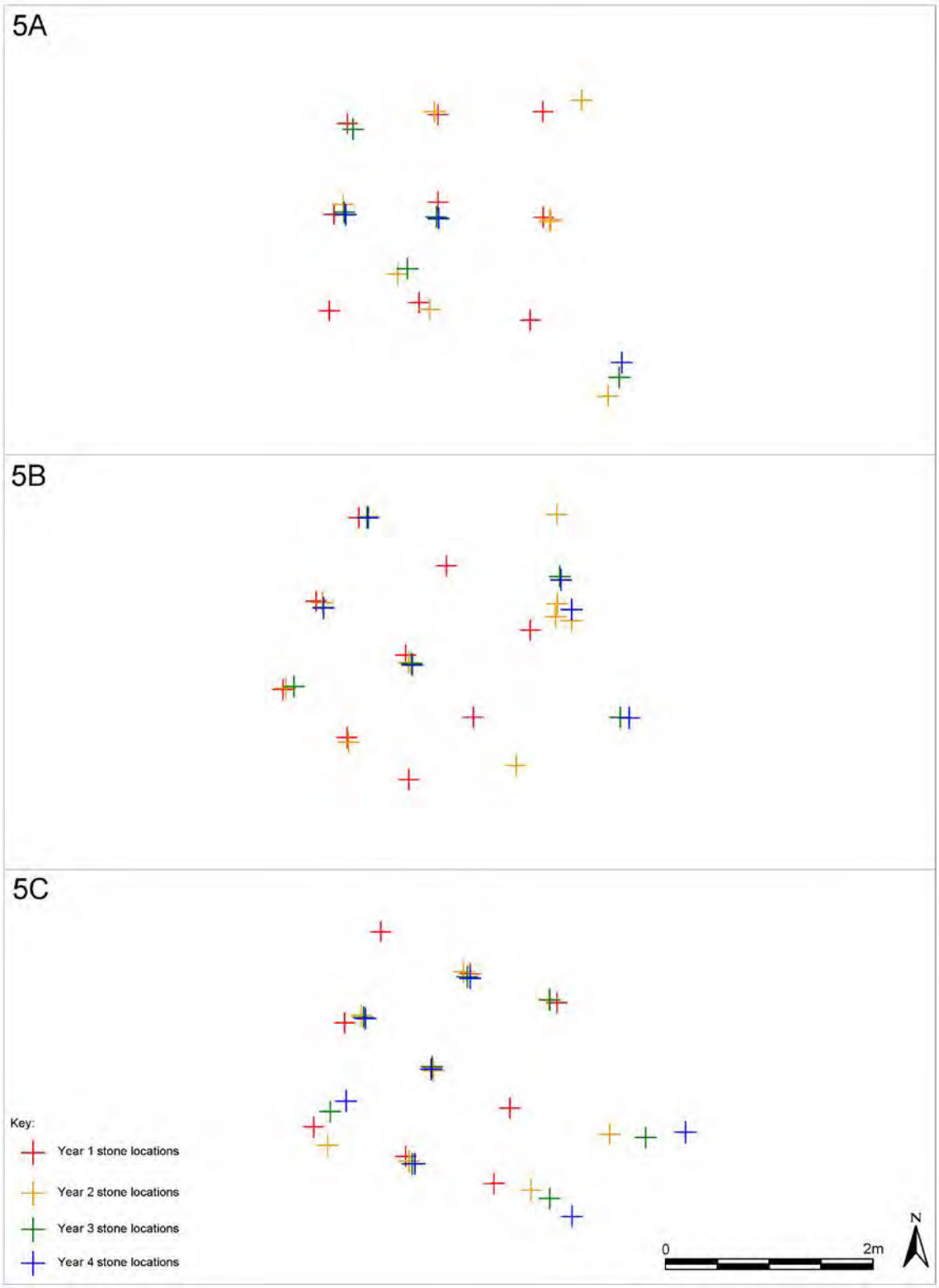


Figure 10: Stone locations in Plot 5 from Years 1-4.

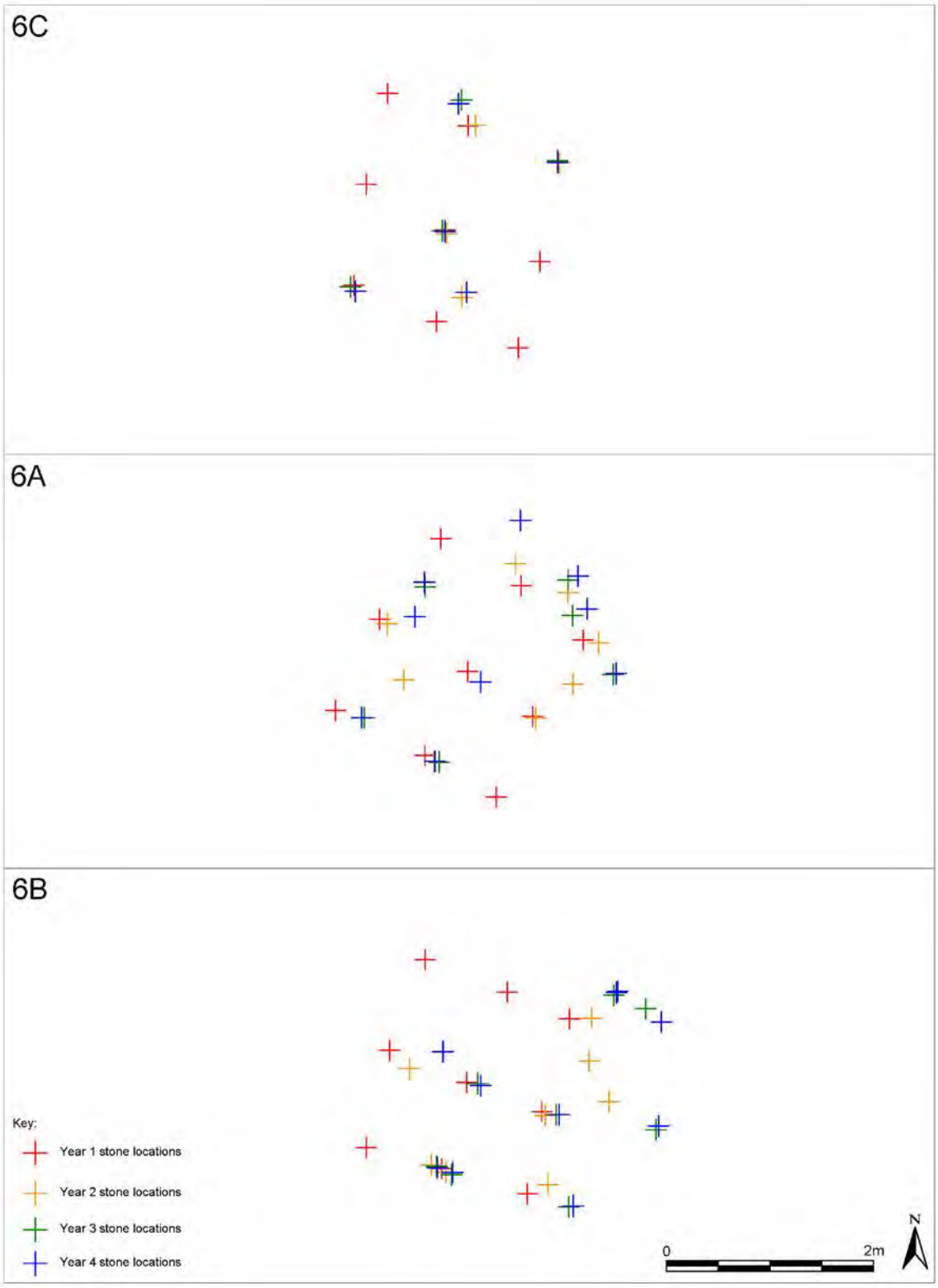


Figure 11: Stone locations in Plot 6 from Years 1-4.

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

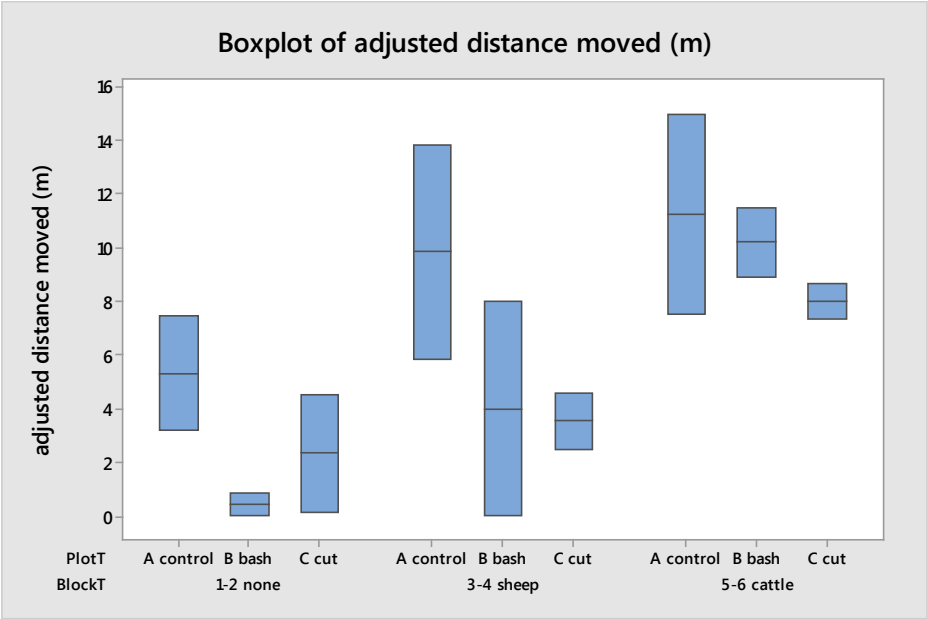


Figure 12: Boxplot of stone movements (Year 4 compared to Year 1)

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

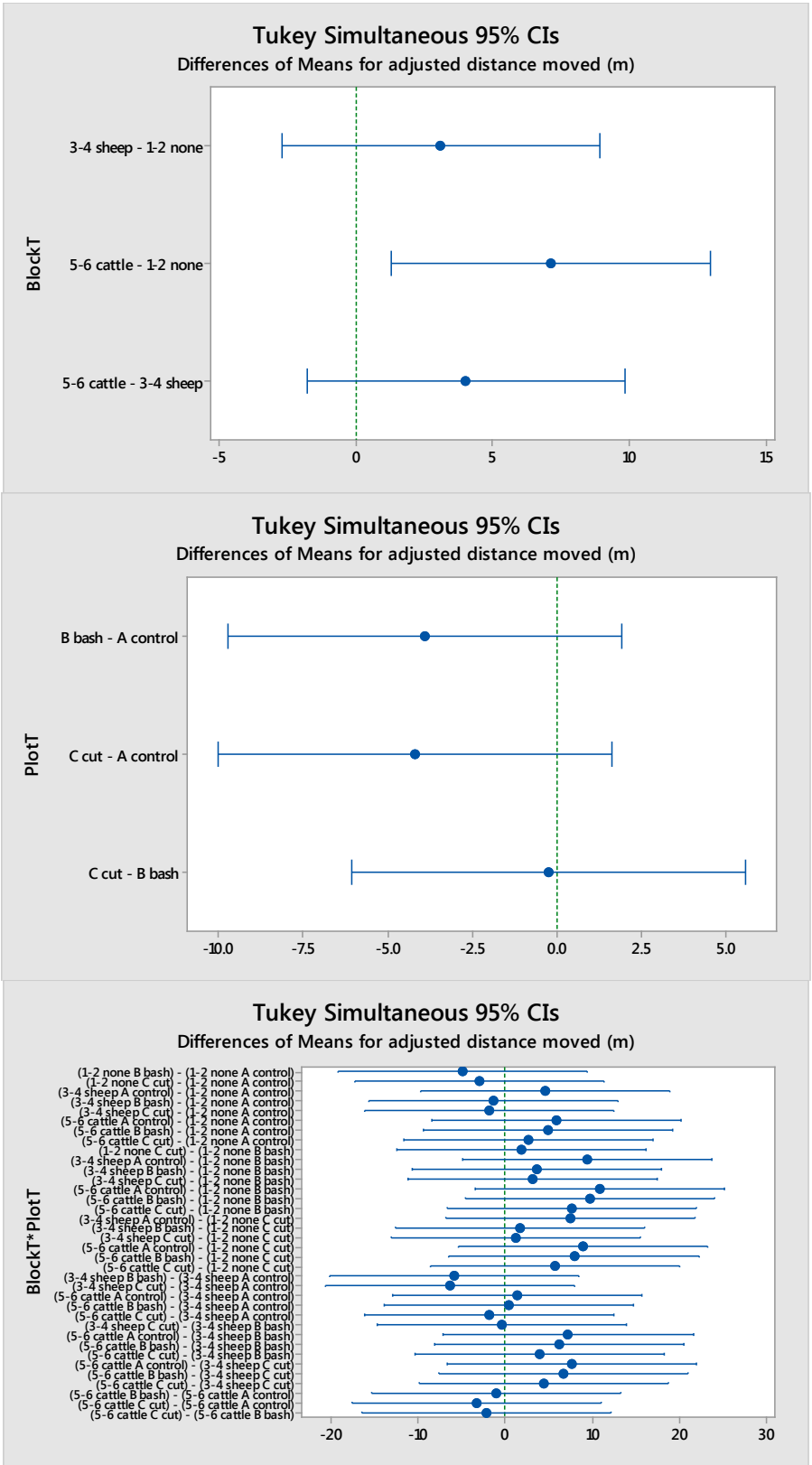


Figure 13: Plots of 95% confidence intervals. Means are only significantly different if the confidence interval includes zero.

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.

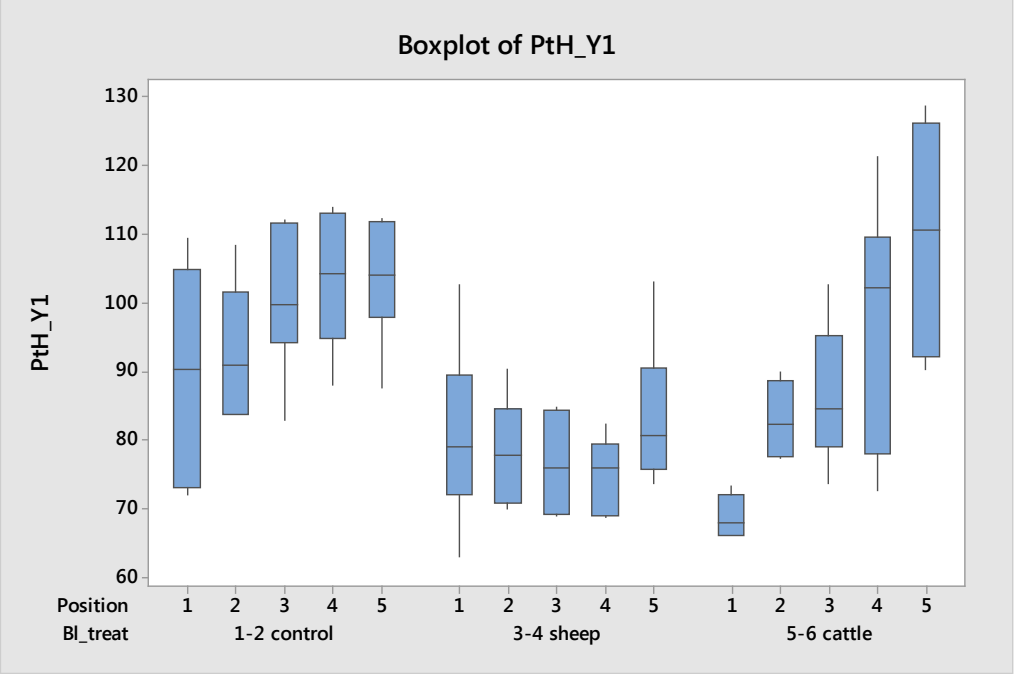


Figure 14. Bracken height prior to treatment (baseline Year 1), by position down slope.

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.

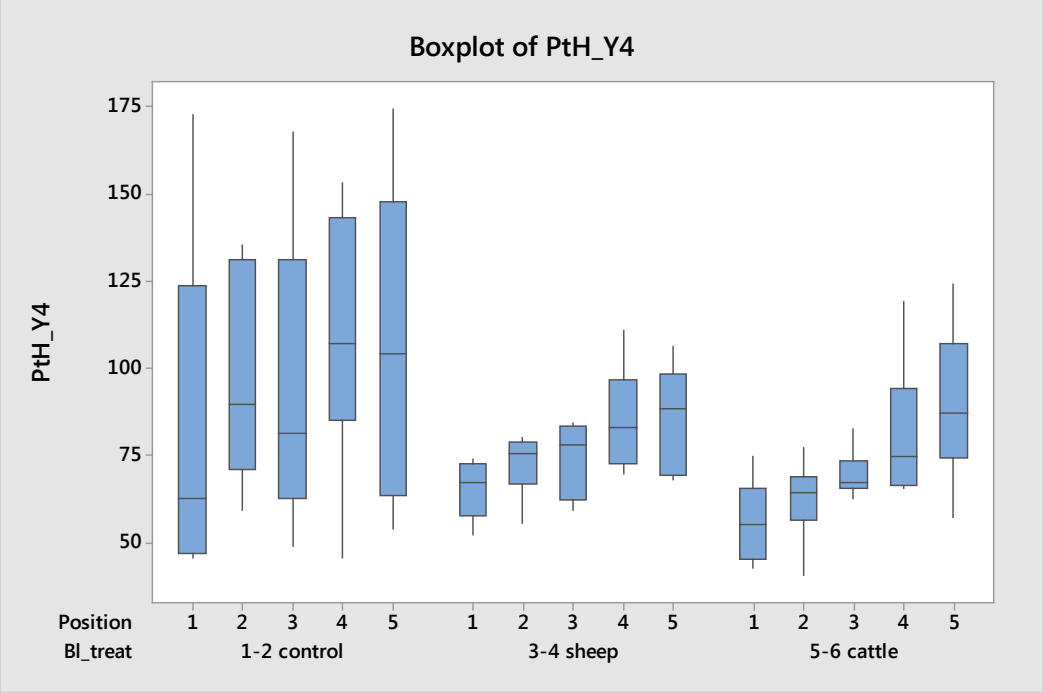


Figure 15. Bracken height after three years of treatment (Year 4), by position down slope.

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.

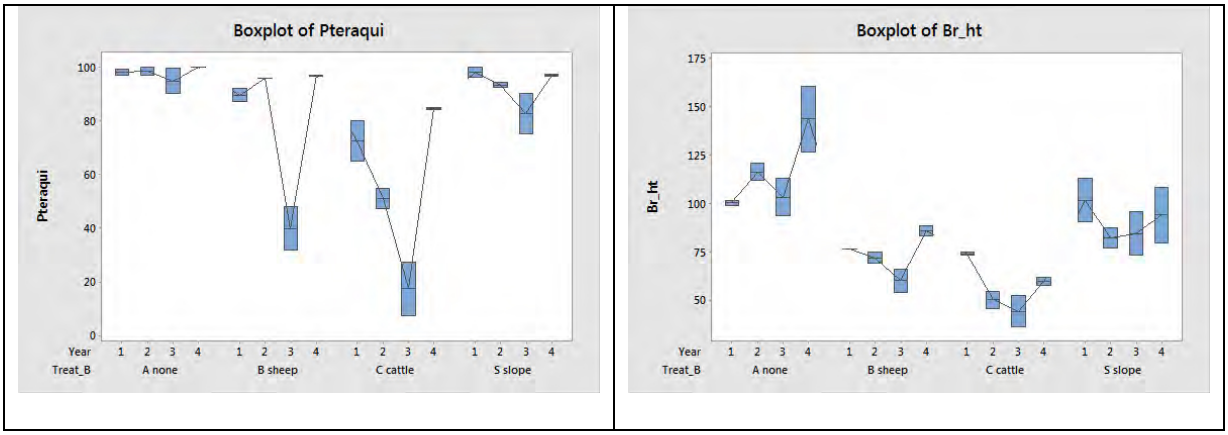
5.3 Changes Year on Year

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.



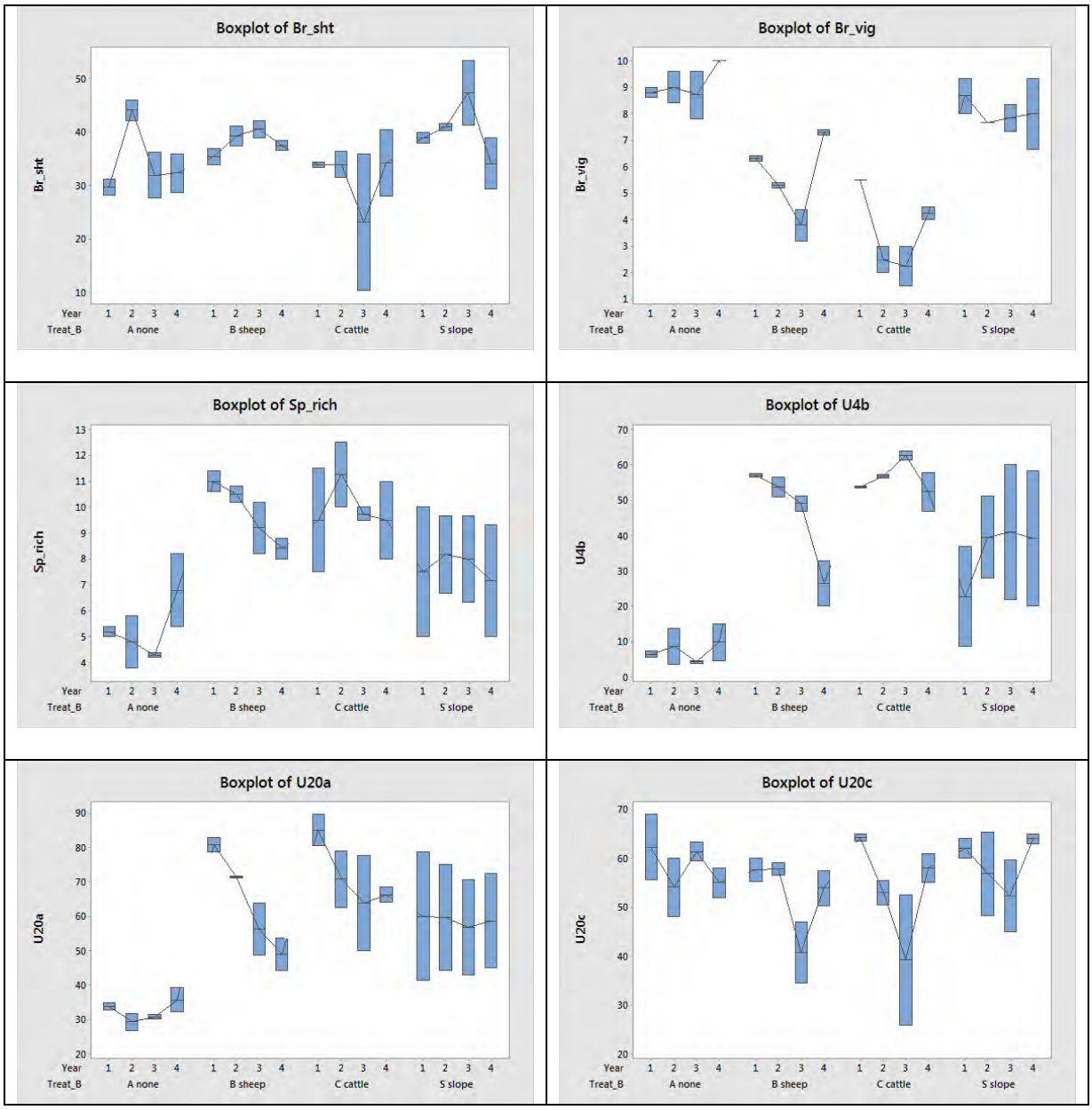


Figure 16. Year on year variation in the control sub-plots (not cut or bashed) in each livestock (plot) treatment

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		
None	-13.43	b
Sheep	4.47	a
Cattle	-3.50	a b
Slope	-5.17	a b
Sub-plot treatment		
Control	4.50	a
Bashed	-0.13	a
Cut	-17.83	b

Combination		
None x Control	2.00	a b
Sheep x Control	7.30	a
Cattle x Control	12.00	a
Slope x Control	-1.00	a b
None x Bashed	-3.20	a b
Sheep x Bashed	1.50	a b
Cattle x Bashed	2.50	a 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

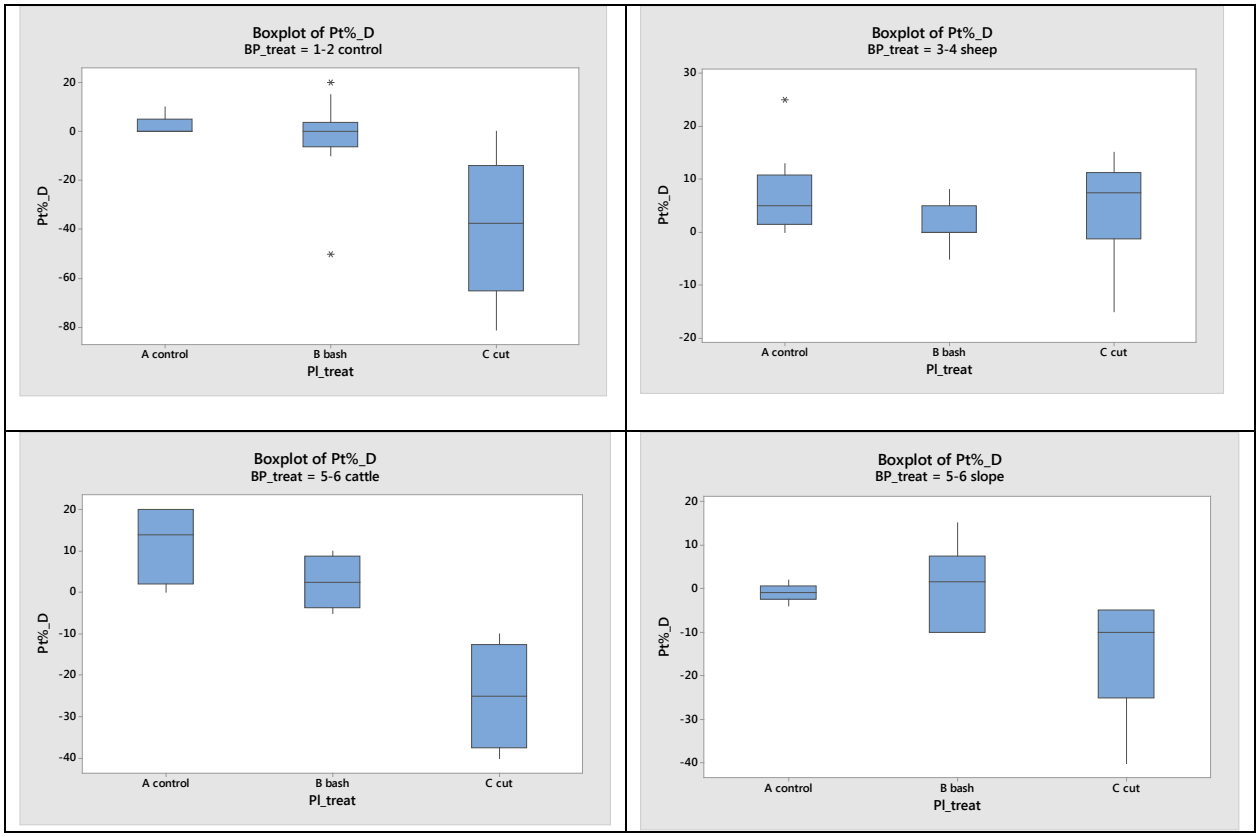


Figure 17. Change in bracken cover after 3 years of treatment (Year 4 – Year 1), by livestock (plot) and mechanical (sub-plot) treatment

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		
None	-0.20	a
Sheep	-2.11	a
Cattle	-16.72	b
Slope	-17.83	b
Sub-plot treatment		
Control	14.24	a
Bashed	-8.17	b
Cut	-25.78	c

Combination		
None x Control	43.40	a
Sheep x Control	9.60	b
Cattle x Control	-14.17	b c d e
Slope x Control	-7.67	b c d
None x Bashed	-6.00	b c
Sheep x Bashed	-7.87	b c d
Cattle x Bashed	-11.42	b c d e
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

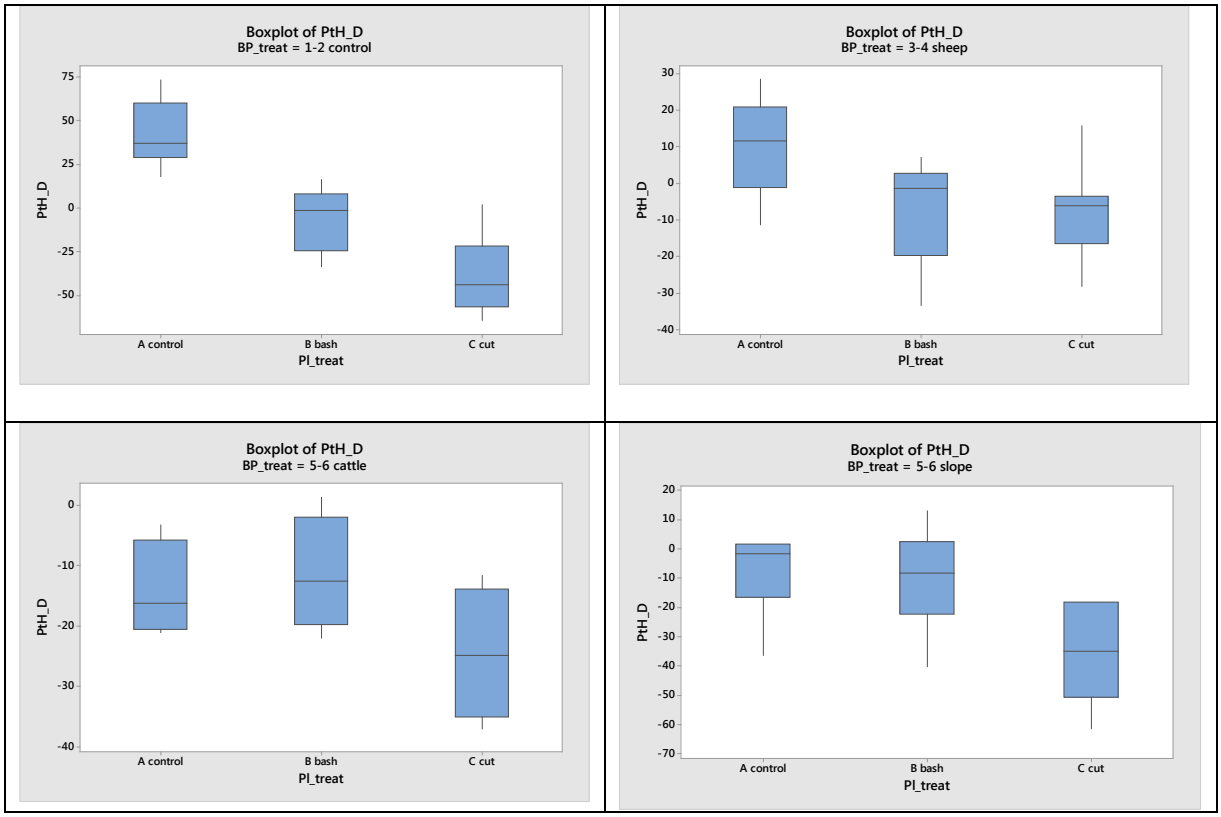


Figure 18. Change in bracken height after 3 years of treatment (Year 4 – Year 1), by livestock (plot) and mechanical (sub-plot) treatment

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.

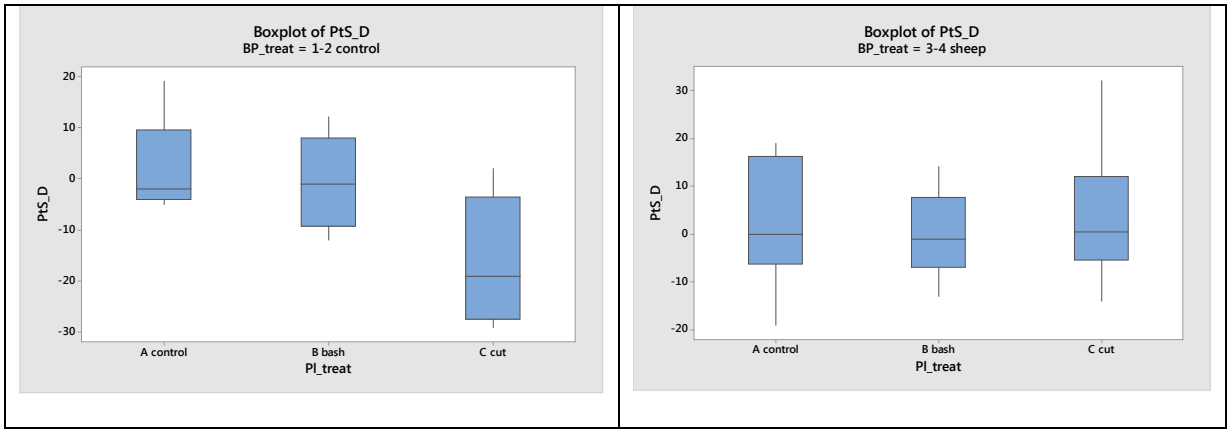
5.4.7.3 The differences between plot treatments and between sub-plot treatments are not significant overall, but there are significant differences between some of the treatment combinations. The greatest increase in density is in the cut sub-plots in the sheep and cattle plots, and the greatest decrease 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



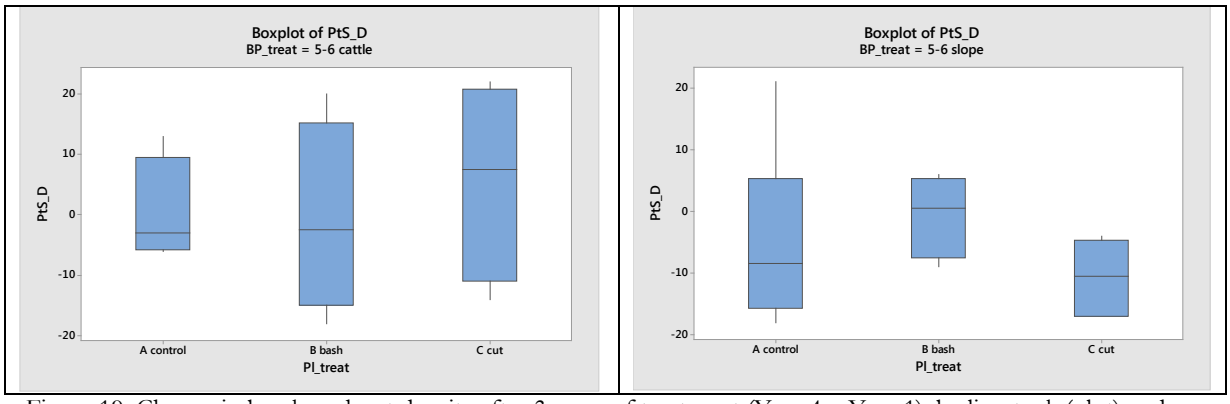


Figure 19. Change in bracken shoot density after 3 years of treatment (Year 4 – Year 1), by livestock (plot) and mechanical (sub-plot) treatment

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

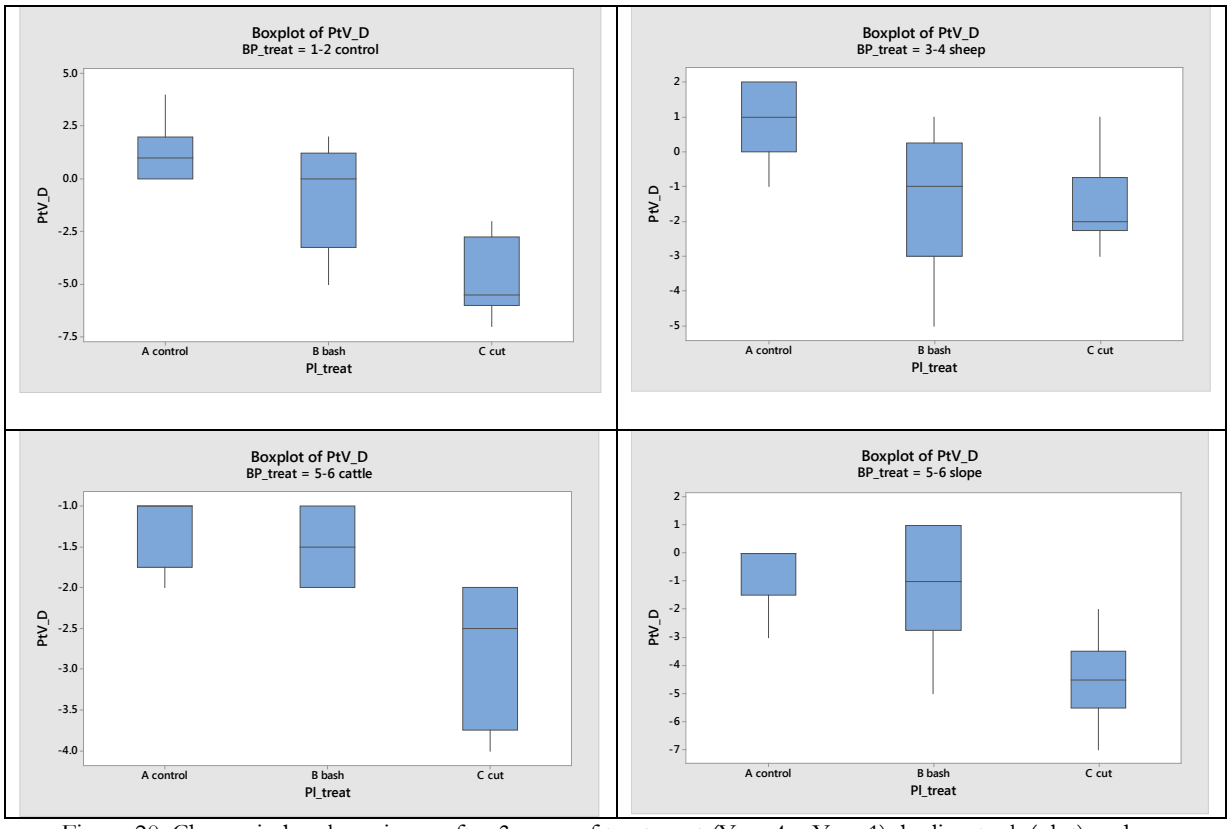


Figure 20. Change in bracken vigour after 3 years of treatment (Year 4 – Year 1), by livestock (plot) and mechanical (sub-plot) treatment

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

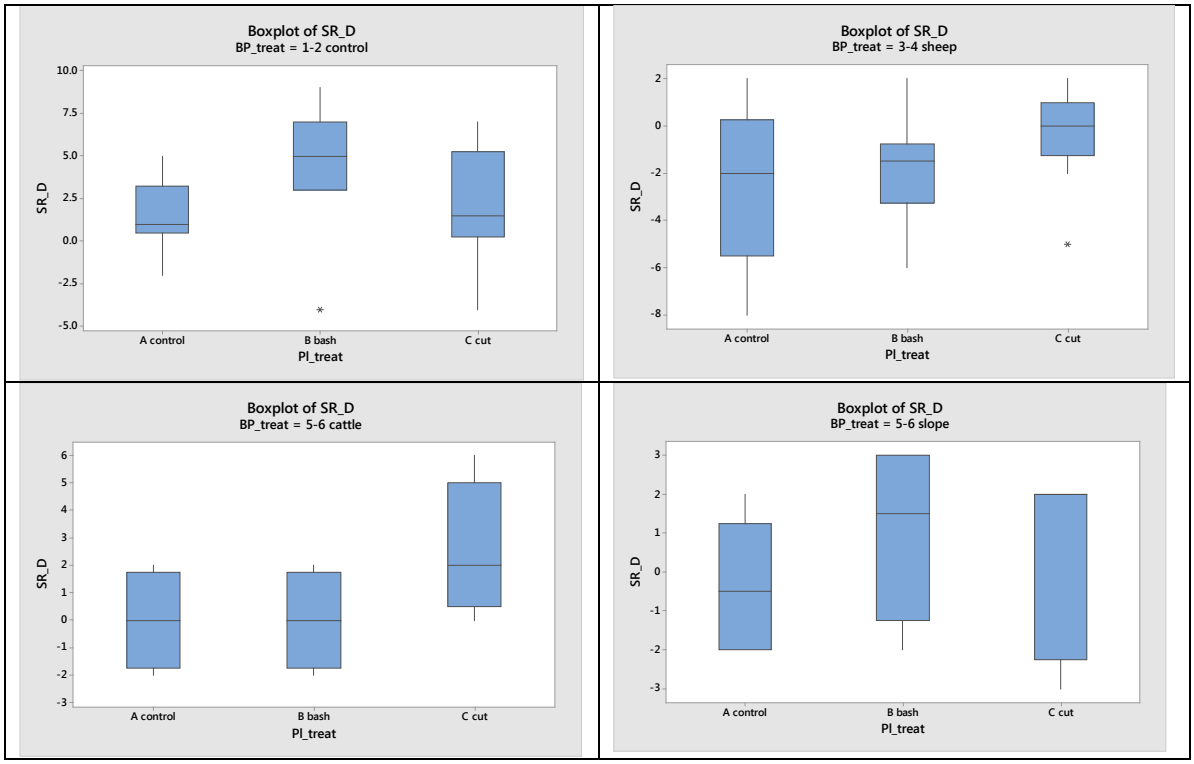


Figure 21. Change in species richness after 3 years of treatment (Year 4 – Year 1), by livestock (plot) and mechanical (sub-plot) treatment

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		
None	31.56	a
Sheep	-3.10	b
Cattle	-34.60	c
Slope	1.67	b
Sub-plot treatment		
Control	-16.07	b
Bashed	13.50	a
Cut	18.20	a

Combination	
None x Control	-6.30
Sheep x Control	-11.50
Cattle x Control	-45.80
Slope x Control	-20.20
None x Bashed	54.10
Sheep x Bashed	-3.30
Cattle x Bashed	-24.50
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

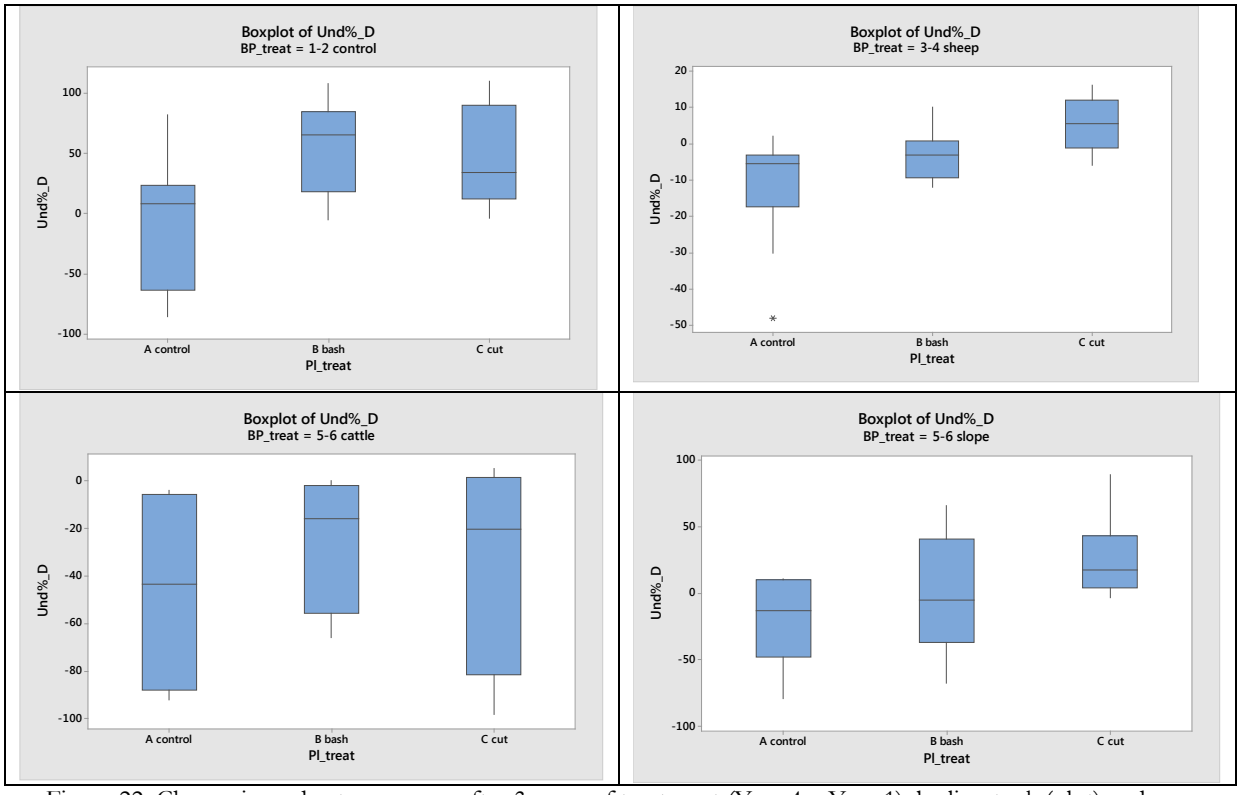


Figure 22. Change in understorey cover after 3 years of treatment (Year 4 – Year 1), by livestock (plot) and mechanical (sub-plot) treatment

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

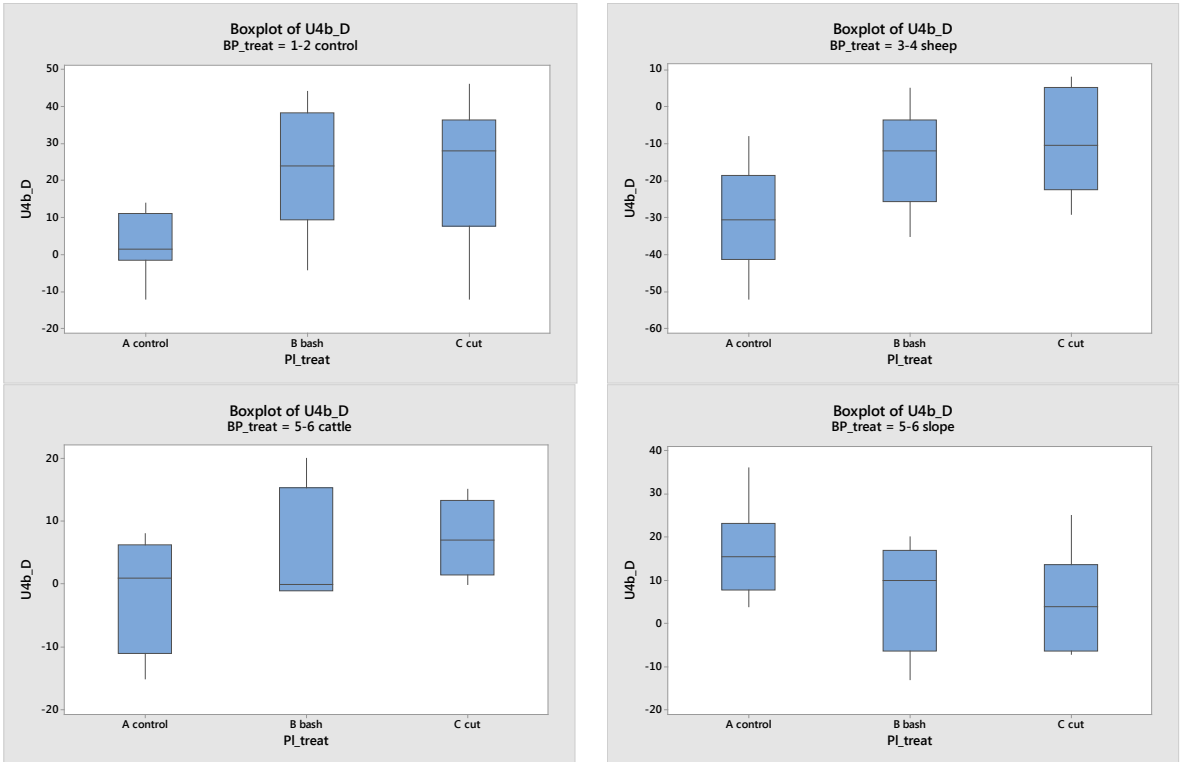


Figure 23. Change in fit to U4a after 3 years of treatment (Year 4 – Year 1), by livestock (plot) and mechanical (sub-plot) treatment

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

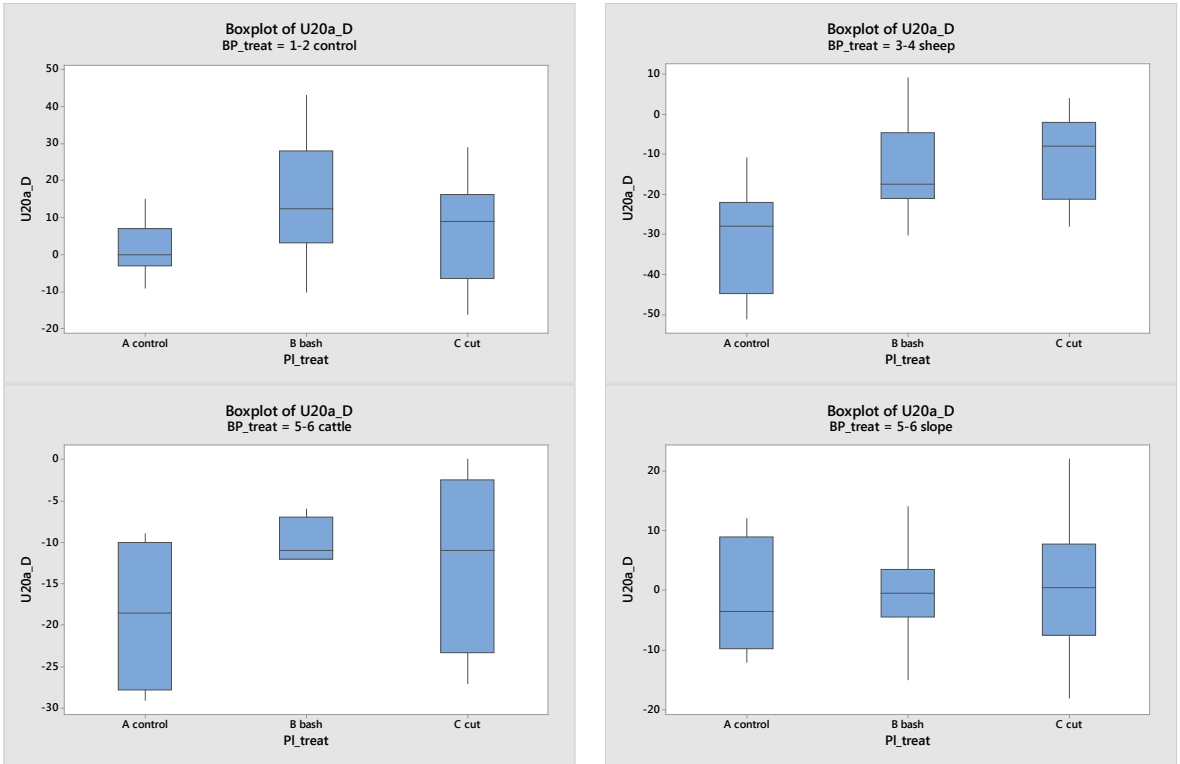


Figure 24. Change in fit to U20a after 3 years of treatment (Year 4 – Year 1), by livestock (plot) and mechanical (sub-plot) treatment

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

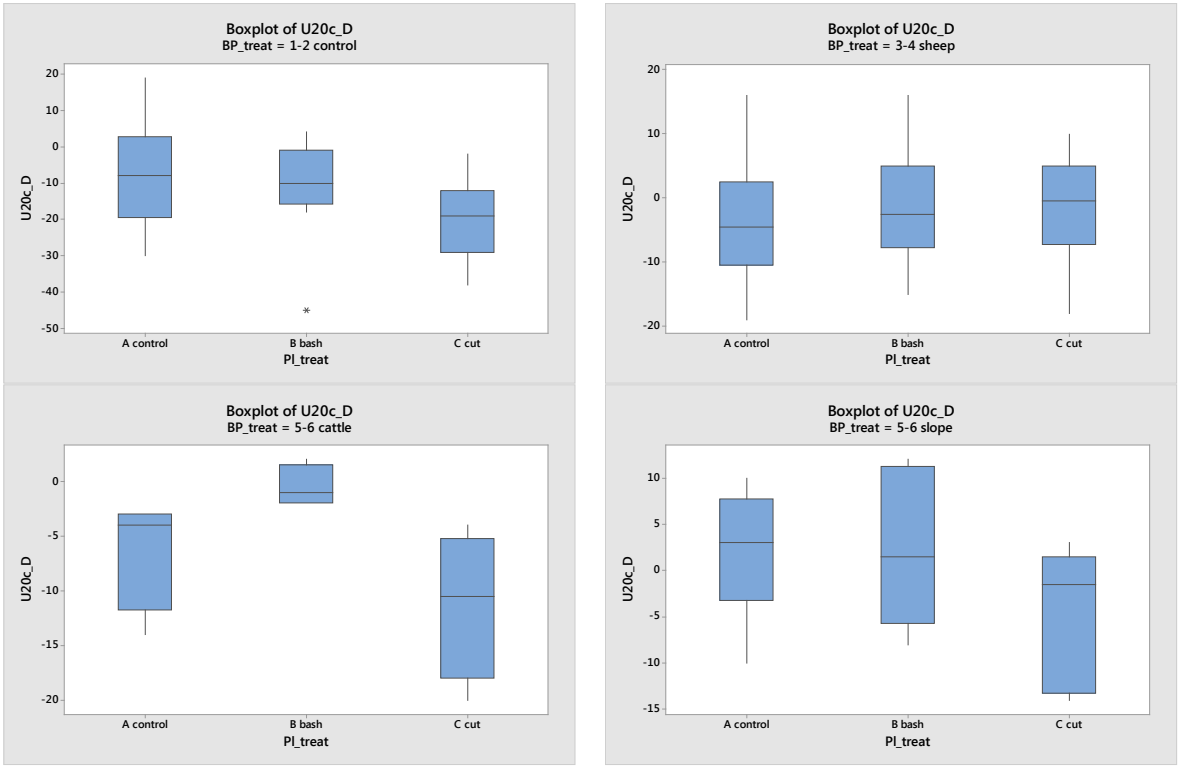


Figure 25. Change in fit to U20c after 3 years of treatment (Year 4 – Year 1), by livestock (plot) and mechanical (sub-plot) treatment

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.

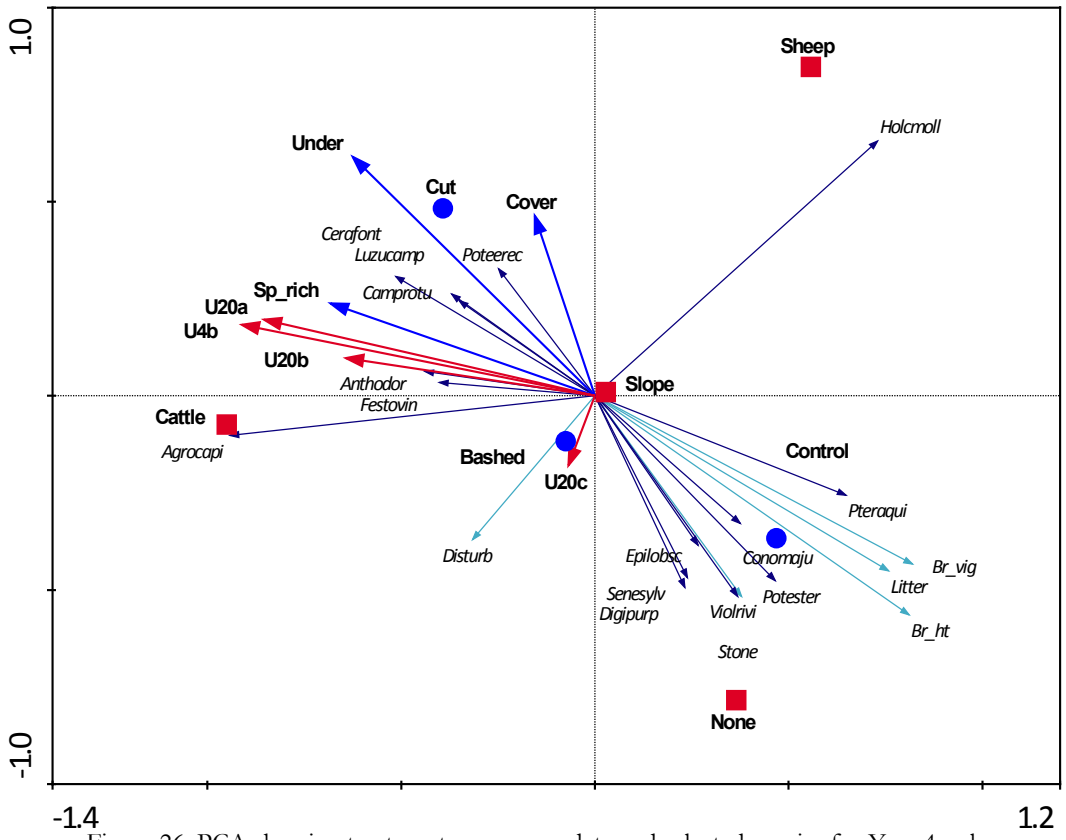


Figure 26. PCA showing treatments, summary data and selected species for Year 4 only

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.

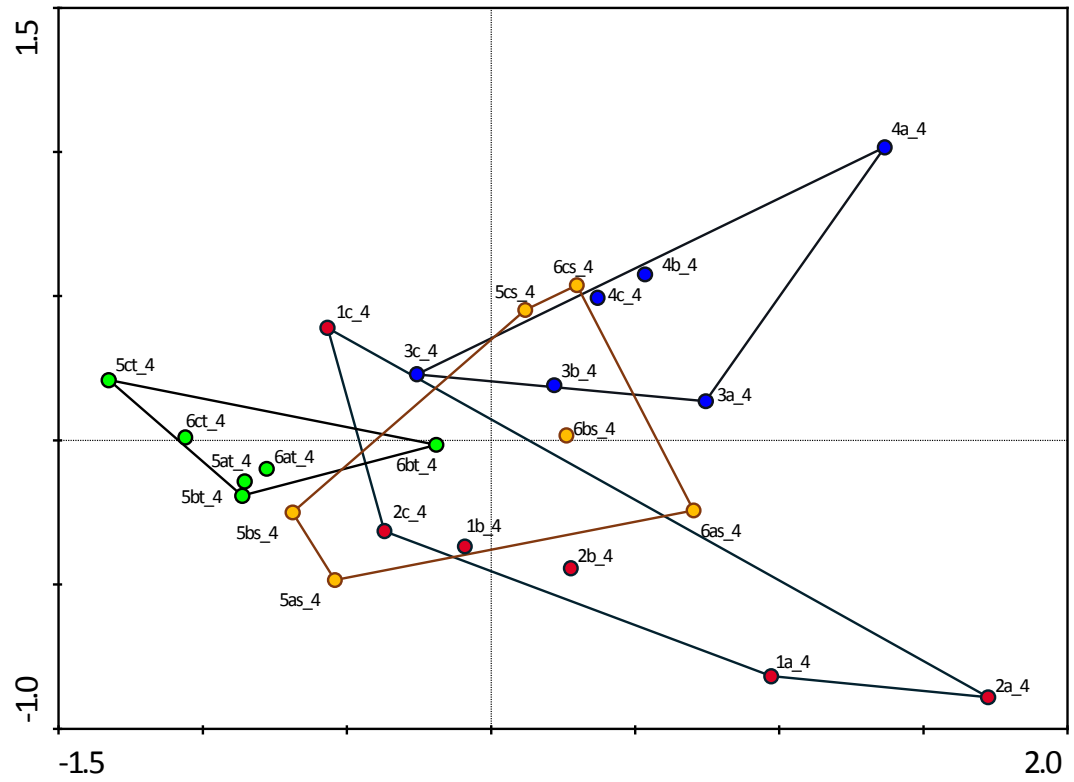


Figure 27. PCA showing samples for Year 4 only, classified by livestock (plot) treatment. Red – control, blue – sheep, green – cattle, yellow – slope.

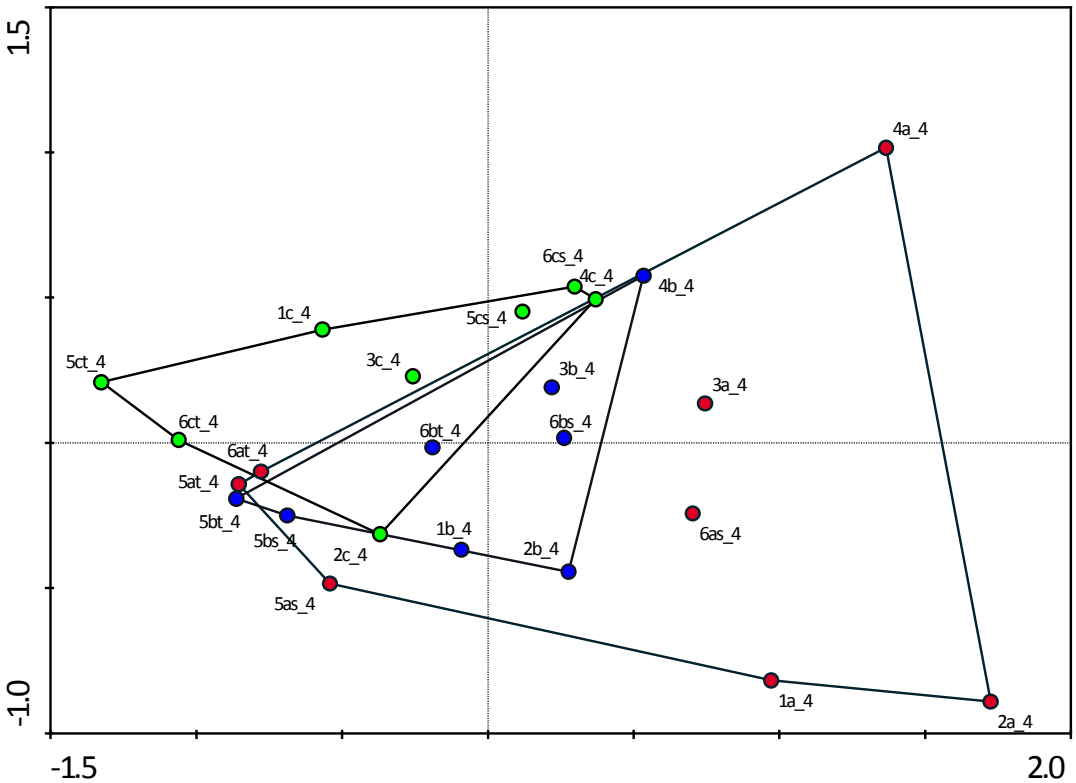


Figure 28. PCA showing samples for Year 4 only, classified by mechanical (sub-plot) treatment. Red – control, blue – bashed green – cut.

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.

Axes	1	2	3	4	Total variance
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.

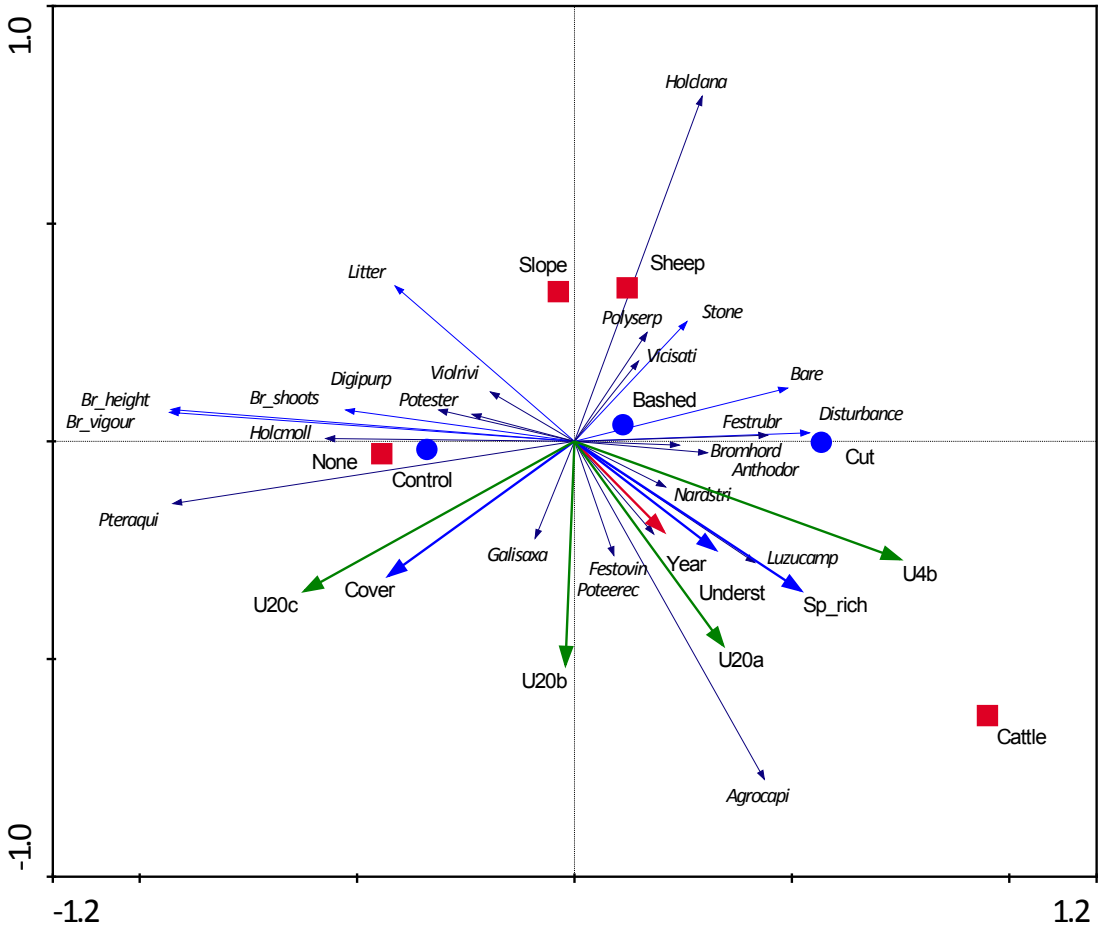


Figure 29. PCA showing treatments, summary data and selected species for Years 1-4

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.

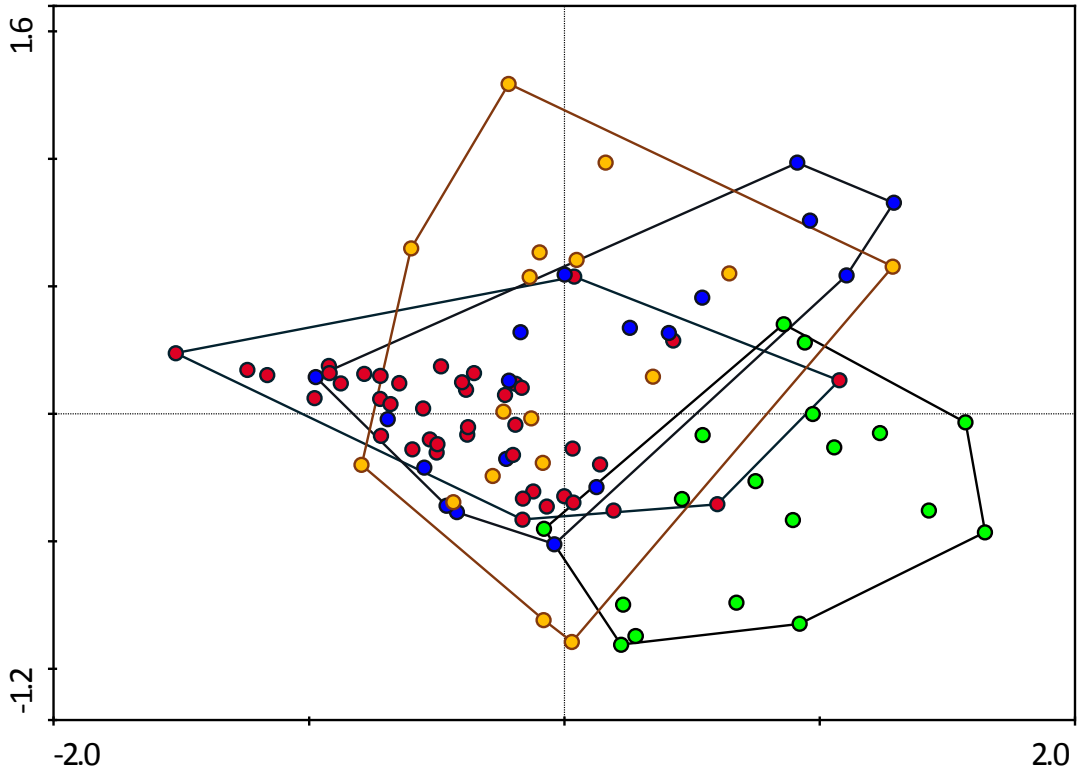


Figure 30. PCA showing samples for Years 1-4, classified by livestock (plot) treatment.
Red – control, blue – sheep, green – cattle, yellow – slope.

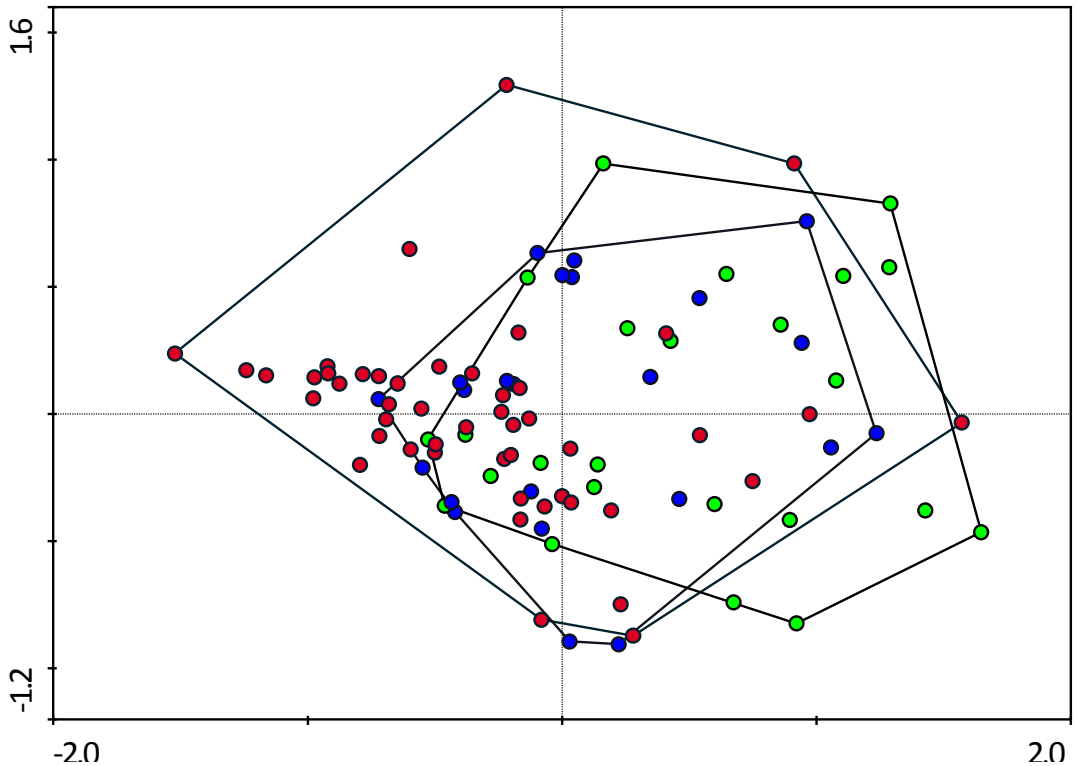


Figure 31 PCA showing samples for Year 4 only, classified by mechanical treatment.
Red – control, blue – bashed green – cut.

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

Task (see also Gantt Chart)	*Performed by:*	*Date deliverable*
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

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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
Pteridium aquilinum	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
Agrostis canina																								
Agrostis capillaris	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
Agrostis stolonifera																								
Anthoxanthum odoratum	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
Bromus hordeceus																								
Carex binervis					0.2		0.4	0.2						0.3				1.7						
Carex pilulifera																				0.7				
Dactylis glomerata																								
Danthonia decumbens																								
Deschampsia cespitosa	0.4		0.6					6.0								5.0								1.7
Deschampsia flexuosa	0.4				0.2					1.2	0.2						4.0	1.7						
Festuca ovina		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
Festuca rubra										0.4	2.4	7.0												
Holcus lanatus				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
Holcus mollis	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
Juncus effusus																								
Luzula campestris								0.4	0.2	0.4	0.2	0.2	0.5					0.3	0.5	0.3			0.5	
Luzula multiflora																								
Molinia caerulea																								
Nardus stricta																	6.5	0.7						
Poa annua																								
Poa pratensis		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
Trisetum flavescens																								

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
Achillea millefolium						0.2																		
Campanula rotundifolia		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
Cerastium fontanum							0.6	0.6		0.2									0.5					1.7
Chamaerion angustifolium																								
Cirsium palustre																								
Cirsium vulgare				2.0							1.8													
Conopodium majus																								
Digitalis purpurea	5.4	10.2	7.4	2.6	2.6	0.8																		
Epilobium obscurum																								
Euphrasia officinalis										0.2														
Galeopsis tetrahit					0.4																			
Galium aparine																								
Galium saxatile	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
Galium verum																								
Hyacinthoides non-scripta																								
Lathyrus linifolius								0.2	0.2	0.6									0.5					
Linum catharticum							0.2																	
Oxalis acetosella					0.8						1.6	1.8												
Plantago lanceolata																								
Polygala serpyllifolia																								
Potentilla erecta					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
Potentilla sterilis																								
Prunella vulgaris																								
Ranunculus acris																								
Ranunculus repens			0.2			0.2																		
Rumex acetosa	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
Rumex acetosella																								
Senecia sylvatica	9.4	2.2	0.2	2.0	2.6	0.6																		
Senecio vulgaris																								
Stellaria holostea	0.2	0.0			0.2															0.3				1.7
Taraxacum officinale																								

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
Teucrium scorodonia																								
Trifolium repens																								
Urtica dioica			1.6			4.0																		
Vaccinium myrtillus																								
Veronica chamaedrys					0.4						0.4													
Veronica officinalis																								
Vicia sativa																								
Vicia sepium																								
Viola riviniana			0.2		0.4	0.4					0.6													0.3
Brachythecium rutabulum	0.2				0.2																			
Dicranum scoparium																								
Hylocomium splendens																								
Hypnum cupressiforme																								0.3
Lophocolea bidentata																								
Lophozia ventricosa																								
Plagiothecium undulatum																								
Pleurozium schreberi								0.2																
Pseudoscleropodium purum			0.2				0.2	0.2		0.2					0.5		1.0	0.3					1.0	
Rhytidiadelphus loreus																								
Rhytidiadelphus squarrosus			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
Pteridium aquilinum	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
Agrostis canina																								
Agrostis capillaris	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
Agrostis stolonifera																								
Anthoxanthum odoratum	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
Bromus hordeceus																								

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
Carex binervis	0.2	0.2															0.5	1.3						
Carex pilulifera																								
Dactylis glomerata																								
Danthonia decumbens																								
Deschampsia cespitosa	0.2		1.6	0.4				1.4																
Deschampsia flexuosa							0.4		4.0				3.0	0.3	1.0	0.3	2.5	3.3		0.3	1.5			
Festuca ovina							4.2	1.4	3.2	0.6		0.4	9.0		13.0		26.5			0.7			3.0	
Festuca rubra	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
Holcus lanatus		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
Holcus mollis			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
Juncus effusus																								
Luzula campestris							0.8			0.2	0.2	0.6	3.5		2.0	0.7	0.5			0.3	2.0		0.5	
Luzula multiflora																								
Molinia caerulea																								
Nardus stricta																	3.0			0.3				
Poa annua																								
Poa pratensis	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
Trisetum flavescens				0.2		0.2											0.5							
Achillea millefolium										0.2														
Campanula rotundifolia			0.2							0.2	0.2		0.5	0.3		2.7				1.0	1.0	1.0	0.5	1.0
Cerastium fontanum							0.6	0.2	0.2	0.2	0.4								0.5		0.5	0.7		0.3
Chamaerion angustifolium																								
Cirsium palustre																								
Cirsium vulgare	0.6		0.4					0.4			0.4	0.2												
Conopodium majus					0.2	0.2	0.2	0.4			0.2													0.3
Digitalis purpurea	2.0	4.2	1.2	2.4	1.6	2.6																		
Epilobium obscurum		0.2																						
Euphrasia officinalis																								
Galeopsis tetrahit				0.2	0.2																			
Galium aparine				0.2																				
Galium saxatile	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
Galium verum																								
Hyacinthoides non-scripta																								
Lathyrus linifolius					0.2					0.2					0.5			0.7			0.5			
Linum catharticum																								
Oxalis acetosella					4.0							2.2												
Plantago lanceolata																								
Polygala serpyllifolia																								
Potentilla erecta			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
Potentilla sterilis																								
Prunella vulgaris																								
Ranunculus acris																								
Ranunculus repens																								
Rumex acetosa	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			
Rumex acetosella																								
Senecia sylvatica				0.4	1.2																			
Senecio vulgaris																								
Stellaria holostea																								0.3
Taraxacum officinale																								
Teucrium scorodonia																								
Trifolium repens										0.2														
Urtica dioica				0.2	0.2	0.2																		
Vaccinium myrtillus																								
Veronica chamaedrys					0.6	0.2					0.2													0.7
Veronica officinalis																								
Vicia sativa																								
Vicia sepium																								
Viola riviniana			2.0	0.8	0.2	0.4																0.3		
Brachythecium rutabulum								0.2																
Dicranum scoparium																								
Hylocomium splendens																								
Hypnum cupressiforme																								

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
Lophocolea bidentata																								
Lophozia ventricosa																								
Plagiothecium undulatum																								
Pleurozium schreberi																								
Pseudoscleropodium purum				0.2				0.2									0.5	0.3				0.3		0.3
Rhytidiadelphus loreus																								
Rhytidiadelphus squarrosus		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
Pteridium aquilinum	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
Agrostis canina																								
Agrostis capillaris	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
Agrostis stolonifera					0.2																			
Anthoxanthum odoratum	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
Bromus hordeceus																	0.5							
Carex binervis		0.2	0.2		3.2	0.2									0.5	0.3		0.3						
Carex pilulifera																								
Dactylis glomerata																								
Danthonia decumbens																								
Deschampsia cespitosa							3.2		6.0								3.0							
Deschampsia flexuosa	0.6		0.4				0.4	3.2	4.6	0.2	0.2	4.2			0.5	0.7		3.3		0.3				
Festuca ovina	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
Festuca rubra			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						
Holcus lanatus	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
Holcus mollis	0.8	0.4		18.4		2.4				2.6	0.4	0.2				10.0				15.0	2.5	60.0		1.7
Juncus effusus																								
Luzula campestris			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
Luzula multiflora									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
Molinia caerulea																								
Nardus stricta									2.0			2.0			2.5		2.5							
Poa annua																								
Poa pratensis	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
Trisetum flavescens																								
Achillea millefolium						0.2																		
Campanula rotundifolia		0.2	1.2			0.4	0.2							0.3		0.3			0.5	0.7		1.0	1.0	0.7
Cerastium fontanum							0.4	0.2	0.2	0.2	0.2	0.2									0.5	1.0	1.0	0.7
Chamaerion angustifolium	0.4	0.2																						
Cirsium palustre											0.2													
Cirsium vulgare	0.4																							
Conopodium majus			0.2		0.2	0.4	0.2	0.6	0.4		0.2			0.3					0.5					
Digitalis purpurea	3.6	3.0		0.8	5.0	0.4																		
Epilobium obscurum																								
Euphrasia officinalis																								
Galeopsis tetrahit					0.2	0.2																		
Galium aparine																								
Galium saxatile					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
Galium verum																								
Hyacinthoides non-scripta																								
Lathyrus linifolius									0.2	0.2														
Linum catharticum																								
Oxalis acetosella												0.8												
Plantago lanceolata																								
Polygala serpyllifolia								0.2	0.2	0.2														
Potentilla erecta					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
Potentilla sterilis																								
Prunella vulgaris																								
Ranunculus acris																								
Ranunculus repens																								
Rumex acetosa	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
Rumex acetosella																								
Senecia sylvatica	8.0	8.2		2.2	1.6	0.8																		
Senecio vulgaris					0.2																			
Stellaria holostea																								
Taraxacum officinale						0.2																		
Teucrium scorodonia																								
Trifolium repens											0.4	0.2												
Urtica dioica	0.2		0.2		0.4	0.2										0.3								
Vaccinium myrtillus																								
Veronica chamaedrys																								
Veronica officinalis																								
Vicia sativa											0.2													
Vicia sepium																								
Viola riviniana			0.4	0.4	2.0	0.8																		
Brachythecium rutabulum																								
Dicranum scoparium																								
Hylocomium splendens																								
Hypnum cupressiforme																								
Lophocolea bidentata																								
Lophozia ventricosa																								
Plagiothecium undulatum																								
Pleurozium schreberi			0.2						0.2			0.2												
Pseudoscleropodium purum									0.2											0.3				
Rhytidiadelphus loreus																								
Rhytidiadelphus squarrosus							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
Pteridium aquilinum	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
Agrostis canina																								
Agrostis capillaris	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
Agrostis stolonifera																								
Anthoxanthum odoratum	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
Bromus hordeceus																								
Carex binervis	2.0	0.2	0.4			0.6																		
Carex pilulifera																								
Dactylis glomerata						0.2																		
Danthonia decumbens																								
Deschampsia cespitosa	6.0		0.2			0.2																		
Deschampsia flexuosa	9.2		17.2		8.0	2.0	0.2		1.0	0.2							0.5							
Festuca ovina	4.8	0.6	4.0			1.0	3.0		4.0			0.6	3.0		2.5						2.0		2.0	
Festuca rubra	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
Holcus lanatus	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
Holcus mollis	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
Juncus effusus																								
Luzula campestris			0.2					0.6	0.2	0.2			2.0	0.7	0.5	0.3	0.5			0.7	0.5			0.7
Luzula multiflora																								
Molinia caerulea																								
Nardus stricta									0.4								4.0							
Poa annua				0.2	6.6	9.4																		
Poa pratensis	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
Trisetum flavescens																								
Achillea millefolium																								
Campanula rotundifolia			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
Cerastium fontanum	0.2		0.8				0.4			0.2	0.2	0.2	1.0				0.5	0.3	0.5				0.5	0.3
Chamaerion angustifolium																								
Cirsium palustre								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
Cirsium vulgare		0.2	0.2	0.2	0.4	0.6		0.2	0.2		0.2												0.5	
Conopodium majus		0.2		0.2	0.2	0.4	0.2	0.4	0.2															
Digitalis purpurea	1.0	4.8	0.8	0.8	3.0	0.8																		0.3
Epilobium obscurum		0.2																						
Euphrasia officinalis																								
Galeopsis tetrahit					0.2																			
Galium aparine						0.2																		0.3
Galium saxatile	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
Galium verum																								
Hyacinthoides non-scripta																								
Lathyrus linifolius										0.2			1.0						0.5					
Linum catharticum																								
Oxalis acetosella												1.6												
Plantago lanceolata																								
Polygala serpyllifolia																								
Potentilla erecta	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
Potentilla sterilis				0.4		0.2																		
Prunella vulgaris																								
Ranunculus acris																								
Ranunculus repens																								
Rumex acetosa	1.0	0.2	1.8		0.6	0.6	0.2	0.4		0.2	0.2	0.8	0.5			0.3				0.3			2.5	0.3
Rumex acetosella																								
Senecia sylvatica	0.2	3.8	0.8	0.6	1.2	0.2											0.5							
Senecio vulgaris																								
Stellaria holostea		0.2	0.2							0.2										0.3				1.0
Taraxacum officinale						0.2																		
Teucrium scorodonia																								
Trifolium repens						1.0					0.4						1.5		0.5		0.5		0.5	
Urtica dioica						1.8																		
Vaccinium myrtillus												0.2												
Veronica chamaedrys					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
Veronica officinalis																								
Vicia sativa																								
Vicia sepium											0.4													
Viola riviniana		0.6	0.6	1.0	0.4	1.0																		
Brachythecium rutabulum		0.2																						
Dicranum scoparium																								
Hylocomium splendens																								
Hypnum cupressiforme																								
Lophocolea bidentata																								
Lophozia ventricosa																								
Plagiothecium undulatum				0.2																				
Pleurozium schreberi																								
Pseudoscleropodium purum	0.2	0.2		0.2			0.2	0.2														0.3		
Rhytidiadelphus loreus																								
Rhytidiadelphus squarrosus	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 none	A none	A none	A none	A none	A none	B sheep	B sheep	B sheep	B sheep	B sheep	B sheep	C cattle	S slope	C cattle	S slope	C cattle	S slope	C cattle	S slope	C cattle	S slope	C cattle	S slope
Sub-plot treatment	B bash	A none	C cut	A none	C cut	B bash	C cut	A none	B bash	A none	B bash	C cut	C cut	C cut	B bash	B bash	A none	A none	B bash	B bash	A none	A none	C cut	C 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	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
	A	A	A	A	A	A	B	B	B	B	B	B	C	S	C	S	C	S	C	S	C	S	C	S
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
	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 treatement 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 none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A 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 bash	B bash	B bash	B bash	B bash	A none	A none	A none	A none	A none	C cut	C cut	C cut	C cut	C cut	A none	A none	A none	A none	A none	C cut	C cut	C cut	C cut	C cut	B bash	B 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 (%)						1																				1	
Stone (%)						1																					
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 (%)																											
Pteridium aquilinum	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
Agrostis canina																											
Agrostis capillaris	1	0.1	3		1	2						2	3	50	40				1	5	50	2				20	
Agrostis stolonifera																											
Anthoxanthum odoratum			1		4	4					1	2	4	2	1	1	3				2					2	1
Bromus hordeceus																											
Carex binervis																						1					
Carex pilulifera																											
Dactylis glomerata																											
Danthonia decumbens																											
Deschampsia cespitosa	1				1										3												
Deschampsia flexuosa					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
Festuca ovina						4					8	40	2	4		1			3		2					25	
Festuca rubra																											
Holcus lanatus																2											
Holcus mollis			10		1					2	5			1	30	80			60	80	30				5		20
Juncus effusus																											
Luzula campestris																											
Luzula multiflora																											
Molinia caerulea																											
Nardus stricta																											
Poa annua																											
Poa pratensis						70	4				5	40	2	20	10	1			2	5	4	2			1	50	
Trisetum flavescens																											
Achillea millefolium																										1	
Campanula rotundifolia						1								2								0.1					
Cerastium fontanum																											
Chamaerion angustifolium																											
Cirsium palustre																											
Cirsium vulgare																			10								
Conopodium majus																											
Digitalis purpurea		20		1	6	10	20	10	3	8	6		30		1	2	4	6		1		12	1			1	2
Epilobium obscurum																											
Euphrasia officinalis																											
Galeopsis tetrahit																					1		1				
Galium aparine																											
Galium saxatile	1				8	1	80	2			2	1	80	6	4							10	1			1	
Galium verum																											
Hyacinthoides non-scripta																											
Lathyrus linifolius																											
Linum catharticum																											
Oxalis acetosella																									4		
Plantago lanceolata																											
Polygala serpyllifolia																											
Potentilla erecta																					1	1	1			1	
Potentilla sterilis																											
Prunella vulgaris																											
Ranunculus acris																											
Ranunculus repens															1												
Rumex acetosa		2									4	10									1						
Rumex acetosella																											
Senecia sylvatica	2	3	4	30	8		1	3	4	3	1					1	4	4	1			10	2	1			3
Senecio vulgaris																											

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
Stellaria holostea				1		0.1															1						
Taraxacum officinale																											
Teucrium scorodonia																											
Trifolium repens																											
Urtica dioica															8												
Vaccinium myrtillus																											
Veronica chamaedrys																					2						
Veronica officinalis																											
Vicia sativa																											
Vicia sepium																											
Viola riviniana														1							1	1					
Brachythecium rutabulum					1																	1					
Dicranum scoparium																											
Hylocomium splendens																											
Hypnum cupressiforme																											
Lophocolea bidentata																											
Lophozia ventricosa																											
Plagiothecium undulatum																											
Pleurozium schreberi																											
Pseudoscleropodium purum														1													
Rhytidiadelphus loreus																											
Rhytidiadelphus squarrosus												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 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	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 (%)																								
Pteridium aquilinum	100	100	100	75	70	90	95	95	65	85	95	90	100	100	95	90	95	98	90	90	90	95	95	90
Agrostis canina																								
Agrostis capillaris	1			35	20	30	10	5	35	20	55	35	50	80	60	10	2		70	55	10	40	30	40
Agrostis stolonifera																								
Anthoxanthum odoratum	2			20	30	40	20	8	45	30	10	40	20	10	10	15	15	10	10	10	5	5	5	20
Bromus hordeceus																								
Carex binervis				1		1			1															
Carex pilulifera																								
Dactylis glomerata																								
Danthonia decumbens																								
Deschampsia cespitosa										30														
Deschampsia flexuosa																			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
Festuca ovina				8	5	10	5	4	6	5	25	5	10	3	25	5	5	2	3	5			3	1
Festuca rubra																			2					
Holcus lanatus	10				3	4	10	25	2			3					45	45		5	60	10	20	5
Holcus mollis	70		100			2	15	40									25	35		20	15	20	40	25
Juncus effusus																								
Luzula campestris									1			1						1			2			
Luzula multiflora																								
Molinia caerulea																								
Nardus stricta																								
Poa annua																								
Poa pratensis				35	40	8	40	15	5	15	8	15	10	5	5	70	10	5	10	5	2	20	1	5
Trisetum flavescens																								
Achillea millefolium																								
Campanula rotundifolia					1			2	1			1	1									1		
Cerastium fontanum					3				1		2								1					
Chamaerion angustifolium																								
Cirsium palustre																								
Cirsium vulgare																								
Conopodium majus																								
Digitalis purpurea	1																							
Epilobium obscurum																								
Euphrasia officinalis																			1					
Galeopsis tetrahit																								
Galium aparine																								
Galium saxatile				5	10	45	6	6	30	1	5	2	5	1	30	5	2	5	1	10		5	30	2
Galium verum																								
Hyacinthoides non-scripta																								
Lathyrus linifolius									1								1		1			2		
Linum catharticum					1																			
Oxalis acetosella																								8
Plantago lanceolata																								
Polygala serpyllifolia																								
Potentilla erecta				1	2	4	5		1	4		2		1	1	1	1				3	1	1	2
Potentilla sterilis																								
Prunella vulgaris																								
Ranunculus acris																								
Ranunculus repens		1																						
Rumex acetosa						1				1	1	2	8					1	1		3		1	
Rumex acetosella																								
Senecia sylvatica																								
Senecio vulgaris																								

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
Stellaria holostea																								
Taraxacum officinale																								
Teucrium scorodonia																								
Trifolium repens																								
Urtica dioica		20																						
Vaccinium myrtillus																								
Veronica chamaedrys																								
Veronica officinalis																								
Vicia sativa																								
Vicia sepium																								
Viola riviniana		2																						
Brachythecium rutabulum																								
Dicranum scoparium																								
Hylocomium splendens																								
Hypnum cupressiforme																								
Lophocolea bidentata																								
Lophozia ventricosa																								
Plagiothecium undulatum																								
Pleurozium schreberi										1														
Pseudoscleropodium purum						1				1										1				
Rhytidiadelphus loreus																								
Rhytidiadelphus squarrosus				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	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	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	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 (%)																									
Pteridium aquilinum	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
Agrostis canina																									
Agrostis capillaris	50	65	5	10	30	40	1	41	15	20	10	25			40	30	10	15	25	45	15	5	40		60
Agrostis stolonifera																									
Anthoxanthum odoratum	10	10	3	2	15	15	1	4	5	15	30	15			15	20	10	5	3	15	15	25	20	2	25
Bromus hordeceus																									
Carex binervis												1											1	4	
Carex pilulifera																									
Dactylis glomerata																									
Danthonia decumbens																									
Deschampsia cespitosa																		15							
Deschampsia flexuosa																				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
Festuca ovina						2				60	45	40			30	35	10		15	10	50	30	30	50	1
Festuca rubra	5	5	2		10	25																			
Holcus lanatus	8	10	65	60			50	4	60			5	25	15	2		30			3					
Holcus mollis	3	10	20	10			40	15	10			5	30	10	4		30		10	3			1		15
Juncus effusus																									
Luzula campestris			1		1						1												1		1
Luzula multiflora																									
Molinia caerulea																									
Nardus stricta																				8	5			2	
Poa annua																									
Poa pratensis	20	5	5	3	35	15	4	10	5	5	10	5	35		5	10	2	5	40	10	10	10	5	40	1
Trisetum flavescens																									
Achillea millefolium																									
Campanula rotundifolia	1	1									4	1	2				1		3					1	1
Cerastium fontanum																									
Chamaerion angustifolium																									
Cirsium palustre																									
Cirsium vulgare			1	8																					
Conopodium majus																									
Digitalis purpurea																									
Epilobium obscurum																									
Euphrasia officinalis																									
Galeopsis tetrahit																									
Galium aparine																									
Galium saxatile	1	1			35	5	1	2		40	6	10	10	80	80	3	20	10	15	80	5	25	5	15	2
Galium verum																									
Hyacinthoides non-scripta																									
Lathyrus linifolius																									1
Linum catharticum																									
Oxalis acetosella							5	4																	
Plantago lanceolata																									
Polygala serpyllifolia																									
Potentilla erecta	3		2		3	1	1		1	2	2	1	2		4	2				1	1	4		1	
Potentilla sterilis																									
Prunella vulgaris																									
Ranunculus acris																									
Ranunculus repens																									
Rumex acetosa		4				1			5		4													1	1
Rumex acetosella																									
Senecia sylvatica																									
Senecio vulgaris																									

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
Stellaria holostea																									
Taraxacum officinale																									
Teucrium scorodonia																									
Trifolium repens																									
Urtica dioica																									
Vaccinium myrtillus																									
Veronica chamaedrys			1	1																					
Veronica officinalis																									
Vicia sativa																									
Vicia sepium																									
Viola riviniana				3																					
Brachythecium rutabulum																									
Dicranum scoparium																									
Hylocomium splendens																									
Hypnum cupressiforme																									
Lophocolea bidentata																									
Lophozia ventricosa																									
Plagiothecium undulatum																									
Pleurozium schreberi																									
Pseudoscleropodium purum															1						2	1			
Rhytidiadelphus loreus																									
Rhytidiadelphus squarrosus	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**
Plot	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Plot treatment	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
Sub-plot	6b	6b	6b	6b	6a	6a	6a	6a	6a	6c	6c	6c	6c	6c
Sub-plot treatment	B bash	B bash	B bash	B bash	A none	A none	A none	A none	A none	C cut	C cut	C cut	C cut	C cut
Quadrat	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Year	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Measurements														
Bracken shoots	31	34	24	43	30	39	37	31	46	32	30	32	37	46
Bracken vigour (1-10)	7	6	7	9	5	6	8	10	10	5	6	7	8	10
Bracken frond height (cm)	90.0	73.7	72.7	102.7	66.0	84.0	92.7	121.3	125.3	66.7	77.3	80.7	103.0	128.7
Litter cover (%)	60	100	100	100	60	100	100	100	100	60	50	100	50	100
Litter depth (cm)	1.0	1.0	1.0	2.0	1.0	2.0	2.0	3.0	4.0	1.0	1.0	1.0	1.0	4.0
Litter volume	0.6	1.0	1.0	2.0	0.6	2.0	2.0	3.0	4.0	0.6	0.5	1.0	0.5	4.0
Disturbed ground within 5m (%)														
Bare ground (%)														
Stone (%)														
Derived data														
Vegetation cover (%)	196	242	186	209	266	174	229	185	199	278	203	206	198	117
Understorey cover (%)	126	152	106	114	206	104	139	85	101	208	113	111	103	17
Species richness	9	9	11	9	8	7	9	2	4	12	8	12	14	5
NVC_U4b score	46	40	50	29	55	53	22		4	59	54	45	63	
NVC_U20a score	74	84	80	59	84	77	67	25	32	97	85	78	81	30
NVC_U20b score	50	70	57	51	69	69	55	33	39	74	74	61	60	38
NVC_U20c score	53	68	53	55	64	66	55	57	68	60	70	56	55	57
Plant cover (%)														
Pteridium aquilinum	70	90	80	95	60	70	90	100	98	70	90	95	95	100
Agrostis canina														
Agrostis capillaris	20	10	50		20	50				30	30	15	45	
Agrostis stolonifera														
Anthoxanthum odoratum	10	10	25	6	10	10	5			25	40	20	20	
Bromus hordeceus														
Carex binervis														
Carex pilulifera			2											
Dactylis glomerata														
Danthonia decumbens														
Deschampsia cespitosa														5
Deschampsia flexuosa														

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
Festuca ovina		5	3		60	20	5			40	10	5	5	
Festuca rubra														
Holcus lanatus				4									1	
Holcus mollis	40	50	10	70			75	85	90			55	5	10
Juncus effusus														
Luzula campestris			1							1				
Luzula multiflora														
Molinia caerulea														
Nardus stricta														
Poa annua														
Poa pratensis	30	20	8	15	10	15	15		10	5	20	5	15	
Trisetum flavescens														
Achillea millefolium														
Campanula rotundifolia	1		1				3			2		2	1	
Cerastium fontanum	1											1	4	
Chamaerion angustifolium														
Cirsium palustre														
Cirsium vulgare														
Conopodium majus														
Digitalis purpurea														
Epilobium obscurum														
Euphrasia officinalis														
Galeopsis tetrahit														
Galium aparine														
Galium saxatile	20	50	1	5	80	5	30		1	80	10	1	1	
Galium verum														
Hyacinthoides non-scripta														
Lathyrus linifolius														
Linum catharticum														
Oxalis acetosella														
Plantago lanceolata														
Polygala serpyllifolia														
Potentilla erecta		5		1						2	2	1	1	
Potentilla sterilis														
Prunella vulgaris														
Ranunculus acris														
Ranunculus repens														
Rumex acetosa					1		1			1			3	
Rumex acetosella														
Senecia sylvatica														
Senecio vulgaris														

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
Stellaria holostea				1								4	1	
Taraxacum officinale														
Teucrium scorodonia														
Trifolium repens														
Urtica dioica														
Vaccinium myrtillus														
Veronica chamaedrys														
Veronica officinalis														
Vicia sativa														
Vicia sepium														
Viola riviniana														1
Brachythecium rutabulum														
Dicranum scoparium														
Hylocomium splendens														
Hypnum cupressiforme														1
Lophocolea bidentata														
Lophozia ventricosa														
Plagiothecium undulatum														
Pleurozium schreberi														
Pseudoscleropodium purum										2				
Rhytidiadelphus loreus														
Rhytidiadelphus squarrosus	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 none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A 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 bash	B bash	B bash	B bash	B bash	A none	A none	A none	A none	A none	C cut	C cut	C cut	C cut	C cut	A none	A none	A none	A none	A none	C cut	C cut	C cut	C cut	C cut	B bash	B 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	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	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 (%)																											
Pteridium aquilinum	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
Agrostis canina																											
Agrostis capillaris	1				15	10					50	25	10							3	60	40		3		30	
Agrostis stolonifera																											
Anthoxanthum odoratum	1	1			4	15		5			10	5	30	5							5	2				20	
Bromus hordeceus																											
Carex binervis		1				1																					
Carex pilulifera																											
Dactylis glomerata																											
Danthonia decumbens																											
Deschampsia cespitosa					1							8								2							
Deschampsia flexuosa																											

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
Festuca ovina																											
Festuca rubra	5	2	4		30	10		3			5	40	40	10	2						10	5					
Holcus lanatus								2																			
Holcus mollis											20			35	40	15	30	80	40	30					60		60
Juncus effusus																											
Luzula campestris																											
Luzula multiflora																											
Molinia caerulea																											
Nardus stricta																											
Poa annua																											
Poa pratensis				1	6	35		60			10	10	10	45	5	60	40	15	40	50	20	20		10	10	50	2
Trisetum flavescens																1											
Achillea millefolium																											
Campanula rotundifolia														1													
Cerastium fontanum																											
Chamaerion angustifolium																											
Cirsium palustre																											
Cirsium vulgare			3												2												
Conopodium majus																					1						
Digitalis purpurea	4	5			1	1		20							6	10	2					5	2	1		1	4
Epilobium obscurum							1																				
Euphrasia officinalis																											
Galeopsis tetrahit																		1						1			
Galium aparine																	1										
Galium saxatile	1																1					3					
Galium verum																											
Hyacinthoides non-scripta																											
Lathyrus linifolius																					1						
Linum catharticum																											
Oxalis acetosella																									20		
Plantago lanceolata																											
Polygala serpyllifolia																											
Potentilla erecta													3								1	1				1	
Potentilla sterilis																											
Prunella vulgaris																											
Ranunculus acris																											
Ranunculus repens																											
Rumex acetosa		3				2					1	4	2														
Rumex acetosella																											
Senecia sylvatica																				2		2	1	3			
Senecio vulgaris																											

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
Stellaria holostea																											
Taraxacum officinale																											
Teucrium scorodonia																											
Trifolium repens																											
Urtica dioica																				1					1		
Vaccinium myrtillus																											
Veronica chamaedrys																					3						
Veronica officinalis																											
Vicia sativa																											
Vicia sepium																											
Viola riviniana															10	2		1		1		1					
Brachythecium rutabulum																											
Dicranum scoparium																											
Hylocomium splendens																											
Hypnum cupressiforme																											
Lophocolea bidentata																											
Lophozia ventricosa																											
Plagiothecium undulatum																											
Pleurozium schreberi																											
Pseudoscleropodium purum																		1									
Rhytidiadelphus loreus																											
Rhytidiadelphus squarrosus									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 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	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	36	38	22	23	30	32	33	44	35	45	45	37	44	45	63	46	54	43	35	32	44	31	45	40
Bracken vigour (1-10)	10	8	7	2	3	2	4	2	4	4	6	7	5	6	7	6	8	5	4	5	6	7	5	4
Bracken frond height (cm)	122.7	97.0	104.3	44.7	57.3	58.0	67.7	67.3	67.7	67.7	73.0	86.7	79.7	72.0	69.7	68.0	83.0	64.3	59.0	65.7	67.3	82.0	73.7	65.3
Litter cover (%)	100	100	90	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Litter depth (cm)	5.0	4.7	0.3	1.0	0.7	2.0	1.7	2.0	2.3	2.0	2.7	2.7	3.3	1.7	2.3	1.3	1.3	1.3	1.3	0.7	3.0	0.7	1.0	2.3
Litter volume	5.0	4.7	0.3	1.0	0.7	2.0	1.7	2.0	2.3	2.0	2.7	2.7	3.3	1.7	2.3	1.3	1.3	1.3	1.3	0.7	3.0	0.7	1.0	2.3
Disturbed ground within 5m (%)			1		1								1	1	1				1			1		1
Bare ground (%)			4		2							1	1	1	1		1		1	1		4	4	2
Stone (%)																						1		
Derived data																								
Vegetation cover (%)	106	105	197	175	174	181	207	205	153	205	204	201	200	172	192	174	194	182	218	205	199	195	211	182
Understorey cover (%)	6	10	102	115	109	111	112	115	56	107	109	103	110	82	97	79	94	97	123	109	100	96	121	102
Species richness	2	6	11	8	9	13	10	11	10	11	7	12	11	7	9	10	7	11	12	10	8	12	12	11
NVC_U4b score		6	33	52	62	72	30	63	52	50	47	55	51	46	44	50	28	59	59	53	40	57	75	67
NVC_U20a score	25	41	47	85	67	90	67	74	68	80	73	59	75	73	79	90	48	72	85	67	62	66	78	77
NVC_U20b score	38	44	36	76	52	70	58	55	54	65	63	37	61	63	74	71	44	55	58	55	51	51	51	52
NVC_U20c score	71	74	40	72	54	58	63	52	58	60	74	45	59	75	71	68	56	58	56	55	66	54	52	55
Plant cover (%)																								
Pteridium aquilinum	100	95	95	60	65	70	95	90	97	98	95	98	90	90	95	95	100	85	95	96	99	99	90	80
Agrostis canina																								
Agrostis capillaris		1	5	70	70	40	1	10	20	20	80	30	5	60	30	20		10	60	5	6	5	40	30
Agrostis stolonifera																								
Anthoxanthum odoratum			5	25	15	15		20	10	20	5	5	15	5	5	3	1	5	15	5	1	5	10	5
Bromus hordeceus																								
Carex binervis																								
Carex pilulifera																								
Dactylis glomerata																								
Danthonia decumbens																								
Deschampsia cespitosa												5	2											
Deschampsia flexuosa				1		1									20									

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
Festuca ovina				4		10	4	3		6			1		3	10		3	2	1				
Festuca rubra			5		10	2		10	1										3	2		1		2
Holcus lanatus						10	5	5				15	30			3	60	60		45	80	45	30	50
Holcus mollis		5	1			2	80	40		2		2	10			20	30	10		30	10	30	5	5
Juncus effusus																								
Luzula campestris						4													1					
Luzula multiflora																								
Molinia caerulea																								
Nardus stricta																								
Poa annua																								
Poa pratensis			80		5	1	8	10	20	50	15	40	25	10	30	4	1	5	15	10	1	2	10	5
Trisetum flavescens			1																					
Achillea millefolium																							1	
Campanula rotundifolia																			1					1
Cerastium fontanum								3				1						1				1		
Chamaerion angustifolium																								
Cirsium palustre																								
Cirsium vulgare												2												
Conopodium majus			1		1				1	1														
Digitalis purpurea	6	2																						
Epilobium obscurum																								
Euphrasia officinalis																								
Galeopsis tetrahit																								
Galium aparine																								
Galium saxatile				8	4	5	10	10	1	2	2		1	2	6	12	1	1	20	6	1	1	1	1
Galium verum																								
Hyacinthoides non-scripta																								
Lathyrus linifolius																			1					
Linum catharticum																								
Oxalis acetosella																								
Plantago lanceolata																								
Polygala serpyllifolia																								
Potentilla erecta		1		4		15	1			2	6	1	20	4	2	6		1			1	1	1	1
Potentilla sterilis																								
Prunella vulgaris																								
Ranunculus acris																								
Ranunculus repens																								
Rumex acetosa					3		1		1	3		1						1	2			1	20	
Rumex acetosella																								
Senecia sylvatica																								
Senecio vulgaris																								

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
Stellaria holostea																								
Taraxacum officinale																								
Teucrium scorodonia																								
Trifolium repens																							1	
Urtica dioica		1																						
Vaccinium myrtillus																								
Veronica chamaedrys			1																					
Veronica officinalis																								
Vicia sativa																								
Vicia sepium																								
Viola riviniana			2																					
Brachythecium rutabulum												1												
Dicranum scoparium																								
Hylocomium splendens																								
Hypnum cupressiforme																								
Lophocolea bidentata																								
Lophozia ventricosa																								
Plagiothecium undulatum																								
Pleurozium schreberi																								
Pseudoscleropodium purum									1															
Rhytidiadelphus loreus																								
Rhytidiadelphus squarrosus			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	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	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	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 (%)																									
Pteridium aquilinum	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
Agrostis canina																									
Agrostis capillaris	60	20		10	80	60	5	5	5	50	50				65	20	10	20		5	50	50	5	10	30
Agrostis stolonifera																									
Anthoxanthum odoratum	10				15	30	5	3	2	15	10				15	5	20	5	10	12	20	4	30	10	20
Bromus hordeceus																									
Carex binervis																				1			1	3	
Carex pilulifera																									
Dactylis glomerata																									
Danthonia decumbens																									
Deschampsia cespitosa																									
Deschampsia flexuosa										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
Festuca ovina									2	8	10				1	25				50	3				
Festuca rubra	4	3				3	1	1							2			1	2		2	15	3	1	5
Holcus lanatus	20	70	80	60			85	70	70	2		50	90	60	5		50	60	40	15			45		40
Holcus mollis	1	2	20	25			2	20	15			10		5			5	5	35						
Juncus effusus																									
Luzula campestris		1			2	1				6	1				1	3	1		1	1					
Luzula multiflora																									
Molinia caerulea																									
Nardus stricta																				6					
Poa annua																									
Poa pratensis	4	1	1	2	2	5	1	1	3	10	25	40	5	1	5	3	10	5	5		20	20	10	1	5
Trisetum flavescens																				1					
Achillea millefolium																									
Campanula rotundifolia										1		1					2	2	4						
Cerastium fontanum	1	1																							
Chamaerion angustifolium																									
Cirsium palustre																									
Cirsium vulgare		1	1						1																
Conopodium majus		1																							
Digitalis purpurea																									
Epilobium obscurum																									
Euphrasia officinalis																									
Galeopsis tetrahit																									
Galium aparine																									
Galium saxatile	1	1			1	8	1	1	1	6	3	25	30	10	10	1	30	1	10	4	1	5	2	60	
Galium verum																									
Hyacinthoides non-scripta																									
Lathyrus linifolius															1									2	
Linum catharticum																									
Oxalis acetosella							3	8																	
Plantago lanceolata																									
Polygala serpyllifolia																									
Potentilla erecta	1	8		1	3	3	6		1	8	8	3			1	5	1	1		1	2	20	3	1	
Potentilla sterilis																									
Prunella vulgaris																									
Ranunculus acris																									
Ranunculus repens																									
Rumex acetosa	2	2		1		1			2		1						1			1	1				1
Rumex acetosella																									
Senecia sylvatica																									
Senecio vulgaris																									

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
Stellaria holostea																									
Taraxacum officinale																									
Teucrium scorodonia																									
Trifolium repens																									
Urtica dioica																									
Vaccinium myrtillus																									
Veronica chamaedrys			1																						
Veronica officinalis																									
Vicia sativa																									
Vicia sepium																									
Viola riviniana																									
Brachythecium rutabulum																									
Dicranum scoparium																									
Hylocomium splendens																									
Hypnum cupressiforme																									
Lophocolea bidentata																									
Lophozia ventricosa																									
Plagiothecium undulatum																									
Pleurozium schreberi																									
Pseudoscleropodium purum																				1		1			
Rhytidiadelphus loreus																									
Rhytidiadelphus squarrosus				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**
Plot	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Plot treatment	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
Sub-plot	6b	6b	6b	6b	6a	6a	6a	6a	6a	6c	6c	6c	6c	6c
Sub-plot treatment	B bash	B bash	B bash	B bash	A none	A none	A none	A none	A none	C cut	C cut	C cut	C cut	C cut
Quadrat	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Year	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Measurements														
Bracken shoots	29	39	38	50	36	27	52	30	43	30	14	35	43	57
Bracken vigour (1-10)	3	3	4	6	2	2	7	8	8	2	2	4	4	6
Bracken frond height (cm)	43.3	52.3	60.7	87.3	47.0	45.3	75.3	94.3	93.3	52.7	46.0	66.0	65.7	82.7
Litter cover (%)	80	90	100	100	90	90	100	100	100	100	90	100	100	100
Litter depth (cm)	0.3	1.0	1.0	2.0	1.0	0.7	2.7	4.7	6.7	0.7	0.7	1.0	1.3	2.7
Litter volume	0.3	0.9	1.0	2.0	0.9	0.6	2.7	4.7	6.7	0.7	0.6	1.0	1.3	2.7
Disturbed ground within 5m (%)	10	1			2	5	1			1	3			
Bare ground (%)	5	10			2	8	1	1		1	5			
Stone (%)														
Derived data														
Vegetation cover (%)	148	175	193	119	159	146	189	202	187	168	131	171	195	198
Understorey cover (%)	108	105	113	29	119	91	104	105	92	128	96	101	115	103
Species richness	9	16	11	7	13	7	9	7	4	10	6	8	14	6
NVC_U4b score	78	71	69	23	66	47	41	23	20	65	54	58	42	37
NVC_U20a score	68	82	81	55	65	60	47	46	40	83	59	72	56	55
NVC_U20b score	47	60	54	55	46	46	35	39	34	60	43	51	40	51
NVC_U20c score	47	52	55	75	43	58	48	41	56	51	55	55	48	66
Plant cover (%)														
Pteridium aquilinum	40	70	80	90	40	55	85	97	95	40	35	70	80	95
Agrostis canina														
Agrostis capillaris	40	30	20		40	35			1	30	10	15	10	10
Agrostis stolonifera														
Anthoxanthum odoratum	10	10	15		5	5	2	1		30	15	10		
Bromus hordeceus														
Carex binervis														
Carex pilulifera														
Dactylis glomerata														
Danthonia decumbens														
Deschampsia cespitosa														
Deschampsia flexuosa		1			3									

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
Festuca ovina		2								6				
Festuca rubra	5	5	4		40	4	2			5			5	
Holcus lanatus	35	10	10	10			80	100	90		60	30	5	90
Holcus mollis		1						1					70	
Juncus effusus														
Luzula campestris		1			4					1				
Luzula multiflora														
Molinia caerulea														
Nardus stricta		1												
Poa annua														
Poa pratensis	10	30	50		10	45	15			25	10	35	15	
Trisetum flavescens														
Achillea millefolium														
Campanula rotundifolia		1	1	1	1	1	1	1	1	1		2	1	
Cerastium fontanum	1				1		2						1	
Chamaerion angustifolium														
Cirsium palustre														
Cirsium vulgare														
Conopodium majus													1	
Digitalis purpurea														
Epilobium obscurum														
Euphrasia officinalis														
Galeopsis tetrahit														
Galium aparine														
Galium saxatile	3	10	5	4	5	1	1			20	1	8	2	1
Galium verum														
Hyacinthoides non-scripta														
Lathyrus linifolius					1									
Linum catharticum														
Oxalis acetosella														
Plantago lanceolata														
Polygala serpyllifolia														
Potentilla erecta		1	4	3									1	
Potentilla sterilis														
Prunella vulgaris														
Ranunculus acris														
Ranunculus repens														
Rumex acetosa		1	1	1	1									
Rumex acetosella														
Senecia sylvatica														
Senecio vulgaris														

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
Stellaria holostea													1	
Taraxacum officinale														
Teucrium scorodonia														
Trifolium repens														
Urtica dioica														
Vaccinium myrtillus														
Veronica chamaedrys													2	
Veronica officinalis														
Vicia sativa														
Vicia sepium														
Viola riviniana							1							
Brachythecium rutabulum														
Dicranum scoparium														
Hylocomium splendens														
Hypnum cupressiforme														
Lophocolea bidentata														
Lophozia ventricosa														
Plagiothecium undulatum														
Pleurozium schreberi														
Pseudoscleropodium purum								1						1
Rhytidiadelphus loreus														
Rhytidiadelphus squarrosus	4	1	3	10	8			1		10		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 none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A 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 bash	B bash	B bash	B bash	B bash	A none	A none	A none	A none	A none	C cut	C cut	C cut	C cut	C cut	A none	A none	A none	A none	A none	C cut	C cut	C cut	C cut	C cut	B bash	B 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	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	3	3
Measurements																											
Bracken shoots	33	29	23	28	28	16	40	24	33	26	14	23	6	10	37	47	38	28	39	29	12	40	30	25	9	23	28
Bracken vigour (1-10)	5	5	8	5	9	6	8	8	8	9	2	2	1	2	4	9	9	10	10	10	3	4	4	4	3	3	4
Bracken frond height (cm)	67.0	77.7	84.0	72.0	80.0	75.0	99.7	94.7	96.7	103.3	40.7	49.7	38.3	45.0	67.0	107.7	107.0	122.3	110.7	117.7	57.3	70.0	70.7	64.0	51.3	53.7	59.3
Litter cover (%)	95	90	95	90	60	90	100	100	98	100	40	30	20	5	30	85	100	100	98	100	98	90	90	60	100	90	100
Litter depth (cm)	1.0	3.7	8.3	3.0	1.7	3.3	7.7	7.3	6.7	6.3	1.0	1.0	2.7	1.0	1.0	11.3	6.7	8.0	6.0	6.3	1.7	1.7	4.0	2.3	1.7	4.0	1.0
Litter volume	1.0	3.3	7.9	2.7	1.0	3.0	7.7	7.3	6.5	6.3	0.4	0.3	0.5	0.1	0.3	9.6	6.7	8.0	5.9	6.3	1.6	1.5	3.6	1.4	1.7	3.6	1.0
Disturbed ground within 5m (%)	3	6	2	5	1	2	3	1	3		5	10	20	50	10	1	1		3	1	20	3	2	40	5		5
Bare ground (%)	3	4	2	3	20	4	2	1	3		3		1	5	2	4			1		4		1	10		2	1
Stone (%)	1	1	1	1	1	1		1	1		2			2	1	1								2		1	
Derived data																											
Vegetation cover (%)	118	107	107	94	135	90	99	100	108	129	98	108	121	111	168	110	106	101	190	107	133	152	92	75	123	177	143
Understorey cover (%)	38	17	12	39	35	20	4	10	13	29	83	93	115	99	88	10	6	1	92	7	103	57	12	25	108	102	53
Species richness	8	5	4	9	3	7	3	4	4	4	8	8	10	8	9	5	4	2	3	7	12	10	6	6	6	12	5
NVC_U4b score	35	7		30		12			4	4	66	53	59	52	39		11		1	11	49	30	6	18	37	65	17
NVC_U20a score	60	32	22	55	22	34	24	27	32	34	47	44	44	29	43	28	40	25	24	40	43	57	39	42	33	66	35
NVC_U20b score	54	38	35	49	35	37	36	35	40	39	31	26	17	12	34	35	45	38	31	37	26	46	44	39	16	39	36
NVC_U20c score	59	56	61	51	59	50	67	62	61	57	29	24	17	18	44	60	71	71	52	63	27	64	73	55	24	43	50
Plant cover (%)																											
Pteridium aquilinum	80	90	95	55	100	70	95	90	95	100	15	15	6	12	80	100	100	100	98	100	30	95	80	50	15	75	90
Agrostis canina																											
Agrostis capillaris	20			2							10	50	70	5	2		1			1	20	20	2	2	5	40	
Agrostis stolonifera																					1						
Anthoxanthum odoratum	3	1		6		8			2	2	25	4	3	2			1				20			1	1	20	1
Bromus hordeceus																											
Carex binervis						1							1								1	15				1	
Carex pilulifera																											
Dactylis glomerata																											
Danthonia decumbens																											
Deschampsia cespitosa																											
Deschampsia flexuosa	3										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
Festuca ovina	4			20							2		2		2												
Festuca rubra											25	30	30	10	20						1	4				10	
Holcus lanatus				1							15			20	40					2	1			1	70	1	50
Holcus mollis				4						2						1			90	1							
Juncus effusus																											
Luzula campestris													1														
Luzula multiflora																											
Molinia caerulea																											
Nardus stricta																											
Poa annua																											
Poa pratensis	6			4		1					4	5	4	60	20				2		55	4			30	25	
Trisetum flavescens																											
Achillea millefolium																										1	
Campanula rotundifolia								1				2	3		1											1	
Cerastium fontanum																											
Chamaerion angustifolium			2				1																				
Cirsium palustre																											
Cirsium vulgare			2																								
Conopodium majus														1							1					1	
Digitalis purpurea		8			10	5		5	5							3				1	1	1	3	20			1
Epilobium obscurum																											
Euphrasia officinalis																											
Galeopsis tetrahit																							1				
Galium aparine																											
Galium saxatile																						1					
Galium verum																											
Hyacinthoides non-scripta																											
Lathyrus linifolius																											
Linum catharticum																											
Oxalis acetosella																											
Plantago lanceolata																											
Polygala serpyllifolia																											
Potentilla erecta																						1	1			1	
Potentilla sterilis																											
Prunella vulgaris																											
Ranunculus acris																											
Ranunculus repens																											
Rumex acetosa	1	3				2						1	1	1													
Rumex acetosella																											
Senecia sylvatica	1	5	8	1	25	3	3	4	6	25						5	4	1		1	1	1	5	1			1
Senecio vulgaris																					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
Stellaria holostea																											
Taraxacum officinale																											
Teucrium scorodonia																											
Trifolium repens																											
Urtica dioica				1											1										2		
Vaccinium myrtillus																											
Veronica chamaedrys																											
Veronica officinalis																											
Vicia sativa																											
Vicia sepium																											
Viola riviniana															2	1				1		10				1	
Brachythecium rutabulum																											
Dicranum scoparium																											
Hylocomium splendens																											
Hypnum cupressiforme																											
Lophocolea bidentata																											
Lophozia ventricosa																											
Plagiothecium undulatum																											
Pleurozium schreberi												1															
Pseudoscleropodium purum																											
Rhytidiadelphus loreus																											
Rhytidiadelphus squarrosus																											

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	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 (%)																								
Pteridium aquilinum	90	70	90	15	20	30	20	15	20	30	30	70	90	30	50	70	50	55	15	15	20	50	60	15
Agrostis canina																								
Agrostis capillaris	1	1	2	25	15	15	1	5	15	10	10	10		20	10	5			45	3	1	1	15	15
Agrostis stolonifera																								
Anthoxanthum odoratum				50	15	40	2	20	25	25	30	40	20	5	15	20	2	4	30	4	1	3	1	10
Bromus hordeceus																								
Carex binervis																								
Carex pilulifera																								
Dactylis glomerata																								
Danthonia decumbens																								
Deschampsia cespitosa				1	15													30					
Deschampsia flexuosa					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
Festuca ovina		2							2	5				10	35	8								
Festuca rubra		1		20	40	40	20	10			5			20				1	1	2		1	2	40
Holcus lanatus		70	75		5		80	65		4		20	50				90	40		70	95	90	80	10
Holcus mollis		10	2																	10	1	1	1	
Juncus effusus																								
Luzula campestris											2		1											1
Luzula multiflora															1									
Molinia caerulea																								
Nardus stricta															5	5								
Poa annua																								
Poa pratensis		3	20	2		3	1	2	30	40	40	15	3	30		25	2					1	3	20
Trisetum flavescens																								
Achillea millefolium																								
Campanula rotundifolia			1			1																		
Cerastium fontanum						1		1		1								1	1					
Chamaerion angustifolium																								
Cirsium palustre																								
Cirsium vulgare																								
Conopodium majus			1		1						1	1	1				1	1						1
Digitalis purpurea	1																							
Epilobium obscurum																								
Euphrasia officinalis																								
Galeopsis tetrahit	1																							
Galium aparine																								
Galium saxatile				2		1	2	2	1	1				1	3	1	1			1				
Galium verum																								
Hyacinthoides non-scripta																								
Lathyrus linifolius																	1		1					
Linum catharticum																								
Oxalis acetosella																								
Plantago lanceolata																								
Polygala serpyllifolia									1									1	1					
Potentilla erecta		1		1		1	2		1	1	1	1	2		3	1	1	1				1		1
Potentilla sterilis																								
Prunella vulgaris																								
Ranunculus acris																								
Ranunculus repens																								
Rumex acetosa					1		1					2	2				2		1				2	
Rumex acetosella																								
Senecia sylvatica	3																							
Senecio vulgaris																								

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
Stellaria holostea																								
Taraxacum officinale			1																					
Teucrium scorodonia																								
Trifolium repens																								2
Urtica dioica	1																							
Vaccinium myrtillus																								
Veronica chamaedrys																								
Veronica officinalis																								
Vicia sativa																								
Vicia sepium																								
Viola riviniana	1	2																						
Brachythecium rutabulum																								
Dicranum scoparium																								
Hylocomium splendens																								
Hypnum cupressiforme																								
Lophocolea bidentata																								
Lophozia ventricosa																								
Plagiothecium undulatum																								
Pleurozium schreberi														1										
Pseudoscleropodium purum															1									
Rhytidiadelphus loreus																								
Rhytidiadelphus squarrosus				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	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 (%)																									
Pteridium aquilinum	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
Agrostis canina																									
Agrostis capillaris	10	40	10	5	15	40	1		10	40	85	30	1	30	25	45	5		35	40	30	20	30	10	45
Agrostis stolonifera																									
Anthoxanthum odoratum	2	2	2		40	20	2	2	10	4	4	6		1	2	5	2		30	20	2	10	30	20	15
Bromus hordeceus																				1					
Carex binervis															1				1					1	
Carex pilulifera																									
Dactylis glomerata																									
Danthonia decumbens																									
Deschampsia cespitosa																				6					
Deschampsia flexuosa					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
Festuca ovina					10				1	15	2	1			10	15	3			3	10		3		10
Festuca rubra	35	3				30	1		1	35	5	60			30	35	10	1	10	4	1	1	3	15	
Holcus lanatus	50	50	70	90			95	95	70	1			95	30	15		65	80	2	15		3	25		3
Holcus mollis		1		1					1								5	5	20						
Juncus effusus																									
Luzula campestris					1	1				1	1	1			1								1		2
Luzula multiflora																									
Molinia caerulea																									
Nardus stricta					10										3	2				2	3				
Poa annua																									
Poa pratensis	2	3	2	3		5	1		3	1	2	6	2	40	10	5	1	15	1	5	50	60	5	45	2
Trisetum flavescens																									
Achillea millefolium																									
Campanula rotundifolia													1					1							
Cerastium fontanum			1						1																
Chamaerion angustifolium																									
Cirsium palustre				1																					
Cirsium vulgare																									
Conopodium majus														1											1
Digitalis purpurea																									
Epilobium obscurum																									
Euphrasia officinalis																									
Galeopsis tetrahit																									
Galium aparine																									
Galium saxatile				1	1	1				1	5	10			1	3	2	1	1			1	1	1	1
Galium verum																									
Hyacinthoides non-scripta																									
Lathyrus linifolius																									
Linum catharticum																									
Oxalis acetosella							1	3																	
Plantago lanceolata																									
Polygala serpyllifolia																									
Potentilla erecta	1	1			2	1	1		1	1	1					1				1	1	1	2		
Potentilla sterilis																									
Prunella vulgaris																									
Ranunculus acris																									
Ranunculus repens																									
Rumex acetosa		2	2									1			1								1		1
Rumex acetosella																									
Senecia sylvatica																									
Senecio vulgaris																									

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
Stellaria holostea																									
Taraxacum officinale																									
Teucrium scorodonia																									
Trifolium repens									1																
Urtica dioica																		1							
Vaccinium myrtillus																									
Veronica chamaedrys																									
Veronica officinalis																									
Vicia sativa				1																					
Vicia sepium																									
Viola riviniana																									
Brachythecium rutabulum																									
Dicranum scoparium																									
Hylocomium splendens																									
Hypnum cupressiforme																									
Lophocolea bidentata																									
Lophozia ventricosa																									
Plagiothecium undulatum																									
Pleurozium schreberi					1																				
Pseudoscleropodium purum																									
Rhytidiadelphus loreus																									
Rhytidiadelphus squarrosus		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**
Plot	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Plot treatment	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
Sub-plot	6b	6b	6b	6b	6a	6a	6a	6a	6a	6c	6c	6c	6c	6c
Sub-plot treatment	B bash	B bash	B bash	B bash	A none	A none	A none	A none	A none	C cut	C cut	C cut	C cut	C cut
Quadrat	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Year	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Measurements														
Bracken shoots	25	29	31	50	38	34	45	50	65	3	18	13	33	41
Bracken vigour (1-10)	2	4	5	6	2	4	8	8	9	1	2	3	4	5
Bracken frond height (cm)	42.3	48.7	54.3	73.0	44.3	60.7	80.0	92.7	115.7	27.7	44.7	44.0	55.0	68.3
Litter cover (%)	98	100	100	100	90	99	100	100	100	90	95	100	100	100
Litter depth (cm)	4.0	2.7	3.0	4.0	3.7	3.3	3.7	6.7	8.3	1.0	3.3	1.7	2.0	5.0
Litter volume	3.9	2.7	3.0	4.0	3.3	3.3	3.7	6.7	8.3	0.9	3.2	1.7	2.0	5.0
Disturbed ground within 5m (%)	1				45	30	5			10	10	1	1	3
Bare ground (%)	1				8	1	2			8	4			
Stone (%)														
Derived data														
Vegetation cover (%)	119	130	184	194	111	125	187	198	146	71	121	127	181	169
Understorey cover (%)	107	105	104	104	81	100	102	103	101	66	101	107	106	99
Species richness	11	13	8	7	9	11	10	5	4	12	10	13	13	6
NVC_U4b score	74	74	57	25	55	73	46	10	10	65	59	73	72	27
NVC_U20a score	75	82	72	51	74	81	63	35	31	66	69	76	80	40
NVC_U20b score	47	59	49	45	61	60	46	31	28	37	51	49	54	34
NVC_U20c score	38	47	48	53	56	49	53	43	39	31	47	42	49	40
Plant cover (%)														
Pteridium aquilinum	12	25	80	90	30	25	85	95	45	5	20	20	75	70
Agrostis canina														
Agrostis capillaris	40	50	45	1	30	20	4			50	60	55	30	
Agrostis stolonifera														
Anthoxanthum odoratum	20	20	30		2	15	4			3	2	4	15	1
Bromus hordeceus														
Carex binervis														
Carex pilulifera														
Dactylis glomerata														
Danthonia decumbens														
Deschampsia cespitosa														
Deschampsia flexuosa		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
Festuca ovina	20	10	10		40	40	1			3	30	10	10	
Festuca rubra														
Holcus lanatus	20	15	10	60	1	10	60	30	10	3	1	30	40	95
Holcus mollis		1	4	40		5	20	70	90			1	3	1
Juncus effusus														
Luzula campestris	1	1			1					1		1	1	
Luzula multiflora														
Molinia caerulea														
Nardus stricta														
Poa annua														
Poa pratensis	1	1	3		5	5	8				2	1	2	1
Trisetum flavescens														
Achillea millefolium														
Campanula rotundifolia	1		2				1	2		1	1	1	1	
Cerastium fontanum						1	3			1	1	1	1	
Chamaerion angustifolium														
Cirsium palustre														
Cirsium vulgare														
Conopodium majus														
Digitalis purpurea														
Epilobium obscurum														
Euphrasia officinalis														
Galeopsis tetrahit														
Galium aparine														
Galium saxatile	1	2			1	2	1			1	3	1	1	
Galium verum														
Hyacinthoides non-scripta														
Lathyrus linifolius														
Linum catharticum														
Oxalis acetosella														
Plantago lanceolata														
Polygala serpyllifolia														
Potentilla erecta	1	1		1		1				1		1		
Potentilla sterilis														
Prunella vulgaris														
Ranunculus acris														
Ranunculus repens														
Rumex acetosa		2								1			1	
Rumex acetosella														
Senecia sylvatica														
Senecio vulgaris														

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
Stellaria holostea														
Taraxacum officinale														
Teucrium scorodonia														
Trifolium repens														
Urtica dioica														
Vaccinium myrtillus														
Veronica chamaedrys														
Veronica officinalis														
Vicia sativa														
Vicia sepium														
Viola riviniana														
Brachythecium rutabulum														
Dicranum scoparium														
Hylocomium splendens														
Hypnum cupressiforme														
Lophocolea bidentata														
Lophozia ventricosa														
Plagiothecium undulatum														
Pleurozium schreberi														
Pseudoscleropodium purum				1										
Rhytidiadelphus loreus														
Rhytidiadelphus squarrosus	2	1		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 none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A none	A 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 bash	B bash	B bash	B bash	B bash	A none	A none	A none	A none	A none	C cut	C cut	C cut	C cut	C cut	A none	A none	A none	A none	A none	C cut	C cut	C cut	C cut	C cut	B bash	B 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
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 (%)																											
Pteridium aquilinum	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
Agrostis canina																											
Agrostis capillaris	45	60	20	10	40	30	20		3	1	30	40	70	50	40	1			3	1	60	75	85	15	5	70	80
Agrostis stolonifera																											
Anthoxanthum odoratum	10	3	1		3	2					15	5	12	6	5						6	20	4	8		10	2
Bromus hordeceus																											
Carex binervis	4	2	4			1						1		1													1
Carex pilulifera																											
Dactylis glomerata																											
Danthonia decumbens																											
Deschampsia cespitosa				30							1																
Deschampsia flexuosa	20	6			20						40	40	3	2	1						40					5	5

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
Festuca ovina		4	20			3						10	10													2	3
Festuca rubra		1		5									5	5	3				1						1		
Holcus lanatus				3			1		1	3	1				2							3	2	4	90	1	
Holcus mollis				2			2	40	15	3	20			40	40	5	90		80	3					2	5	10
Juncus effusus																											
Luzula campestris													1														
Luzula multiflora																											
Molinia caerulea																											
Nardus stricta																											
Poa annua																			1		2	5	20	4	2	20	2
Poa pratensis	25	20	50	50	30	60		2		1	2	4	4	3	15												
Trisetum flavescens																											
Achillea millefolium																											
Campanula rotundifolia												2	2	3							1					2	
Cerastium fontanum	1										3		1														
Chamaerion angustifolium																											
Cirsium palustre																											
Cirsium vulgare							1								1			1							2		1
Conopodium majus						1											1				1					1	1
Digitalis purpurea			5			1	15	1	6	1	4					3		1				4		10	1		
Epilobium obscurum							1																				
Euphrasia officinalis																											
Galeopsis tetrahit																						1					
Galium aparine																										1	
Galium saxatile		1	1											1								1				1	1
Galium verum																											
Hyacinthoides non-scripta																											
Lathyrus linifolius																											
Linum catharticum																											
Oxalis acetosella																											
Plantago lanceolata																											
Polygala serpyllifolia																											
Potentilla erecta	4	1											2										2			5	4
Potentilla sterilis																			2								
Prunella vulgaris																											
Ranunculus acris																											
Ranunculus repens																											
Rumex acetosa	3				2	1					2	4	3										3			3	
Rumex acetosella																											
Senecia sylvatica		1				3	6	1	4	5	2			2		1		2			1	2		2	1		
Senecio vulgaris																											

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
Stellaria holostea						1									1												
Taraxacum officinale																											
Teucrium scorodonia																											
Trifolium repens																										1	4
Urtica dioica																											
Vaccinium myrtillus																											
Veronica chamaedrys																									1		1
Veronica officinalis																											
Vicia sativa																											
Vicia sepium																											
Viola riviniana										3					3	1			2	2		1			1		
Brachythecium rutabulum						1																					
Dicranum scoparium																											
Hylocomium splendens																											
Hypnum cupressiforme																											
Lophocolea bidentata																											
Lophozia ventricosa																											
Plagiothecium undulatum																			1								
Pleurozium schreberi																											
Pseudoscleropodium purum	1					1											1										
Rhytidiadelphus loreus																											
Rhytidiadelphus squarrosus		1				1						1	4				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 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	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 (%)																								
Pteridium aquilinum	100	100	100	85	80	95	80	90	90	98	97	100	100	95	95	98	100	100	98	90	95	100	100	95
Agrostis canina																								
Agrostis capillaris	5	1		90	70	65	5	40	20	10	25	1		75	30	70	2	15		3		1	1	25
Agrostis stolonifera																								
Anthoxanthum odoratum				2	5	10	2	5		4	3	3	15	1	15	3	1	3		4	1			1
Bromus hordeceus																								
Carex binervis	2																							
Carex pilulifera																								
Dactylis glomerata			1																					
Danthonia decumbens																								
Deschampsia cespitosa		1																						
Deschampsia flexuosa							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
Festuca ovina						15									5	15								
Festuca rubra				5	2		5	5		3	5	20	5	15				1	1	2		1	1	4
Holcus lanatus	50	35	50	1	15																			5
Holcus mollis	20	2	20				80	50	70	80		20	20				95	80	95	85	95	95	90	60
Juncus effusus																								
Luzula campestris									1	1	1					1				1				
Luzula multiflora																								
Molinia caerulea																								
Nardus stricta																2								
Poa annua	15		10																					
Poa pratensis				3	5	10	8	5	10		70	50	60	20	35	5	1		3	4	1	1	1	5
Trisetum flavescens																								
Achillea millefolium																								
Campanula rotundifolia								1																
Cerastium fontanum					1			1														1		
Chamaerion angustifolium																								
Cirsium palustre													1											
Cirsium vulgare	1	1										1					1							
Conopodium majus					1					1		1					1							
Digitalis purpurea	1	3																						
Epilobium obscurum																								
Euphrasia officinalis																								
Galeopsis tetrahit																								
Galium aparine																								
Galium saxatile				1		10	5	3			1		1	1	40	4	1	2		1	2	3	1	
Galium verum																								
Hyacinthoides non-scripta																								
Lathyrus linifolius																				1				
Linum catharticum																								
Oxalis acetosella																								
Plantago lanceolata																								
Polygala serpyllifolia																								
Potentilla erecta				3	1	2	1			2	1		1			2		1		2		1		
Potentilla sterilis			1																					
Prunella vulgaris																								
Ranunculus acris																								
Ranunculus repens																								
Rumex acetosa								1					2										1	
Rumex acetosella																								
Senecia sylvatica	1																							
Senecio vulgaris																								

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
Stellaria holostea																						1		
Taraxacum officinale			1																					
Teucrium scorodonia																								
Trifolium repens																								2
Urtica dioica	1		8																					
Vaccinium myrtillus																								
Veronica chamaedrys																								
Veronica officinalis																								
Vicia sativa																								
Vicia sepium																								
Viola riviniana	1		4																					
Brachythecium rutabulum																								
Dicranum scoparium																								
Hylocomium splendens																								
Hypnum cupressiforme																								
Lophocolea bidentata																								
Lophozia ventricosa																								
Plagiothecium undulatum																								
Pleurozium schreberi																								
Pseudoscleropodium purum								1	1															
Rhytidiadelphus loreus																								
Rhytidiadelphus squarrosus				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	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	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	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 (%)																									
Pteridium aquilinum	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
Agrostis canina																									
Agrostis capillaris	40	70	1	10	90	95	10		1	90	70	40	30		80	80	65	85	85	85	75	90	90	40	20
Agrostis stolonifera																									
Anthoxanthum odoratum	1				3	1	3	2	1	3	2	5	2		3	3	1	1	4	5	10	5	3	4	10
Bromus hordeceus																									
Carex binervis																									
Carex pilulifera																									
Dactylis glomerata																									
Danthonia decumbens																									
Deschampsia cespitosa																									
Deschampsia flexuosa																					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
Festuca ovina					3					4	2				3	2									
Festuca rubra	5	2	1	1	1	3		2		2	5	8	6		8	2	5	3	8	3	4	2	4	30	5
Holcus lanatus	2	2						2							1		2	2					1		1
Holcus mollis	30	20	95	80		1	85	90	95			40	20	40	4		10	6	1	10					30
Juncus effusus																									
Luzula campestris										2	2		1	1		1	1				1				
Luzula multiflora																									
Molinia caerulea																									
Nardus stricta																					8				
Poa annua																									
Poa pratensis	10	2	1	5	5	3	1	1	3	1	15	10	40	60	4	10	20	5	5	1	2	5	3	25	35
Trisetum flavescens																									
Achillea millefolium																									
Campanula rotundifolia		1						1		1	2			2			2	1	1			1			1
Cerastium fontanum		1							1	1	1									1		1			
Chamaerion angustifolium																									
Cirsium palustre									3																
Cirsium vulgare		1																							
Conopodium majus																									
Digitalis purpurea																									
Epilobium obscurum																									
Euphrasia officinalis																									
Galeopsis tetrahit																									
Galium aparine																									
Galium saxatile					5	1	1			2	20	3	30	30	15	1	40	10	10		1	1	2	2	2
Galium verum																									
Hyacinthoides non-scripta																									
Lathyrus linifolius										2															1
Linum catharticum																									
Oxalis acetosella							4	4																	
Plantago lanceolata																									
Polygala serpyllifolia																									
Potentilla erecta	3	1			8	2	5			1	1	6	5	1	2	2	1	4	1	1	1	2	1	1	
Potentilla sterilis																									
Prunella vulgaris																									
Ranunculus acris																									
Ranunculus repens																									
Rumex acetosa			1					1	3		1						1								
Rumex acetosella																									
Senecia sylvatica																					1				
Senecio vulgaris																									

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
Stellaria holostea																									
Taraxacum officinale																									
Teucrium scorodonia																									
Trifolium repens																				3					
Urtica dioica																									
Vaccinium myrtillus					1																				
Veronica chamaedrys													1									1			
Veronica officinalis																									
Vicia sativa																									
Vicia sepium				2																					
Viola riviniana																									
Brachythecium rutabulum																									
Dicranum scoparium																									
Hylocomium splendens																									
Hypnum cupressiforme																									
Lophocolea bidentata																									
Lophozia ventricosa																									
Plagiothecium undulatum																									
Pleurozium schreberi																									
Pseudoscleropodium purum																									
Rhytidiadelphus loreus																									
Rhytidiadelphus squarrosus	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**
Plot	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Plot treatment	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
Sub-plot	6b	6b	6b	6b	6a	6a	6a	6a	6a	6c	6c	6c	6c	6c
Sub-plot treatment	B bash	B bash	B bash	B bash	A none	A none	A none	A none	A none	C cut	C cut	C cut	C cut	C cut
Quadrat	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Year	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Measurements														
Bracken shoots	51	40	29	47	43	38	58	31	28	49	28	27	33	35
Bracken vigour (1-10)	6	7	8	9	4	5	8	10	10	3	4	5	4	6
Bracken frond height (cm)	77.0	70.3	85.7	101.7	53.0	63.0	82.7	119.3	124.0	46.0	65.7	62.7	66.3	81.7
Litter cover (%)	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Litter depth (cm)	1.3	1.7	2.3	1.0	0.3	0.3	2.3	4.3	3.0	0.3	0.7	0.3	0.3	0.7
Litter volume	1.3	1.7	2.3	1.0	0.3	0.3	2.3	4.3	3.0	0.3	0.7	0.3	0.3	0.7
Disturbed ground within 5m (%)					1	1				1	1			
Bare ground (%)														
Stone (%)														
Derived data														
Vegetation cover (%)	182	205	134	200	194	183	192	196	122	160	164	210	195	196
Understorey cover (%)	102	125	39	100	114	93	102	96	22	110	104	135	110	106
Species richness	11	11	9	8	10	6	8	3	4	12	10	14	12	7
NVC_U4b score	66	56	37	25	56	38	39	4	18	59	60	55	66	5
NVC_U20a score	68	83	65	59	75	53	58	33	44	70	73	81	77	32
NVC_U20b score	49	58	52	46	60	47	53	36	39	51	64	51	54	29
NVC_U20c score	53	60	64	67	59	63	62	60	67	48	61	53	55	44
Plant cover (%)														
Pteridium aquilinum	80	80	95	100	80	90	90	100	100	50	60	75	85	90
Agrostis canina														
Agrostis capillaris	80	85	20	15	65	70	85	1	10	90	60	40	50	2
Agrostis stolonifera														
Anthoxanthum odoratum	5	5	1		1					1	4	1	5	
Bromus hordeceus														
Carex binervis														
Carex pilulifera														
Dactylis glomerata														
Danthonia decumbens														
Deschampsia cespitosa														
Deschampsia flexuosa														

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
Festuca ovina					4					2	2			
Festuca rubra	2	5	1		1	1	3			2	3	3	8	
Holcus lanatus	1			1					5			1	1	
Holcus mollis	5	8	7	80			5	95	7			30	25	90
Juncus effusus														
Luzula campestris		2			1							1	1	
Luzula multiflora														
Molinia caerulea														
Nardus stricta														
Poa annua														
Poa pratensis	5	1	5	1	30	20	5			3	30	20	10	10
Trisetum flavescens														
Achillea millefolium														
Campanula rotundifolia			3									1		2
Cerastium fontanum	1										1		1	
Chamaerion angustifolium														
Cirsium palustre														
Cirsium vulgare										1				
Conopodium majus														
Digitalis purpurea														1
Epilobium obscurum														
Euphrasia officinalis														
Galeopsis tetrahit														
Galium aparine														1
Galium saxatile	1	15	1	1	10		2				1	30	5	
Galium verum														
Hyacinthoides non-scripta														
Lathyrus linifolius														
Linum catharticum														
Oxalis acetosella														
Plantago lanceolata														
Polygala serpyllifolia														
Potentilla erecta		2		1		1				3	1	3	3	
Potentilla sterilis														
Prunella vulgaris														
Ranunculus acris														
Ranunculus repens														
Rumex acetosa		1								5		1		
Rumex acetosella														
Senecia sylvatica														
Senecio vulgaris														

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
Stellaria holostea				1								3		
Taraxacum officinale														
Teucrium scorodonia														
Trifolium repens	1				1					1				
Urtica dioica														
Vaccinium myrtillus														
Veronica chamaedrys										1				
Veronica officinalis														
Vicia sativa														
Vicia sepium														
Viola riviniana														
Brachythecium rutabulum														
Dicranum scoparium														
Hylocomium splendens														
Hypnum cupressiforme														
Lophocolea bidentata														
Lophozia ventricosa														
Plagiothecium undulatum														
Pleurozium schreberi														
Pseudoscleropodium purum							1							
Rhytidiadelphus loreus														
Rhytidiadelphus squarrosus	1	1	1		1	1	1			1	2	1	1	