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New Forest Restoration Monitoring 2024

Higher Level Stewardship Agreement
The Verderers of the New Forest
AG00300016

NEW FOREST NATIONAL PARK

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Summary

Forestry England is carrying out a programme of heathland restoration within selected inclosures under the New Forest 2019 Forest Plan and funded by the New Forest Higher Level Stewardship Scheme. The restoration involves felling the remaining crop of coniferous trees and removing stumps and ridges and furrows where necessary.

An ongoing monitoring programme has been set up to establish how the vegetation recovers after heathland restoration (stump shearing and, where present, ridge and furrow flattening). It is based on the existing New Forest wetland monitoring protocol. Baseline monitoring was conducted in 2021 and further monitoring work was carried out at Denny in 2023.

This report summarises the results of the vegetation monitoring undertaken at all four sites during summer 2024 and provides a comparison with results from 2021 (Lake. et al., 2022). In 2024, 144 quadrats were recorded across four restoration sites (Turf Hill 1 (N), Turf Hill 2 (S), Dunces Arch and Denny. Areas that supported different broad habitat types in 2021 were sampled separately. Vegetation composition together with physical attributes including cover of bare ground, litter, vegetation height, litter depth and heather stage were recorded.

Prior to restoration, the sites were largely dominated by thick Bracken under a pine canopy with some scrub and young broad-leaved trees and occasional more open dry heathy patches. Wet heath was limited to a small area at Dunces Arch.

Following restoration, overall species-richness increased, with smaller herbs and grasses typical of heath and acid grassland more frequent post-restoration. There was a corresponding decrease in some typical woodland herbs and ferns and some bryophytes. However, this varied between sites and community types, with the greatest increase seen in wet heath at Dunces Arch and no change seen in the heathy community at Turfhill 1.

However, the most visually striking difference was the reduction in overall vegetation cover, with a corresponding increase in bare ground and decrease in both the cover and depth of leaf litter, a consequence of the initial disturbance caused by the restoration process.

The decline in vegetation cover was largely driven by a decrease in Bracken, although there was also an overall decrease in the cover of bryophytes and dwarf shrubs. In

contrast, there was a small but signficant overall increase in the cover of herbs and graminoids. There were differences between sites and vegetation communities, for example, there was a trend towards an increase in dwarf shrub cover on Denny, where restoration had taken place a year earlier, in previously Bracken dominated areas, while Bracken cover had increased somewhat in some open areas. The response was also little different on wet heath, with a noticeable increase in the cover of bryophytes, mainly bog mosses and a decrease in the cover of graminoids. There may be an interaction with grazing, as the largest increase in dung was noted on the site with wet heath.

The age structure of dwarf shrubs also changed, with an increase in the proportion of pioneer phase heather (including seedlings), although the cover of dwarf shrubs was generally low. The overall height of vegetation had reduced.

These results show the initial changes to the vegetation following on from restoration. Future monitoring will show how the vegetation regenerates.

Contents

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1. Introduction

Overview

1.1 The New Forest is a highly designated landscape (National Park, RAMSAR, Special Protection Area, Special Area for Conservation and Site of Special Scientific Interest) largely due to the extent of lowland heathland and its associated species. However, some of this heathland was in the past planted up for forestry purposes. Under its 2019 Forest Plan[1], and funded by the New Forest Higher Level Stewardship Scheme[2], Forestry England (FE) is carrying out a programme of heathland restoration. This includes felling the remaining crop of trees from selected areas within inclosures and removing stumps and ridges and furrows where necessary (these were often dug on wet sites in order to create a drier bank on which to plant the trees). On the drier sites there are no ridges and furrows, and restoration simply involves infilling any drainage ditches and shearing the stumps off at ground level to allow follow up management (e.g. tractor access across the site for bracken management and because the stumps can be hazardous during stock management).

Terrestrial restoration monitoring plan

1.2 A programme of vegetation monitoring at new ridge and furrow restoration sites was implemented in 2021 to monitor how sites respond after restoration from commercial forestry to open habitats (Lake, S. et al., 2022) This followed the pre-existing methodology already used in the monitoring programme for wetland restoration in the New Forest to ensure continuity across the different habitat types within the New Forest.

[1] https://www.forestryengland.uk/forest-planning/new-forest-inclosures-forest-plan-2019-2029
[2] https://www.hlsnewforest.org.uk/projects/habitat-restoration-and-maintenance/heathland-restoration/

Sites

1.3 Four sites were chosen and are shown in Map 1: Turf Hill 1 and 2, Dunces Arch and Denny. Ridge and furrow flattening and stump shearing was carried out at Denny and Turfhill 1, while only stump shearing was needed at Dunces Arch and Turfhill 2. Heathland restoration at Denny was undertaken in 2023 and post-restoration monitoring is summarised in Lake & Bishop (2023). Restoration was undertaken at the remaining sites over the winter of 2023/4.

1.4 This report summarises the findings of the post-restoration monitoring undertaken in 2024 compared to the baseline monitoring from 2021.

2. Methods

2.1 The methods used follow those used by FE for mire monitoring, with minor modifications, and are detailed below (see also Lake et. al, 2022 for a description of how stratified random sampling points were identified). Field work was carried out between 1st July – 12th August 2024.

2.2 Quadrat locations were found using printed aerials and the random sampling locations uploaded to a GPS. At each quadrat location, 4m x 4m quadrats were set up with the quadrat point at the centre, orientated North-South. Variables recorded were:

- % cover of all plant species present (not including the tree canopy)
- % cover of bare ground, dung, leaf litter and deadwood
- Vegetation height for cryptogams (liverworts, mosses and lichens), herbs and graminoids (grasses, sedges, rushes), dwarf shrubs (e.g., heather species), and shrubs[3]. Five height measurements for each vegetation type per quadrat were recorded. In 2024, sward heights were also recorded for bracken where appropriate.

[3] The methodology states that separate height measurements should be taken for Purple Moor-grass *Molinia caerulea*, but none of the quadrats surveyed included tussocky Purple Moor-grass for which this would be appropriate, therefore it was recorded together with herbs and other graminoids. Shrubs includes saplings and Gorse.

- % cover of different Heather age classes (pioneer, building, maturing and degenerate). Seedling heather was included in the pioneer category.
- Depth of litter (this was combined with thatch due to the nature of the vegetation)
- Any signs of obvious human impacts on the habitat
- A photograph was taken from the south-western corner of each quadrat (photos were also taken from the north eastern corner in 2021, but a single photo was found to be adequate).

2.3 Location and quadrat data are summarised in Table 1 and shown in Map 2 (note that although 3 quadrats appeared to fall outside of the restoration area at Turfhill 1, they were within the area affected by the works).

2.4 The initial study started with a walkover survey to identify different vegetation communities, which were then sampled separately. The 2024 survey continued this differentiation, as it was felt that areas previously heavily dominated by Bracken may have responded differently to areas that were more heathy in nature, and particularly wet heath. The "Bracken" community comprised almost 100% dense Bracken. "Heathy Bracken" was differentiated from "Bracken" by the low-level presence of dwarf shrubs. "Heath" areas were open and lacked Bracken and generally included some species typical of heathland (e.g. Heather, Purple Moor-grass or Bent grasses), although these areas are not a good fit with typical heathland National Vegetation Classification communities (Rodwell, 1991).

Analysis

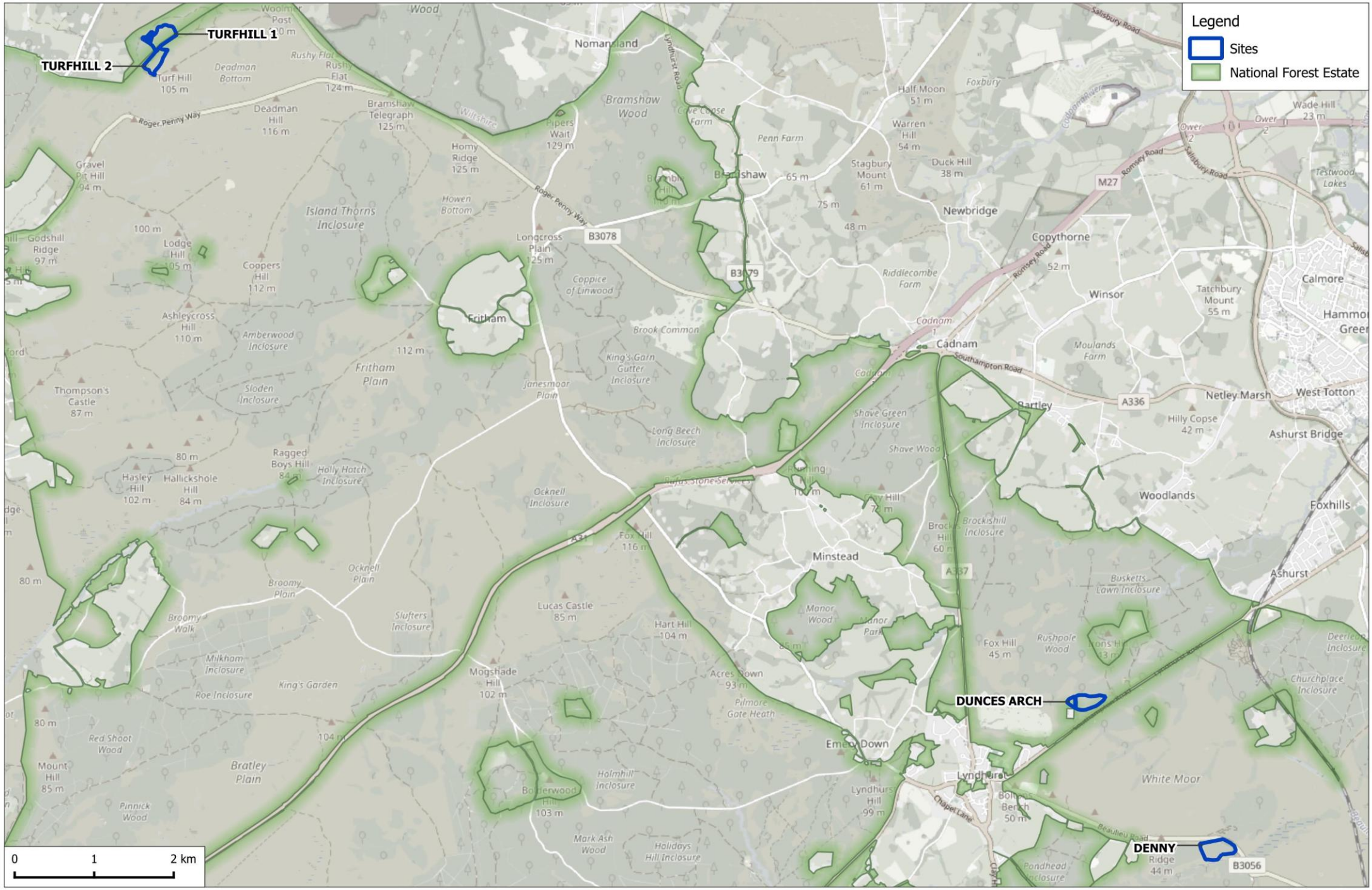
2.5 Summary statistics were generated in Excel. Minitab was used to undertake Ryan-Joiner normality tests and Kruskall-Wallis tests, used to analyse the difference in median between years for key variables.

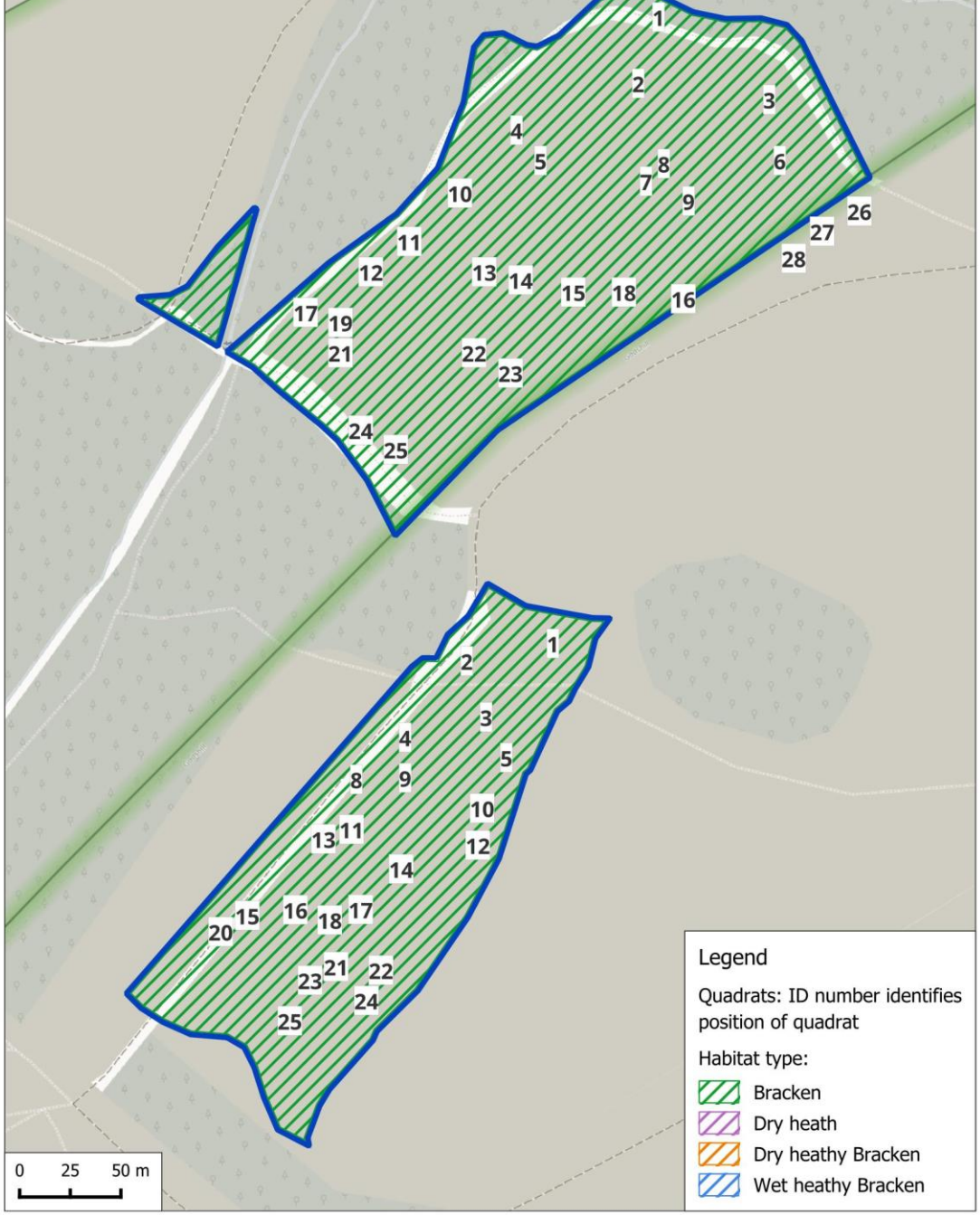
2.6 For species richness, some 2024 quadrats were excluded to ensure that the same degree of sampling effort was considered in both years (to prevent a greater number of quadrats resulting in a higher species count).

Table 1: Summary of quadrat composition across all sites by year.

Site	Central grid ref	Restoration area (ha)	Year	No. of quadrats within each habitat type			
				Bracken	Heathy Bracken	Heath	Wet Heath
Denny	SU322940732	5.18	2021	20	N/A	20	N/A
			2024	21	N/A	20	N/A
Dunces Arch	SU31300918	3.2	2021	20	20	N/A	10
			2024	20	20	N/A	10
Turf Hill 1	SU19731751	4.22	2021	20	N/A	5	N/A
			2024	23	N/A	5	N/A
Turf Hill 2	SU19631721	1.95	2021	20	N/A	N/A	N/A
			2024	25	N/A	N/A	N/A

Map 1: Location of the sites





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3. Results

3.1 Table 2 summarises key variables across all sites and between years. These include species richness; percentage cover of dwarf shrubs, graminoids, herb, and bryophytes (mosses and liverworts); heather structure and physical characteristics such as bare ground and sward height. Full data (including groups with low representation such as fungi and lichens and ferns other than Bracken) are provided in the accompanying spreadsheet and image folder.

3.2 Several box and whisker plots are used to help with visual interpretation of data. The 'box' shows the upper and lower quartiles and is typically where 50% of the values lie for each variable. The line extending from the box shows the complete range of values (minimum to maximum) across all quadrats for each site. Single points or circles show any outliers and 'crosses' depict the average value.

3.3 Human impacts, other than management etc., were only recorded once, in 2021 (a campfire site at Turfhill 2), and are not reported on further.

Table 2: Summary of change in variables from baseline (2021) to recent post-restoration monitoring (2024) at each of the four sites.

Variable		Sites							
		Denny (2021)	Denny (2024)	Dunces Arch (2021)	Dunces Arch (2024)	Turfhill 1 (2021)	Turfhill 1 (2024)	Turfhill 2 (2021)	Turfhill 2 (2024)
Plant species richness (median no. of species present within the quadrats ± interquartile range)		8 (6.25-11)	14 (11.25-16)	10 (8-12)	11.5 (9-15)	12.5 (10-15)	12.5 (9.5-16)	6 (5-8.5)	9 (8-11.5)
Vegetation cover (%)	Mean ±SE vegetation cover	57.55 (5.07)	53.46 (4.36)	85.74 (4.2)	36.91 (3.67)	117.84 (9.96)	25.38 (2.97)	98.2 (5.77)	50.99 (4.27)
Area cover (percentage) vegetation type (median ± interquartile range):	Dwarf shrubs	3 (0-8)	1 (0.5-2)	37.5 (3.63-54.25)	10.6 (1.2-31.5)	11.1 (4-39.05)	1 (0.2-1.88)	0 (0-1.25)	0.5 (0-0.55)
	Graminoids	10.15 (3-18.33)	12.5 (6-21.75)	7.05 (2.75-28.58)	10 (2.5-19.83)	5 (2-12.5)	8.75 (3.13-21.15)	6 (3-18.5)	6 (1.75-23.35)
	Herbs	0 (0-0)	1.5 (0.5-4)	0 (0-0)	0.05 (0-9.53)	0 (0-0)	1.5 (0.7-3.1)	0 (0-0)	2 (0.6-3.75)
	Bryophytes	2 (0.63-6.5)	0 (0-0)	1.05 (0.45-2.275)	0 (0-0)	28 (8.7-58.05)	0 (0-0)	0.75 (0-3.75)	0 (0-0)
Species height (median and interquartile range)	Dwarf shrubs	5.8 (2.55-7.45)	7.5 (5-10)	11.2 (7.1-16.15)	3 (2-5)	11.2 (5.2-16.1)	15.5 (7-18.69)	11 (8.6-23)	12 (9.97-20.2)
	Herbs/grasses	4.5 (3.25-6.1)	4.1 (3.15-5)	5.2 (1.6-8.6)	3 (2-5)	9.2 (5.6-12.5)	8.7 (4.75-16.12)	7 (5.4-7.6)	7 (5.1-9.3)
	Bracken	62.6 (47.6-82.6)	36 (20.5-45)	73.2 (30.75-88.4)	47.7 (30.6-69.05)	50.3 (24-62.5)	9.8 (5.5-16.7)	54 (34.4-79.2)	9.2 (7.75-13.95)
Heather stage (% cover, median ± interquartile range):	Pioneer	100 (0-100)	100 (5-100)	40 (0-100)	40 (1-100)	0 (0-0)	0 (0-100)	0 (0-0)	0 (0-100)
	Building	0 (0-0)	0 (0-0)	0 (0-36.25)	50 (0-78.75)	0 (0-42.5)	0 (0-0)	0 (0-0)	0 (0-0)
	Mature	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-22.5)	0 (0-0)	0 (0-0)	0 (0-0)
	Degenerate	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
Physical characteristics (% cover, median ±	Bare ground	0 (0-0.5)	10 (6-23.5)	0 (0-2)	7 (3-14.5)	0 (0-0)	24.5 (10.75-67.5)	0 (0-0)	15 (7-32.5)
	Leaf litter	62.5 (37-80)	24 (14.5-43)	40 (9.25-75)	30 (7-60)	20 (11-67.5)	31 (7.75-54)	29 (20.75-52.5)	25 (14.5-38.5)

Variable		Sites							
		Denny (2021)	Denny (2024)	Dunces Arch (2021)	Dunces Arch (2024)	Turfhill 1 (2021)	Turfhill 1 (2024)	Turfhill 2 (2021)	Turfhill 2 (2024)
interquartile range):	Dung	0 (0-0)	0 (0-0.75)	0 (0-0)	0 (0-1)	0 (0-0)	0 (0-1)	0 (0-0)	0 (0-1)
	Deadwood	2 (0.5-3)	3 (0.75-5.5)	0 (0-3)	6 (2-11.75)	0 (0-3)	5 (2.25-7.75)	0 (0-2)	7 (3-14)

Species richness

3.4 Figure 1 (below) shows the difference in species richness across all four sites pre and post restoration.

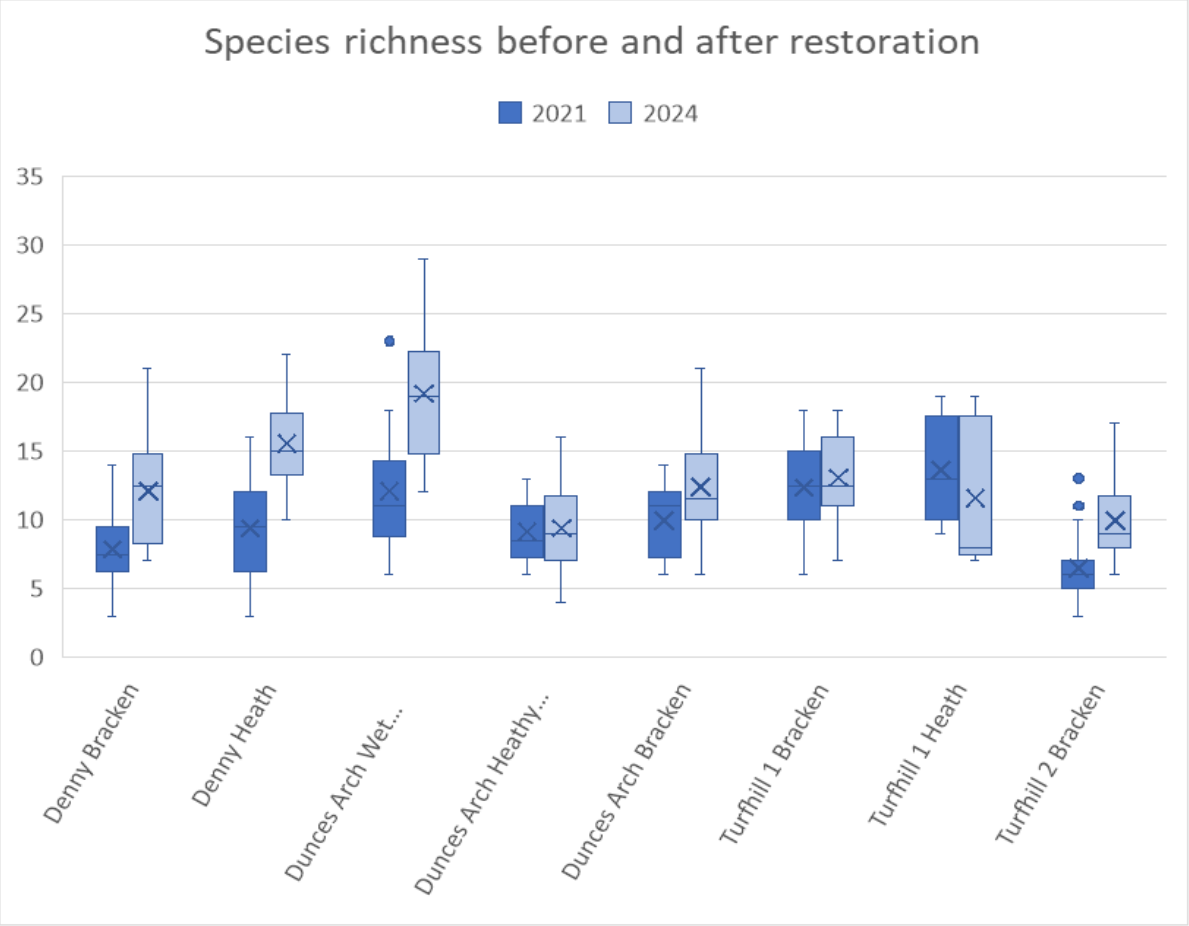

Figure 1: Species richness in different community types at all sites following restoration

3.5 Overall, species richness significantly increased post-restoration (2024) (Kruskall Wallis, H = 38.09, DF = 1, P = 0.000). The median total count had increased by 33% from 9 (interquartile range 7-10) in 2021 to 12 (interquartile range 9-15.5) in 2024. There was some variation between sites and communities, with Denny (which has had the longest post-recovery period) and then Dunces Arch wet heath plus Turfhill 2 bracken showing the greatest difference, but little difference seen at Turfhill 1 (see Figure 1).

3.6 Tables in Appendix 3 show the change in species within each community type at each site. Here we highlight the most consistent changes in species occurrent.

3.7 Overall, there was an increase in the frequency of less robust species. This included fine-leaved grasses such as Common Bent, Bristle Bent, Creeping Bent and the annual Early Hair-grass. Small herbs typical of heathland also increased, such as Tormentil, Sheep's Sorrel and Heath Bedstraw, with occasional new records of Heath Speedwell, Wood Sage, Procumbent Pearlwort and Lesser Trefoil. There was a consistent increase in Pill Sedge across all sites and the occasional appearance of Yellow Sedge and Green-ribbed Sedge. Heath and Field Woodrush generally increased, while occasional records of Hairy Woodrush (a species typical of shady places) decreased.

3.8 Overall, species typical of disturbed conditions also increased, including Bulbous Rush, Toad Rush and Foxglove and, on wet heath, both Round-leaved and Oblong-leaved Sundew. Climbing Corydalis, a woodland species typical of clearings and felled areas, also appeared in 2024.

3.9 There was a consistent decline in the frequency of the woodland ferns Broad-leaved Buckler-fern and Narrow Buckler-fern, while there were occasional new records of Royal Fern. Bracken remained ubiquitous.

3.10 There was a notable switch from the moss *Polytrichum formosum* (a woodland species typical of banks) to *P. juniperinum* and *P. commune*, species typical of open conditions. On wet heath, there was an increase in some bogmoss species, while others were recorded less frequently. This may be an artefact of the small number of wet heath quadrats included in the analysis for consistency between years (10 quadrats were recorded in 2024, which will make future comparisons more robust). Changes in other mosses were less consistent and records of liverworts were too few to show a trend.

3.11 In general, few lichens were recorded. However, there was a clear decline in the occurrence of *Cladonia coniocraea (*typical of rotting stumps in woodland), although new species included *Cladonia pyxidata* and *Cladonia pocillum*.

3.12 Change in the occurrence of dwarf shrubs was more variable and depended on the initial community and site. For example, at Denny,

which has had a longer recovery period post-restoration, Heather, Bell Heather and Cross-leaved Heath all increased in frequency in the areas that were previously dominated by Bracken, although Heather decreased a little in the areas that were more heathy pre-restoration. At Dunces Arch, the frequency of Heather decreased in previously more heathy Bracken-dominated areas, but, together with Dwarf Gorse, increased in areas that were overall more Bracken dominated prior to restoration. At Turfhill 1 and 2, ericoids decreased in frequency throughout. The frequency of Bog Myrtle remained fairly constant at Dunces Arch, where it was more abundant, but decreased at Turfhill 2 and the heathier areas of Turfhill 1 (it was not recorded from Denny).

3.13 The frequency of broad-leaved trees seedlings increased, particularly Birch, also Willow, Rowan and occasionally Alder Buckthorn. European Gorse bushes and seedlings generally increased, with the exception of Dunces Arch.

Species cover

3.14 Total species cover includes layered species, so a higher value can indicate great complexity as well as less bare ground. Across the sites that had been restored in 2023/4, there was an overall reduction in cover (Kruskall Wallis, H = 49.97 DF = 1 P = 0.000). However, at Denny, there was the suggestion of an increase in species cover in areas that were classified as heathy before the restoration process. It should be noted that Bracken made up a large proportion of the species cover on all sites prior to restoration (see Figure 3). Figure 2 below compares the total species cover between sites (accounting for all species recorded). A detailed list of all species found pre and post restoration can be found in Appendix 2.

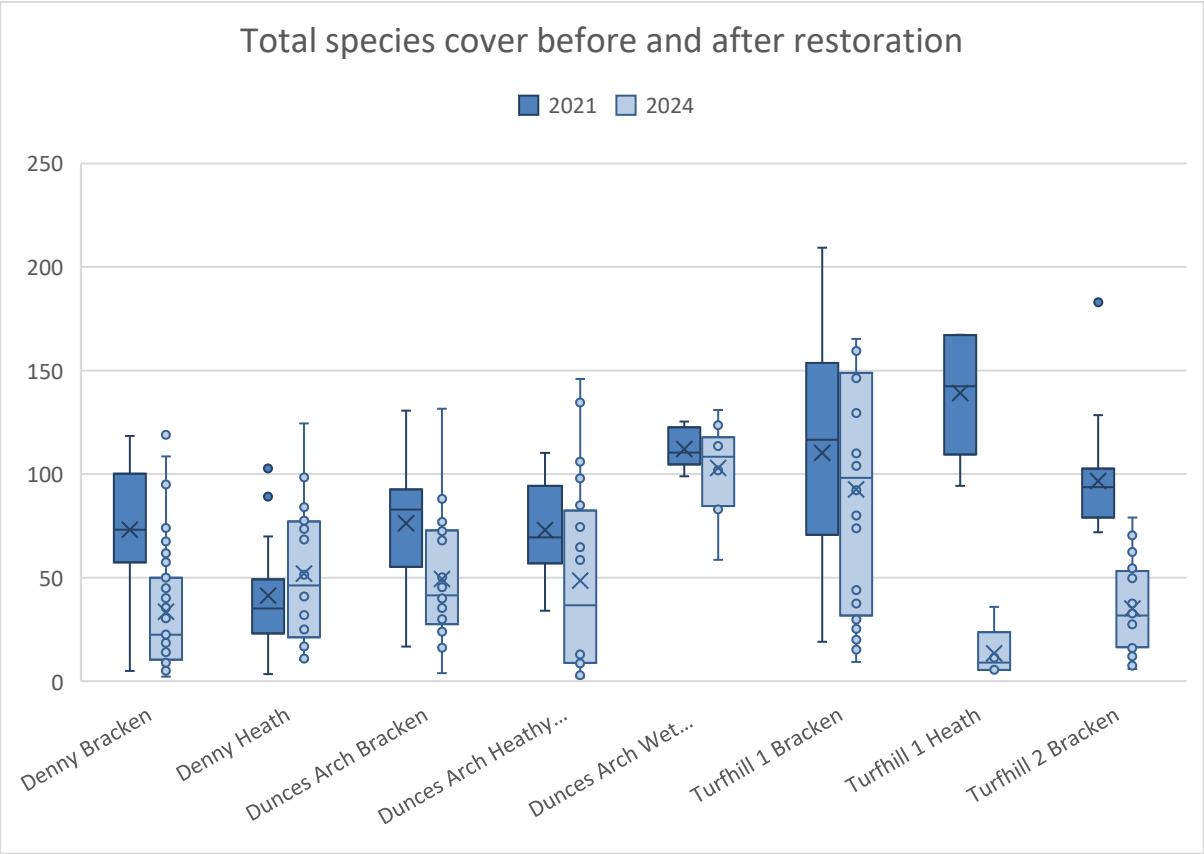

Figure 2: Change in species cover by site and community type, including all quadrats surveyed at each site.

3.15 Table 3 summarises the average percentage cover of different plant groups recorded pre-restoration in 2021 and post-restoration in 2024. The occurrence of ferns, lichen and fungi was too low to make changes in cover meaningful, but changes in individual species are discussed under species richness above.

3.16 Figure 3 depicts the general trend in the cover of graminoids, herbs, bryophytes, dwarf shrubs, understory trees and shrubs and Bracken across sites. There is a clear decline in Bracken (pre restoration median 30%, post restoration median 3%; Kruskall Wallis H = 15.44 DF = 1 P = 0.000) despite a substantial range in 2024. The overall cover of dwarf shrubs also decreased (pre restoration median 5.2%, post restoration median 1%; Kruskall Wallis H = 10.63 DF = 1 P = 0.003) as did that of bryophytes, although this was very low in both years (pre restoration median 2 %, post restoration median 0%; Kruskall Wallis H = 99.36 DF = 1 P = 0.000). The cover of understory trees and shrubs

also decreased (pre restoration median 4 %, post restoration median 1.5%; Kruskall Wallis H = 20.15 DF = 1 P = 0.000) .

3.17 There was a slight increase in the cover of herbs, although cover remained very low (pre restoration median 0 %, post restoration median 1%) (H = 70.63 DF = 1 P = 0.000). There was also an overall increase in graminoids (median 7 to median 11.85; H = 4.97 DF = 1 P = 0.026).

Figure 3: Changes in the cover of different plant groups pre (2021) and post (2024) restoration.

Table 3: Median values (with interquartile range) for the % cover of species groups in previously Bracken- dominated, heathy and wet heath areas pre-restoration (2021) and post-restoration (2024).

Variable	Heath		Heathy Bracken		Bracken		Wet Heath	
Year	**2021**	**2024**	**2021**	**2024**	**2021**	**2024**	**2021**	**2024**
Dwarf shrubs	10 (4.05-21)	1 (0.5-2.25)	52.75 (42-65.78)	2.5 (0.53-18.75)	1.05 (0-5.15)	0.6 (0.5-2)	50 (43.75-56.25)	35 (28.5-43)
Graminoids	11 (2.55-16.15)	14.1 (11.25-29.25)	4 (0.5-11.5)	2.1 (1-6.88)	6.5 (2.03-15)	8.5 (3-18.5)	45 (37.4-55.58)	32.35 (30.50-34.32)
Herbs	0 (0-0)	2 (1-4.75)	0 (0-0)	0 (0-9.08)	0 (0-0)	1 (0-2.75)	1 (0.5-2.25)	0.25 (0.10-1.05)
Bryophytes	8 (1.5-19)	0 (0-0)	1 (0.5-1.875)	0 (0-0)	2 (0.5-8.3)	0 (0-0)	3.05 (0.425-5.5)	14.0 (5-26.28)
Scrub	2.1 (0.75-4.6)	2 (1.5-3.25)	4.6 (3.05-10.13)	1.25 (0.125-2.375)	4.1 (1-6.83)	1.5 (0.5-2.85)	3.75 (1.55-10.25)	1.6 (0.63-6.83)
Bracken	0 (0-8.5)	5 (0.25-42)	0 (0-2.25)	21 (0-55.5)	60 (38.75-78)	2 (0-20)	0.05 (0-9)	31 (2-60)

3.18 The cover of different species groups varied between community types and sites following restoration. For example, there was a greater increase in graminoids at Denny and Turf Hill 2 (although both had large range in percentage cover of graminoids, both compared to other sites and to the baseline monitoring in 2021). Dunces Arch and Turfhill 2 saw the greatest increase in herbaceous species, but Dunces Arch also saw a decrease in the cover of graminoids on wet heath.

Vegetation height

3.19 There were some changes in vegetation height (Figure 4). Note that this was a measure of volume (using a drop disc of known weight), rather than the greatest height.

3.20 Most noticeably, there was a significant decrease in the height of Bracken (pre-restoration median 58.10, post restoration median 23, Kruskall Wallis H = 50.07 DF = 1 P = 0.000). This was strongly driven by the Bracken-dominated areas, with Heathy Bracken showing a contrasting trend (Table 4 and Figure 5).

3.21 The reduction in height of the Bracken canopy did not result in a significant overall increase in height of other plant groups. There was an overall decrease in the height of cryptograms (pre-restoration median 2.2, post restoration median 1; Kruskall Wallis H = 8.68, DF = 1 P = 0.003). This is likely to be associated with the replacement of well-established, spongy mats of bryophytes with smaller, younger shoots.

3.22 There was no significant change overall in the height of herbs and graminoids (which were measured together), with a varying trend between sites and community types – in contrast to the other sites, there was an apparent increase in height at Dunces Arch and within the heathy community at Denny. There was no overall change in the height of dwarf shrubs, with a decline in wet heath and heathy bracken and an increase in bracken-dominated communities.

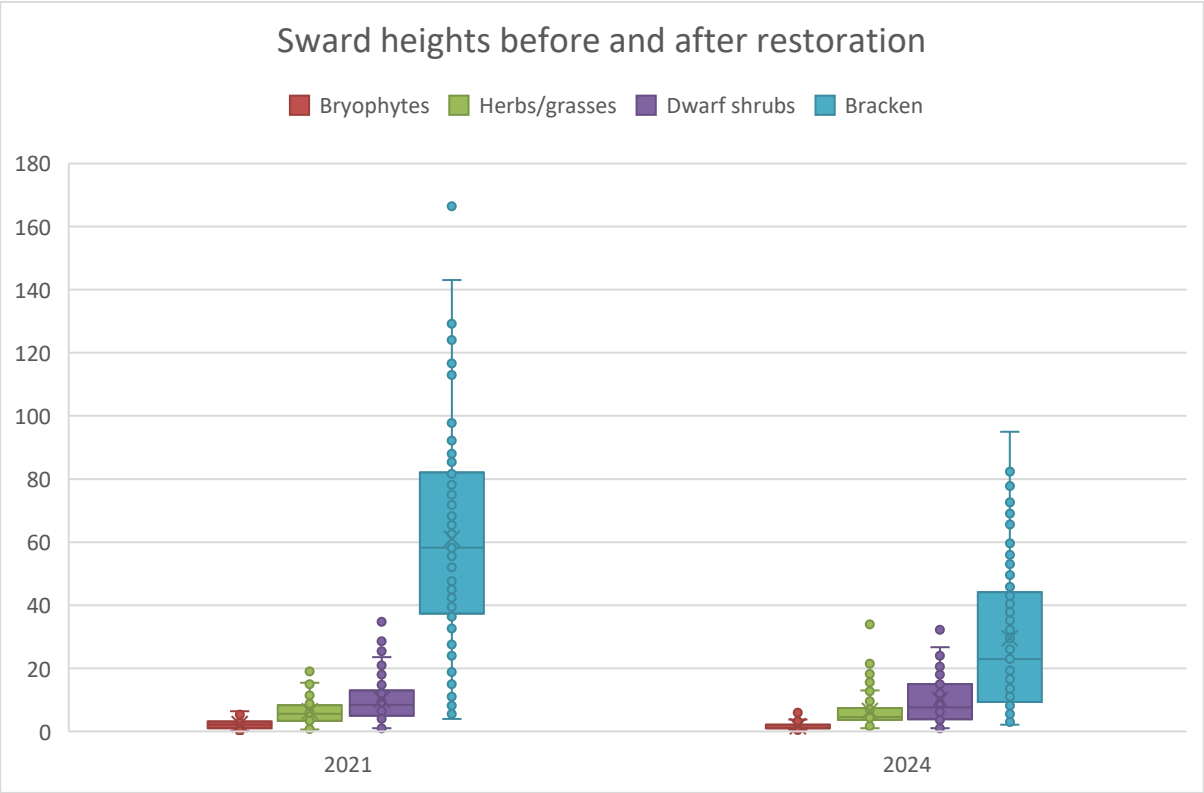

Figure 4: Changes in the height of different plant groups pre (2021) and post (2024) restoration.

Table 4: Median values (with interquartile range) for the height of different plant groups pre (2021) and post-restoration (2024).

Variable	Heath		Heathy Bracken		Wet Heath		Bracken	
	2021	**2024**	**2021**	**2024**	**2021**	**2024**	**2021**	**2024**
Bracken	27.6 (15.8-47.8)	28.58 (16.94-43.75)	40.6 (26.55-64.1)	56 (45.8-69)	52.2 (35.5-83.7)	49.6 (41.4-71.5)	65.4 (45-83.2)	14.1 (8-30.9)
Dwarf shrub	6.8 (4.35-8.05)	7.5 (5.5-13)	9.2 (6.9-12.5)	3 (2.08-4.67)	21.6 (18.15-27.1)	2.9 (1.375-3.45)	8.6 (4.2-12.9)	11.27 (7.3-18)
Graminoid & herb	4.7 (4-6.2)	4.2 (3.8-5)	3.4 (1.6-5.4)	4.37 (3.49-12.9)	10.5 (1.8-15.2)	4 (3-4.6)	6 (4.1-8.5)	4.8 (3.6-9)
Bryophytes	2.8 (1.7-3.95)	1 (1-2.1)	1.5 (0.6-2.2)	1 (1-1.75)	1.2 (0.43-2.4)	1.17 (1-2.75)	2.4 (1.2-3.2)	1.5 (1-2.2)

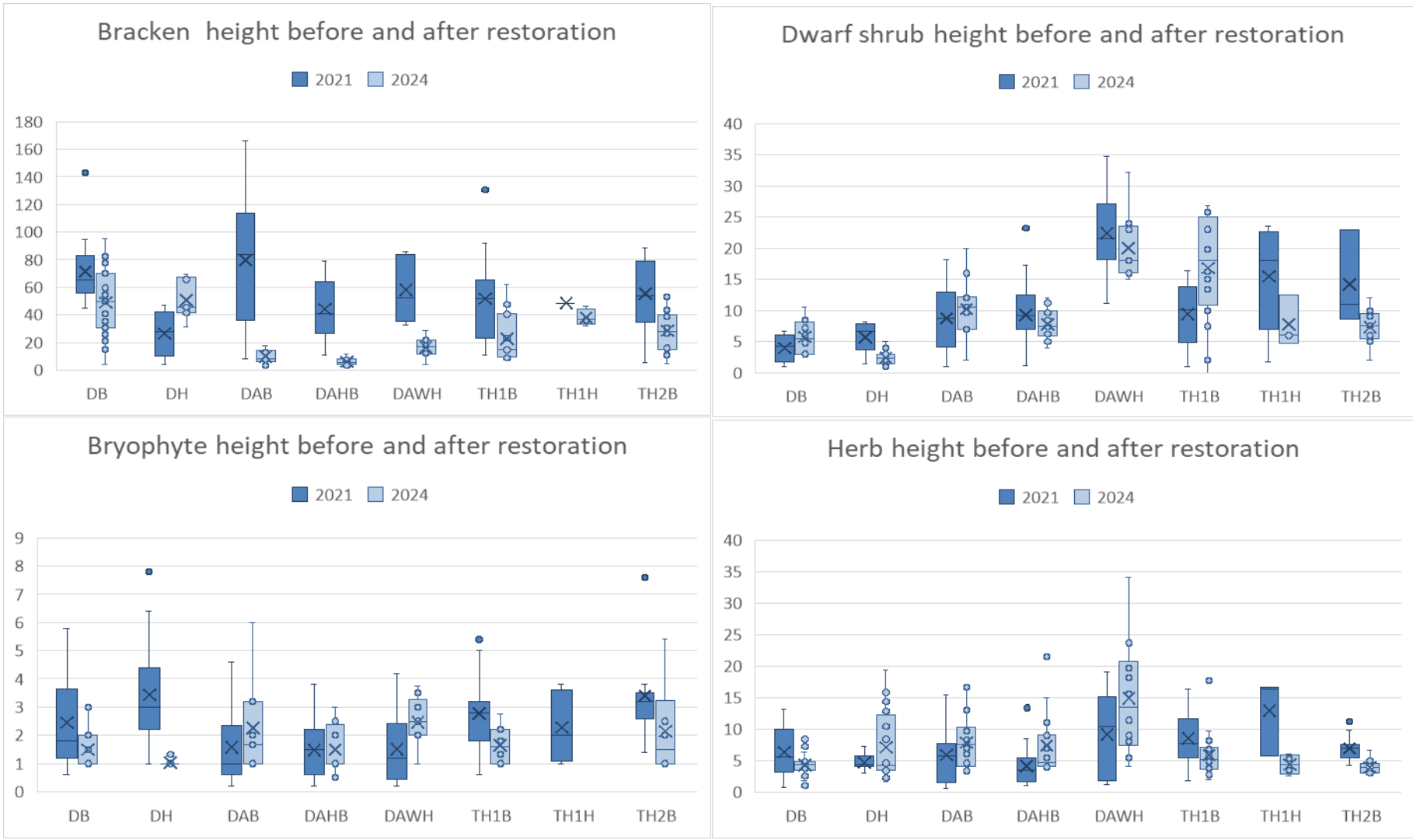

Figure 5: Height of different plant groups between years in Denny bracken (DB) and Heath (DH), Dunces Arch bracken (DAB), heath (DAB) and wet heath (DAWH), Turfhill 1 bracken (TH1B), Turfhill 1 heath (TH1H), Turfhill 2 bracken (TH2B).

Physical variables

3.23 Overall, there was a significant increase in the cover of bare ground (pre-restoration median 0, post restoration media 10; Kruskall Wallis H = 181.87 DF = 1 P = 0.000). There was a significant decrease in both the cover and depth of leaf litter (cover pre-restoration median 45, post restoration median 26; Kruskall Wallis H = 17.39 DF = 1 P = 0.000; depth pre-restoration median 4, post restoration media 0, Kruskall Wallis H = 120.4 DF = 1 P = 0.000), although there was variation between sites, with a noticeable increase in litter on wet heath at Dunces Arch and at Turfhill 1. Unsurprisingly, there was an increase in the cover of deadwood (see Table 2) and also in dung (H = 18.66 DF = 1 P = 0.000), particularly on wet heath.

Table 5: Overall differences in the cover of bare ground and the cover and depth of leaf litter before and after restoration.

Variable	Heath		Heathy Bracken		Wet Heath		Bracken	
Year	2021	2024	2021	2024	2021	2024	2021	2024
% Bare ground	0 (0-2)	16 (7.5-45.5)	0 (0-2)	12 (4.25-27)	2.5 (1.5-5.25)	11 (6.25-22.5)	0 (0-0)	9 (5-22)
% Leaf litter	65 (55-80)	33.5 (12-52)	37.5 (16-53.75)	26.5 (7.5-44.25)	2.5 (0-3.5)	28 (22.5-45.75)	45 (20.75-80)	25 (8-50)
Depth of leaf litter (cm)	4 (2.6-5.3)	0 (0-0.5)	2.6 (1.85-3.35)	0.5 (0-2.375)	1.7 (0-2.65)	1.5 (0-3)	5 (3-10.3)	0 (0-1.5)
% Dung	0 (0-0)	0 (0-0.5)	0 (0-0)	0 (0-1)	0 (0-0)	0.25 (0-1)	0 (0-0)	0 (0-1)
% Deadwood	3 (2-7)	4 (1.5-7.5)	2.5 (0-4)	1.5 (0.5-5.75)	0 (0-0.13)	4 (1-8.25)	0 (0-2)	6 (3-10)

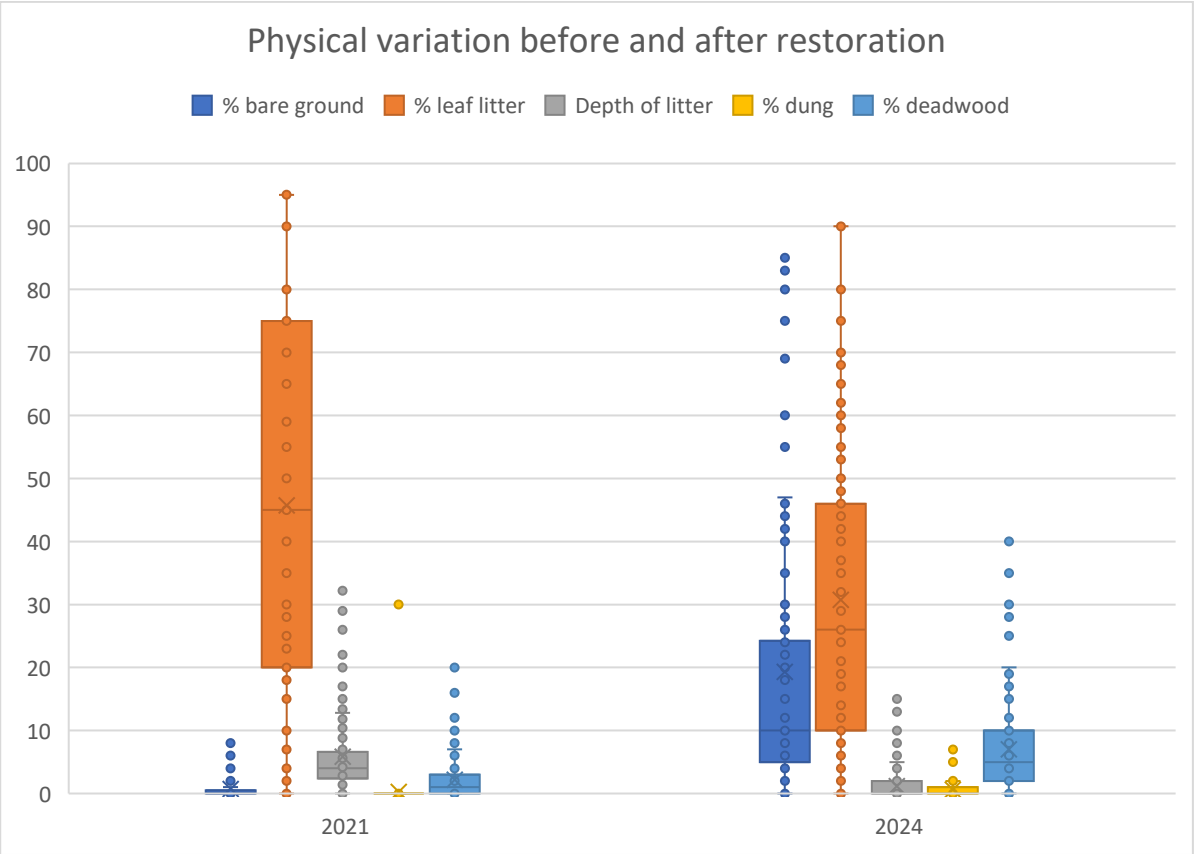

Figure 6: Changes in the cover of bare ground and leaf litter and the depth of litter and cover of dune and deadwood pre (2021) and post (2024) restoration.

3.24 There were also changes in the structural phases of Heather, with a greater proportion of Heather categorized as pioneer post-restoration in 2023 and a smaller proportion as mature (but note that sample sizes were very small as there was often little Heather recorded) (see Figure 7). Degenerate heather was not recorded in 2021 or 2024.

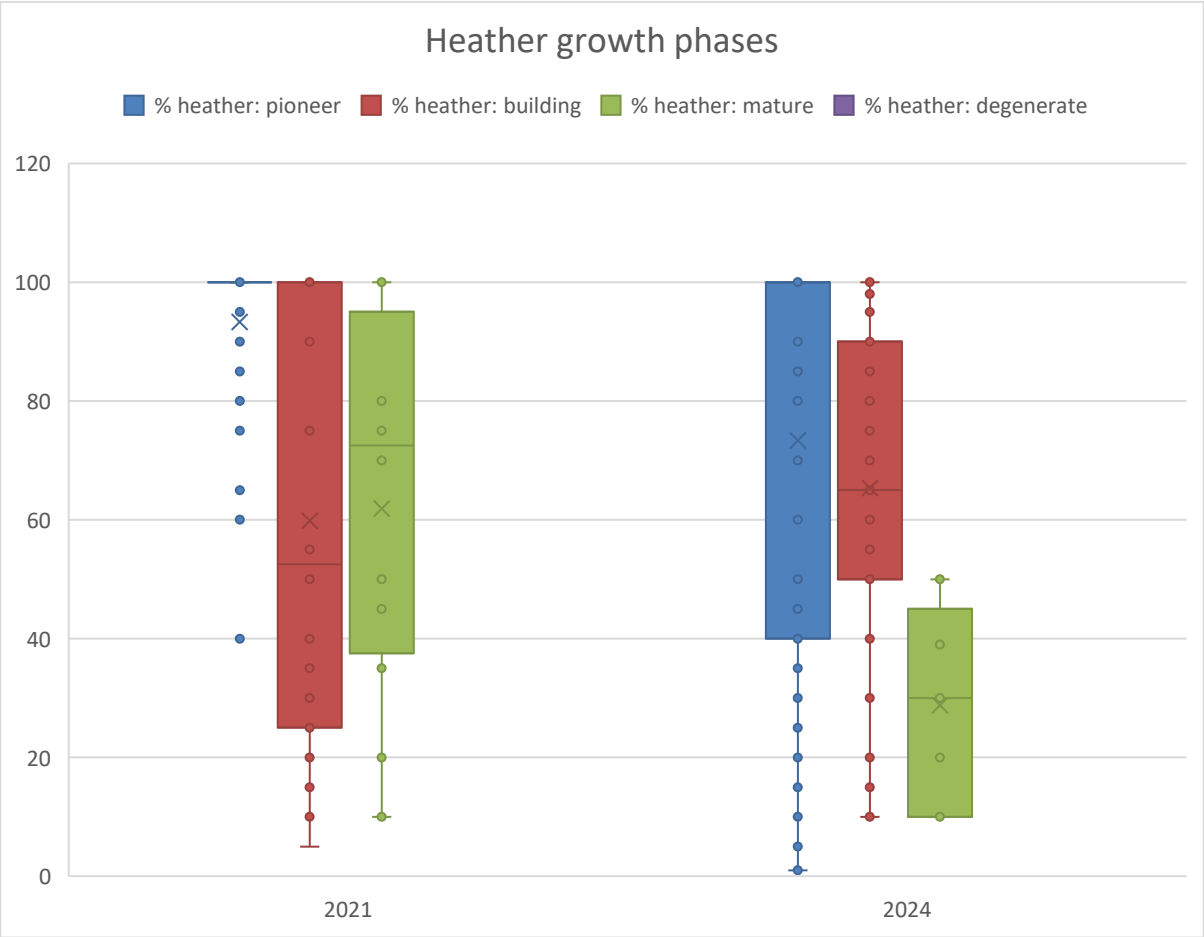

Figure 7: The % of Heather that fell within different growth phases in 2024 compared to 2021 across all sites.

Site summaries

3.25 In this section, a summary description highlighting key changes is provided for each site. More detailed information on the change in species occurrence can be found in Appendix 2.

Denny

Community type	Pre-restoration	Post-restoration
Bracken	Thick, tall Bracken under a canopy of Corsican Pine. There was very occasional Purple Moor-grass and Heather, with a little Bell Heather towards the edges and some low-growing Bramble and occasional ferns.	Total vegetation cover decreased but these areas were still characterised by patchy dense Bracken with varying amounts of Purple Moorgrass and frequent but small amounts of Early Hair-grass, other fine grasses such as Common Bent and Pill Sedge. There was a corresponding increase in the area of bare ground which had been colonised by species such as Toad Rush, Bulbous rush and Foxglove, also small herbs at low frequency. Heather and Birch seedlings were also frequent (but at very low cover), as were bryophytes. Bramble and Gorse were also frequent at low cover. Overall, diversity increased.
		

Community type	Pre-restoration	Post-restoration
"Heath"	Open areas with less Bracken supported either occasional building phase Heather over pine needles with Purple Moor-grass, or denser vegetation of the same species. Shallow ridges running across the site often supported cushions of moss, e.g. *Polytrichum formosum.*	Both the cover and height of Bracken increased overall, while Heather had decreased. However, the diversity of graminoids and herbs had increased with several new species including small heathland herbs such as Sheep Sorrel, Tormentil, Heath Bedstraw, annual grasses (Early Hair-grass, Squirrel's-tail Fescue) and other fine grasses. The occurrence of both European and Dwarf Gorse also increased. There was a notable switch from *P. formosum* to *P. juniperinum*.
Quadrat 45, showing a "heathy" area in 2021 dominated by pine litter with a little building-phase heather and in 2024, with Sheep Sorrel, Foxglove, fine grasses and Tormentil.		

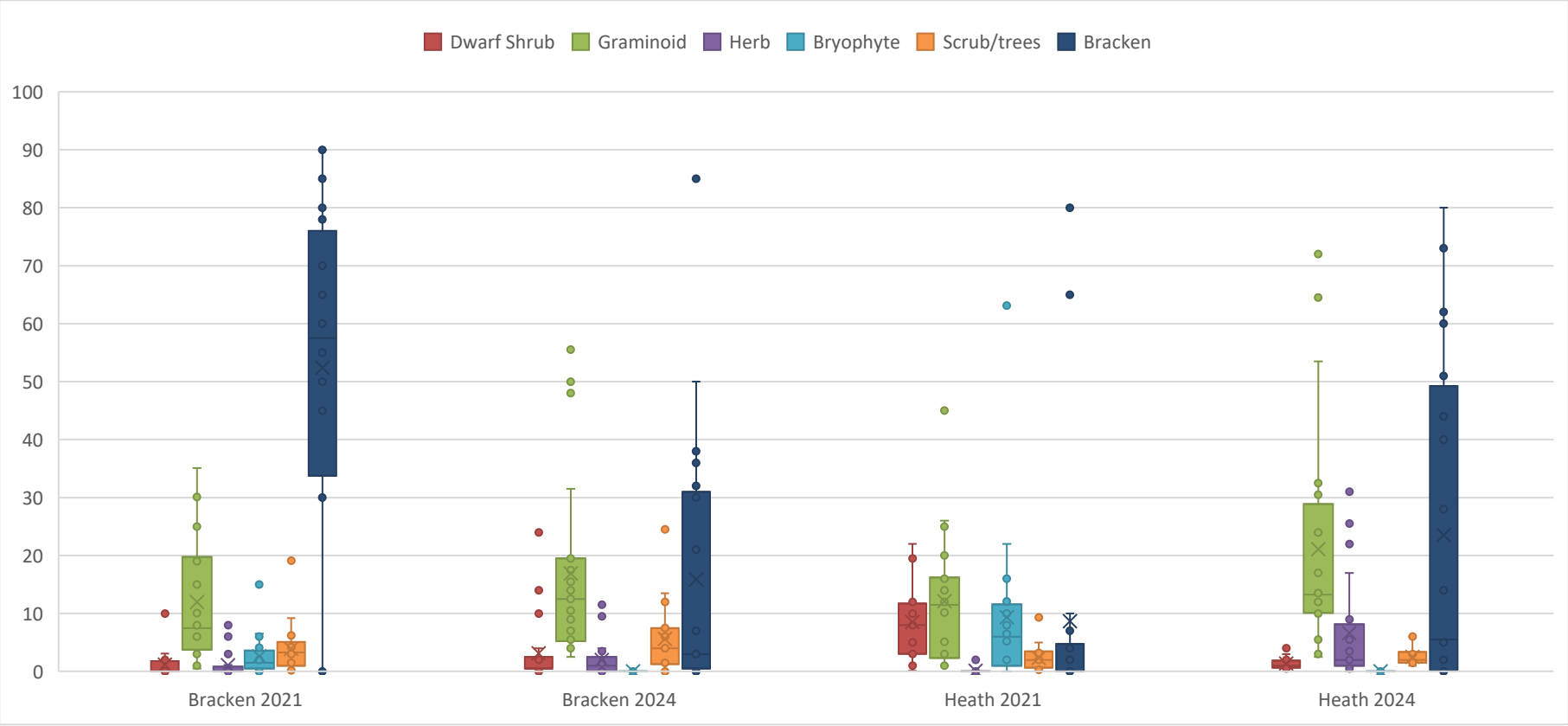

Figure 8: Species cover within areas originally identified as Bracken, Heathy Bracken or Wet heath in 2021 and 2024 at Denny.

Dunces Arch

Community type	Pre-restoration	Post-restoration
Wet Heath	Wetter areas with an open tree canopy and sparse Bracken along the southern boundary were notably more diverse than other areas, with characteristic wet heath species including Cross-leaved Heath and bog mosses and a higher cover of graminoids (mostly Purple Moor-grass) than elsewhere on the site.	Characterised by grazed Purple Moor-grass and Heather and Cross-leaved Heath with frequent (but not abundant) bog mosses and occasional characteristic wet heath species such as Deergrass, also young scrubby Birch. Wet Heath species characteristic of bare ground, such as Round-leaved and Oblong-leaved Sundew increased, as did Willow seedlings. Overall, the cover of dwarf shrubs became more variable, while that of bryophytes increased notably as did species richness.
Quadrat 48, in 2021 with a closed sward of Cross-leaved Heath and Purple Moor-grass with Bracken and trees nearby and nearby in 2024, with similar species but a more open, disturbed sward		

Community type	Pre-restoration	Post-restoration
Heathy Bracken	Drier open patches were present in a series of interlinked “glades” in the Bracken (with a fairly consistent coniferous canopy). These supported varying amounts of young (mostly building-phase) heather.	Overall, the cover of Bracken increased in the areas that were previously most open, with a sparse Bracken canopy over regenerating mosses and Heather, including some remnant mature Heather and young Cross-leaved Heath and Bilberry. Overall, Heather cover decreased. Very occasional small herbs including Tormentil, Procumbent Pearlwort. Fine grasses such as Velvet Bent, Bristle Bent, Creeping Bent and Wavy Hair-grass increased in frequency, as did sedges and annual rushes.
Quadrat 30 in 2021, with discrete patches of young Heather interspersed with mosses and pine litter and in 2024, with grazed Purple Moor-grass, scattered Heather and Birch seedlings and felling debris		

Community type	Pre-restoration	Post-restoration
Bracken	The majority of the site supported dense, tall Bracken with a poor ground flora and thick litter. There was some Rowan and Silver Birch in the understorey.	The overall cover of Bracken declined. Some areas still supported thick Bracken while more open areas showed an increase in dwarf shrubs and graminoids with a little grazed Purple Moor-grass and pioneer Heather seedlings, and pine and birch seedlings. Some species typical of woodland including Holly, Ivy, ferns and some cryoptograms (such as *Cladonia coniocraea* and *Polytrichum Formosum*) decreased, while the frequency of small herbs (as above) increased, together with sedges and annual rushes, resulting in an increase in diversity. There was a notable decrease in the depth of leaf litter.
		

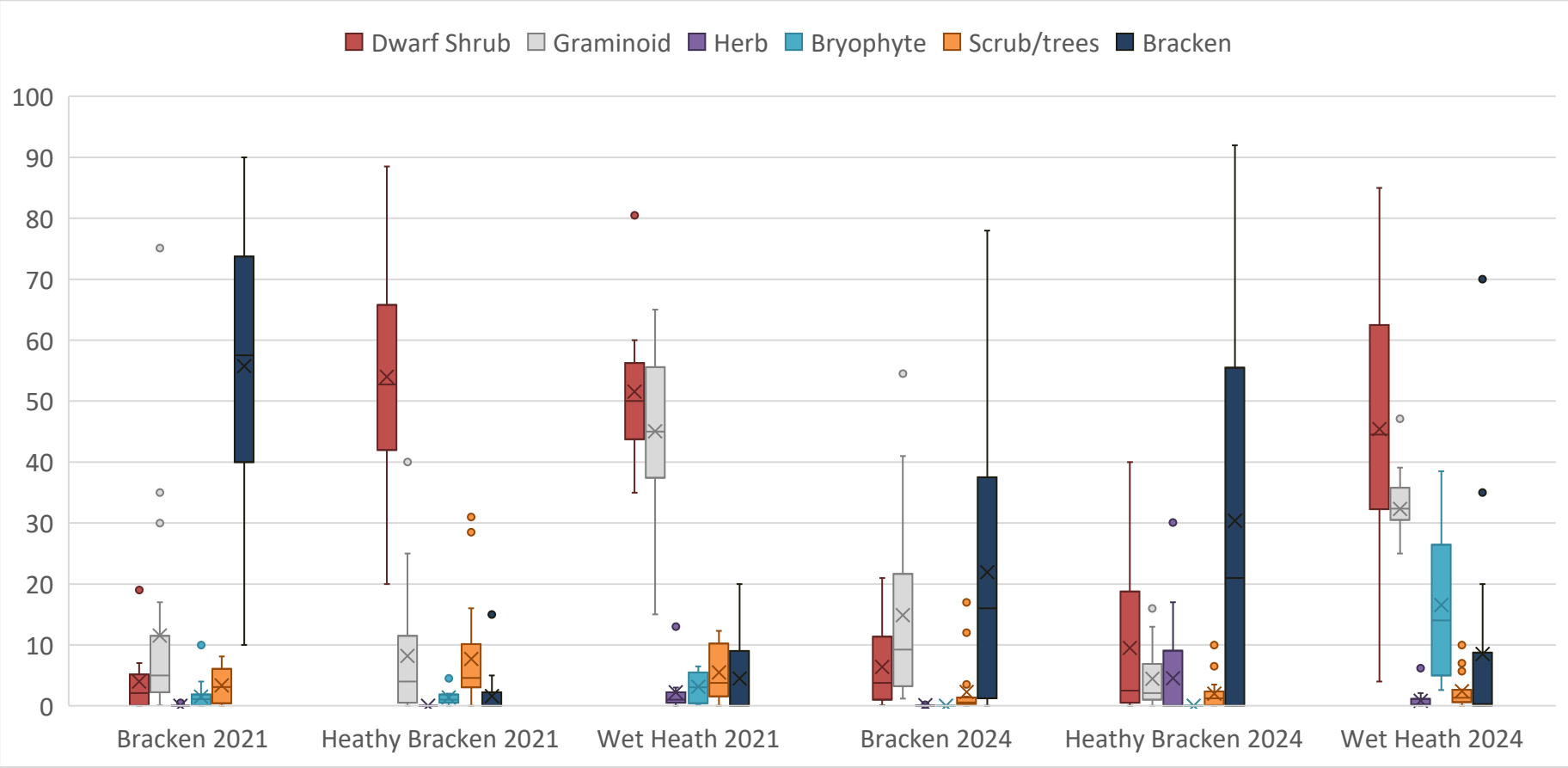

Figure 9: Species cover within areas originally identified as Bracken, Heathy Bracken or Wet heath in 2021 and 2024 at Dunces Arch.

Turfhill 1

Community type	Pre-restoration	Post-restoration
Bracken	A mosaic of thick Bracken under a more or less continuous canopy. There were some more open areas with Heather, Cross-leaved Heath and Bilberry. Birch regeneration was common in the understorey in the eastern corner, and Holly was occasional. In some small areas there was a mossy groundflora.	Variable cover of Bracken (driving the greater range of vegetation cover overall) with abundant (and increased) litter cover. Cover of most species groups decreased. Bilberry, pioneer Heather, birch and Holly seedlings were recorded, with a little Tormentil and Heath Bedstraw present in the north-eastern end while Sheep's Sorrel was more frequent. There were some extensive bare patches. There was a slight increase in overall species richness with new records for species such as Early Hair-grass, perennial fine grasses, Climbing Corydalis, Heath Cudweed, Sheep's Sorrel, Bristle Club-rush Pill Sedge, Heath Woodrush, and species indicative of disturbance such as small annual rushes and Foxglove. Cover of bryophytes decreased notably.
Quadrat 5 in 2021, with dense Bracken under a pine canopy. In 2024, the Bracken was patchier and shorter and bare areas supported occasional Purple Moor-grass, Wavy Hair-grass, Foxglove seedlings and Heath Woodrush.		

Community type	Pre-restoration	Post-restoration
"Heath"	Towards the southern boundary where the Bracken was shorter a small, marginally more diverse area of heathier vegetation was recorded.	Total vegetation cover reduced markedly, particularly due to reductions in the area of Bracken and dwarf shrubs. Many areas were largely bare, with much lying deadwood and small amounts of Purple Moor-grass, Common Bent, pioneer Heather and frequent annual rushes in damp hollows. There was however an increase in the cover of herbs and graminoids and bare areas supported some Tormentil and occasional Early Hair-grass and very occasional small herbs such as Bird's-foot. Birch seedlings and saplings were also new species. The cover of litter remained high. As in the Bracken areas, there was little change in species richness.
"Heath" quadrats in 2021 showing patchy Heather and litter under a pine canopy and in 2024, with sparse grasses and Heather.		

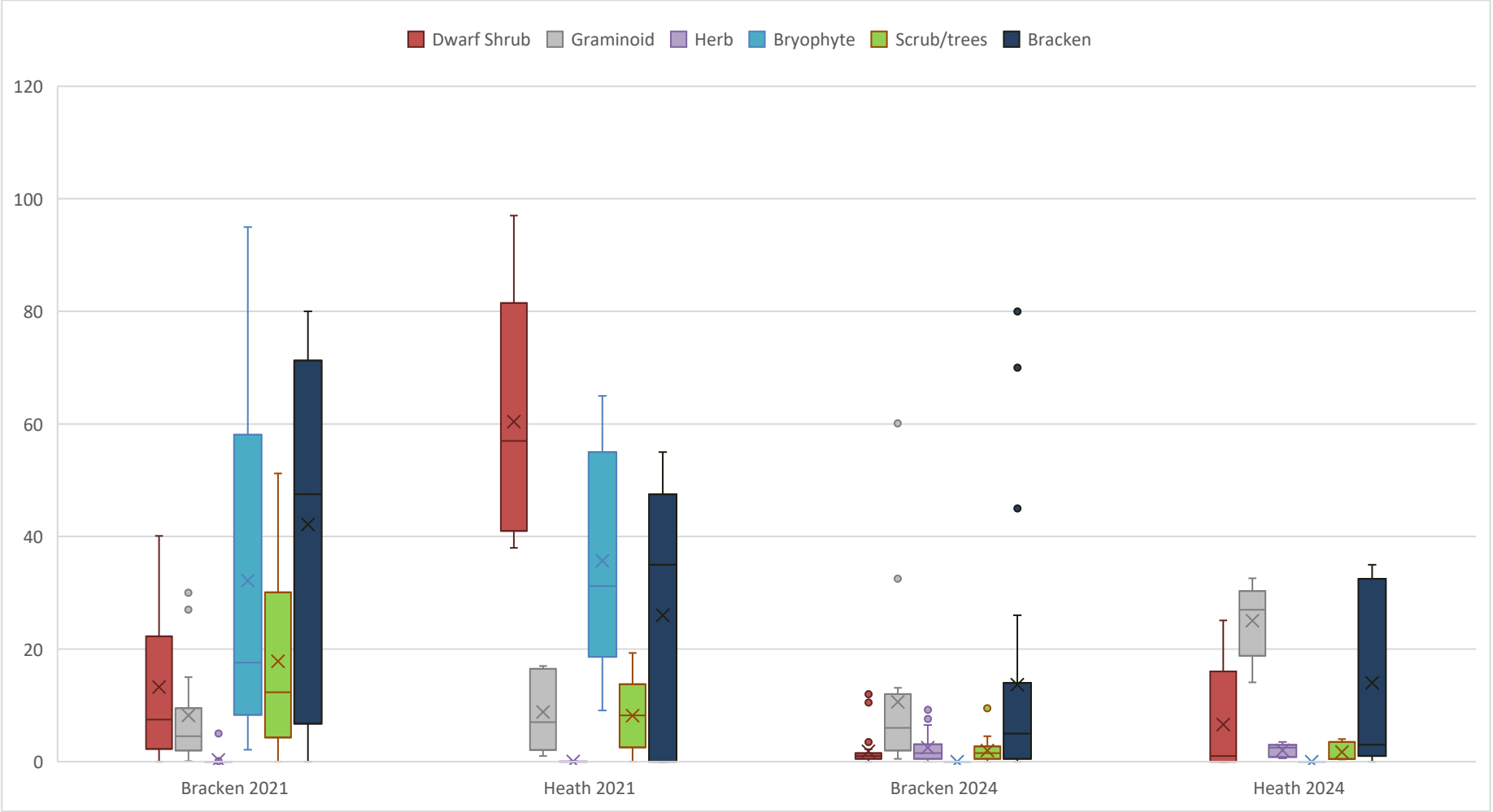

Figure 10: Species cover within areas originally identified as Bracken, and "Heath" in 2021 and 2024 at Turfhill 1.

Turfhill 2

Community type	Pre-restoration	Post-restoration
Bracken	Characterised by a thick, tall ground flora of Bracken with a little Purple Moor-grass and Bilberry under a continuous coniferous canopy, This site was fairly uniform and with a deep litter layer. The only notable instance of human impact was observed here (a campfire site).	Overall, vegetation cover decreased. The slope remained largely dominated by Bracken but this decreased in height as well as cover. Both graminoid and dwarf shrub cover remained very low, with occasional Purple Moor-grass and Bell Heather. Although the cover of leaf litter remained high, its depth appeared to have decreased. Species richness increased overall due to the increase in small heathland herbs (Tormentil, Sheep's Sorrel, Procumbent Pearlwort). At the foot of the slope, species characteristic of wetter conditions were recorded, including Deergrass and several species of Bog moss.
Quadrat 19, with dense Bracken under a pine canopy in 2021 and shorter, patchier Bracken interspersed with litter with some Purple Moor-grass and very small amounts of Tormentil and Heather in 2024		

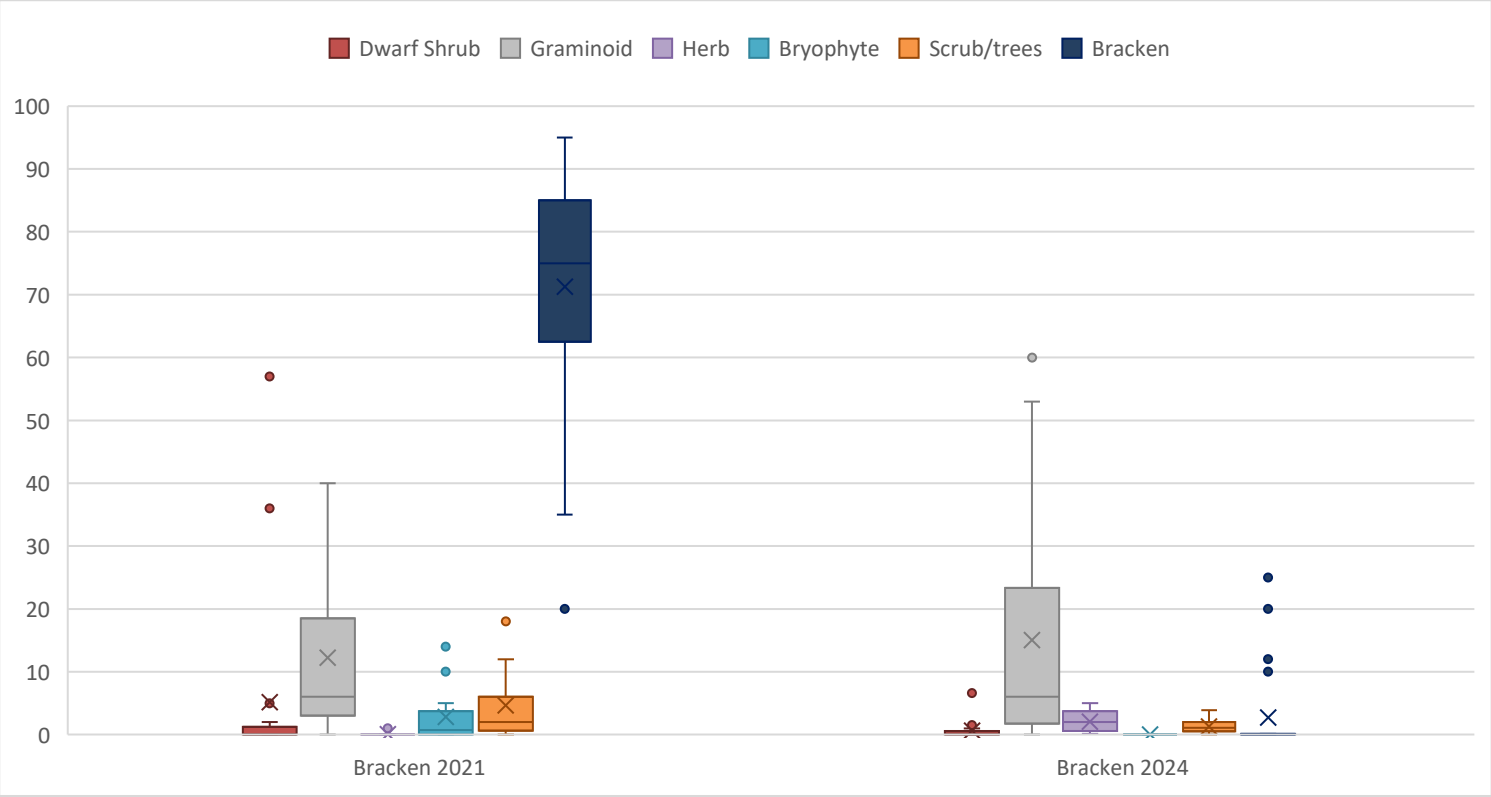

Figure 11: Species cover at Turfhill 2 in 2021 and 2024.

4. Conclusions

4.1 Heathland restoration from forestry involves techniques that are highly disturbing to the ground flora in the short term. Consequently, the overall cover and height of plants declined after restoration, while the area of bare ground increased. The vegetation decline was largely driven by the decrease in Bracken cover, which has been dominant across the majority of all four sites. There were also decreases in the cover of dwarf shrubs and bryophytes.

4.2 Despite the overall reduction in vegetation cover, there was a small but significant increase in the cover of herbs and graminoids. This was related to an increase in the occurrence of grasses and small herbs that are typical of heathland and acid grassland. Unsurprisingly, there was also an increase in species typical of disturbed conditions such as Foxglove and small annual rushes (note that nutrient-loving ruderals such as Nettle, Cleavers etc. were not recorded). There was a corresponding decline in the frequency of some typical woodland species, for example ferns and woodland mosses.

4.3 In addition to an increase in bare ground, structural changes included an overall reduction in both the cover and depth of litter, and a related change in Heather structure. While the proportion of mature heather declined, there was a notable increase in the proportion of pioneer Heather (although the overall cover was low). This included seedling Heather. Heather generally forms a strong seedbank and seeds can germinate when they are exposed through disturbance. On the restoration sites, regeneration from the seedbank (as opposed to vegetative layering) may lead to a Heather sward with greater degree of vitality (Schellenberg & Bergmeier, 2022).

4.4 There were some differences between the different vegetation communities. While Bracken decreased in the areas that were previously heavily Bracken-dominated, there was a noticeable trend for an increase in Bracken cover within the “heathy” areas. A different response was also seen in the wet heath areas (which were only

present on Dunces Arch), where there was a notable increase in the cover of bryophytes and a decrease in the cover of graminoids. The area appears to be attractive to ponies, with many observed during field work in 2024 and a corresponding increase in the cover dung; an increase in grazing pressure may have contributed to the decline in graminoid cover.

4.5 In conclusion, the restoration work carried out prior to the 2023 monitoring has resulted in a more sparse, shorter sward of Bracken with frequent patches of bare ground, although there was some increase in Bracken on previously “heathy” areas. The cover and species-richness of graminoids and herbs has increased slightly, while the cover of bryophytes increased on wet heath. While the cover of dwarf shrubs had decreased, there have been changes in the age structure, with a greater proportion of young heather. There is some indication (through the increase in the cover of dung) that grazing pressure may have increased.

4.6 At Denny, the restoration was carried out a year earlier (in 2022), and heathland recovery is a little more advanced. For the remaining three sites, this is the initial phase of an ongoing monitoring programme carried out the same year as restoration work. Future monitoring will show how the heathland vegetation recovers following the removal of the coniferous canopy.

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Appendix 1 – Species recorded

Table 6: Species recorded pre-restoration in 2021 and post-restoration in 2024 across all sites organised by plant group. Note that tree species were in the understorey rather than the canopy, which was not recorded.

Plant group	Pre-restoration	Post-restoration
Bryophytes	*Campylopus introflexus* *Dicranella varia* *Dicranium heterophylla* *Dicranium scoparium* *Diplophyllum albicans* *Drosera rotundifolia* *Hypnum jutlandicum* *Kindbergia praelonga* *Leucobryum glaucum* *Liverwort sp.* *Lophocolea bidentata* *Lophocolea heterophylla* *Pleurozium schreberi* *Polytrichum formosum* *Polytrichum juniperinum* *Pseudoscleropodium purum* *Pseudotsuga menziesii* *Rhytidiadelphus loreus* *Sphagnum compactum* *Sphagnum denticulatum* *Sphagnum inundatum* *Sphagnum papillosum* *Sphagnum tenellum* *Thuidium tamariscum*	Acrocarpous moss *Bryum sp.* *Campylopus brevipilus* *Campylopus introflexus* *Dicranella heteromalla* *Dicranum scoparium* *Ditrichum sp.* *Hypnum cupressiforme* *Hypnum jutlandicum* *Kinbergia praelonga* *Leucobryum glaucum* *Pogonatum aloides* *Polytrichum commune* *Polytrichum formosum* *Polytricum juniperum* *Polytricum longisetum* *Pseudoscleropodium purum* *Sphagnum compactum* *Sphagnum cuspidatum* *Sphagnum denticulatum* *Sphagnum fallax* *Sphagnum tenellum* *Thuidium tamariscinum*
Climber	*Hedera helix* *Lonicera peryclymenum*	*Hedera helix* *Lonicera caprifolium*
Dwarf shrub	*Calluna vulgaris* *Erica cinerea* *Erica tetralix* *Ulex minor* *Vaccinium myrtillus*	*Calluna vulgaris* *Erica cinerea* *Erica tetralix* *Ulex minor* *Vaccinium myrtillus* *Veronica officinalis*
Fern	*Blechnum spicant* *Dryopteris carthusiana* *Dryopteris dilatata* *Osmunda regalis*	*Athyrium filix-femina* *Blechnum spicant* *Dryopteris sp.* *Dryopteris cartusiana* *Dryopteris dilatata* *Osmunda regalis*
Graminoid	*Agrostis capillaris* *Agrostis curtisii*	*Agrostis canina* *Agrostis capillaris* *Agrostis curtisii*

Plant group	Pre-restoration	Post-restoration
	Carex binervis *Carex pilulifera* *Danthonia decumbens* *Deschampsia flexuosa* *Juncus bulbosus* *Juncus squarrosus* *Luzula campestris* *Luzula multiflora* *Luzula pilosa* *Molinia caerulea* *Poa annua* *Rhynchospora alba* *Trichophorum germanicum*	*Agrostis stolonifera* *Aira praecox* *Carex binervis* *Carex demissa* *Carex pilufera* *Danthonia decumbens* *Deschampsia flexuosa* *Eleocharis multicaulis* *Holcus mollis* *Isolepis setacea* *Juncus bufonis* *Juncus bulbosus* *Juncus effusus* *Juncus squarrosus* *Luzula campestris* *Luzula multiflora* *Molinia caerulea* *Nardus stricta* *Poa annua* *Poa pratensis* *Pteridium aquilinum* *Trichophorum cespitosum* *Vulpia bromoides*
Herb	*Galium saxatile* *Genista anglica* *Hydrocotyle vulgaris* *Hypericum elodes* *Oxalis acetosella* *Potentilla erecta* *Rumex acetosella*	*Anagallis arvensis* *Arcticum lappa* *Coeratocapnos claviculata* *Digitalis purpurea* *Digitalis purpurea (seedling)* *Drosera Intermedia* *Drosera rotundifolia* *Galium saxatile* *Gnaphalium sylvaticum* *Hypochaeris radicata* *Ornithopus perpusillus* *Oxalis acetosella* *Pedicularis sylvatica* *Persicaria hydropiper* *Plantago coronopus* *Polygonum aviculare* *Potentilla erecta* *Rumex acetosella* *Rumex sanguineus* *Sagina procumbens* *Scorzoneroides autumnalis* *Senecio sylvaticus* *Senecio vulgaris* *Stacys sylvatica (seedling)* *Teucrium scorodonia*

Plant group	Pre-restoration	Post-restoration
		Trifolium dubium *Trifolium repens*
Lichen	*Cladonia chlorophaea* *Cladonia coniocraea* *Cladonia pyxidata* *Cladonia squamules*	*Cladonia chlorophaea* *Cladonia pocillum* *Cladonia pyxidata* *Cladonia squamoles*
Scrub	*Rubus fruticosus agg.* *Ulex europaeus* *Pinus sylvestris (g)* *Betula saplings* *Sorbus aria (g)* *Picea sp (g)* *Sorbus aucuparia (g)*	*Betula sp.* *Betula pendula* *Rubus fruticosus* agg. *Salix sp.* *Sorbus aria* *Sorbus aucuparia* *Ulex europaeus*
Tree	*Betula pendula* *Betula pubescens* *Conifer* *Fagus sylvatica* *Frangula alnus* *Ilex aquifolium* *Larix sp. (c)* *Pinus* *Pinus sylvestris* *Salix cineria* *Sorbus aucuparia* *Tsuga heterophylla*	Conifer sp. *Betula sp.* *Betula pendula* *Crataegus monogyna* *Frangula alnus* *Ilex aquifolium* *Picea sp.* *Pinus sp.* *Quercus seedling* *Rhododendron ferrugineum* *Salix sp.* *Sorbus aria* *Sorbus aucuparia*

Appendix 2

Table 7: Changes in species occurrence in quadrats recorded at Denny (1 indicates a difference of only one record)

New species	Increase in occurrence	Decrease in occurrence	Species no longer recorded in 2024
Bracken			
Early Hair-grass	Common Bent	Narrow Buckler-fern	*Cladonia coniocraea (1)*
Silver Birch	Heather	Broad-leaved Buckler-fern	*Leucobrium glaucum*
Campylopus introflexus (1)	Pill Sedge	Ivy	Wood Sorrel
Green-ribbed Sedge (1)	*Dicranium scoparium*	*Hypnum jutlandicum*	*Polytrichum formosum*
Foxglove	Bell Heather	Holly	
Common Cat's-ear (1)	Cross-leaved Heath	Pine (seedlings and saplings)	
Toad Rush	Bracken	Rowan (seedlings and saplings)	
Bulbous Rush	European Gorse		
Soft Rush			
Heath Woodrush			
Honeysuckle (1)			
Buck's-horn Plantain			
Annual Meadow-grass			
Polytrichum juniperinum			
Sheep Sorrel			
Willow sp. seedling (1)			
Heath Groundsel (1)			
Wood Sage (1)			
Lesser Trefoil (1)			
Heath Speedwell (1)			
Denny Heathy			
Creeping Bent (1)	Common Bent	Bell Heather	*Polytrichum introflexus* (1)
Early Hairgrass	Bristle Bent	Ivy	*Cladonia coniocraea*

New species	Increase in occurrence	Decrease in occurrence	Species no longer recorded in 2024
Foxglove	Birch (seedlings & saplings)	*Hypnum jutlandicum*	Broad-leaved Buckler-fern
Heath Grass (1)	Pill Sedge	Holly	Petty Whin (1)
Heath Bedstraw	*Cladonia* squamules	Pine (seedlings & saplings)	*Leucobryum glaucum (1)*
Soft Grass (1)	Bramble		Field Woodrush (1)
Common Cat's-ear	Sheep Sorrel		*Pleurozium schreberi* (1)
Toad Rush	European Gorse		*Polytrichum formosum*
Bulbous Rush	Dwarf Gorse (1)		*Pseudoscleropodium purum*
Soft Rush			Oak seedling (1)
Kindbergia praelongum (1)			Autumn Hawkbit
Heath Woodrush			
Matt Grass			
Polytrichum juniperinum			
Tormentil			
Wood Sage			
Squirrel's-tail Fescue (1)			

Table 8: Changes in species occurrence in quadrats recorded at Dunces Arch (1 indicates a difference of only one record)

New species	Increase in occurrence	Decrease in occurrence	Species no longer recorded in 2024
Wet heath			
Common Bent (1)	Velvet Bent (1)	Tormentil (1)	Lady Fern (1)
Campylopus introflexus	Birch (seedlings & saplings)	*Sphagnum compactum*	*Cladonia coniocraea*
Cladonia pocillum	Green-ribbed Sedge (1)		Marsh Pennywort (1)
Cladonia pyxidata	Heath Grass		Luzula multiflora (1)
	Dicranium scoparium		*Polytrichum formosum*
Oblong-leaved Sundew	Round-leaved Sundew (1)		White Beak-sedge (1)
Narrow Bucker-fern	*Hypnum jutlandicum*		*Sphagnum inundatum*

New species	Increase in occurrence	Decrease in occurrence	Species no longer recorded in 2024
Toad Rush	Bulbous Rush		*Sphagnum papillosum (1)*
Soft Rush	Heath Rush		
Leucobryum glaucum	Royal Fern (1)		
Common Lousewort (1)	Bracken (1)		
Water-pepper (1)	Bramble		
Polytrichum commune	Willow (seedlings)		
Polytricum juniperinum	*Sphagnum auriculatum*		
Pseudoscleropodium purum	*Sphagnum tenellum*		
Whitebeam (saplings)			
Sphagnum cuspidatum			
Sphagnum fallax			
Thuidium tamariscinum			
Heathy Bracken			
Velvet Bent	Birch (seedlings & saplings)	Heather	Early Hair-grass (1)
Common Bent	Hard Fern	*Campylopus introflexus* (1)	*Cladonia coniocraea* (1)
Bristle Bent (1)	Bramble	*Cladonia* squamules	Heath Grass (1)
Creeping Bent (1)	Bracken	*Dicranium scoparium*	Round-leaved Sundew (1)
Campylopus brevipilus (1)		Bell Heather	Ivy (1)
Green-ribbed Sedge (1)		Cross-leaved Heath	*Polytrichum formosum* (1)
Pill Sedge		*Hypnum jutlandicum*	Oak seedling (1)
Yellow Sedge		Holly	Rhododendron (1)
Wavy-hair Grass		Purple Moor-grass	European Gorse (1)
Foxglove (1)		Pine (seedlings and saplings)	
Heath Bedstraw		Dwarf Gorse	
Hypnum cupressiforme			
Bristle Club-rush			
Road Rush			
Bulbous Rush			

New species	Increase in occurrence	Decrease in occurrence	Species no longer recorded in 2024
Heath Rush (1)			
Soft Rush (1)			
Kinbergia praelonga (1)			
Leucobryum glaucum (1)			
Field Wood-rush (1)			
Annual Meadow-grass (1)			
Polytricum juniperinum			
Pseudoscleropodium purum			
Procumbent Pearlwort (1)			
Sheep's Sorrel			
White Clover (1)			
Dunces Arch Bracken			
Bristle Bent (1)	Common Bent	Wavy Hair-grass (1)	*Cladonia coniocraea* (1)
Creeping Bent (1)	Birch (seedlings & saplings)	Ivy	Broad-leaved Buckler-fern
Green-ribbed Sedge (1)	Heather	Holly	Marsh St. John's-wort (1)
Yellow Sedge (1)	*Campylopus introflexus*	Purple Moor-grass (1)	*Polytrichum formosum*
Cladonia pyxidata (1)	Pill Sedge	Bracken	*Rhytidiadelphus loreus* (1)
Alder Buckthorn (seedlings)	*Hypnum jutlandicum*	Oak (seedling)	Rhododendron (1)
Toad Rush	*Pseudoscleropodium purum*	Bramble	European Gorse (1)
Bulbous Rush	Dwarf Gorse (1)	Rowan (seedlings)	
Leucobryum glaucum (1)		Bog Myrtle (1)	
Foxglove			
Heath Woodrush			
Royal Fern (1)			
Annual Meadow-grass			
Polytrichum commune			
Polytrichum juniperinum			
Polytricum longisetum (1)			

New species	Increase in occurrence	Decrease in occurrence	Species no longer recorded in 2024
Tormentil			
Procumbent Pearlwort (1)			
Sheep's Sorrel (1)			
Heath Groundsel (1)			
Willow (seedlings)			
Sphagnum compactum (1)			
Sphagnum fallax (1)			
Sphagnum auriculatum			
Sphagnum tenellum (1)			
Deergrass (1)			

Table 9: Changes in species occurrence in quadrats recorded at Turfhill 1 (1 indicates a difference of only one record)

New species	Increase in occurrence	Decrease in occurrence	Species no longer recorded in 2024
Bracken			
Early Hair-grass (1)	Common Bent	Heather	Hard Fern
Bristle Bent (1)	Wavy Hair-grass	Broad-leaved Buckler-fern	*Cladonia coniocraea*
Creeping Bent	*Kindbergia praelongum*	Bell Heather (1)	*Dicranium scoparium*
Burdock (1)	Tormentil	Cross-leaved Heath	Hairy Woodrush (1)
Birch (seedlings and saplings)		Alder Buckthorn	*Pleurozium schreberi* (1)
Pill Sedge		Ivy	*Thuidium tamariscinum*
Climbing Corydalis (1)		Holly	
Heath Grass (1)		*Hypnum justlandicum*	
Foxglove (1)		Pine sp.	
Heath Cudweed		*Polytrichum formosum*	
Bristle Club-rush (1)		Rhododendron sp.	
Toad Rush		Bramble	

New species	Increase in occurrence	Decrease in occurrence	Species no longer recorded in 2024
Bulbous Rush		Rowan (seedlings & saplings)	
Heath Woodrush		Bog Myrtle	
Wood Sorrel (1)		Dwarf Gorse (1)	
Polytrichum juniperinum			
Sheep's Sorrel			
Procumbent Pearlwort (1)			
Willow sp. seedlings (1)			
European Gorse (1)			
Heath			
Common Bent	Tormentil	Heather (1)	Bristle Bent (1)
Early Hair-grass		Wavy Hair-grass	Hairy Woodrush (1)
Birch (seedlings & saplings)		Bell Heather	*Polytrichum formosum*
Foxglove		Cross-leaved Heath	*Thuidium tamariscinum*
Dicranum scoparium (1)		Holly	
Heath Bedstraw (1)		*Hypnum jutlandicum*	
Toad Rush		Pine sp. seedlings (1)	
Bulbous Rush		Bracken	
Bird's-foot (1)		Oak seedlings (1)	
Polytrichum juniperinum (1)		Bog Myrtle	
Bramble			
Rowan seedlings (1)			
European Gorse (1)			

Table 10: Changes in species occurrence in quadrats recorded at Turfhill 2 (1 indicates a difference of only one record)

New species	Increase in occurrence	Decrease in occurrence	Species no longer recorded in 2024
Bracken		Heather (1)	Ivy

New species	Increase in occurrence	Decrease in occurrence	Species no longer recorded in 2024
Common Bent	Pine sp. seedlings	Broad-leaved Buckler Fern	*Polytrichum formosum* (1)
Creeping Bent	*Pseudoscleropodium purum* (1)	Cross-leaved Heath (1)	Yew seedlings (1)
Birch (seedlings & saplings)	Bramble	*Hypnum* spp.	
Pill Sedge	European Gorse seedlings	Holly	
Climbing Corydalis (1)	Dwarf Gorse	Purple Moor-grass (1)	
Hawthorn (seedlings)		Bracken (1)	
Narrow Buckler-fern		Rowan seedlings (1)	
Heath Bedstraw		Bog Myrtle	
Toad Rush			
Bulbous Rush			
Kinbergia praelonga			
Heath Woodrush			
Annual Meadow-grass			
Smooth Meadow-grass			
Polytrichum juniperinum			
Polytrichum longisetum			
Tormentil			
Puffball (1)			
Sheep's Sorrel			
Wood Dock (1)			
Hedge Woundwort (1)			