Stroud Valleys Project

Rodborough Common

Footpath, Botanical and Skylark Surveys 2021

Stroud Valleys Project

October 2021

Contents

List of Figures and Tables 5
Figures 5
Tables 6
Executive Summary 7
Background 9
Report Description 10
Part 1 – Narrow Path Botanical Survey 11
1.1 Objectives 11
1.2 Method 12
1.3 Results 12
1.3.1 Bare Ground 12
1.3.2 Grass / Herb Ratio 12
1.3.3 Average Vegetation Height 13
1.4 Discussion 14
1.5 Recommendations 14
1.6 Acknowledgments 14
Part 2 – Wide/widening path botanical survey 15
2.1 Objectives 15
2.2 Method 15
2.2.1 Transect methodology 17
2.2.2 Analysis Methods 18
2.3 Results 18
2.3.1 Sward heights 18
2.3.2 Percentage ground coverage 20
2.3.3 Plantain Cover 22
2.3.4 Dandelion cover 24
2.3.5 Clover cover 24
2.3.6 Grass species cover 25
2.3.7 Herbaceous species cover 26
2.4 Comparison of Wide and Narrow path results 2021 27
2.4.1 Sward heights 27
2.4.2 Percentage ground coverage 28

2.4.3 Plantain cover 28
24.4 Dandelion cover 28
2.4.5 Clover cover 28
2.5.6 Grass species cover 28
2.5.7 Herbaceous species cover 29
2.6 Discussion 31
2.6.1 Sward height 31
2.6.2 Percentage ground coverage 31
2.6.3 Grass species cover 32
2.6.4 Herbaceous species cover 32
2.6.5 Plantain cover 33
2.6.6 Dandelion cover 33
2.6.7 Clover cover 34
2.7 Conclusion 34
2.8 Recommendations 34
2.9 Acknowledgements 36
Part 3 – Fixed-point photography path survey 37
Objectives 37
Method 37
Results 40
Recommendations 40
Part 4 – Skylark Breeding Season Survey 41
4.1 Objectives 41
4.2 Method 41
4.3 Results 43
Part 5 – Skylark citizen science project 46
5.1 Objectives 46
5.2 Method 46
5.3 Results 46
5.3.1 Public Engagement 46
5.3.2 Recorded Sightings 48
5.4 Citizen Science Lessons Learned and suggestions for future surveys 48
5.5 Skylark surveying – transect and citizen science discussion 50
5.6 Recommendations 51
5.6.1 Protection Zones 51

5.6.2 Visual Footpath Markers 51
5.6.3 Dog Management 51
5.6.4 Repeat surveys 52
5.7 Acknowledgements 52
Part 6 - Discussion and recommendations summary 53
Appendix 1.1 – Narrow Path 1 detailed survey results 55
Appendix 1.2 – Narrow path 2 detailed survey results 57
Appendix 1.3 – Narrow path survey graphs 59
Appendix 2.1 – Wide path survey data collection form 61
Appendix 2.2 - Wide path sward height and ground cover data 63
Appendix 2.3 – Wide path full results – graphs 66
Appendix 4.1 – Full Skylark Transect Survey Results 72
Appendix 4.2 – Full Skylark Transect Survey Method and Instructions 75
Appendix 4.3 - Skylark transect section location mapping 80
Appendix 5.1 - Citizen Science Press Coverage – Stroud News and Journal 82
Appendix 5.2 – Citizen science Skylark sightings 84
References 87
Part 2 87
Part 4 88

List of Figures and Tables

Figures

Figure 1.1 – Map showing location of narrow path, wider path and skylark surveys
Figure 1.2 – Narrow path transects ground cover ratios
Figure 1.3 – Narrow path transects average vegetation height

Figure 2.1 – Wide path survey width and position
Figure 2.2 – Wide path survey transect positions
Figure 2.3- Transect Locations
Figure 2.4 – Sward Height Measurements Transect 5
Figure 2.5 – Sward height measurement Transect 3
Figure 2.6 – Sward height measurements transect 6
Figure 2.7 – Proportion of ground cover transect 5
Figure 2.8 – Proportion of ground cover transect 3
Figure 2.9 – Proportion of ground cover transect 6
Figure 2.10 Plantain and dandelion cover transect 5
Figure 2.11 Plantain and dandelion cover transect 3
Figure 2.12 - Plantain and dandelion cover transect 6
Figure 2.13 – Red & white clover transect 5
Figure 2.14 – Grass species domin scale cover transect 3
Figure 2.15 – Wide path recovery zones

Figure 3.1 – Images illustrating fixed-point photography method
Figure 3.2 – Example of comparison images, 2017 to 2021
Figure 3.3 – Example of images taken along route of skylark survey transect B

Figure 4.1 – Skylark behaviour by grid square graph
Figure 4.2 - Transect areas with Narrow path survey sites marked
Figure 4.3 – Skylark transect survey sightings mapped

Figure 5.1 – Map showing citizen science recorded sightings of skylarks

Tables

Table 2.1 – Species average occurrence in outer and central quadrats
Table 2.2 – Wide path grass species frequency
Table 2.2 - Wide path herbaceous species frequency
Table 2.1: Narrow path grass species frequency
Table 2.4 – Narrow path herbaceous species frequency

Table 4.1 – Skylark survey transect summary

Executive Summary

Rodborough Common Special Area of Conservation (SAC) is, in common with many other open-access areas, coming under increasing pressure from urban development, changes in farming practices, increased recreational use and increasing traffic, to say nothing of the wider challenges posed by global climate change. It is essential that this ancient landscape is protected and preserved, in the interests of current and future generations and in order to continue to comply with the requirements of its multiple conservation designations.

This report outlines the results of survey activities undertaken in the spring and summer of 2021 examining the health of the area's distinctive botanicals and its birdlife that found that:

- Path widening and the number of frequently used paths is continuing to increase
- Narrower paths are showing signs of increased footfall and concomitant decreases in sward quality, botanical biodiversity and ground cover
- Merging wider paths pose a particular threat to the overall health of the sward composition and quality
- Areas of heavy footfall and compaction show a tendency to be overtaken by resilient species such as perennial rye grass and greater plantain, leaving less room for indicator species such as upright brome
- Ground nesting birds appear to share the human preference for the plateau areas of the common, increasing their vulnerability to nest disturbance
- Visitors to the common are both interested and engaged with conservation activities but are apt to blame 'outsiders' for problems or not recognise the impact of their own behaviours

Rodborough Common represents a fine example of unimproved limestone grassland, which is a resource that has suffered massive decline in the past 90 years. Back from the Brink (2021) estimate that only 1.5% of the Cotswolds is now given over to this iconic land type (down from 40%) and that overall, this land type has decreased by 95% since 1930. Mitigation actions are necessary if further degradation and loss of distinctive habitat markers is to be avoided.

We recommend a programme of:

- Education and Engagement
    - An extended programme of education and engagement to explain the importance of the common and the reasons for mitigation actions in order to encourage their acceptance and promotion among the general public.
- Protection and recovery zones
    - Where necessary, and for limited periods, areas should be allowed to rest and recover. Members of the public (and in some cases their dogs) would be excluded from certain areas of the common, but these areas would be limited and would not include major footpaths, except where these run in parallel with another path, causing path merging. Additionally, we recommend the

provision visual prompts and education to encourage year-round use of certain footpaths.

- Enforcement
    - In tandem with education and engagement, a degree of enforcement may be necessary to ensure that those who are disinclined to consider others are encouraged to do so. The appointment of voluntary wardens may be a partial solution to this.
- Additionally, we recommend that surveys are repeated to track the effectiveness of mitigation actions and that findings are shared with managers of Minchinhampton Common

If the above measures can be successfully implemented, we are hopeful that areas of the common that are currently showing signs of decline can be recovered. Furthermore, we believe that the programme of enhanced engagement and education will encourage a longer-term change in attitudes and behaviours and a recognition of the responsibilities that necessarily come with rights of access, to other commons users and stakeholders, current and future generations and multiple species.

Pressures, both local and global, are unlikely to decrease in the short to medium term. Therefore, it is vital that actions are taken now to prevent further degradation and loss of habitat.

Background

Rodborough Common is a SAC, representing the most extensive area of semi-natural grasslands surviving in the Cotswolds today. In common with many sensitive habitats, it is however coming under increasing pressure from recreational users from the surrounding urban area, who have a right of access to the area under the Countryside Rights of Way Act (2000).

In response to these increasing pressures, the Rodborough Common Conservation Programme (RCCP) was set up in 2015 to provide an Interim Impact Avoidance Strategy, via a collaboration between Stroud District Council as the Competent Authority, the National Trust as landowners, and Stroud Valleys Project as a provider of local environmental expertise. The Strategy aims to identify and implement measures to protect this unique environment via a variety of mitigation actions.

Under the auspices of the RCCP, a botanical and footpath survey were commissioned, and these were completed in 2017. A footpath survey compared aerial photographs taken in 1950 with a drone survey carried out in July 2017. This identified a significant degradation rate in the vegetation community with a 0.15km average increase in footpath network extents demonstrated year on year (Afana, 2018). Additionally, future projected increases of 0.184km/year were possible (Afana, 2018). The results also showed that the Rodborough Common plateau was greatly dissected by many types of paths. In 2017 the footpath density was found to be a ratio of approximately 60 km/km2 (Afana, April 2018).

The recommendation from this report was that similar annual surveys were carried out to offer a 'like for like' comparison between images, recognising that the 1950 and 2017 surveys were carried out using significantly different methods and equipment. To date however, the drone footpath survey has not been repeated.

Additionally, two of the narrower paths on the Common were the subject of a botanical survey carried out to monitor the impact of footfall on the flowering grassland. This was intended to be a baseline survey, with further surveys to be carried out to measure any degradation of quality in the sword composition and coverage, which in turn would inform management strategies and mitigation actions. This report recommended that the botanical survey be repeated every two to three years. As it is now over three years since this baseline survey was carried out, it is timely to investigate repeating this survey.

A Natural England periodical SSSI assessment in 2020 of Rodborough common SAC found that largely it was in favourable condition from improved grazing. However, 'unit 1 has a condition threat of recreational impact on the plateau' (Natural England, 2020).

At the meeting of the RCCP that took place in early 2021 Stroud Valleys Project were commissioned to carry out narrow footpath, wide footpath, and skylark surveys during the spring and early summer of 2021. This report gives the results of those surveys, along with recommendations for management and mitigation actions and future surveys.

Report Description

- **Part 1** gives the results of a repeat narrow path botanical survey. This includes a comparison between the original 2017 survey and the 2021 data.
- **Part 2** gives the results of a baseline wider path botanical survey.
- **Part 3** gives the results of a fixed-point photography survey. In the original proposal this was positioned as a citizen science survey. Following on from further discussions with the National Trust, this was changed to a fixed-point photography survey. This survey includes a comparison between photographs taken in 2017 and photographs taken in 2021
- **Part 4** gives the results of a transect-based skylark survey.
- **Part 5** provides the results of a citizen science skylark survey and includes a 'lessons learned' section for anyone planning on future surveys of this type.
- **Part 6** provides a discussion and recommendations summary for all surveys

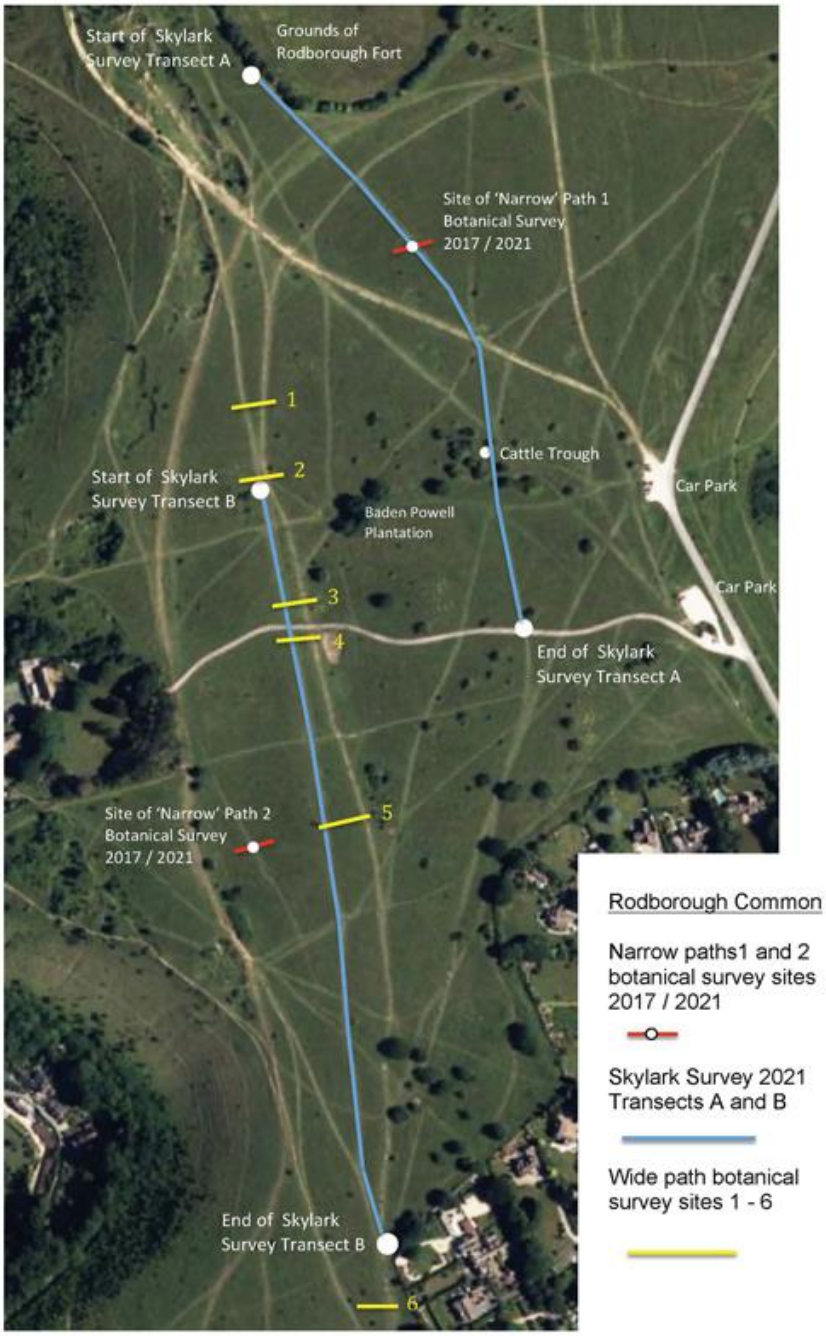
Part 1 – Narrow Path Botanical Survey

1.1 Objectives

- To provide comparative data in order to measure the year-on-year impact of footfall on the flowering grassland, since the completion of the initial survey in 2017
- To inform management strategies and mitigation activities
- To create a repeatable assessment that can be carried out to measure impact of increasing footfall and the effectiveness of mitigation activities

Figure 1.1 – Map showing location of narrow path, wider path and skylark surveys

Aerial view of the plateau of Rodborough Common showing sites of botanical surveys 2017 / 2021 and the route of skylark survey transects 2021



1.2 Method

The method used in the 2017 was repeated (full details can be found here)

In summary:

- Two relatively narrow paths were surveyed. Path 1 is on the plateau near Rodborough Fort. Path 2 is just off the plateau, traversing the western slope. Full location details can be found in the 2017 report.
- A CG3/CG5 species list was used. Transects consisting of 5 adjoining 2m x 2m quadrats were set up on an east-west orientation across the paths. The outer quadrats extend into the surrounding habitat of the paths to provide a control with the walked central areas.
- A direct comparison was completed between the results from the 2017 and 2021 surveys
- A comparison between the results of the narrow and wide path surveys was carried out. This can be found in section 2.4

1.3 Results

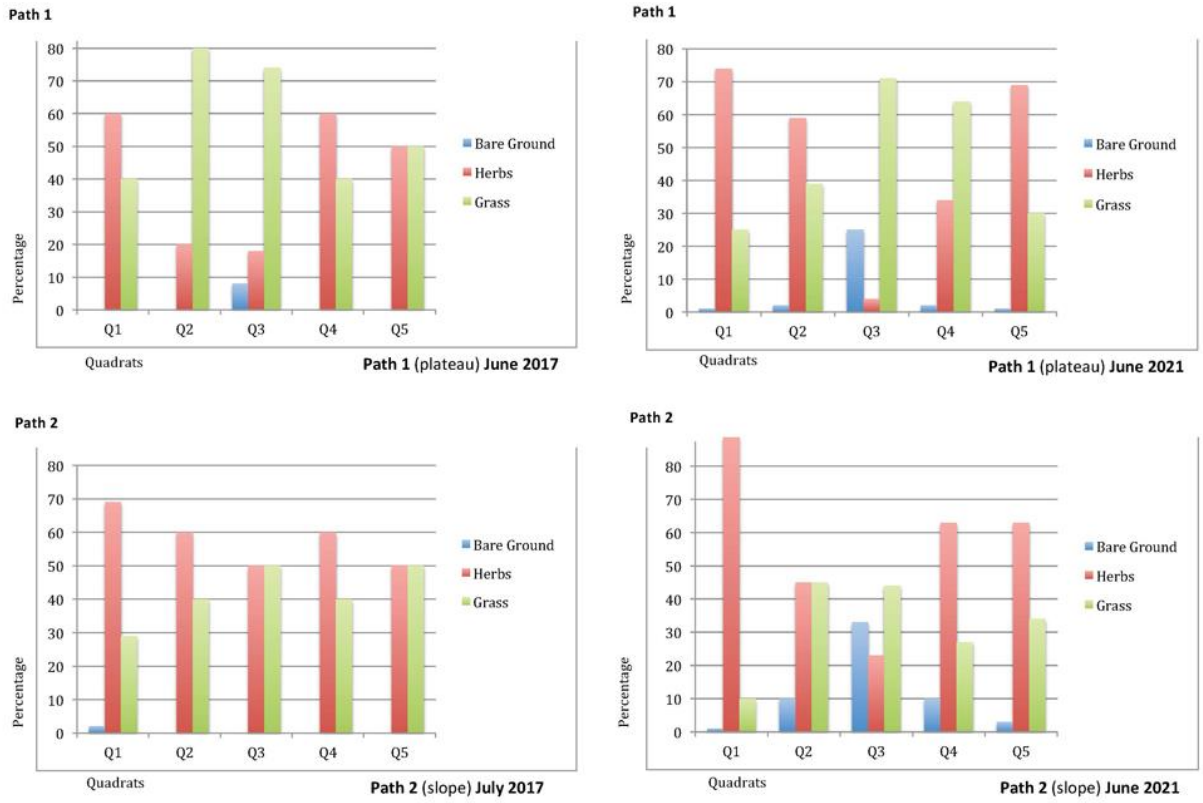
1.3.1 Bare Ground

- The percentage of bare ground has increased. Bare ground was recorded in 1 in 5 of the quadrats in 2017, compared to bare ground recorded in all 10 of the transects in 2021. Particular increases were recorded in the central quadrats of the paths.
- Bare ground increased in central quadrat 3 of Path 1 (plateau) from 8% in 2017 to 25% in 2021
- Bare ground increased in central quadrat 3 of Path 2 (slope) from 0% in 2017 to 33% in 2021
- Bare ground increased in quadrats 2 and 4 of Path 2 (slope) from 0% in 2017 to 10% in each quadrat in 2021

1.3.2 Grass / Herb Ratio

- In the central areas of both Paths 1 and 2 there is a decrease in the percentage of herbs.
- In Path 1 (plateau), there were increases in the ratio of herbs in the outer quadrats but in central Quadrat 3 there is a decrease from 18% to 4% and in Quadrat 4 from 60% to 34%.
- In path Path 2 (slope), there were increases in the ratio of herbs in the outer quadrats but in central Quadrat 3 there is a decrease from 50% to 23% and in Quadrat 2 from 65% to 45%.

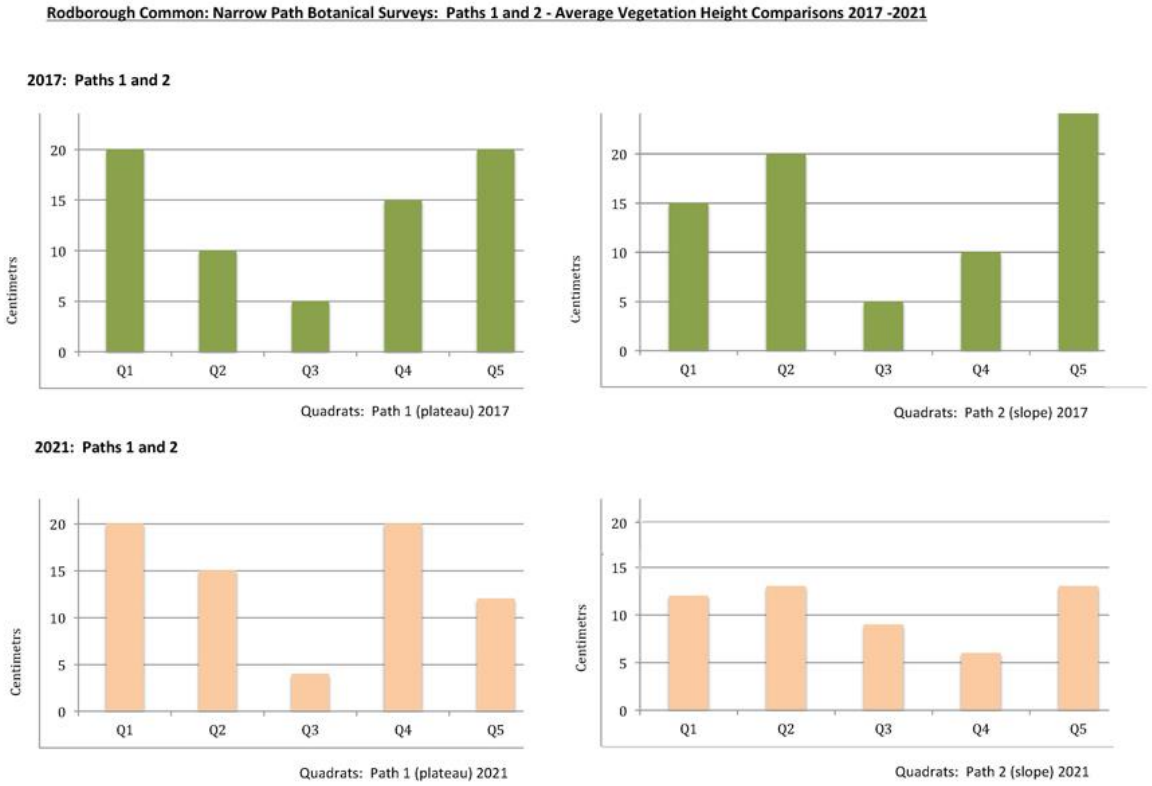
Figure 1.2 – Narrow path transects ground cover ratios



1.3.3 Average Vegetation Height

- Path 1 results show that average vegetation height has increased in some quadrats and decreased in others, following a similar pattern to 2017 with shorter vegetation in the central quadrats. Across the whole transect the average vegetation height remains the same at an average of 14cm.
- Path 2 results show a decrease in the average vegetation height across the whole transect from 15cm in 2017 to 10cm in 2021. There has been a slight increase in the height of vegetation in central Quadrat 3 from 5cm to 9cm but decreases all other quadrats. The most notable decrease occurs in outer Quadrat 5, from 25cm in 2017 to 13cm in 2021.

Figure 1.3 – Narrow path transects average vegetation height



1.4 Discussion

- The most significant finding of the repeat surveys of these 2 paths has been the increase in bare ground found across the transects since 2017. The difference in herb / grass / bare ground cover and average vegetation heights suggests there has been increased footfall along the surveyed sections of the paths.
- Differences between 2017 and 2021 results in some of the quadrats suggest there may have been some changes in walking patterns along these routes. For example, the decrease in vegetation height and percentage of herbs in the outer Quadrat 5 of Path 2 on the slope could suggest that people are beginning to walk more toward one of the outer edges to avoid a muddier channel in the centre of the path. The pattern of changes could also possibly suggest that people have been increasingly walking in pairs or groups along the paths.

1.5 Recommendations

- To reduce erosion and conserve the biodiversity of the grassland, the implementation of 'recovery zones' for periods of time to 'rest' these paths from footfall could be beneficial. As these particular paths run close to skylark breeding territories this action could also protect these and other nesting birds from disturbance by walkers with dogs off leads. Increased publicity and interpretation boards could heighten visitor awareness of the impact of walking on the Common

1.6 Acknowledgments

Many thanks for the assistance of all our volunteer surveyors.

Part 2 – Wide/widening path botanical survey

2.1 Objectives

1. To investigate wide path botanical diversity by carrying out a baseline survey of sward quality and composition
2. To assess the impact of path widening by comparing the narrow and wide path surveys
3. To utilise this information to estimate the sward quality and composition of other footpaths across the common

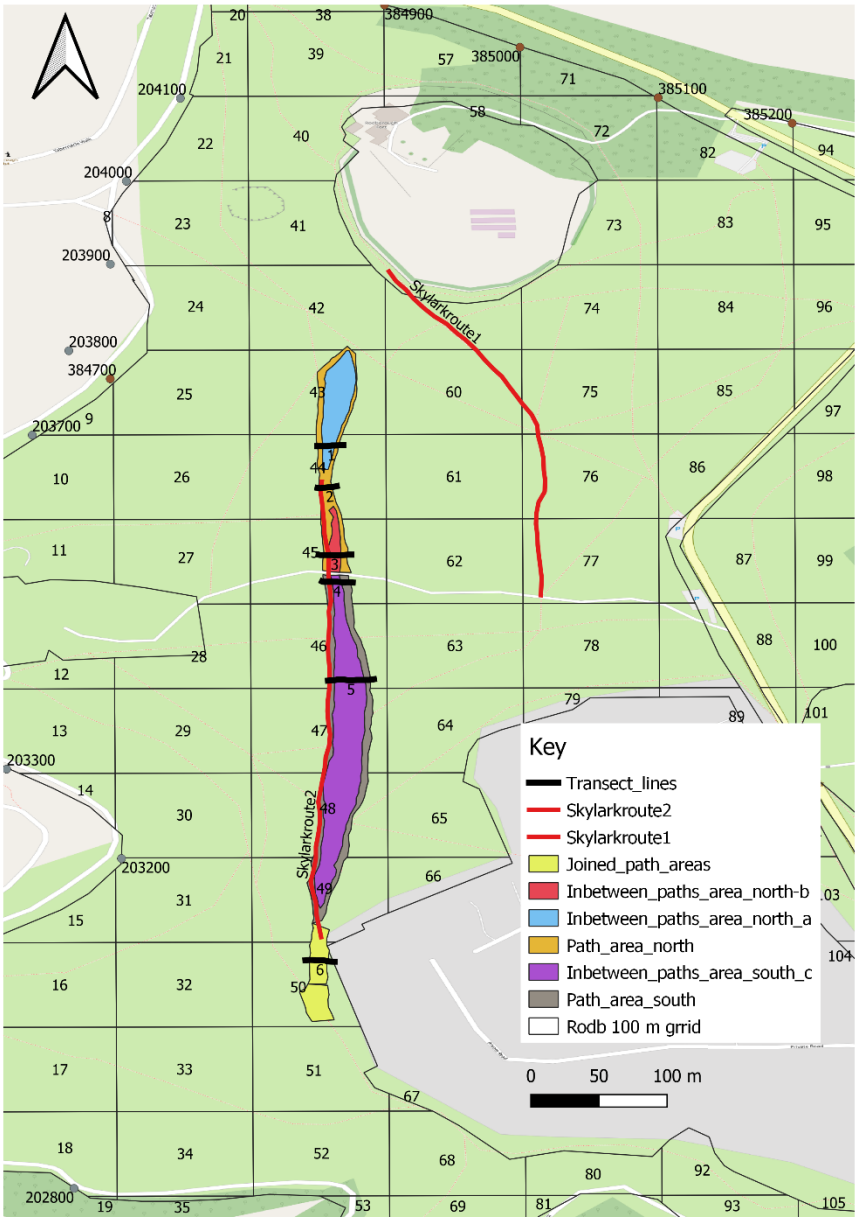
2.2 Method

After an initial investigation survey efforts were concentrated on the two main paths on the 'plateau' of Rodborough common, traversing in a north/south direction from the Fort. These were deemed to be the widest and some of the most heavily used paths, additionally part of one coincided with Transect B of the skylark survey (see figure 1.1).

To be able to provide a comparison with the narrow path survey the same methodology was adopted as a basis for the wide path surveys. However, a few adaptations and additional measures were undertaken. The adaptations were made to reduced surveying time which allowed an increase in the number of surveys that could be carried out. The additional measures were undertaken to try to establish a methodology to measure the extent of general footpath widening and deterioration on Rodborough common.

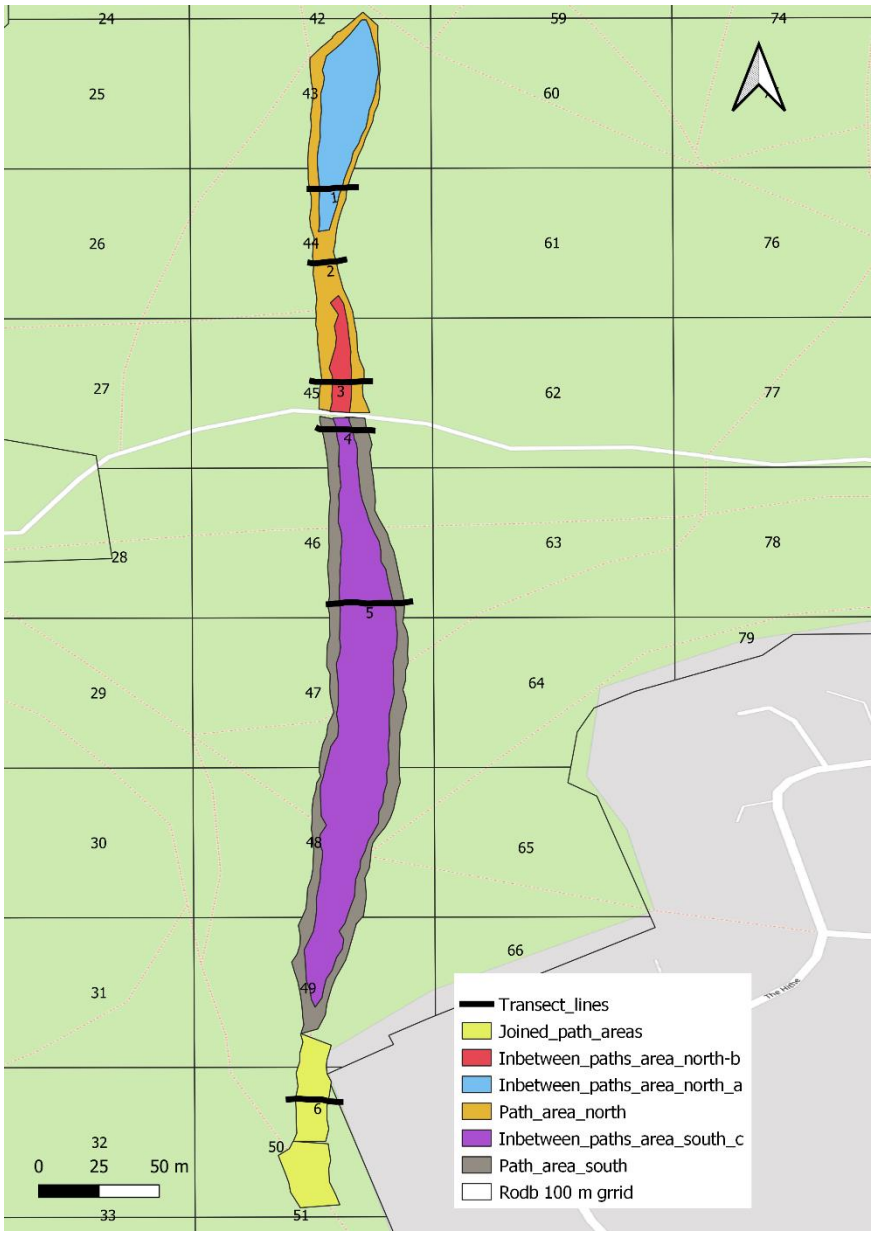
The two main paths to be investigated were initially traced using GPS points taken at eight paced intervals along the grass margin edge of each path length, on the 8th and 9th of June. The path grass margin edge was determined by the transition from flattened and/or stunted grasses to fully upright grasses. This data was plotted using QGIS software to produce a map of each path width and position (see figure 2.1).

Figure 2.1 – Wide path survey width and position



From this and the initial investigation, six points were chosen to conduct botanical transect surveys. These represented points where the two paths were joined (transect 2 and 6), those that were merging over a wider area (transect 3 and 4) and where the paths were distinctly separate (1 and 5) (see figure 2.2).

Figure 2.2 – Wide path survey transect areas



The surveying was carried out between 28th June to 7th July 2021, to maximise the amount of herbaceous and graminoid vegetation in flower, for ease of identification purposes.

2.2.1 Transect methodology

1. The transects were carried out by a minimum of two people, one an experienced botanical surveyor, the other(s) volunteer(s).
2. The transects were aligned approximately in an east/west direction at 90 degrees intersection across the paths.
3. Each transect was marked out with 2m x 2m quadrats across each path width and extended a minimum of 2m into the surrounding habitat, to provide a control with the undisturbed vegetation. GPS coordinates were taken at the north-eastern corner of each quadrat for future reference and mapped using QGIS.
4. In each quadrat 3 sward height measurements were taken. The first 2 used a metre rule to measure maximum sward height and average sward height (80% of

vegetation deemed to be at that height). The third measurement was made using a drop disc, a standard method for average sward height measurement.

5. The percentage of ground cover was estimated by eye and recorded for total herb, total grass, and bare ground cover. These are standard botanical surveying measurements.
6. A set species recording list was drawn up from the narrow path survey of commonly occurring species and using the National vegetation classification CG3 dry grassland B*romopsis erecta* classification (Rose, 2006, Hubbard, 1992) were used as references for identifying species (See appendix 2.1)
7. Only select species were recorded using the full National Vegetation Classification domin scale of cover. These were grass species specific to CG3 grasslands (Rodwell, 1992) as well as a select number of herbaceous species associated with change in nutrients and disturbed ground. This included all plantain species, as Ribwort and Hoary plantain are associated with CG3 grasslands, and Greater plantain is associated with amenity grassland in NVC classification (Rodwell 1992). Dandelion species and red and white clover were also recorded on the NVC domin scale of cover) as these species can also be indicators of change in nutrient levels and disturbance (Rodwell, 1992)
8. All other species on the recording list were marked as present/absent only, to speed up surveying. Additional species not found on the list were also recorded as a present/absent only.

2.2.2 Analysis Methods

All measured data was assessed using excel and QGIS, and where appropriate plotted graphically.

Central quadrats were determined for each transect by selecting the two adjacent quadrats with the lowest sward height measurements and maximum bare ground cover. This was obtained from Sward height and ground cover data (see appendix 2.2). The Outer quadrats were simply the first and last quadrat for each path transect.

Area calculations were made from the map (fig2.3) for paths 1 & 2 North and South of the driveway, and the areas in between the two paths.

- South paths 1&2 area= 3,638 m2
- North Paths 1&2 area= 2,173m2
- Area in between paths 1&2 North (a)=2046m2
- Area in between paths 1&2 North (b)= 501m2
- Area in between paths 1&2 South (c)=6691m2

2.3 Results

2.3.1 Sward heights

The differences for the drop disc height measure were not so clear, this methodology is considered less reliable with shorter grass swards (Stewart et al, 2002). The drop disc data was not considered any further in the analysis.

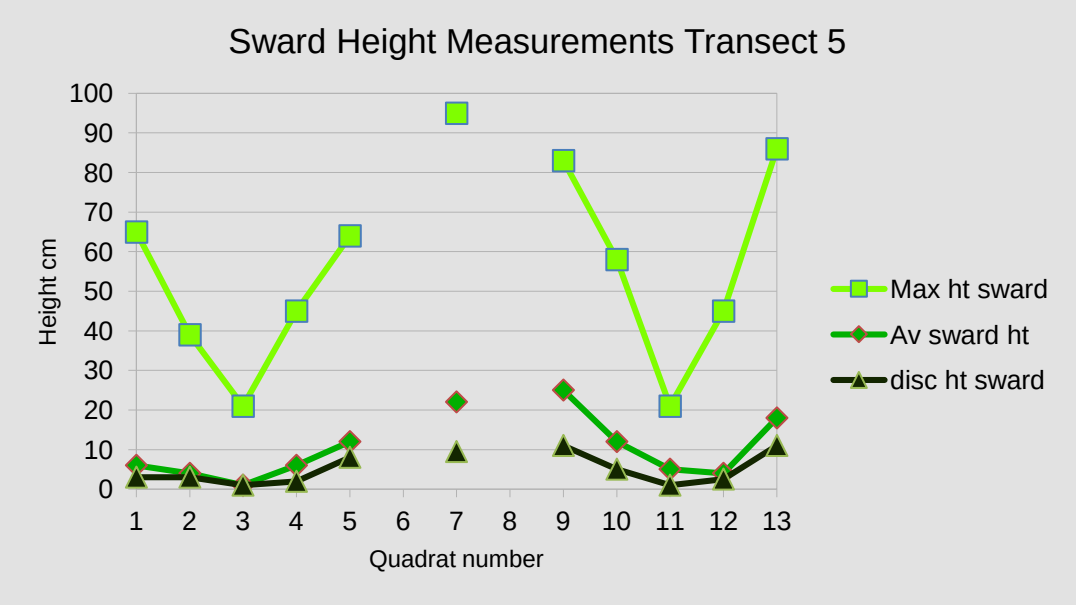
The range of sward heights measured was:

Quadrat type	Maximum sward height (cm)	Average sward height (cm)
Outer quadrat range	90 -50	25-6
Central quadrat range	30-18	4-0.5

For all transects greatest sward heights, maximum, average and disc were found to be in the outer quadrats and lowest in the central quadrats (see appendix 2.2 for full results).

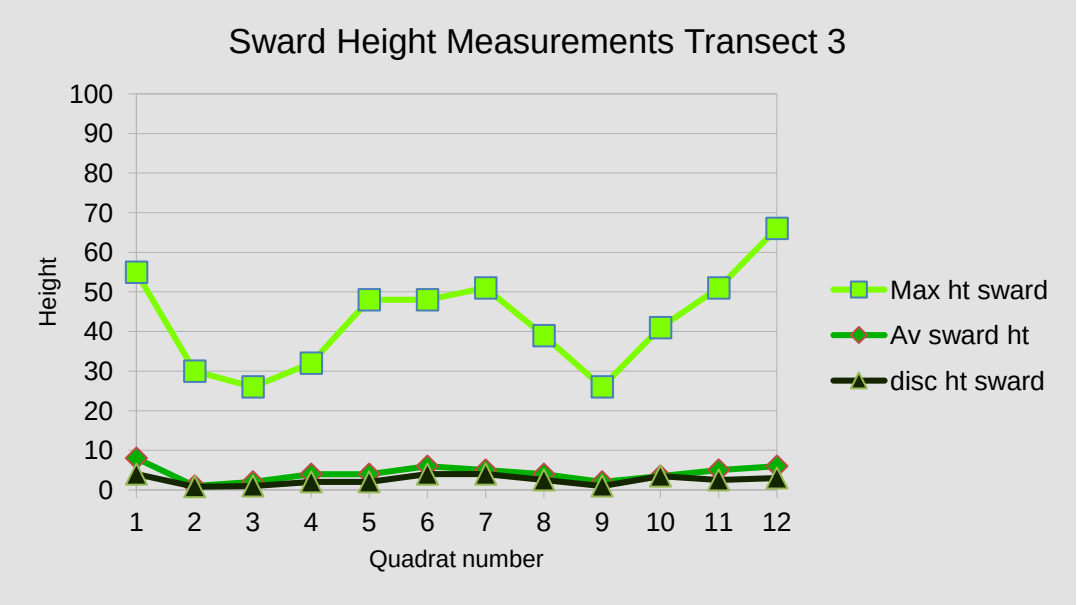
For separated path transects (1&5) there was an increase in all sward heights towards the edge of the path from the central quadrats following a sharp ‘v’ shape profile (see figure 2.4).

Figure 2.4 – Sward Height Measurements Transect 5



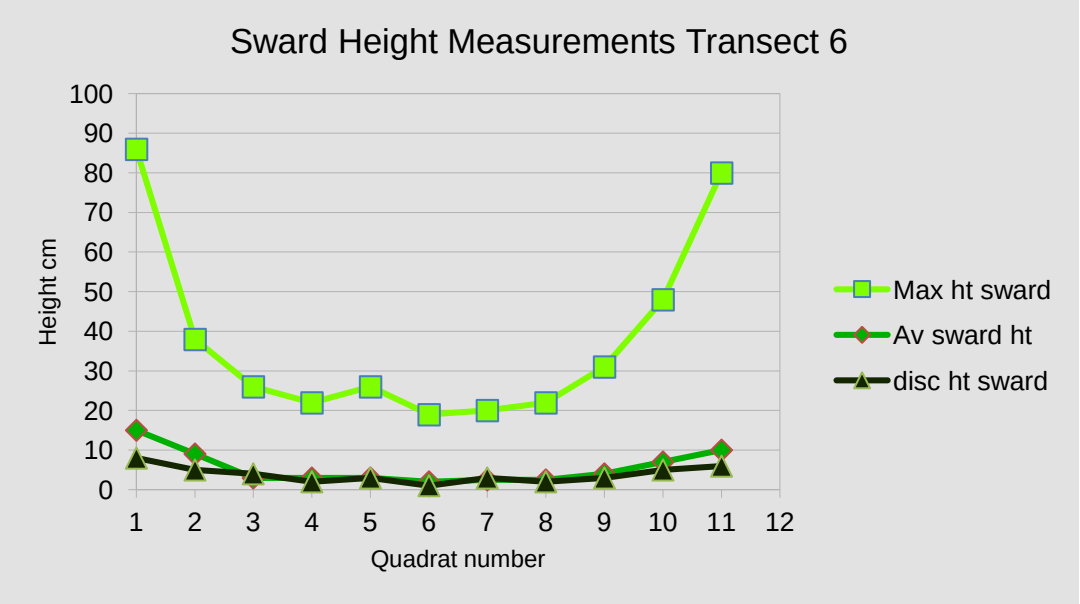
For merging path transects (3&4) there was an increase in sward heights towards the middle of the transect and the edges from the Central quadrats forming two gentle ‘v’ and ‘u’ shaped profiles (see figure 2.5)

Figure 2.5 – Sward height measurement Transect 3



For joined paths transects (2&6) all the sward heights were much reduced in the central section forming a wide 'u' shape profile with increased sward height only in the outer quadrats (see figure 2.6)

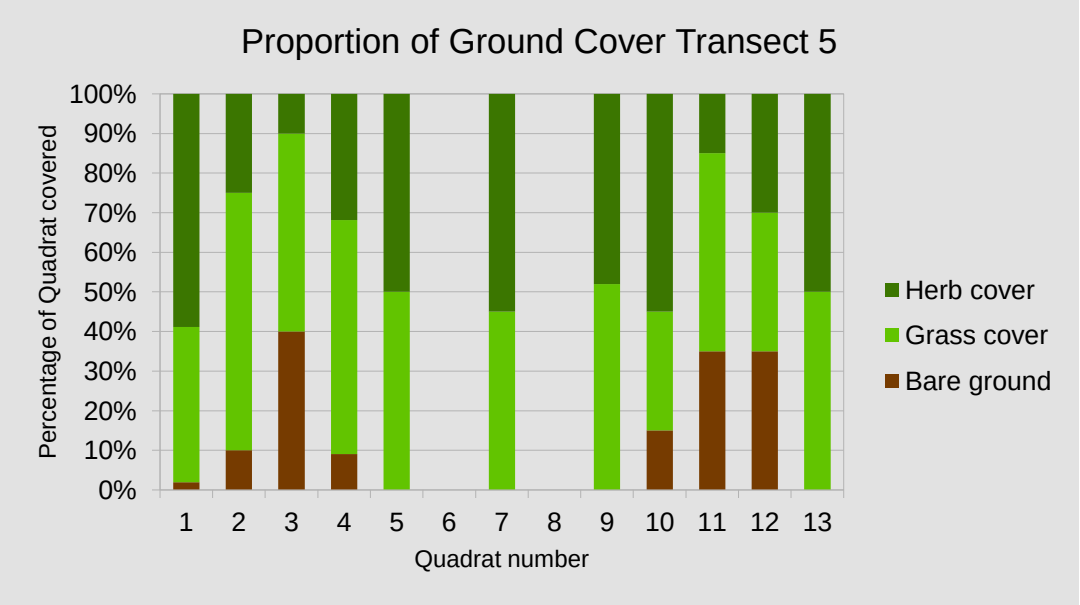
Figure 2.6 – Sward height measurements transect 6



2.3.2 Percentage ground coverage

For all transects Outer path quadrats showed the highest herbaceous cover 50-60%, and the Central quadrats had the lowest herbaceous cover 10-20% (see appendix 2.3 for full results).

Figure 2.7 – Proportion of ground cover transect 5



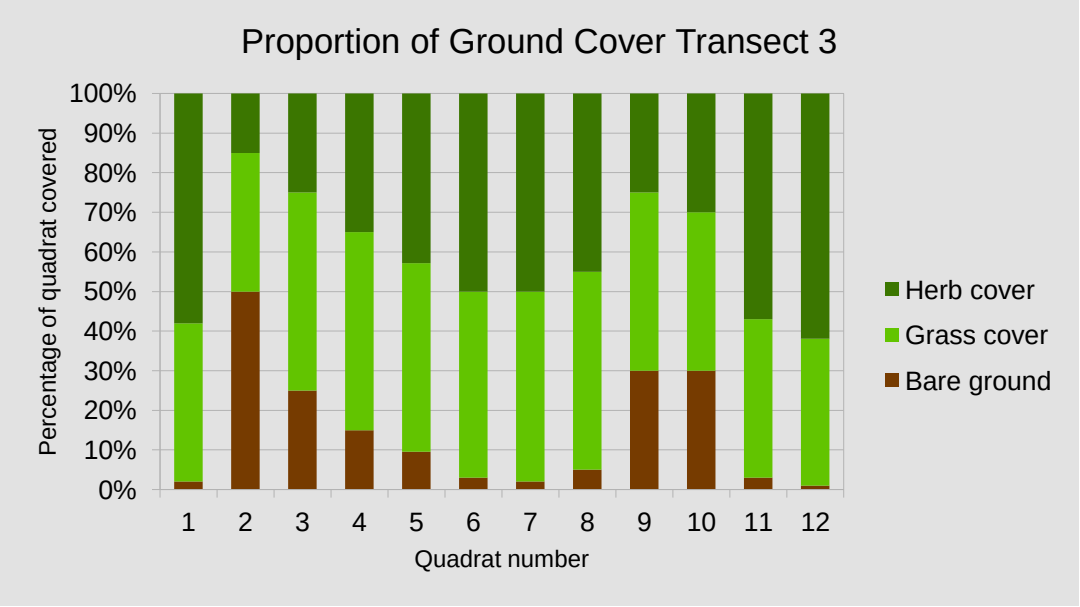
The central quadrats had the largest cover of bare ground 30-50% and the outer quadrats had the least bare ground cover 0-5%.

The grass cover in the outer quadrats for all transects was between 40-50%, all other quadrats showed an increase in grass cover up to 60-70%.

For all transects as grass cover increased herbaceous cover diminished and in central quadrats grass and bare ground became the dominant covers, with herbaceous cover very reduced (see appendix 2.3).

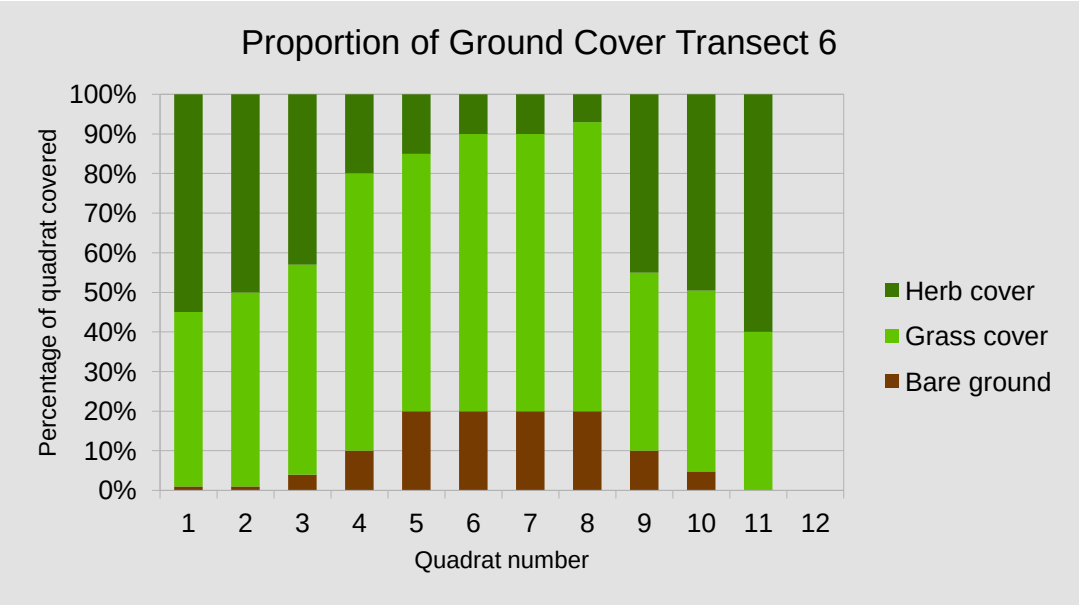
For the separated path transects (1&5) the amount and extent of bare cover was much less than for the merging path transects (3&4) in both spread (4/5 quadrats to 6/8) and amount (40% versus 50% max.), but they both displayed two separate zones of bare ground. Whilst the joined path transects (2&6) had a large central expanse of bare ground cover (6/7 quadrats). See figures 2.7, 2.8 and 2.9.

Figure 2.8 – Proportion of ground cover transect 3



Herb cover in separate path transects (1&5) was similar to that of the merging paths (3&4) with loss of cover concentrated in central path quadrats but in intermediate quadrats the herb loss was much less. Both joined path transects (2&6) showed a wide area of herb loss across the central 4/5 quadrats. See figures 2.7, 2.8 and 2.9.

Figure 2.9 – Proportion of ground cover transect 6



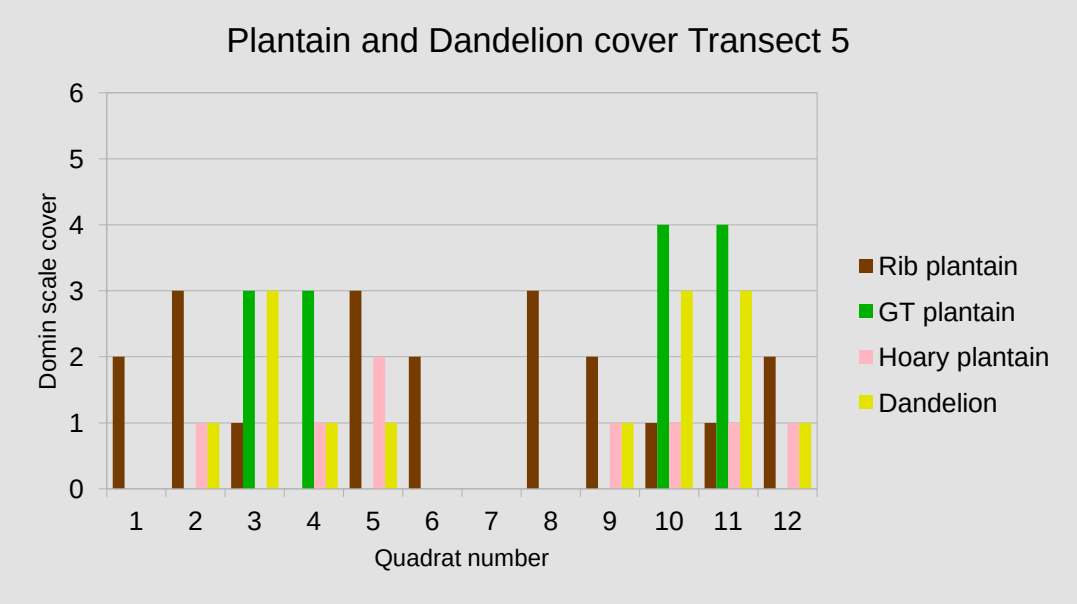
2.3.3 Plantain Cover

Ribwort plantain was found in 95% of quadrats of all transects, however its cover was depleted in the central quadrats, at domin scale 2/1 from 3/4. See figures 2.10, 2.11 and 2.12.

Hoary plantain was not so widespread hence it's pattern of occurrence was not so discernible. However, it appeared to occur more frequently with reduced sward height.

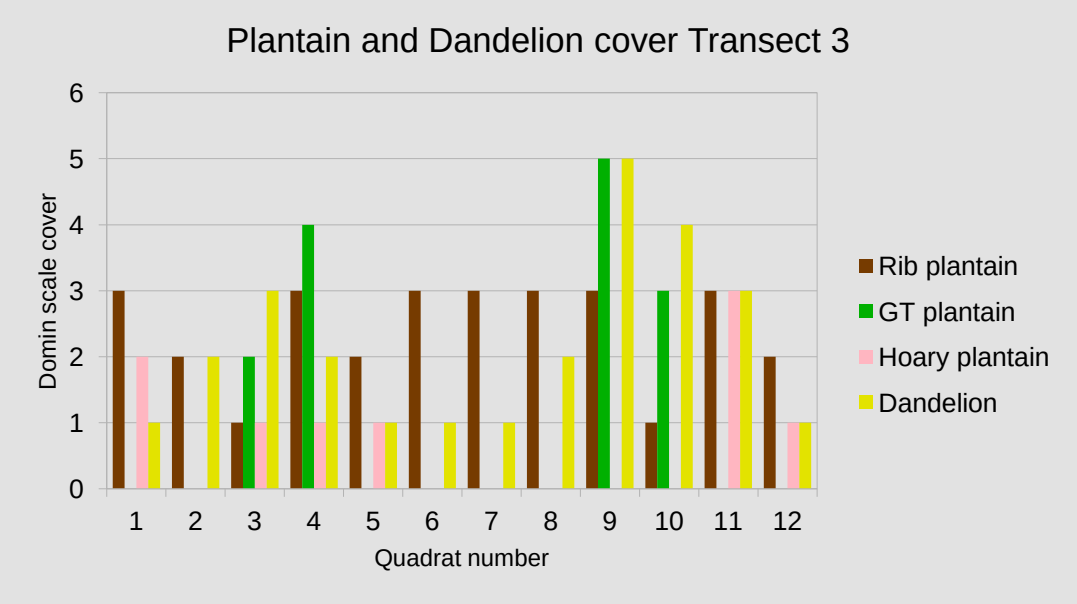
Greater plantain was only found in the central quadrats and was not found in any of the outer quadrats, and very little in intermediate quadrats (see appendix 2.3 for all graphs).

Figure 2.10 Plantain and dandelion cover transect 5



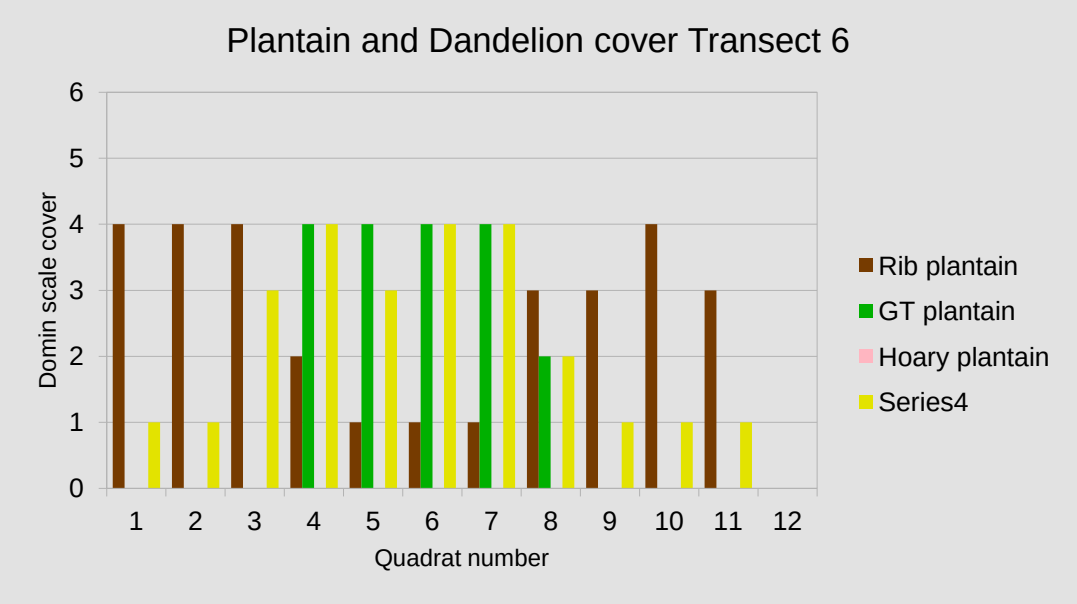
In separated path transects (1&5) greater plantain only occurs in the central 2 or 3 quadrats and a similar pattern appears in the merging path transects (3&4). Correspondingly ribwort plantain cover is reduced in the central 2/3 quadrats as well but remains well represented in all other quadrats.

Figure 2.11 Plantain and dandelion cover transect 3



In the joined path transects (2&6) Greater plantain cover extends to the central 5 quadrats and correspondingly Ribwort plantain is very reduced in cover in these quadrats. But remains well covered outside of these quadrats.

Figure 2.12 Plantain and dandelion cover transect 6



2.3.4 Dandelion cover

For all transects Dandelions were widespread over a large number of quadrats at low levels (domin scale 1/2), but in the central quadrats their cover greatly increased to domin scale 3/4. Dandelion occurrence was greatest where there was high greater plantain cover (see appendix 2.3 for all graphs).

In separated path transects (1&5) dandelion cover increased in just the central quadrats (see figure 2.10) but in merging path transects (3&4) the number of central quadrats showing an increase rose to 3/4 (see figure 2.11). However, this dropped back down in the areas between high footfall.

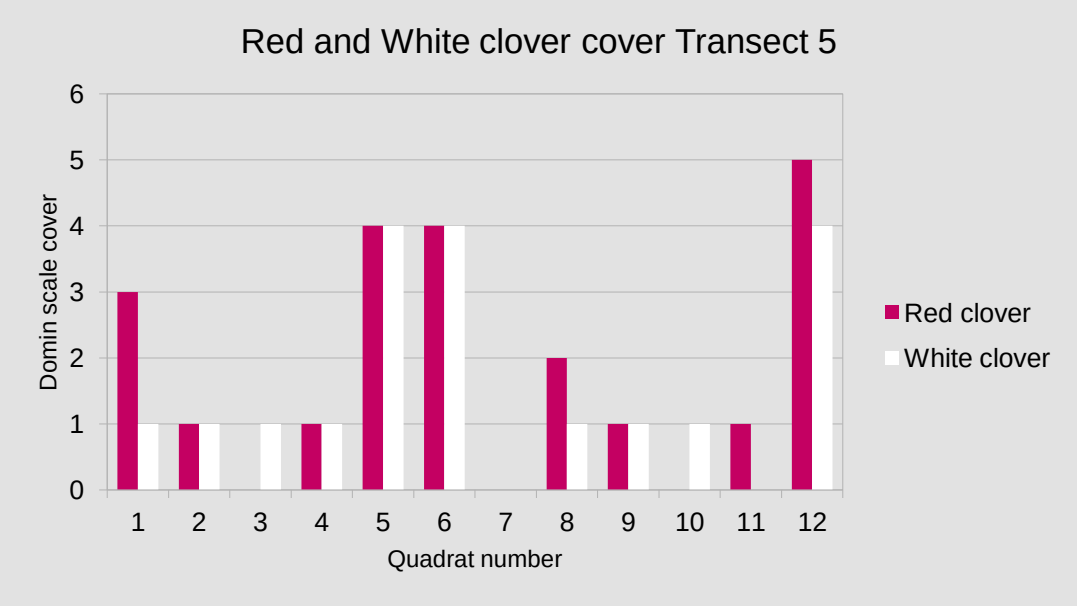
In the joined path transects (2&6) dandelion cover had increased and spread over the central 4/6 quadrats (See figure 2.12)

2.3.5 Clover cover

Both clovers occurred at similar cover levels in the outer quadrats (domin scale 4) except transect 1 & 2 where there was no real distinct pattern of occurrence. White clover was widespread in most quadrats of all transects but it's cover generally reduced in the central quadrats.

Red clover was also widespread in all transects but it's cover was reduced or absent in the central quadrats. This pattern was similar for all transects but loss in cover extent was greatest for the joined path transects (see appendix 2.3). Anecdotally, white clover appeared to be more robust in higher footfall areas.

Figure 2.13 – Red & white clover transect 5



2.3.6 Grass species cover

Upright brome was the most frequently occurring grass in 100% of quadrats (see Table 2.2 below). The other three most frequently occurring grasses were perennial rye grass (95%), crested dog's tail (92%), and red fescue (90%).

Quaking grass occurred in 64% and cock's foot in 41%. All other grass species had considerably less coverage (see Table 1). This would seem to confirm a CG3 dry grassland *bromopsis erecta* classification overall (Rodwell 1992).

On average the number of grass species in central quadrats was reduced to 4 whilst in outer quadrats it rose to 7.

Table 2.1 – Species average occurrence in outer and central quadrats

Average number	Outer Quadrats	Central quadrats	All quadrats
Herb species	17	6	12
Extra species recorded	3	2	2

Perennial rye grass was widely present in all transects. However, in outer quadrats it was present at a low cover, (domin scale 1 or 2), but greatly increased in cover towards central quadrats to a domin scale 5-7.

Upright brome had a domin scale 6 to 7 in outer quadrats of all transects but reduced to 5 or 3 in central quadrats.

Crested dog's tail and red fescue were also widespread but reduced in cover from outer quadrats domin scale 5-4 to central quadrats domin scale 2-1.

Quaking grass appears as a lower cover grass generally domin scale 3/2 but was absent from central quadrats in all transects.

Cock's foot grass is not widely distributed so no real pattern of occurrence could be discerned. See figure 2.14 for example transect. Full graphs can be found in Appendix 2.3.

Figure 2.14 – Grass species domin scale cover transect 3

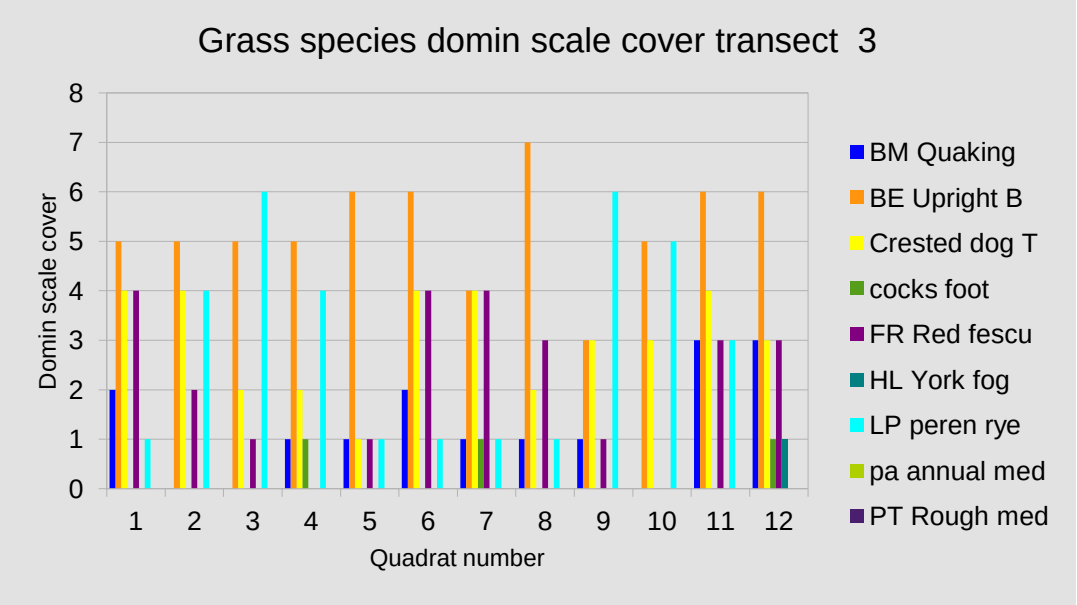


Table 2.2 – Wide path grass species frequency

Botanical name	Common name	Number of Quadrats occurs in	Percentage occurrence
Koeleria macrantha	Crested hair grass	4	7%
Brachypodium pinnatum	Tor grass	4	7%
Anthoxanthum odoratum	Sweet vernal grass	5	8%
Poa Trivialis	Rough meadow grass	10	16%
Holcus lanatus	Yorkshire fog	11	18%
Avenula pratensis	Meadow oat grass	13	21%
Dactylis glomerata	Cock's foot	25	41%
Briza media	Quaking grass	39	64%
Festuca rubra agg.	Red fescue	55	90%
Cynosurus cristatus	Crested dog's tail	56	92%
Lolium perenne	Perenial rye grass	58	95%
Bromopsis erecta	Upright brome	61	100%

2.3.7 Herbaceous species cover

Most frequently occurring species were ribwort plantain (95%), white clover (92%), salad burnet (87%), dandelion (87%), red clover (69%), rough hawkbit (66%), knapweed (64%), bird's foot trefoil (62%) (see table 2.2).

The average number of herb species from all wide path quadrats was 12, but the average for the central quadrats was 6 and the average for the outer two quadrats was 17. The species most commonly occurring in the central quadrats were Ribwort plantain, greater plantain, salad burnet, dandelion, white clover and rough hawkbit (see table 2.2). Anecdotally it was noted that rough hawkbit, salad burnet, knapweed and the 2 clovers were the last herbaceous species to disappear due to footfall or compaction.

Table 2.2 - Wide path herbaceous species frequency

Botanical name	Common name	Number of Quadrats occurs in	Percentage occurrence
Hippocrepis comosa	Horseshoe vetch	1	2
Knautia arvensis	Field scabious	1	2
Leucanthemum vulgare	Oxeye daisy	1	2
Anthyllis vulneraria	Kidney vetch	3	5
Asperula cynanchica	Squinancywort	3	5
Gymnademia conopsea	Fragrant orchid	3	5
Viola hirta	Hairy violet	3	5
Hieracium pilosellia	Mouse ear hawkweed	4	7
Rhinanthus minor agg.	Yellow rattle	10	16
Cerastium fontanum	Mouse eared chickweed	14	23
Medicago lupulina	Black medic	15	25
Thymus praecox	Thyme	17	28
Galium verum	Lady's bedstraw	24	39
Prunella vulgaris	Self heal	24	39
Plantago media	Hoary plantain	25	41
Primula veris	Cowslip	26	43
Cirsium acaule	Dwarf thistle	27	44
Plantago major	Greater plantain	28	46
Scabiosa columbaria	Small scabious	28	46
Helianthemum nummularium	Common rock rose	29	48
Ranunculus bulbosus	Bulbous buttercup	31	51
Carex flacca	Glaucous sedge	33	54
Lotus corrniculatus	Birdsfoot trefoil	38	62
Centaurea nigra agg.	Knapweed	39	64
Leontodon hispidus	Rough hawkbit	40	66
Trifolium pratensis	Red clover	42	69
Sanguisorba minor	Salad burnet	53	87
Taraxacum officinale	Dandelion	53	87
Trifolium repens	White clover	56	92
Plantago lanceolata	Ribwort plantain	58	95

2.4 Comparison of Wide and Narrow path results 2021

2.4.1 Sward heights

Both narrow paths 1& 2 transects showed a decrease in maximum height and average height in the central quadrats from the outer quadrats (se figure 1.3). This pattern of cover was also recorded in the wide path transects. However, the extent was greater in wide path transects. The two wide path transects where separated (1 & 5) seemed to show more correlation in their sward height profiles with the narrow paths (see figure 2.4) than the joined (1&6) or merging (3&4) transects.

2.4.2 Percentage ground coverage

Each narrow path transect only had bare ground cover present in the central quadrats, of 25% and 33% respectively (see appendix 1.3). The outer quadrats had a maximum of 3% bare ground in common with the wide paths, although path 2 showed a slight increase in bare ground either side of the central quadrat to 10%. Separated wide path transects (1&5) had high bare ground cover in 2 or 3 central quadrats. In merged and joined path transects the extent was even more at 4/7 quadrats. Wide path transects had considerably more bare ground cover than found in the narrow path transects.

In both the narrow path transects, herbaceous cover is reduced in the central quadrat and correspondingly grass cover is increased (see figure 1.2) This pattern of cover was also recorded in the wide path transects; however, the extent was much greater. The separated wide paths transects (1 & 5) showed a similarity in their ground cover profiles with the narrow paths (see appendix 1.3)

2.4.3 Plantain cover

All plantains were present on the narrow path transects. Mainly greater plantain occurred in the central quadrats of both paths.

There was a less clear pattern of plantain cover in the narrow path transects than in the wide path transects. Narrow path 2 had more ribwort and hoary plantain cover than narrow path 1 (see appendix 1.3)

24.4 Dandelion cover

Dandelions did not display any distinct pattern of occurrence on the narrow path transects. Where dandelion occurred, it was at a low domin scale cover of 1 in all quadrats. In the wide path transects however there was a very clear increased cover of dandelions in the central quadrats to 3/4.

2.4.5 Clover cover

Red clover disappeared in narrow path transect 1's central quadrat and in transect 2's central quadrat it had a reduced domin scale cover (see appendix 1.3)

White clover reduced in domin scale cover in the central quadrat of narrow path 1's transect but increased in narrow path 2's central quadrat. However, in this transect white clover was absent in two outer quadrats and so was red clover so this makes patterns of distribution difficult to quantify. On the wide path transects red clover was found to reduce and disappear in the central quadrats, and to a lesser degree this also occurred with white clover.

2.5.6 Grass species cover

The main difference in grass species frequency between the wide and narrow path transects was

- crested hair grass increased 7-20%, sweet vernal grass increased 8% - 60% and quaking grass increased 64%-90% from wide to narrow paths.
- rough meadow grass decreased 16-0%, and perennial rye grass decreased 95-30% between wide to narrow paths.
- Yorkshire fog, meadow oat grass, cock's foot, tor grass, red fescue, crested dog's tail and upright brome remained similar in cover between the two path types.

Table 2.2: Narrow path grass species frequency

Botanical name	Common name	Number of Quadrats occurs in	Percentage occurrence
Koeleria macrantha	Crested hair grass	2	20%
Brachypodium pinnatum	Tor grass	1	10%
Anthoxanthum odoratum	Sweet vernal grass	6	60%
Poa Trivialis	Rough meadow grass	0	0%
Holcus lanatus	Yorkshire fog	2	20%
Avenula pratensis	Meadow oat grass	2	20%
Dactylis glomerata	Cock's foot	4	40%
Briza media	Quaking grass	9	90%
Festuca rubra agg.	Red fescue	10	100%
Cynosurus cristatus	Crested dog's tail	10	100%
Lolium perenne	Perenial rye grass	3	30%
Bromopsis erecta	Upright brome	10	100%

2.5.7 Herbaceous species cover

Even taking into account the much smaller sample size for the narrow path transects, there were differences in herbaceous species frequency between the wide and narrow path transects.

On the narrow paths, there was an increase in

- Yellow rattle (16% to70%)
- Bird's foot trefoil (62% to 90%)
- glaucous sedge (54% to 90%)
- Bulbous buttercup (51% to 70%)
- Common rock rose (48% to 90%)
- Cowslip (43% to 80%)
- Dwarf thistle (44% to 80%)
- Ladies bedstraw (39% to 80%)
- Small scabious (46% to 60%)
- Hoary plantain (41% to 60%)
- Thyme (28% to 60%)
- Mouse ear hawkweed (7% to 40%)
- Kidney vetch and squinancywort (5% to 30%)
- Horseshoe vetch (2% to 30%)

There were decreases in the following herbaceous species cover from wide to narrow paths

- Ribwort plantain (95% to 70%)
- Dandelion (87% to 40%)

- Greater plantain (46% to 30%)
- Mouse ear chickweed (23% to 10%)

In the following species there was no significant difference

- Red clover
- Salad burnet
- Rough hawkbit
- Knapweed
- Self-heal

Table 2.4 – Narrow path herbaceous species frequency

Botanical name	Common name	Number of Quadrats occurs in	Percentage occurrence
Hippocrepis comosa	Horseshoe vetch	3	30
Knautia arvensis	Field scabious	0	0
Leucanthemum vulgare	Oxeye daisy	2	20
Anthyllis vulneraria	Kidney vetch	3	30
Asperula cynanchica	Squinancywort	3	30
Gymnademia conopsea	Fragrant orchid	5	50
Viola hirta	Hairy violet	3	30
Hieracium pilosellia	Mouse ear hawkweed	4	40
Rhinanthus minor agg.	Yellow rattle	7	70
Cerastium fontanum	Mouse eared chickweed	1	10
Medicago lupulina	Black medic	4	40
Thymus praecox	Thyme	6	60
Galium verum	Lady's bedstraw	8	80
Prunella vulgaris	Self heal	5	50
Plantago media	Hoary plantain	6	60
Primula veris	Cowslip	8	80
Cirsium acaule	Dwarf thistle	7	70
Plantago major	Greater plantain	3	30
Scabiosa columbaria	Small scabious	6	60
Helianthemum nummularium	Common rock rose	9	90
Ranunculus bulbosus	Bulbous buttercup	7	70
Carex flacca	Glaucous sedge	9	90
Lotus corrniculatus	Birdsfoot trefoil	9	90
Centaurea nigra agg.	Knapweed	6	60
Leontodon hispidus	Rough hawkbit	6	60
Trifolium pratensis	Red clover	7	70
Sanguisorba minor	Salad burnet	9	90
Taraxacum officinale	Dandelion	4	40
Trifolium repens	White clover	8	80
Plantago lanceolata	Ribwort plantain	7	70

2.6 Discussion

2.6.1 Sward height

Maximum and average sward heights are useful indicators for monitoring how sward height changes with footfall, as all paths transect sward height measurements showed a negative response to increased footfall and compaction.

Looking at the different path transects it can be seen in transect 3 &4 (see figure 2.5), where the 2 paths are beginning to merge, grass height is generally lower for all categories of height across the transect. This means that footfall is beginning to affect not just the paths themselves but the areas in between them. Considering these two transects were 24m and 22m respectively, this is quite a sizeable area. In transect 1& 5 however, where the paths are still distinctly separated, the reduced sward height for all categories is only in the 2 or 3 central quadrats of each path (4m and 6m respectively). This implies high levels of compaction are more contained and do not have an effect on the habitat separating them.

This can be seen even more clearly in the narrow path transects where the effects are in just one or possibly two quadrats (2 and 4m respectively).

Ultimately in transects 2 and 6, where the two paths are joined, sward heights displayed a u-shape of very low sward height over the entire transect (see figure 2.6). This indicates that the whole transects width (8m and 16m respectively) has degraded in terms of footfall and compaction to central quadrat levels.

In fact, transect 2 is where the 2 wide surveyed paths meet but in transect 6 an additional large path and narrower path meet as well (i.e., 4 paths converge). This implies that as more paths join, the larger the area of reduced sward height becomes.

Lighter footfall appears to reduce, stunt or flatten grasses, heavy footfall severely stunts grass height and extremely heavy footfall prevents grasses from growing. This is clearly seen in the changes to sward height profiles from narrow paths to wide paths, to merging paths to joined paths.

2.6.2 Percentage ground coverage

The results clearly show that as there is a progression from narrow to wider paths with increased footfall (transects 1&5), the extent and amount of bare ground and grass cover increases, and the herb cover reduces.

If wider paths that are in close proximity begin to merge (transects 3 &4) the area in between them shows, an increase in bare ground, a reduction in herb cover and an increase in grass cover, albeit smaller. However, if footfall continues current level or increases, the paths are likely to become joined. At this point, herb cover will become severely reduced, grass cover will be greatly increased, and the extent of bare ground will increase over the whole width (as in transects 2&6).

A case study by Footprint Ecology at Cannock chase SAC and SSSI (White et al.,2012) ascertained that when paths were in close proximity more new routes were created between them. This resulted in more paths that became wider and areas of habitat that became more dissected. Eventually triangles of habitat became completely cut off from the rest of the area.

2.6.3 Grass species cover

It is clear from the difference in frequencies of grass species between the narrow and wide path surveys (Table 2.2 to 2.3) that increased footfall on the wider paths has caused a compositional change, resulting in a decrease of the more delicate grass species such as quaking grass.

When grass species are looked at over the wide path transects, high footfall had a positive association with increased perennial rye grass. This can be demonstrated by looking at the central path quadrats where upright brome, the dominant grass species of CG3 grassland, reduce and struggle against the more dominant perennial rye grass. Additionally, in the outer quadrats and the narrow path quadrats upright brome is the dominant grass and perennial rye grass is at a much lower level of cover.

The diversity of grass species has also reduced in the central quadrats of wide paths to 4 species from 7 and the overall composition has changed from the designated CG3 grassland. This area of reduction in diversity varies in extent with path type and increases from separated to merging and to joined paths.

From this aspect the level of perennial rye grass cover would be a useful indicator for extent of CG3 grassland loss.

Crested dog's tail and red fescue are also quite resilient and appear to become severely reduced only under very high footfall conditions similar to upright brome.

2.6.4 Herbaceous species cover

Comparing all the different path transects it is clear that as footfall increases from narrow to fully joined paths herbaceous cover decreases more rapidly for some species than others. This can be seen in the species (e.g., yellow rattle, common rock rose). that increased in frequency from the wide to narrow paths (table 2.2 & 2.4 & section 2.5.7). This implies that these species are more sensitive to footfall and compaction.

However, some species such as ribwort, greater plantain and dandelion decreased between the wide and narrow path transects. The implication from this is they are more resilient and are therefore able to thrive in higher footfall areas. Bernard (2009) found this to be the case for greater plantain.

Some species remained fairly constant in their frequency between the narrow and wide path transects. This implies that whilst they are relatively resilient to higher footfall, (e.g., rough hawkbit, knapweed, salad burnet) they do not increase with higher footfall.

These factors could enable certain species to become indicators of differing levels of footfall and state of compaction

At some point of compaction (as a result of higher footfall) not only does herbaceous cover reduce in extent and amount, but the herbaceous quality is reduced to about 10/12 species from 17 (See table 2.2). With even heavier footfall/compaction this changes further, so that ultimately only 6 species are left, (salad burnet, ribwort plantain, dandelion, greater plantain, rough hawkbit and knapweed).

The main conclusion to draw is that increased compaction/footfall reduces herbaceous cover, changes its composition, and hence reduces herbaceous diversity. Looking at the map in fig 2.3 it is very likely the area (b) North of the driveway will be lost if footfall/compaction levels remain the same or increase. This area is already showing signs of degradation, loss and change from the transect 3 data, and is likely to become similar in diversity loss to the joined-up path areas (transect 2 data). This area is 501m2 and will increase the path area North of the driveway by approximately 20% to 2,547m2. A similar area is developing at the Northern tip of area (c) South of the driveway, as found in transect 4 data. This would bring the path area South of the driveway to approximately 4,138m2. At present the total path area North and South is 5,811m2.

It may be possible to halt and reverse this loss, particularly in areas where despite loss of herbaceous cover, the diversity has not yet reduced to only the 6 most resilient species. These areas are mainly along the edges of the paths and the areas in between merging paths.

Another point to consider is the necessity of having two wide paths covering exactly the same trajectory and effectively joining and separating at points, causing habitat loss, degradation and fragmentation. This is likely to be occurring with other paths on Rodborough common plateau, that are parallel and/or in close proximity. From a botanical perspective this is just a net loss of CG3 grassland area. But for ground nesting birds and invertebrates this can lead to disturbance and isolated populations. This in turn can reduce populations and their long-term viability.

2.6.5 Plantain cover

Ribwort plantain was widely distributed but became gradually reduced under very high footfall where there was a transition to greater plantain cover.

Greater plantain only occurred in wide path transect quadrats where there was higher footfall, and none occurred in lower footfall areas. Greater plantain is widely understood to withstand high levels of compaction. This would be a good choice of an indicator plant species to measure extent of compaction (Ignatieva &Konechnaya, 2004), as even this species declines under very high compaction levels where erosion of soil becomes more dominant (Barnard 2009). The relationship between ribwort and greater plantain species could also be utilised to measure degree of footfall/compaction.

Both species are easily identified by their leaves with little training. This fact would readily allow volunteers and/or citizen science to monitor paths in future.

2.6.6 Dandelion cover

Dandelion also occurred in greater numbers in quadrats of higher footfall but had low cover elsewhere. Where greater plantain cover was high there was correspondingly high dandelion cover. Dandelion's transition from low to higher cover could also be used as an indicator of higher footfall and compaction. This species is also easily identified by its leaf shape and flowers, enabling future volunteer and citizen science monitoring.

2.6.7 Clover cover

White clover seemed more robust, withstanding higher footfall/ disturbance than red clover both in the results and anecdotally. However, on lower footfall levels there wasn't a clear-cut pattern in cover. These clover species would not on their own mark a distinct enough change and hence not be reliable enough for a set of indicator species.

These clear indicator species of footfall and compaction levels could easily be mapped for any path on the common and used as a guide to path widening extent. Using GIS mapping software such as QGIS the area for this can be easily calculated.

2.7 Conclusion

Sward height and ground cover are affected by differing amounts of footfall. Lighter footfall starts to reduce herb cover and the grass cover increases so that the overall composition starts to change. As footfall increases the herb cover and quality become more reduced, such that more resilient species increase, resulting in overall composition change. Additionally, grass cover becomes even more dominant, and diversity is beginning to reduce. In areas of heavy footfall, the composition has changed to favour more robust and resilient grasses. With extremely heavy footfall grass cover diminishes, bare ground increases and greater plantain and dandelion dominate as herbaceous cover. This clearly demonstrates a transition to compaction and eventually erosion is likely to occur. Although the exact mechanisms and cut off points between compaction and erosion are not clearly defined once bare ground has established winter rainfall increases erosion (Cole 2003).

Ultimately if widening and merging paths are allowed to continue, with a predicted rise in visitor numbers and corresponding footfall, more paths will have joined areas.

The wide path survey data show that where paths join, excessive widening and compaction is taking place and large areas of CG3 habitat are being lost. Additionally, the more paths that join the greater this area is.

On a positive note, whilst all edges of paths and areas in between merging paths show a level of deterioration, this is not complete. If rested, these areas have the capacity to recover.

Whilst 1m to 2m along the edge of a path is a relatively small amount, over the total length of a path this accounts for a considerable area path (700m) is considerable area. For area (b) and (c) in between the paths this is likely to be in the region of 1000m2.

2.8 Recommendations

Rodborough Common is a vital part of the last remaining 1.5% of Cotswold unimproved limestone grassland habitat that has suffered 95% loss since 1930's (Back from the Brink, 2021)

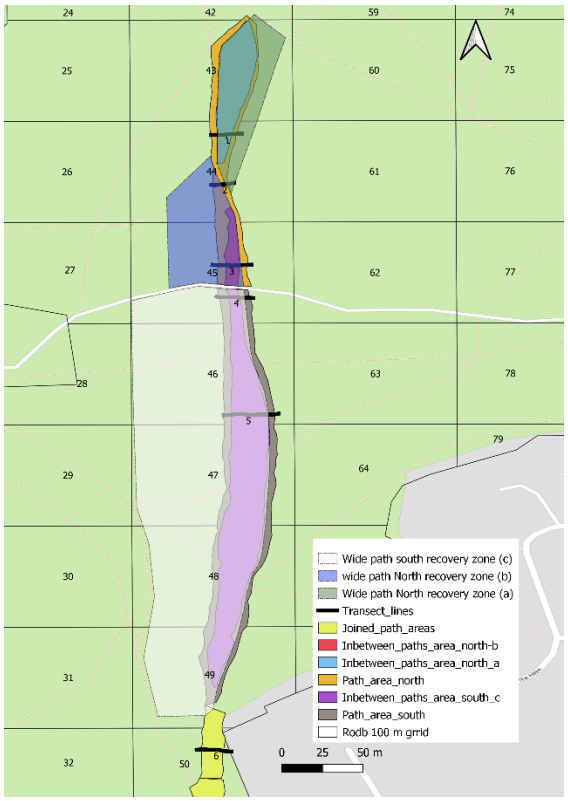
To keep the whole area of Rodborough Common SAC and SSSI in good condition, species loss and deterioration needs to be halted on the plateau path networks, and recovery allowed.

Several strategies should be considered and adopted to allow this recovery:

1. Constriction of wide paths to prevent future width increase, allowing edges to fully recover. This could just be seasonal, or for limited periods of time.
2. Prevent alternative routes establishing by erecting educational signage and waypoint markers encouraging walking on main paths only and instructing visitors not to damage the flora or disturb fauna.
3. Consider removing unnecessary parallel paths by fencing in entire areas, allowing them to recover and to change walking habits. This may allow wide paths to revert to narrow ones, and in-between areas to recover, re-joining areas of habitat loss. See figure 2.15 for details of candidate path.
4. Establish with Stroud Dsitrict Council and other interested parties alternative walking areas to reduce intensity of footfall. These areas would need to be of similar visual and recreational value. (e.g., a river Frome bankside walk Stroud to Eastington, with purchase/lease/negotiation with landowners for access to fields alongside the river). This could be deployed as part of new housing development mitigation, and at the same time be part of the district council's flood mitigation scheme. Recreation of river flood meadow habitat would increase the district's net gain on biodiversity. There may be financial incentives for this.
5. The surveyors engaged with many visitors whilst carrying out the transect surveys and it was noted that very few people knew of the significance of Rodborough Common for its wildlife value and status. Mainly older local people knew about wild plants and could see how the common was deteriorating from higher visitor numbers. This would suggest that a program of education, including open days, walks, school visits and the introduction of a voluntary warden scheme might increase understanding and appreciation of Rodborough Common as a vital habitat, alongside appreciation for its aesthetic value.

In light of the current heavy usage of Rodborough Common over the last 18 months due to COVID, it is suggested strategies 1, 2 and 3 are adopted as a priority to halt further decline. Strategies 4 and 5 are longer term solutions.

Figure 2.15 – Wide path recovery zones



Further repeat surveys would also be needed to establish other areas where strategies 1, 2 and 3 are needed, and afterwards to see how effective they have been.

Areas highlighted by the fixed-point photography survey that are of particular concern on the path network could be evaluated using an adapted methodology to quickly establish deterioration.

1. Survey efforts could be reduced to measuring just maximum and average sward heights across path widths, as this appears to be a reliable indicator of path extent, alongside a GPS recording of the path edge margin. These surveys would be needed to be carried out in May/June to early July to get reliable maximum grass sward height measurements.
2. Additionally, rather than record all species it would be adequate to monitor just ribwort plantain, greater plantain and dandelion cover as indicators of the extent of severe compaction. This would facilitate locating other viable areas to be allowed to rest and recover.
3. Measure bare ground to look at erosion extent.

2.9 Acknowledgements

We are very grateful for the assistance of our volunteer surveyors in collecting the data for this survey.

Part 3 – Fixed-point photography path survey

Objectives

- To provide a visual record of general footpath condition in a number of selected sites.
- To inform management strategies and mitigation activities.
- To create a repeatable assessment that can be carried out to measure impact of increasing footfall and the effectiveness of mitigation activities.
- To provide a methodology for further Fixed-Point Photography

Method

- Fixed Point Photography (FPP) images were taken along a number of paths. The majority of these were on the plateau as aerial images have shown the most evidence of path widening and erosion in this area.
- Map reference and What 3 Words (W3W) readings were recorded at each FPP site. A mobile phone was useful for providing screen grabs beside the images taken, to show aerial positions etc. in Apps such as W3W, OS, GPS, Compass
- Landmarks such as trees, large bushes, benches, and distinctive distant skylines, were included in the framing of the photographs in order to aid replication of images.
- In some cases, an additional, wider framed image of the scene was provided to show the exact point from which FPP images were taken in relation to the path and landmarks. The point was indicated in 2021 images by a trundle wheel marking the position of the FPP spot. (see Figure 3.1)
- Most images were taken in April and May, as during this time cowslips appear in many sites. This can assist in defining the path from the less trodden flowering grassland. A number of visits may be required to such sites to choose an appropriate time in the flowering season to conduct equivalent FPP. (Figure 3.2)
- In some cases, 4 images were taken from an FPP spot in north, south, east, and west directions, to provide details of surrounding vegetation and adjoining paths (see figure 3.3)
- Standard camera settings were used (no zoom).
- Photographs taken in previous years were printed out at A4 size to aid replication of images at the sites.
- Sites of photographs taken casually in 2017 were revisited on a similar date in 2021 to provide a current comparison. In cases where the 2017 image may not have been taken at an ideal angle to show the path condition, new FPP position points were added.
- Details of images taken were recorded in a spread sheet. Details include date, site number, GPS, W3W, path direction, image filenames and whether it is a baseline or comparison image.
- Images filenames were prefixed with a site number and the number of the FPP image taken at the site. Date and site details were included, and the unique camera image number retained. e.g.'s
  Site1_FPP1_2021_DogTree_North_RodboroughCommon_22_4_21_IMG_9421.jpg
  Site1_FPP2_2021_DogTree_South_RodboroughCommon_22_4_21_IMG_9426.jpg

- High- and low-resolution jpg files of images were made. Low resolution for ease of use in documents etc. and high resolution available to enable detailed examination of FPP scenes

Figure 3.1 Images illustrating Fixed Point Photography (FPP) methodology

FPP Image 1 22/4/21 From centre of path facing North.

FPP Image 2. 22/4/21 From centre of path facing South

FPP Position. Images showing standing position of photographer in relation to the path / landmark. In this case a trundle wheel marks the spot by a hawthorn bush, known locally as the 'Dog Tree'.

Mobile phone screen grabs.
GPS, What 3 Words and compass readings from FPP point. These details plus date and image filenames are recorded in a spread sheet.

Figure 3.2 Example of comparison between 2017 and 2021 images

22 April 2017

9 May 2021

29 April 2021. This scene was re-photographed on 9 May 2021 as cowslips were late flowering due to a dry Spring.

Trundle wheel marking FPP position

Figure 3.3 Example of images taken in 4 directions from a FPP site on 4/5/21 along route of Skylark Survey Transect B

North

South

East

West

Results

- A method for conducting FPP on Rodborough Common was established.
- FPP was conducted between April – August 2021, the majority of images being taken during April and May. Photographs of over 30 views along pathways were collected, including comparison images at number of sites that were photographed in 2017.
- Where there were comparison images from previous years, some of the sites appear to show path erosion and a negative impact on flowering vegetation.

Recommendations

- It is recommended that the 2021 FPP sites are photographed annually in order to monitor path conditions. This would also allow consideration of differing annual weather patterns that could have an impact on the appearance of paths.
- New sites of FPP could be added to the survey if required, using the established methodology.

Part 4 – Skylark Breeding Season Survey

4.1 Objectives

- To gather location data to create a baseline of skylark territories across specific areas of Rodborough Common.
- To create a repeatable survey that can be deployed easily each year to measure the impact of increasing footfall and the effectiveness of mitigation activities.
- To provide recommendations for improvement of skylark breeding habitats on Rodborough Common

4.2 Method

Fixed Width Line Transect surveying (after the BTO breeding birds survey method) was carried out weekly on Friday mornings between 8am and 9am from the beginning of April to the end of June, when weather allowed. Surveying was only postponed once due to inclement weather, but the missed survey was completed on the following morning instead. Surveyors and recorders walked 2 500m Fixed Width Line Transects, each split into 100m sections.

Transect areas were divided into 50x100m squares, allowing sightings to be more accurately mapped. Birds were recorded in 50m distance bands to the left and the right of the transect line. Each survey had a minimum of one recorder and one (more often two) observer, allowing for discussion between surveyors of distance bands where needed and maximising sightings. Sightings were only taken if the birds were seen or heard at right angles to, or ahead of, the surveyors on the transect line. Birds that were observed behind the surveyors were not recorded, helping to minimise double counting. Similarly, birds spotted ahead of observers were not recounted as the observer moved closer towards them. Surveyors maintained a steady pace along the transect line and completed each transect in approximately 15-20 minutes.

A single data collection form was submitted for each transect on each survey date. Survey forms recorded the date, start and finish times, weather conditions, the location of birds, species observed and number of birds. Comments were also recorded where needed.

The transect results were transposed onto a spreadsheet. The transect locations were converted to the grid references used by the *Back from the Brink* project and the type of behaviour observed was recorded (see results summary, section 4.3).

In addition to the planned transect surveys, an additional activity was undertaken on the 26th of June to trial using a thermal imaging device to locate nests to a greater degree of accuracy. This survey was carried out between 4.30am and 8.30am on that day. The location of nests was inferred by close observation of skylark parent behaviour. Both territorial and feeding behaviours were noted which indicated the site of nests. Despite this, no nests were observed using the thermal imaging camera, although adult birds were seen in the grass using this device. This activity acted as confirmation of the results that we had

seen during the transect walks, confirming the primary areas of territory/nesting, as detailed below (see section 4.3)

Volunteer surveyor using the thermal imaging device on the 26th of June

The full survey method, including exact instructions for surveyors and data processors, can be found in Appendix 4.2.

4.3 Results

A total of 44 skylark sightings were recorded during the transect walks. The table below shows a summary of the recorded results, sorted by grid reference, and transect, and recorded bird behaviour.

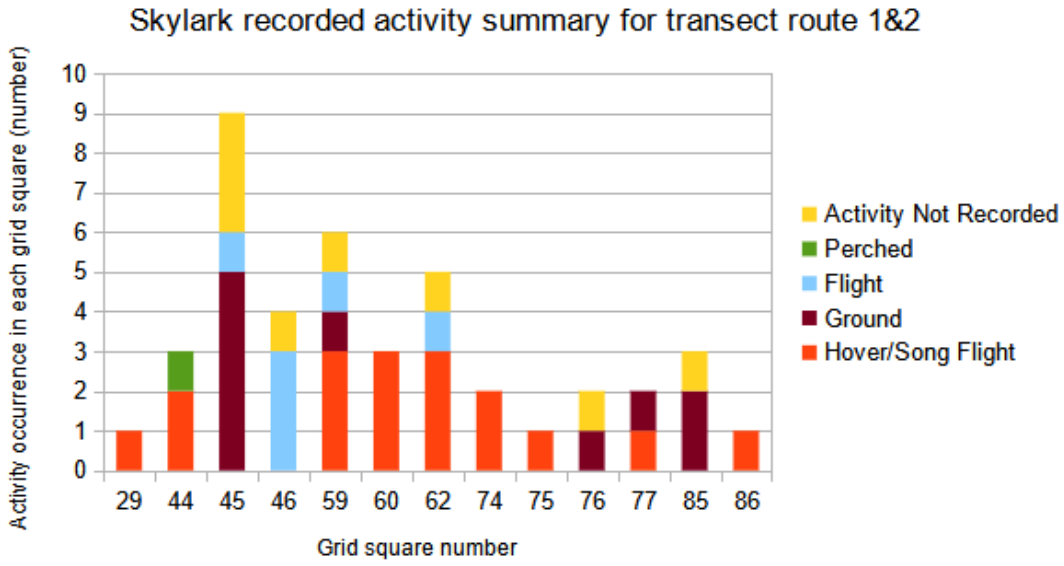
Table 4.1 – Skylark survey transect summary

Grid Reference	Transect	Hover/Song Flight	Ground	Flight	Perched	Activity Not Recorded	Total
59	A	3	1	1		2	7
60	A	3					3
74	A	2					2
75	A	1					1
76	A		1			1	2
77	A	1	1				2
85	A		2			1	3
86	A	1					1
29	B	1					1
44	B	2			1		3
45	B		5	1		3	9
46	B			3		1	4
61	B	1					1
62	B	3		1		1	5
TOTAL		18	10	6	1	9	44

Sightings were evenly split between transects, with 21 sightings recorded in Transect A and 23 in Transect B. The concentration of sightings showed that just over a third of sightings in transect A (31%) occurred in grid reference 59, or transect sections 1L or 1R, indicating that the birds were seen within the first 100m along the transect and to 50m either side (to left or right).

Similarly, the greatest concentration of sightings in transect B (39%) occurred in grid reference 45 or transect sections 1L or 1R. The concentration of sightings in these areas suggests that there these may be suitable areas for management intervention (see section 5.6). Figure 4.1 shows the number of skylarks sighted in each grid square, including the behaviour observed, where noted.

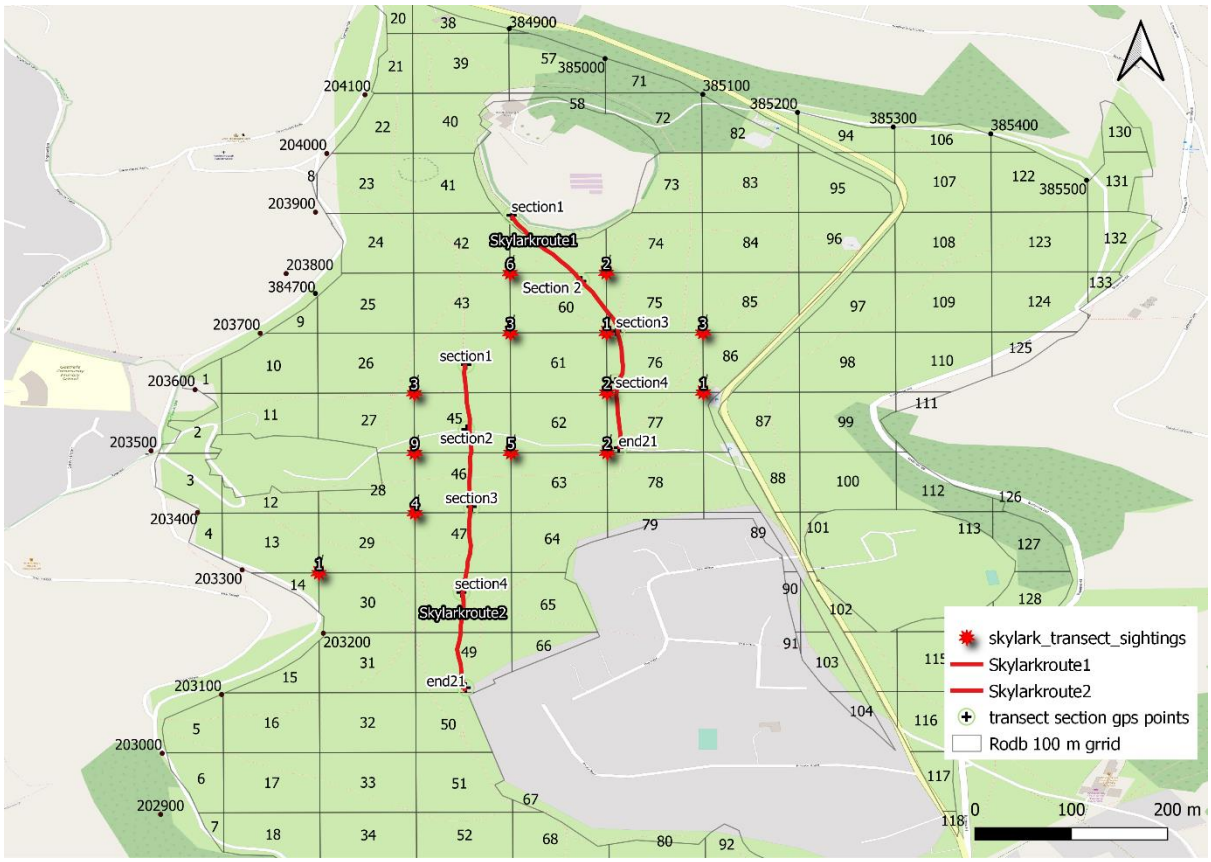
Figure 4.1 – Skylark behaviour by grid square graph



The relationship between all grid references and transect sections can be found in appendix 4.3.

Transect sightings recorded can be seen in Figure 4.2

Figure 4.2 – Skylark transect survey sightings mapped



Part 5 – Skylark citizen science project

5.1 Objectives

- Gather additional data on skylark territories outside the immediate transect recording area
- Seek confirmation (or otherwise) of transect sightings
- Engage with general public and increase awareness of skylark territories, breeding areas and species challenges on Rodborough Common

5.2 Method

A survey was set up in the citizen science application iRecord, to capture skylark sightings on Rodborough Common. In addition to the app-based option for recording sightings, a paper-based recording form was produced, allowing those who were not smartphone users, or who did not wish to use iRecord, to participate.

The general public were invited to participate in the project via Stroud Valleys Project's website, social media and via posters displayed in the eco-shop on Threadneedle Street. In addition, a press release was prepared, and stories ran in the on-line Stroud Times and in the print and online versions of the Stroud News and Journal (see Appendix 5.1).

Participants who contacted Stroud Valleys Project expressing an interest were sent instructions on how to set up and use the app, along with guidance about how to identify skylarks. They were also sent an invitation from iRecord, allowing them to record their sightings against the specific survey.

Paper observers were also provided with full instructions as well as a paper recording form which was either posted to them or that they could collect from the eco shop.

The iRecord app enabled observers to locate a sighting automatically and provided the facility to record additional details and photographs should the observer wish to.

Recorded sightings were extracted from the iRecord website and transposed into a spreadsheet with the SO references. It should have been possible to extract the records automatically, but this functionality did not work in iRecord, so this process was completed manually by a Stroud Valleys Project volunteer (see lessons learned).

5.3 Results

5.3.1 Public Engagement

Table 5.1 – Public engagement with skylark surveying

Channel	**Potential/Confirmed reach**	**Direct Engagements**	**Participants via iRecord/Paper Forms**
Stroud News and Journal print edition	19,000 circulation* 46,880 readership*		

Twitter	3658 followers		
Facebook (call for participants)	3402	270	
Facebook (results)	1961	59	
The Commoner	1926 households 4543 population#		
Direct engagements whilst surveying		c.100 – 120 conversations with commons users whilst surveying	
Participants			c.15

*Wikipedia, found at https://en.wikipedia.org/wiki/Stroud_News_%26_Journal. (Accessed 10/08/2021)

Ourhero.in available at: https://ourhero.in/uk-wards/rodborough-stroud-e05004396 (Accessed 30/09/2021)

The results above show that we achieved a good level of public engagement, with the Facebook post in particular being widely and enthusiastically shared, both from our own Facebook page and via other social media groups on Facebook and What's App.

The article in the Stroud News and Journal was placed prominently with a half page article in the print version using a striking skylark image provided by Deb Roberts.

Additionally, we found that members of the public using the common were keen to hear what we were doing whilst carrying out all surveys, and this afforded a good opportunity to talk about the challenges facing the common and how commons users could help to mitigate these.

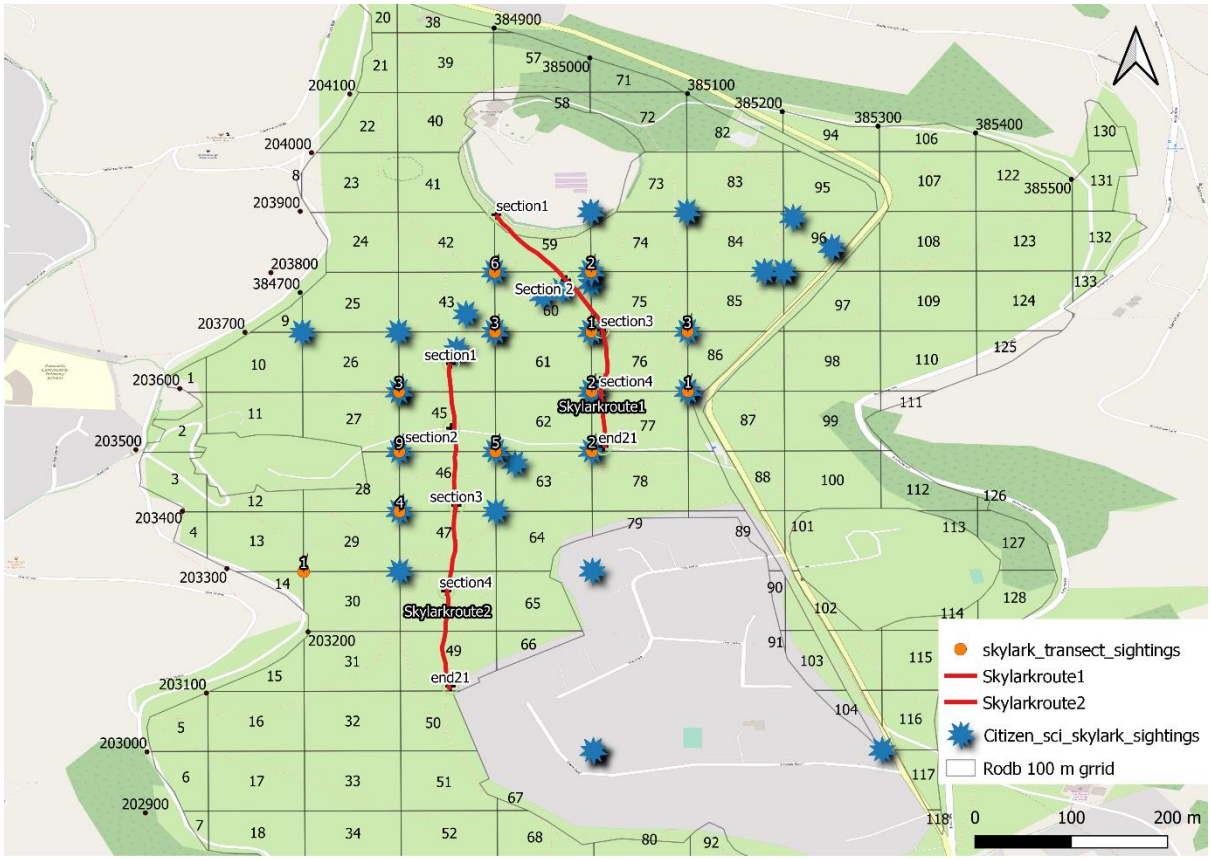
Despite the call for participants being widely shared, the number of subsequent enquiries was relatively low, with active participants reducing further. The reasons for this are unclear, although anecdotally this is not an uncommon experience in citizen science projects of this nature. Some suggestions for improving active participation in future surveys are included in the lessons learned section. A request for feedback from those who expressed an interest but did not participate was made, but without results.

Given that the objective of this part of the project was however, at least in part to raise awareness of the skylark population on Rodborough Common and to engage a wider public with the challenges faced by ground nesting birds such as skylarks, the level of engagement recorded above would suggest that this objective was successfully achieved.

5.3.2 Recorded Sightings

Citizen scientists recorded 51 sightings on iRecord during the 3-month survey period (see appendix 5.2 for full results). These results recorded sightings predominantly on 'the plateau' area of the common, between Rodborough Fort and The Hithe. There were a few outliers recorded, but on the whole, the results of the citizen science surveying aligned with the sightings recorded in Transect A and Transect B.

Figure 5.1 – Map showing citizen science and transect recorded sightings of skylarks



The data recorded by our citizen scientists is useful in terms of confirming the findings of the transect walks (i.e., the concentration of skylark territories on the plateau). However, this generally coincides with the preferences of walkers on the common to also stick to this area, so the absence of recorded sightings in other areas should not be assumed to indicate a lack of skylark territories. Having said this, both surveys suggest that the skylarks have a preference for nesting on flat ground, with sightings on the slopes being rare or non-existent in both surveys.

5.4 Citizen Science Lessons Learned and suggestions for future surveys

Despite good publicity and extensive sharing on social media, survey take-up was low. Future surveys should consider options that were not available to us this year due to Covid restrictions, for example launching the citizen science survey alongside an event, such as a skylark walk and talk. We also recommend further engagement with existing survey groups in the district to organise more extensive and wide-ranging survey activity.

Future surveys may wish to explore outside of this immediate area for as yet unidentified territories. They could be more directive and/or engage more directly – for example by leading transect walks or directing citizen scientists to walk on different areas of the common.

The iRecord application and website was difficult to set up, not particularly intuitive to use, and not easy to extract data from. Future surveys may wish to examine other available platforms, for example iNaturalist, or to examine whether iRecord has undergone revision to make it more user-friendly.

5.5 Skylark surveying – transect and citizen science discussion

This study suggests that skylarks have a definite preference for nesting on the flat ground on the plateau area of the common. This coincides with human users' walking preferences (as evidenced by footpath widening and usage).

In terms of numbers of breeding pairs, this study is a baseline; judging whether skylark numbers are increasing or declining on the common will require a repeat of this survey in future years.

In the absence of comparable data sets for Rodborough Common we have examined the existing literature regarding the impact of recreational use and in particular domestic dog disturbance on ground nesting birds to inform our recommendations.

We have not been able to locate a specific study that details the impact of dogs and/or human disturbance on the success of ground nesting skylarks. Studies of similar species however (e.g, woodlark, plover, meadowlark) showed that:

- Birds will generally avoid nesting near the sites of greatest disturbance
- Nests show greater levels of net predation when disturbance is prevalent (this is due in part to flushing drawing the attention of predators to the nest site)
- Breeding density is reduced with an impact observed on breeding success at all stages of the breeding cycle
- Responses of birds to a dog walker is greater than to a walker alone
- Dog management can have a significant positive impact on hatching success

(Showler et al., 2010)

Anecdotally walkers reported to us that they had observed dogs directly predating on skylark chicks and we witnessed several incidences of dogs 'flushing' birds from the ground during the course of our survey.

According to Weston and Stankowich (2014) 'disturbance effectively lowers habitat quality and this reduces carrying capacities' (p. 94). Furthermore, 'dogs … often evoke particularly strong and typically deleterious responses among wildlife' (p. 94). The inclusion in the Countryside and Rights of Way (2000) act of a specific instruction to keep dogs on leads on open access land between March and July to protect ground nesting birds would further suggest that dog disturbance is a recognised threat to ground nesting bird breeding success.

During the early part of the nesting season, prior to the development of longer grasses away from established footpaths (which was later in the season this year due to a cold and dry spring), we observed walkers (both with and without dogs) ranging away from paths and walking on or over skylark territories. This was exacerbated by the very short grass conditions in the early part of this year which made it difficult to easily identify the course of some of the footpaths. Even the surveyors found it difficult at times to locate the starting point of their transect and would have potentially failed to do so without the detailed instructions provided.

5.6 Recommendations

Given the negative impact on ground nesting birds of human and, in particular, dog disturbance, we provide a number of options for improving habitats for ground nesting birds on the common, namely:

5.6.1 Protection Zones

Our primary recommendation is that 4 key areas for skylark nesting are protected, particularly during the early part of the nesting season (i.e., from March to May). These protection zones are informed by the concentration of skylark territories observed during the survey. These areas, in part, coincide with the areas of widening footpaths that we are proposing resting (see section 2.8). A map showing proposed protection and recovery areas can be found in section 6.

The areas concerned would not encompass main pathways on the whole, except where they correlate with areas of widening or merging footpaths (see section 2.8), minimising inconvenience to walkers.

Protection zones would need to be dog proof, dogs being the primary disturbance agents for ground nesting birds and would have to be checked regularly for breaches. We recommend preventing all access through the protection zones.

5.6.2 Visual Footpath Markers

In addition, we suggest that walkers are directed more carefully during the skylark breeding season and are actively encouraged to keep to footpaths and not stray into skylark breeding territory.

This could be achieved by a combination of:

- publicity, active engagement with walkers by NT staff and/or voluntary wardens
- the placing of visual ‘prompts’ to encourage walkers to stick to established/certain footpaths
- the publication of suggested walking routes and inclusion of walking routes on interpretation boards in the main car parks.

5.6.3 Dog Management

If physical fencing or markers are not considered appropriate, given the correlation between dog disturbance and nesting population density, we recommend that efforts are made to educate the public further regarding the requirement to keep dogs on leads as required for all open access land as follows:

- between 1 March and 31 July - to protect ground-nesting birds
- at all times around livestock

Source: https://www.gov.uk/right-of-way-open-access-land/use-your-right-to-roam.

In addition to education, there would need to be an active effort to enforce this rule, particularly during periods of increased usage (e.g., public holidays). At the last Commons

Committee there was a suggestion that the role of voluntary wardens be re-introduced onto the common and this may be something that these individuals could assist with.

An Australian study found that ‘hatching success was significantly higher where there was dog management’ (Showler et al. 2010, p. 24), suggesting that this measure could have a positive impact on the prevalence of skylarks on the Common.

Signage regarding ground nesting birds observed in Northumberland

5.6.4 Repeat surveys

Finally, we recommend that annual surveys of skylark territories are carried out to measure the success or otherwise of mitigation activities. In addition to transect walking, the experience of the thermal imaging survey suggested that longer observations of candidate skylark territories would be beneficial in terms of pinpointing nests more accurately.

5.7 Acknowledgements

With much thanks to our volunteer transect observers/recorders as well as our citizen science participants.

Part 6 - Discussion and recommendations summary

The results of all surveys, combined with the results from the 2017 report, show that the impact of increasing numbers of visitors to the Common is likely to have a deleterious effect on biodiversity and multi-species flourishing. Increased footfall, path widening, new paths being formed, and large numbers of free-ranging dogs will cause degradation of habitat, including the reduction in abundance of species relating to the SAC designation, and negative impact on the breeding success of the ground nesting bird population. With unimproved limestone grassland representing such a rare commodity, this should be considered a cause for concern.

However, studies have shown that with correct management and the support of the general public for mitigation measures, such degradation can be minimised, halted and reversed. In the interests of future generations, as well as the other species that occupy the common, we recommend that mitigation actions are put in place as follows.

- Establish protection and recovery zones. Where necessary, and for limited periods, members of the public (and in some cases their dogs) should be prevented from using from certain areas of the common, to allow other species to flourish and recover from overuse. Additionally, suggested footpaths could be marked, and standardised routes published/socialised. Suggested protection and recovery zones can be found in Figure 6.1. Note that Skylark protection zone 3 coincides with the resting of merging paths (see section 2)
- Education and Engagement. Recognising the particular nature of this site, which has existed as common land since at least the 13th century, we propose that an extended programme of education and engagement is carried out to explain the reason for mitigation actions and to encourage their acceptance and promotion among the general public.
- Enforcement. In tandem with education and engagement, a degree of enforcement may be necessary to ensure that those who are disinclined to consider others are encouraged to do so. The appointment of voluntary wardens may be a partial solution to this. This is in line with the historic management of the common, which was managed for centuries by the Court Leet, who had the power to enforce common rules and regulations.

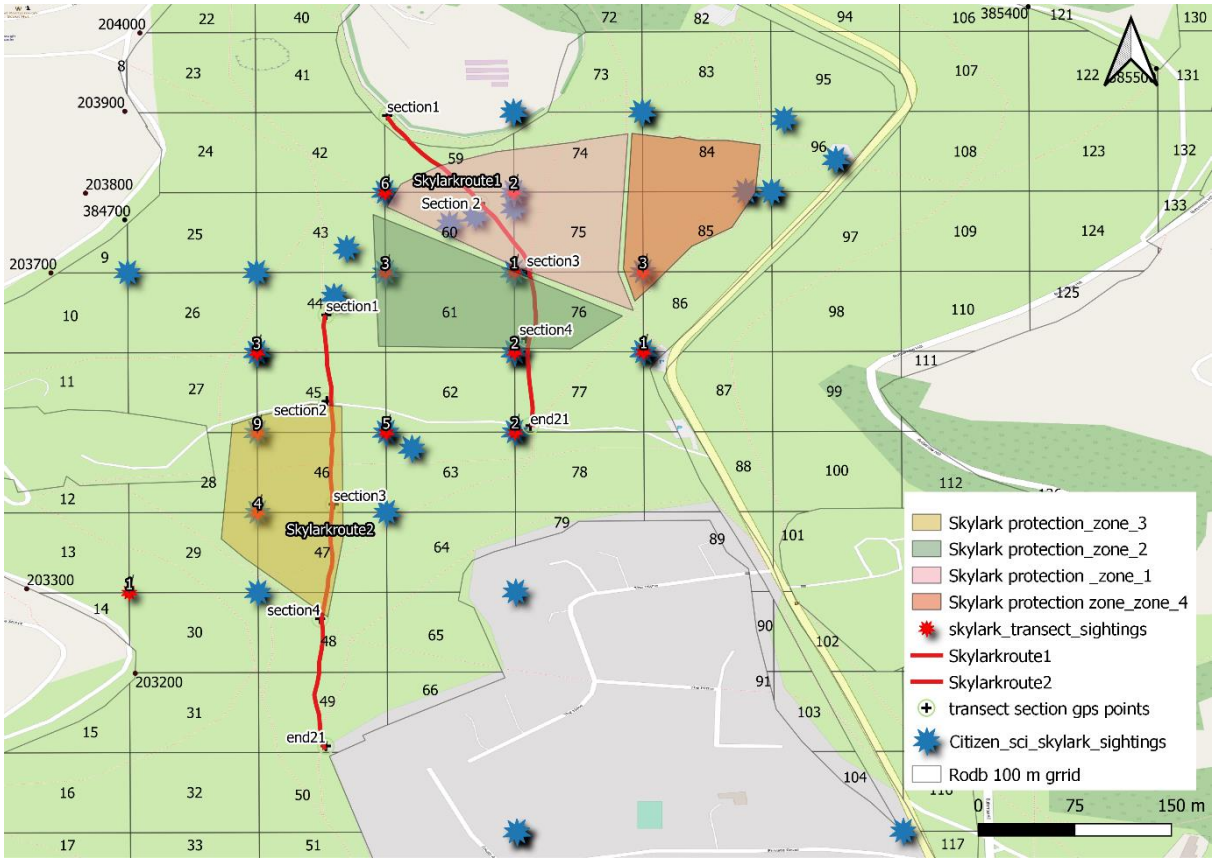
Additionally, we recommend that surveys are repeated at the following frequencies, to monitor the overall health of the common, to gauge the effectiveness of mitigation actions and to inform future strategies:

- Skylarks – ideally annually or at least bi-annually
- Fixed point photography – ideally annually or at least bi-annually
- Full botanicals – every 2-3 years
- Partial botanicals – focussed surveying after mitigation actions taken

Actions suggested and taken on Rodborough Common, along with results of effectiveness or otherwise should also be shared as best practice with managers of Minchinhampton Common, so that similar actions can be considered there.

We do acknowledge the difficulties that may be created in terms of compliance and public perception resulting from fencing off, restricting access, or otherwise directing behaviour on areas of common land. However, we feel that this action, or action of a similar nature, is required if we are to ensure the continuing survival of this rare habitat.

Figure 6.1 – Proposed protection and recovery zones



Appendix 1.1 – Narrow Path 1 detailed survey results

			quadrat 1. 25/6/21: On mound west of quadrat 2	quadrat 2. 25/6/21: Adjoining path to west	quadrat 3. 25/6/21: path centre	quadrat 4. 25/6/21: on east side of path	quadrat 5. 25/6/21 east of 4		**TOTAL frequency across 5 Quadrats 2021**
Path 1 (Plateau)									
GPS: SO 84975 / 03787									
Survey Date: 25 June 2021									
% bare soil			1%	2%	25%	2%	1%		
% bare soil - Domin Scale			1	2	5	2	1		**11**
Max height vegetation cm.			84	58	27	68	65		
Av. height. vegetation cm.			20	15	4	20	12		
% cover herbs / grasses			74/25	59 / 39	4/71	34 / 64	69/30		
GRASSES									
Anthoxanthum odoratum	Sweet Vernal grass	I	4	3	2		2		**11**
Avenula pratensis	Meadow Oat-grass	III	1			2			**3**
Briza media	Common Quaking Grass	IV	1	1		2	3		**7**
Bromopsis erecta	Upright Brome	**V**	5	3	8	7	6		**29**
Cynosurus cristatus	Crested dogstail		5	5	5	5	3		**23**
Dactylis glomerata	Cocksfoot	I				1	1		**2**
Festuca rubra agg.	Red Fescue	I	4	4	2	2	3		**15**
Holcus lanatus	Yorkshire Fog	I	2	2					**4**
Lolium perenne	Common ryegrass			3	3				**6**
SEDGES									
Carex flacca	Glaucous Sedge	**V**	3	3		2	4		**12**

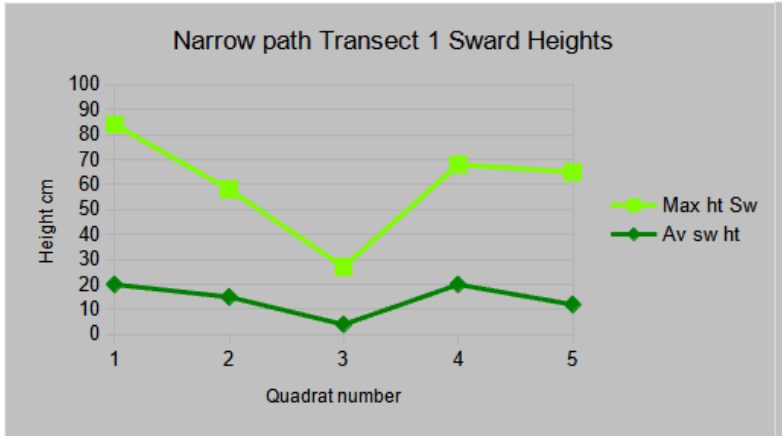
HERBS									
Anthyllis vulneraria	Kidney Vetch	**III**	1						**1**
Asperula cynanchica	Squinancywort	**II**	1						**1**
Bellis perennis	Daisy	I			1				**1**
Centaurea nigra agg.	Common knapweed	I		2		1	3		**6**
Cirsium acaule	Dwarf Thistle	**IV**	2	1		2			**5**
Galium verum	Lady's bedstraw	**I**	3	3		2	4		**12**
Gymnadenia conopsea	Fragrant-orchid		2				1		**3**
Helianthemum nummularium	Common Rock-rose	**IV**	4	3		4	5		**16**
Hieracium pilosella (Pilosella officinarum)	Mouse-ear Hawkweed	**IV**	3			1	2		**6**
Hippocrepis comosa	Horseshoe Vetch	**I**	1						**1**
Leontodon hispidus	Rough Hawkbit	**IV**	2	2					**4**
Lotus corniculatus	Birdsfoot trefoil	**IV**	5	3		4	5		**17**
Medicago lupulina	Black medick	I	2	4		2	4		**12**
Plantago lanceolata	Ribwort Plantain	II			1		3		**4**
Plantago major	Greater Plantain	I		1		3			**4**
Plantago media	Hoary Plantain	I	2	3					**5**
Polygala vulgaris	Common Milkwort	**I**	3						**3**
Primula veris	Cowslip	I	2	2		4	4		**11**
Prunella vulgaris	Self Heal	II	1	1		1	1		**4**
Ranunculus bulbosus	Bulbous Buttercup	I		1	1	1	1		**4**
Rhinanthus minor agg.	Yellwow rattle	I	3	1			4		**8**
Sanguisorba minor	Salad burnet	**IV**	4	4	2		5		**19**
Scabiosa columbaria	Small Scabious	**III**	2				2		**4**
Taraxacum officinale	Dandelion	II				1			**1**
Thymus praecox (drucei)	Wild Thyme	**III**	3						**3**
Trifolium pratense	Red Clover	I	3	3		2	3		**11**
Trifolium repens	White Clover		4	4	3	5	4		**20**

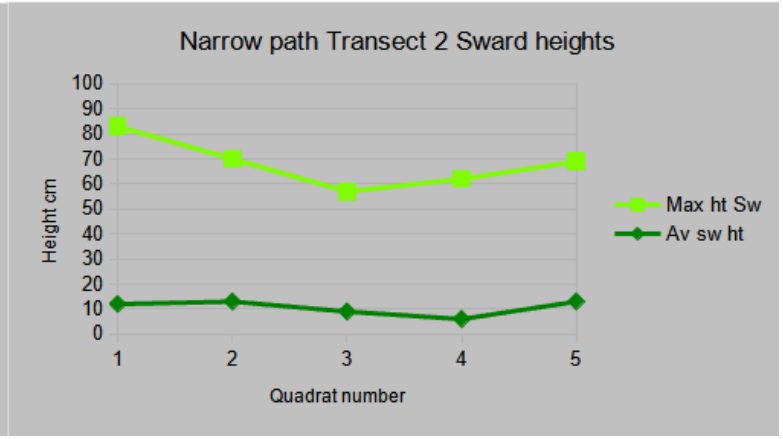
Appendix 1.2 – Narrow path 2 detailed survey results

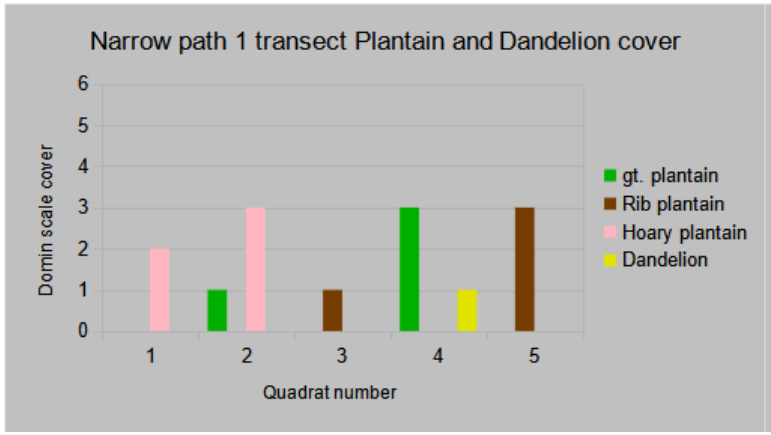
		CG5 - expected out of 5 quadrats	Quadrat 1. 25/6/21	Quadrat 2. 25/6/21:	Quadrat 3. 25/6/21:	Quadrat 4. 25/6/21:	Quadrat 5. 25/6/21:	TOTAL across 5 Quadrats 2021
Path 2 (Slope)								
GPS: SO 84805 / 03407								
Survey Date: 25 June 2021								
% bare soil			1%	10%	33%	10%	3%	
% bare soil Domin Scale			1	4	6	4	3	**18**
Max height vegetation cm.(tall grass fowers)			83	70	57	62	69	
Av. height. vegetation cm.			12	13	9	6	13	
% cover herbs / grasses			89/10	45/45	27/50	63/27	63/34	
GRASSES								
Anthoxanthum odoratum	Sweet Vernal grass	I	2		1			**3**
Brachypodium pinnatum	Tor Grass	V					1	**1**
Briza media	Common Quaking Grass	IV	4	3	2	4	4	**17**
Bromopsis erecta	Upright Brome	V	5	6	5	5	5	**26**
Cynosurus cristatus	Crested dogstail		1	4	5	5	4	**19**
Dactylis glomerata	Cocksfoot	I	1		1			**2**
Festuca rubra agg.	Red Fescue	I	3	3	4	2	3	**15**
Koeleria macrantha	Crested Hair-grass	II			3		2	**5**
Lolium perenne	Common ryegrass				6			**6**
SEDGES								
Carex flacca	Glaucous Sedge	V	3	4	2	4	3	**16**
HERBS								

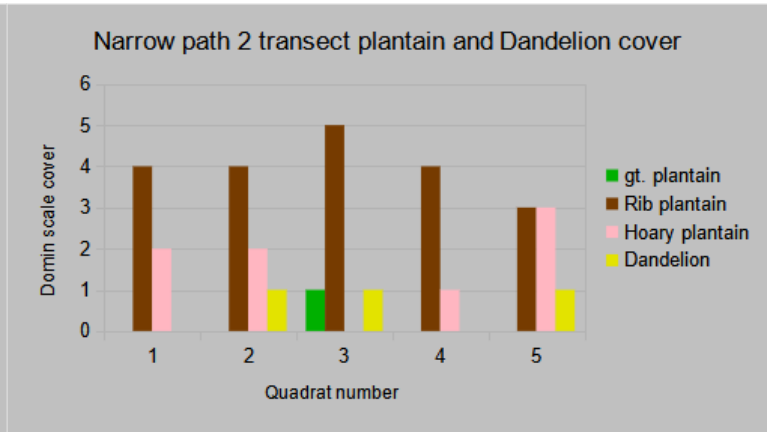
Anthyllis vulneraria	Kidney Vetch	III				3	3	**6**
Asperula cynanchica	Squinancywort	II				4	3	**7**
Centaurea nigra agg.	Common knapweed	I			1	1	1	**3**
Cerastium fontanum	Mouse-eared chickweed	I	1					**1**
Cirsium acaule	Dwarf Thistle	IV	2		1	2	2	**7**
Galium verum	Lady's bedstraw	I	4	2	4	4		**14**
Gymnadenia conopsea	Fragrant-orchid		2			1	2	**5**
Helianthemum nummularium	Common Rock-rose	IV	6	4	3	6	5	**24**
Hieracium pilosella (Pilosella officinarum)	Mouse-ear Hawkweed	IV	1					**1**
Hippocrepis comosa	Horseshoe Vetch	I	5				2	**7**
Leontodon hispidus	Rough Hawkbit	IV	3	3	2	3	5	**16**
Leucanthemum vulgare	Ox-eye daisy	I			2	2		**4**
Linum catharticum	Fairy flax	III		1			1	**2**
Lotus corniculatus	Birdsfoot trefoil	IV	4	5	3	5	5	**22**
Plantago lanceolata	Ribwort Plantain	II	4	4	5	4	3	**20**
Plantago major	Greater Plantain	I			1			**1**
Plantago media	Hoary Plantain	I	2	2		1	3	**8**
Polygala vulgaris	Common Milkwort	I					1	**1**
Primula veris	Cowslip	I	4	3		4	4	**15**
Prunella vulgaris	Self Heal		1					**1**
Ranunculus bulbosus	Bulbous Buttercup	I			1	1	1	**3**
Rhinanthus minor agg.	Yellow rattle	I	3	2		2	2	**9**
Sanguisorba minor	Salad burnet	IV	4	5	5	4	4	**22**
Scabiosa columbaria	Small Scabious	III	2	2	2	3	3	**12**
Succisa pratensis	Devils bit scabious	I	1	1	1			**3**
Taraxacum officinale	Dandelion	II		1	1		1	**3**
Thymus praecox (drucei)	Wild Thyme	III	5	2	3	5	1	**16**
Trifolium repens	White Clover				5	1	1	**7**
Trifolium pratense	Red Clover	I	2	3	1	4		**10**
Viola hirta	Hairy Violet	III	2		1	1		**4**

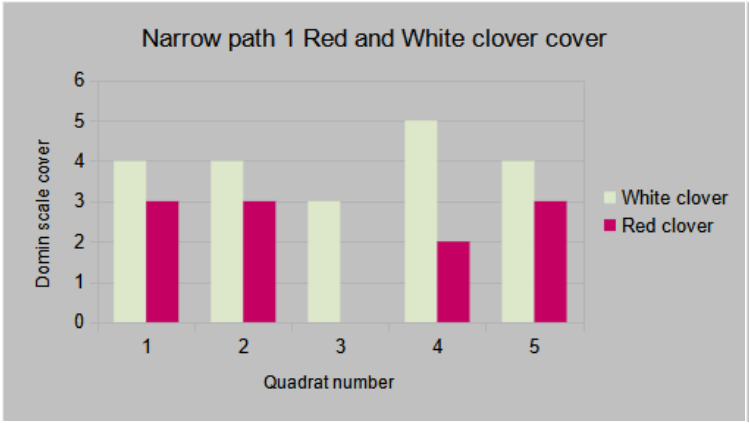
Appendix 1.3 – Narrow path survey graphs

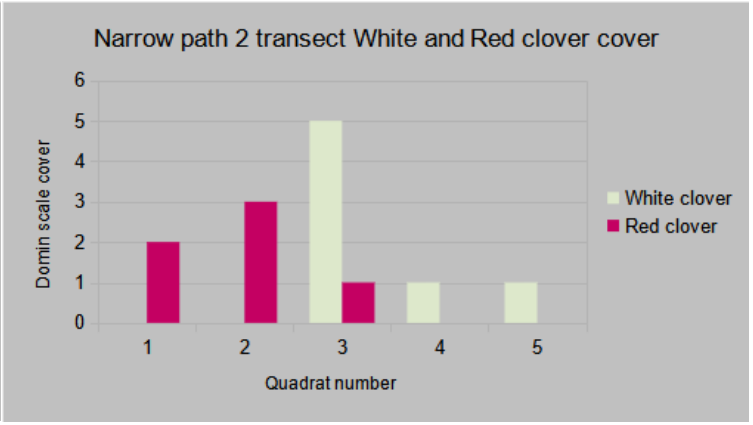









Narrow path 1 Red and White clover cover
Domin scale cover
0
1
2
3
4
5
6
1
2
3
4
5
Quadrat number
White clover
Red clover

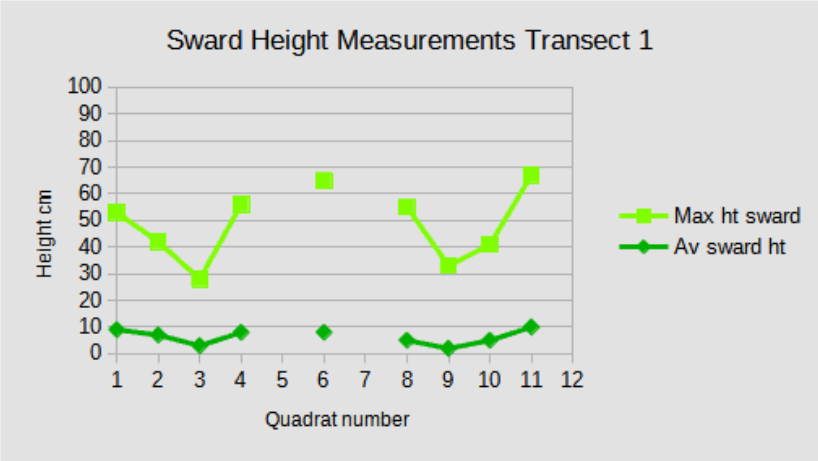

Narrow path 2 transect White and Red clover cover
Domin scale cover
0
1
2
3
4
5
6
1
2
3
4
5
Quadrat number
White clover
Red clover

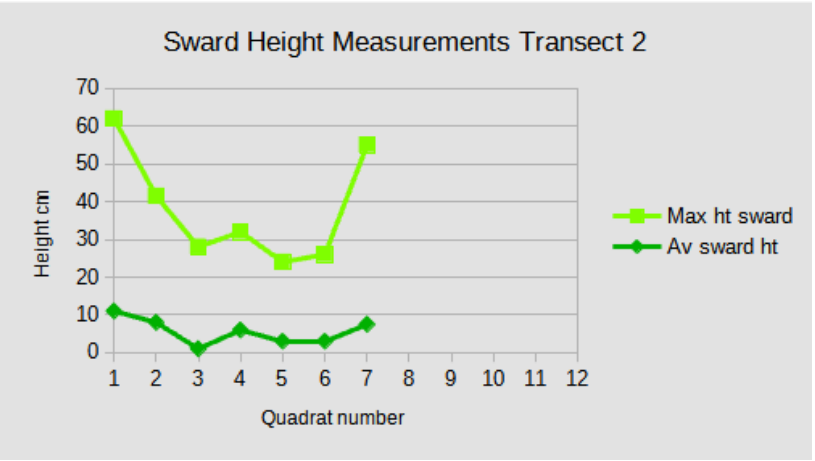
Appendix 2.1 – Wide path survey data collection form

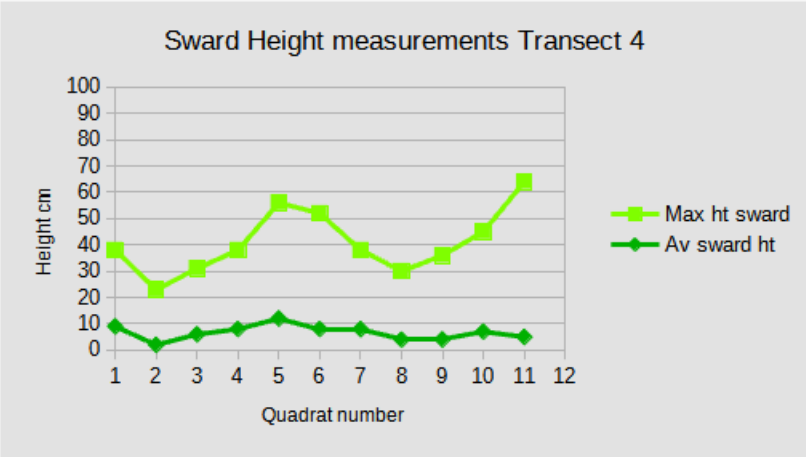
Surveyors	Quadrat No.	1	2	3	4	5	6	7	8	9	10	11	12
	Max height veg.												
	Av. height veg.												
	Disc height veg.												
	Bare ground												
	Grass cover												
	Herb cover												
	Herb/grass ratio												
Grass species													
Avenula pratensis	Meadow oat grass												
Anthoxanthum odoratum	Sweet vernal grass												
Brachypodium pinnatum	Tor grass												
Briza media	Quaking grass												
Bromopsis erecta	Upright brome												
Cynosurus cristatus	Crested dog's tail												
Dactylis glomerata	Cock's foot												
Festuca rubra agg.	Red fescue												
Holcus lanatus	Yorkshire fog												
Koeleria macrantha	Crested hair grass												
Lolium perenne	Perenial rye grass												
Poa annua	Annual meadow grass												
Poa Trivialis	Rough meadow grass												
Sedge species													
Carex caryophyllea	Spring sedge												
Carex flacca	Glaucous sedge												
Herb species													
Anacamptis pyramidalis	Pyramid orchid												
Anthyllis vulneraria	Kidney vetch												
Asperula cynanchica	Squinancywort												
Carlina vulgaris	Carlin thistle												
Centaurea nigra agg.	Knapweed												
Cerastium fontanum	Mouse eared chickweed												
Cirsium acaule	Dwarf thistle												
Galium verum	Lady's bedstraw												
Gymnademia conopsea	Fragrant orchid												
Helianthemum nummularium	Common rock rose												
Hieracium pilosellia	Mouse ear hawkweed												
Hippocrepis comosa	Horseshoe vetch												
Knautia arvensis	Field scabious												
Leontodon hispidus	Rough hawkbit												
Leucanthemum vulgare	Oxeye daisy												

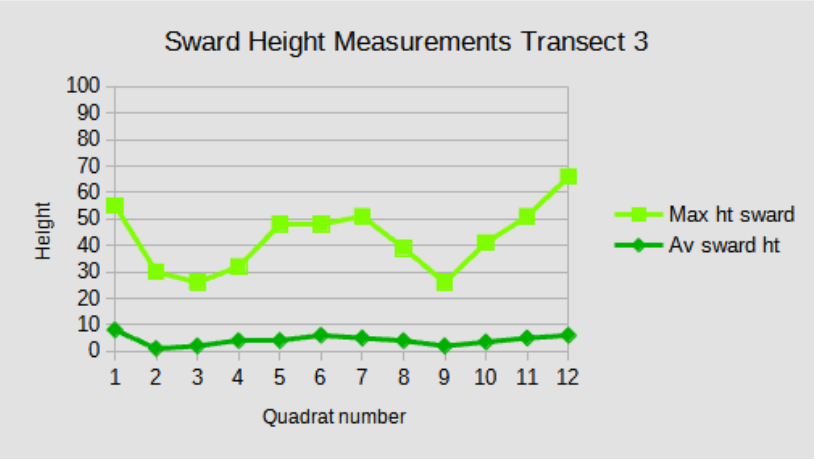
Linum cartharticum	Fairy flax												
Lotus corrniculatus	Birdsfoot trefoil												
Medicago lupulina	Black medic												
Plantago lanceolata	Ribwort plantain												
Herb species	**Quadrat number**	1	2	3	4	5	6	7	8	9	10	11	12
Plantago major	Greater plantain												
Plantago media	Hoary plantain												
Primula veris	Cowslip												
Prunella vulgaris	Self heal												
Ranunculus bulbosus	Bulbous buttercup												
Rhinanthus minor agg.	Yellow rattle												
Sanguisorba minor	Salad burnet												
Scabiosa columbaria	Small scabious												
Succisa pratensis	Devil's bit scaboius												
Taraxacum officinale	Dandelion												
Thymus praecox	Thyme												
Trifolium pratensis	Red clover												
Trifolium repens	White clover												
Viola hirta	Hairy violet												
Extra /notable species													

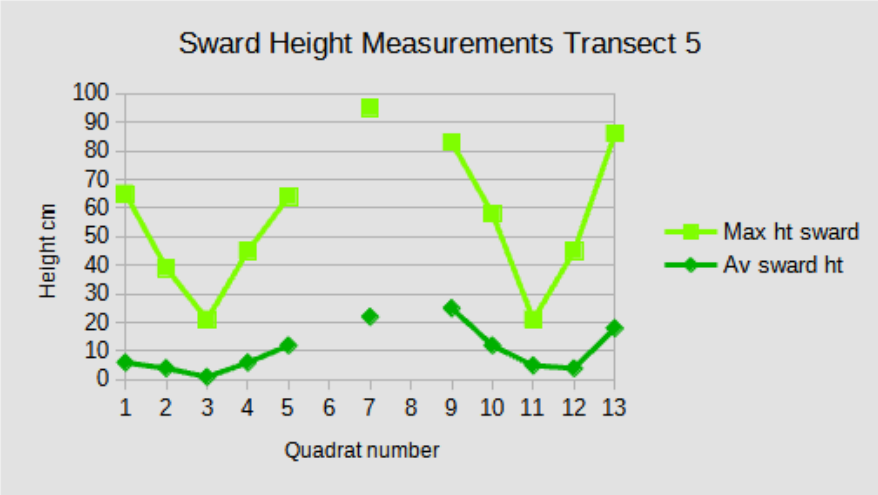
Appendix 2.2 - Wide path sward height and ground cover data

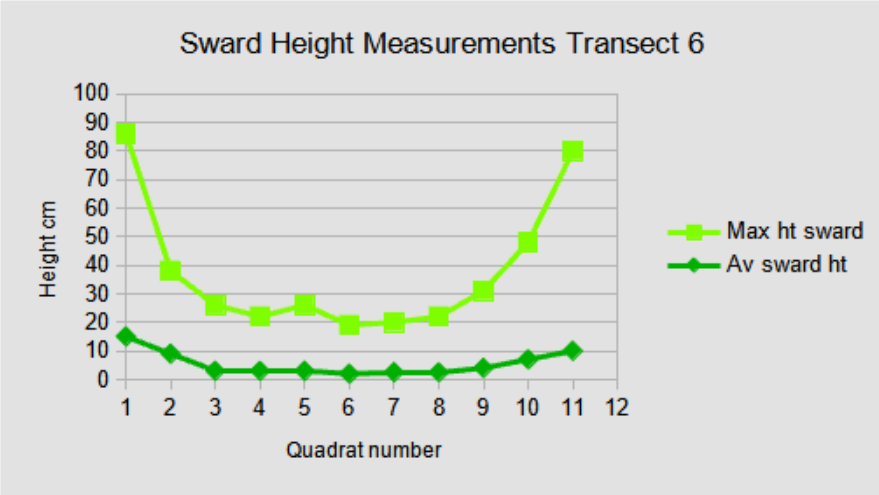


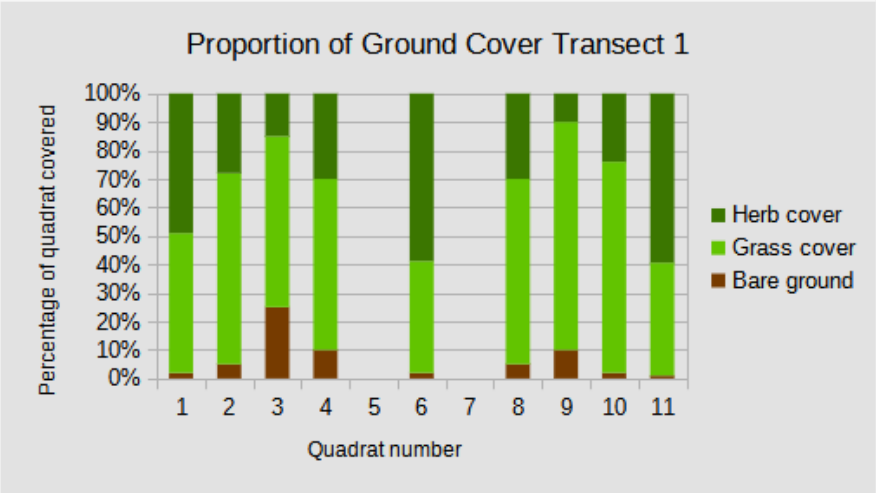


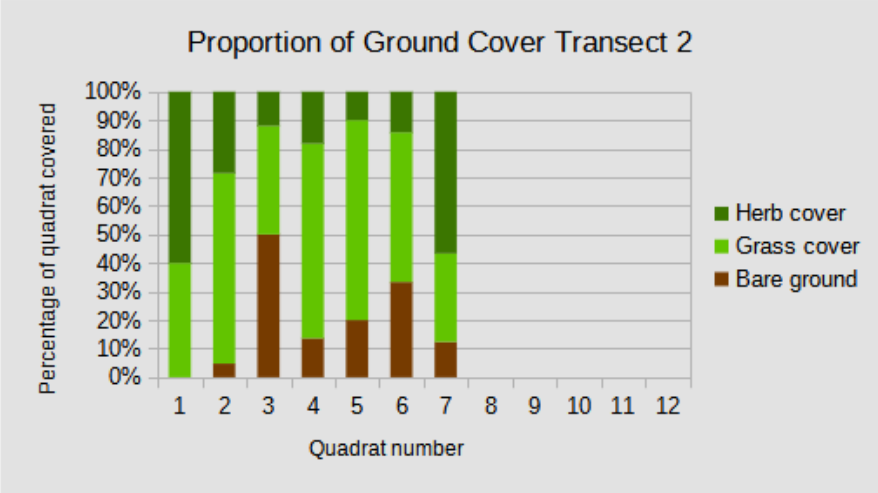


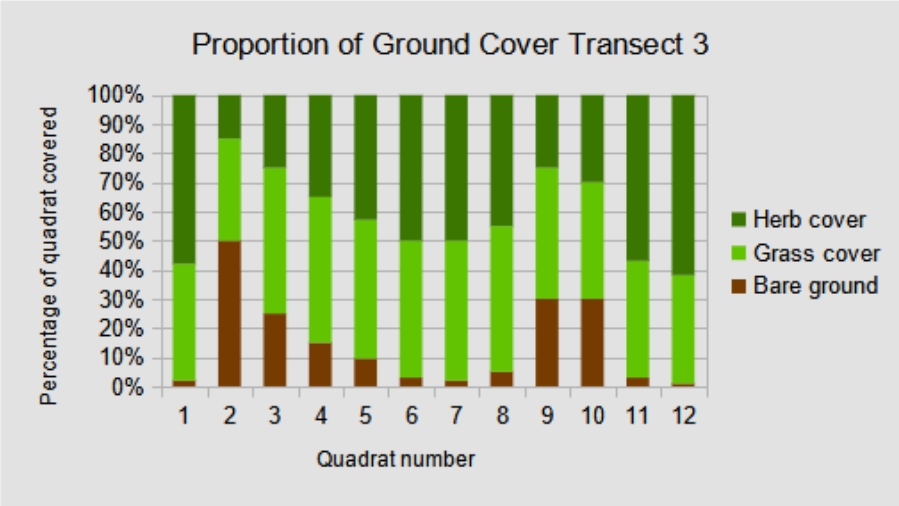


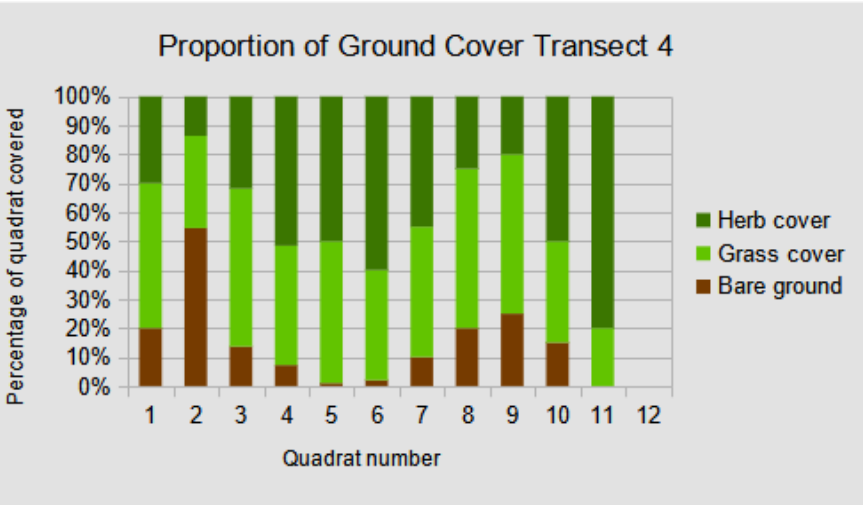

Sward Height Measurements Transect 5
Height cm
Quadrat number
Max ht sward
Av sward ht

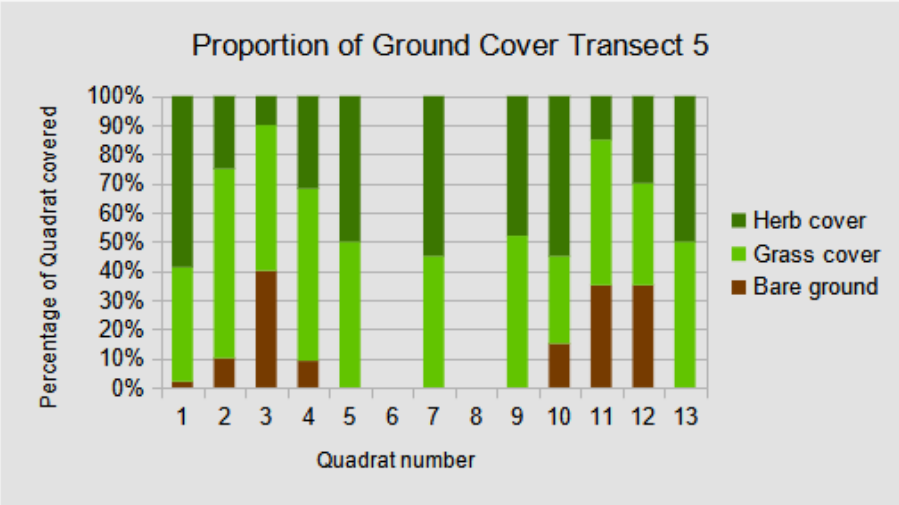

Sward Height Measurements Transect 6
Height cm
Quadrat number
Max ht sward
Av sward ht

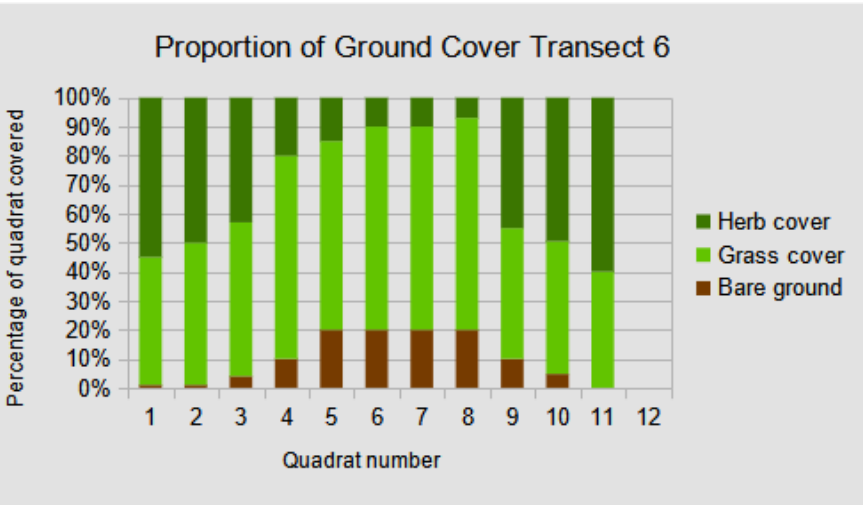

Proportion of Ground Cover Transect 1
Percentage of quadrat covered
Quadrat number
Herb cover
Grass cover
Bare ground


Proportion of Ground Cover Transect 2
Percentage of quadrat covered
Quadrat number
Herb cover
Grass cover
Bare ground

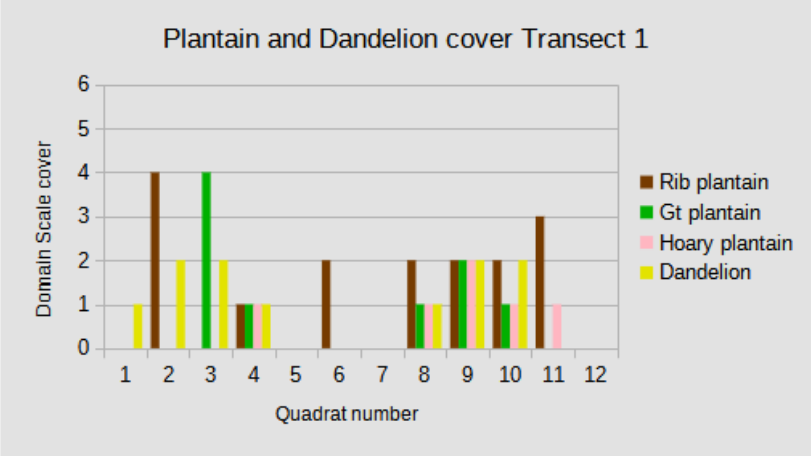

Proportion of Ground Cover Transect 3
Percentage of quadrat covered
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 2 3 4 5 6 7 8 9 10 11 12
Quadrat number
Herb cover
Grass cover
Bare ground

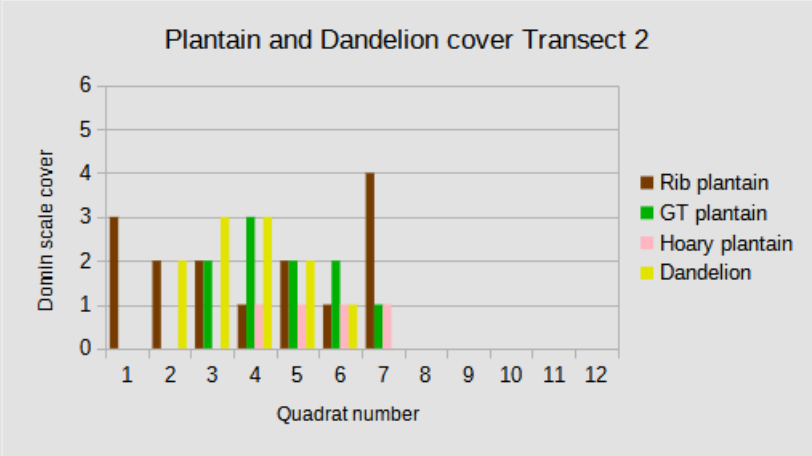

Proportion of Ground Cover Transect 4
Percentage of quadrat covered
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 2 3 4 5 6 7 8 9 10 11 12
Quadrat number
Herb cover
Grass cover
Bare ground

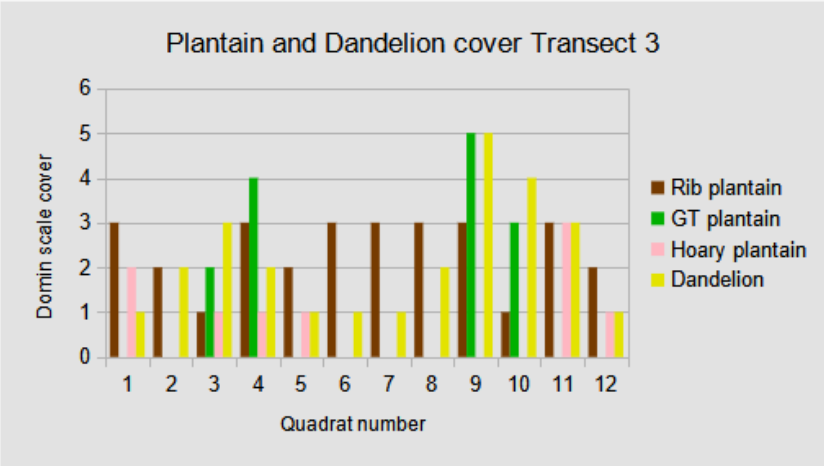

Proportion of Ground Cover Transect 5
Percentage of Quadrat covered
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 2 3 4 5 6 7 8 9 10 11 12 13
Quadrat number
Herb cover
Grass cover
Bare ground

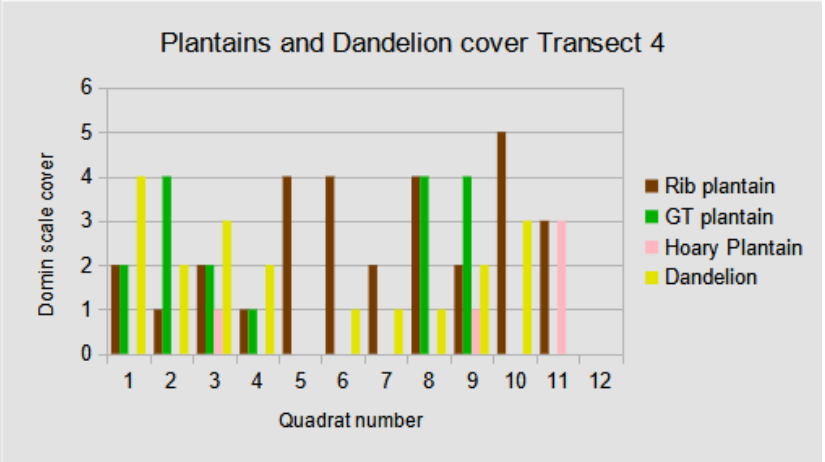

Proportion of Ground Cover Transect 6
Percentage of quadrat covered
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1 2 3 4 5 6 7 8 9 10 11 12
Quadrat number
Herb cover
Grass cover
Bare ground

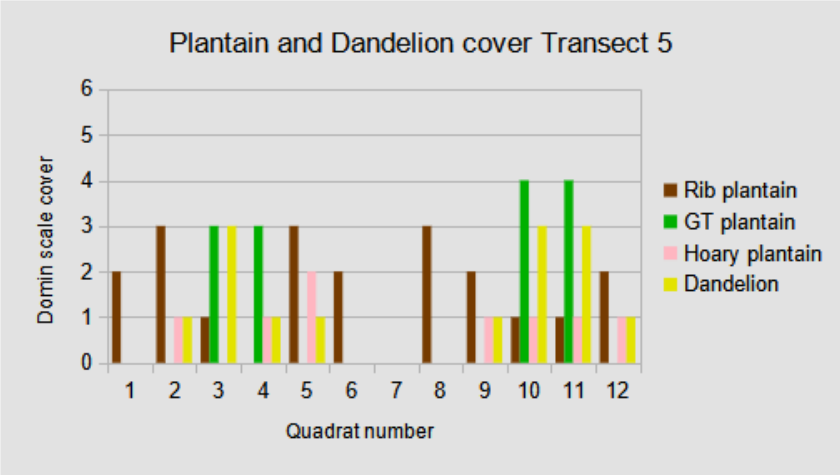
Appendix 2.3 – Wide path full results – graphs

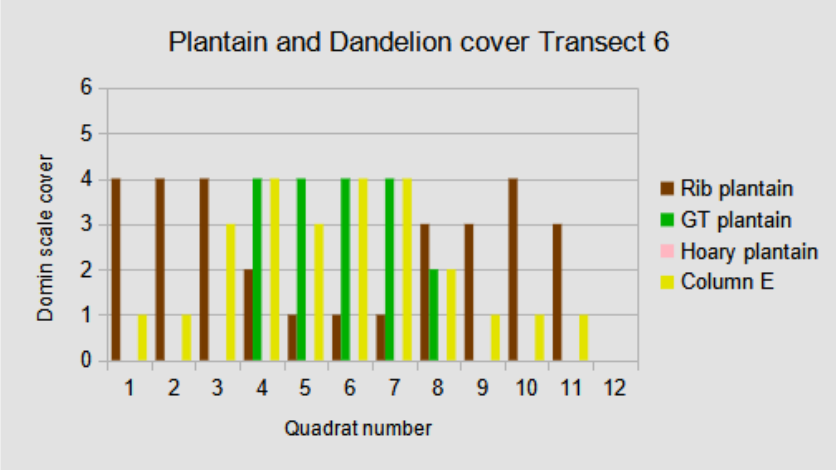


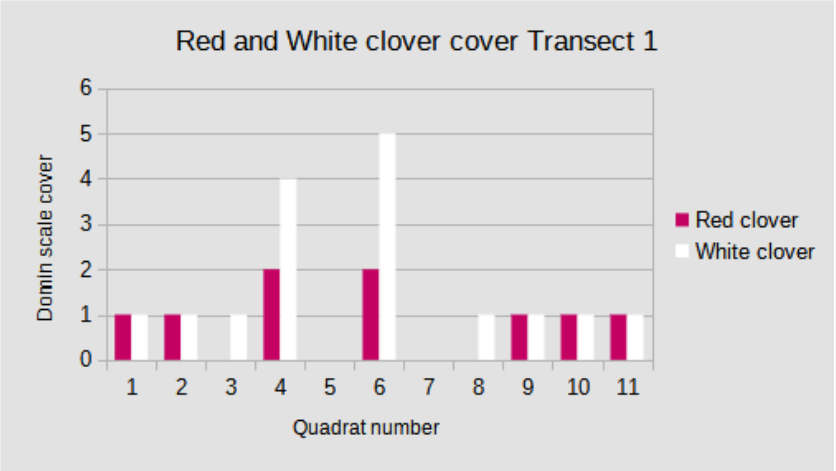


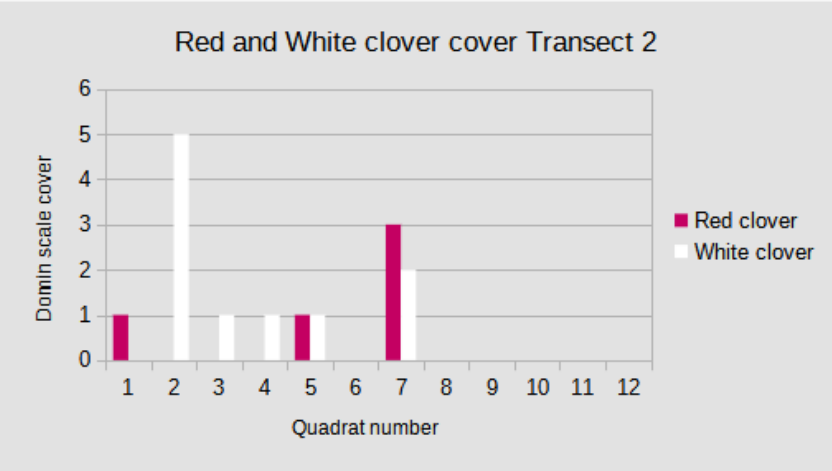


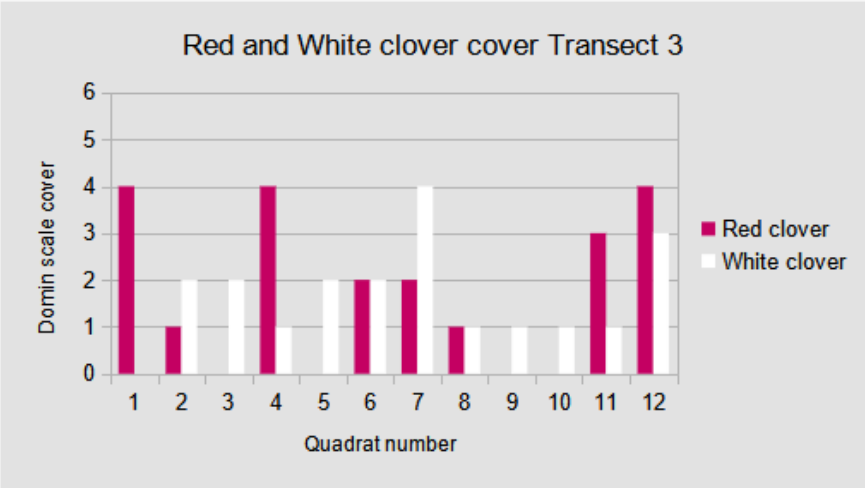


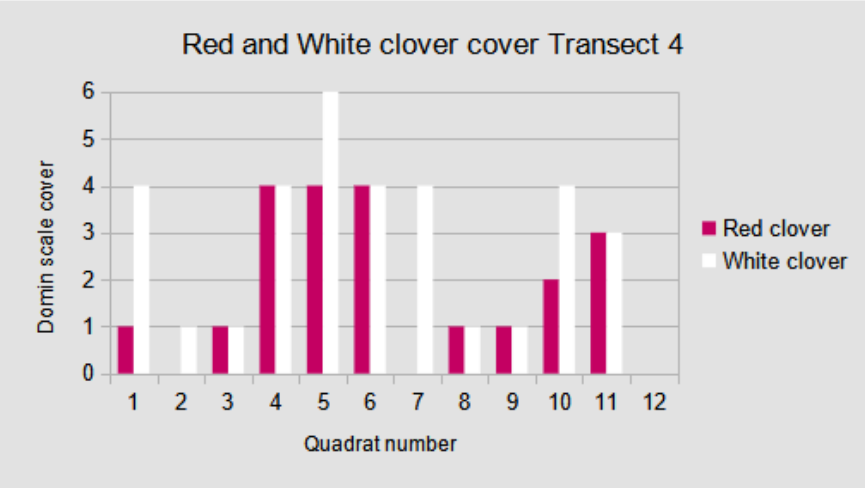

Plantain and Dandelion cover Transect 5
Domin scale cover
Quadrat number
Rib plantain
GT plantain
Hoary plantain
Dandelion

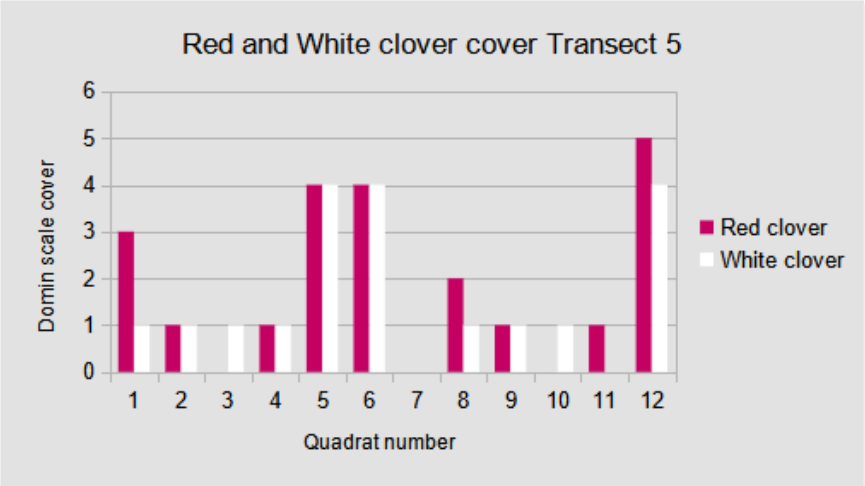

Plantain and Dandelion cover Transect 6
Domin scale cover
Quadrat number
Rib plantain
GT plantain
Hoary plantain
Column E

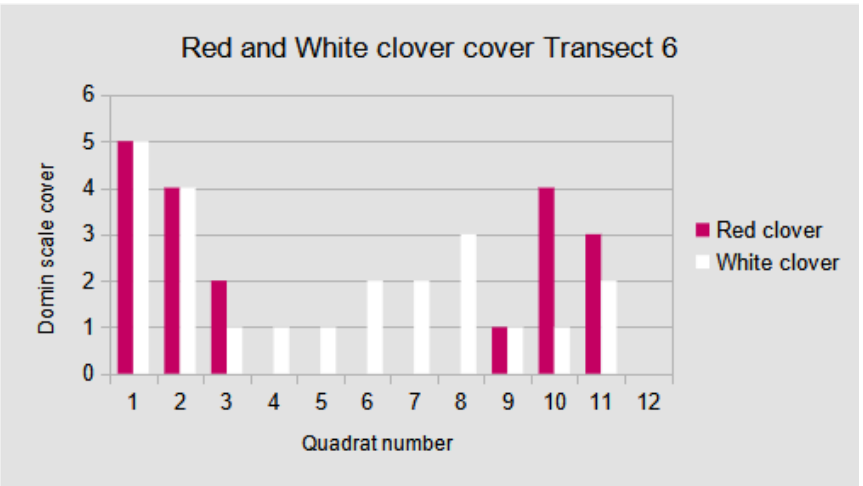

Red and White clover cover Transect 1
Domin scale cover
Quadrat number
Red clover
White clover

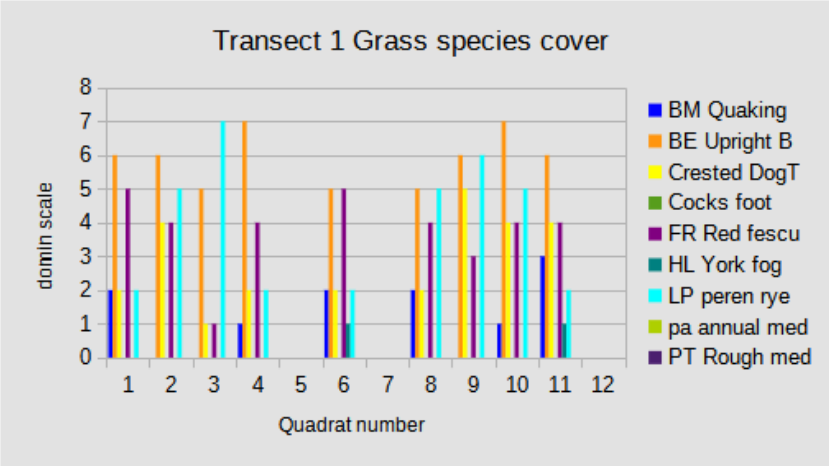

Red and White clover cover Transect 2
Domin scale cover
Quadrat number
Red clover
White clover

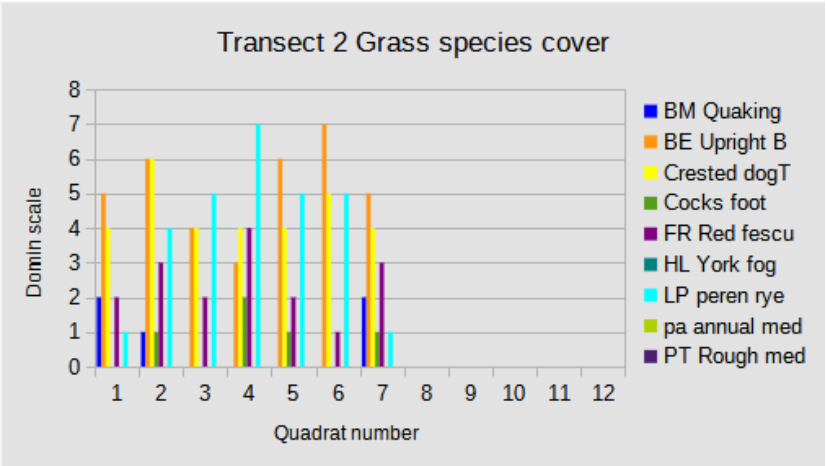

Red and White clover cover Transect 3
Domin scale cover
0
1
2
3
4
5
6
1 2 3 4 5 6 7 8 9 10 11 12
Quadrat number
Red clover
White clover

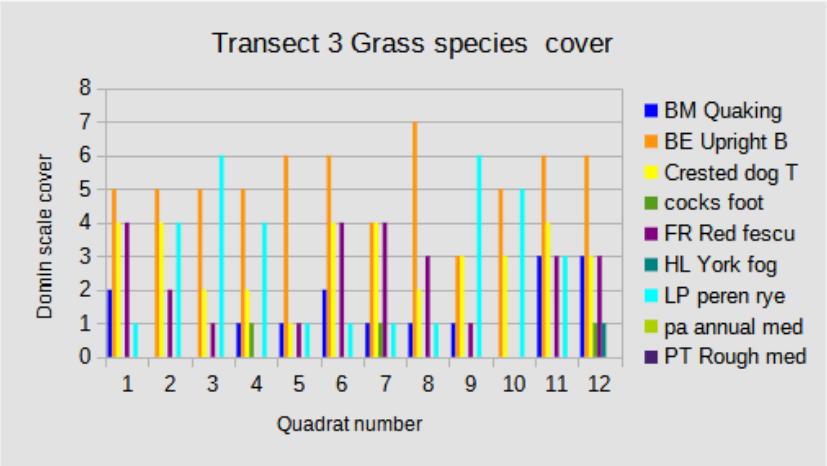

Red and White clover cover Transect 4
Domin scale cover
0
1
2
3
4
5
6
1 2 3 4 5 6 7 8 9 10 11 12
Quadrat number
Red clover
White clover

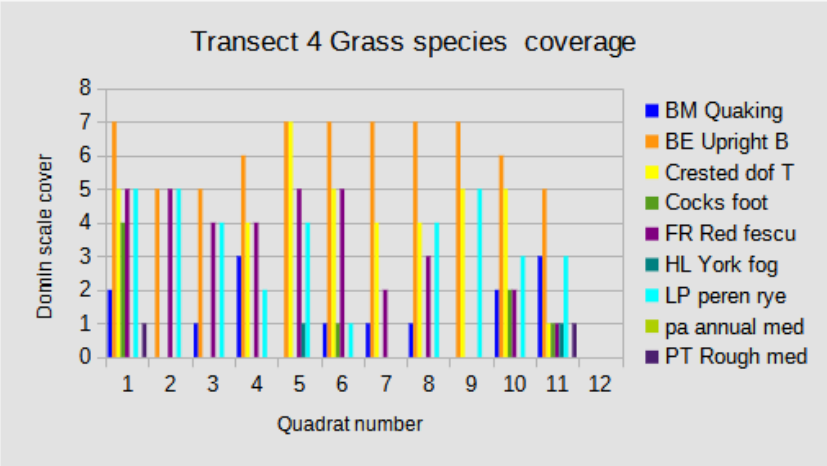

Red and White clover cover Transect 5
Domin scale cover
0
1
2
3
4
5
6
1 2 3 4 5 6 7 8 9 10 11 12
Quadrat number
Red clover
White clover

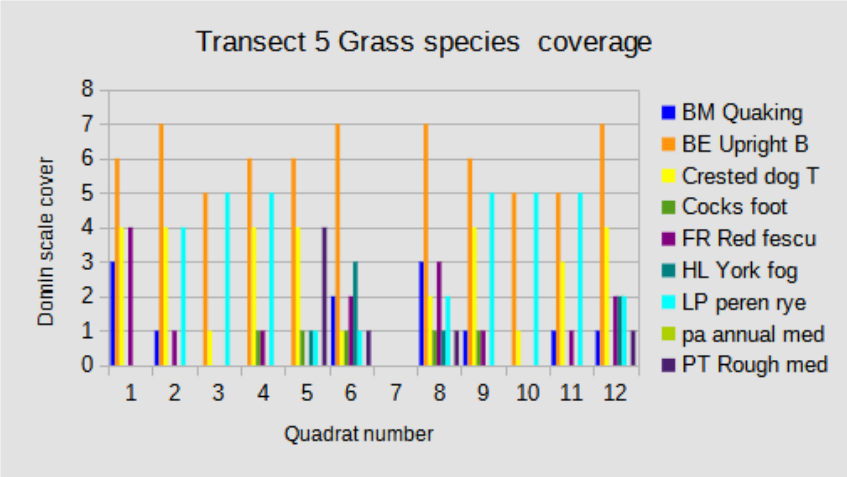

Red and White clover cover Transect 6
Domin scale cover
0
1
2
3
4
5
6
1 2 3 4 5 6 7 8 9 10 11 12
Quadrat number
Red clover
White clover

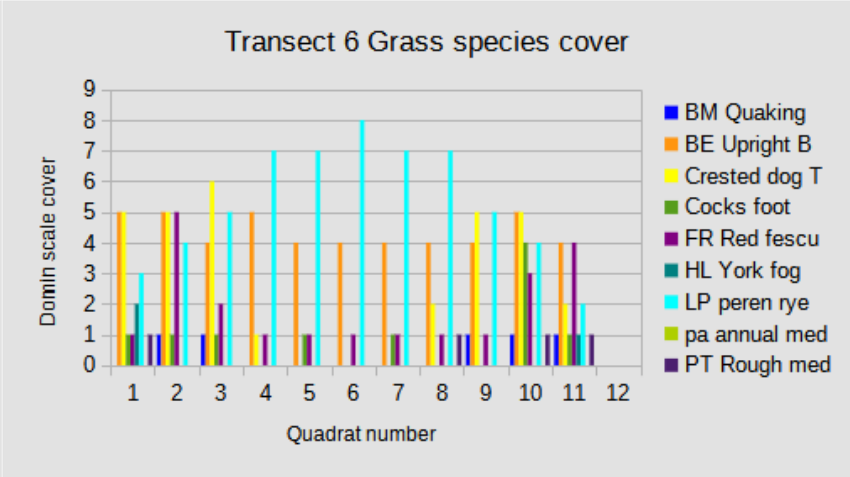

Transect 1 Grass species cover
domin scale
Quadrat number
BM Quaking
BE Upright B
Crested DogT
Cocks foot
FR Red fescu
HL York fog
LP peren rye
pa annual med
PT Rough med


Transect 2 Grass species cover
Domin scale
Quadrat number
BM Quaking
BE Upright B
Crested dogT
Cocks foot
FR Red fescu
HL York fog
LP peren rye
pa annual med
PT Rough med


Transect 3 Grass species cover
Domin scale cover
Quadrat number
BM Quaking
BE Upright B
Crested dog T
cocks foot
FR Red fescu
HL York fog
LP peren rye
pa annual med
PT Rough med


Transect 4 Grass species coverage
Domin scale cover
Quadrat number
BM Quaking
BE Upright B
Crested dof T
Cocks foot
FR Red fescu
HL York fog
LP peren rye
pa annual med
PT Rough med


Transect 5 Grass species coverage
Domin scale cover
Quadrat number
BM Quaking
BE Upright B
Crested dog T
Cocks foot
FR Red fescu
HL York fog
LP peren rye
pa annual med
PT Rough med


Transect 6 Grass species cover
Domin scale cover
Quadrat number
BM Quaking
BE Upright B
Crested dog T
Cocks foot
FR Red fescu
HL York fog
LP peren rye
pa annual med
PT Rough med

This page left intentionally blank

Appendix 4.1 – Full Skylark Transect Survey Results

Date of Survey	Observer Name	Recorder Name	Weather Conditions	Transect	Start time	Finish Time	Section	Distance Band	Grid Ref.	Species Code	Number of Birds	Comments
08/04/2021			Cloudy Still Cold	A	8.08am	8.20am	2	1L	59	S	1	Not recorded
							3	1R	76	MP	3	Not recorded
							3	1L	76	S	1	Not recorded
				B	8.30am	8.45am						ZERO RETURN
										Total	5	
16/04/2021			Cold Sunny Still	A	8.10am	8.20am	2	1L	75	S	1	Hover/Song Flight
							2	1R	60	S	1	Hover/Song Flight
				B	8.30am	8.45am	1	1R	44	MP	2	Ground
							2	3L	62	S	1	Hover/Song Flight
							3	1R	46	MP	1	Ground
							3	1L	46	S	1	Flight
							4	1L	47	MP	2	Not recorded
										Total	9	
23/04/2021			Cold Bright sunshine Breezy	A	8.10am	8.20am	4	1R	77	S	1	Hover/Song Flight
				B	8.25am	8.40am						ZERO RETURN
										Total	1	
30/04/2021			Cold (5c) Still Low Cloud	A	8.20am	8.30am	1	2L	74	S	1	Hover/Song Flight
							2	2L	85	S	1	Ground
							2	2L	85	S	1	Ground

							1	1L	59	S	1	Flight
				B	8.40am	8.55am	2	3L	62	S	1	Hover/Song Flight
										Total	5	
07/05/2021			Sunny Breezy Mild (12c)	A	9.20am	9.30am	1	1R	59	S	1	Hover/Song Flight
							2	1R	60	S	1	Hover/Song Flight
				B	9.35am	9.50am	4	1L	47	MP	1	Flight
										Total	3	
14/05/2021			Low Cloud Cool (9c) Still	A	8.10am	8.35am	2	2L	85	S	1	Not recorded
							3	2L	86	S	1	Hover/Song Flight
							4	1R	77	S	1	Ground
							4	1R	77	MP	2	Ground
							4	2R	62	S	1	Flight
				B	8.40am	8.50am	2	3R	62	S	1	Hover/Song Flight
										Total	7	
22/05/2021				A								ZERO RETURN
				B	8.19am	8.35am	1	1L	44	S	1	Hover/Song Flight
							2	1L	45	S	1	Ground
							3	1R	46	S	2	Flight
										Total	4	
28/05/2021			Cloudy Slight breeze Mild (11c)	A	8.10am	8.20am	4	3R	62	S	1	Not recorded
				B	8.25am	8.35am	2	1R	45	S	1	Ground
							2	1L	45	S	1	Ground
							2	1R	45	S	2	Ground
										Total	5	

04/06/2021			Slight breeze Light clooud Mild (13c)	A	8.15am	8.30am	1	2L	74	S	1	Hover/Song Flight
				B	8.35am	8.50am	1	1R	44	S	1	Perched
							2	1L	45	S	1	Flight
										Total	3	
11/06/2021			Light rain Windy Mild (15c)	A	8.25am	8.40am	1	1L	59	S	1	Hover/Song Flight
							1	1R	59	S	1	Hover/Song Flight
							2	1R	60	S	1	Hover/Song Flight
							3	1R	76	S	1	Ground
				B	8.45am	9.05am	2	1R	45	S	1	Not recorded
							2	1L	45	S	1	Not recorded
							3	1R	46	S	1	Not recorded
							2	1R	45	S	1	Not recorded
										Total	8	
25/06/2021			Windy Sunny Mild (12c)	A	8.10am	8.20am	1	1L	59	S	1	Ground
				B	8.25am	8.40am	1	1L	44	S	1	Hover/Song Flight
							4	2R	29	S	1	Hover/Song Flight
										Total	3	

Appendix 4.2 – Full Skylark Transect Survey Method and Instructions

STROUD VALLEYS PROJECT
SKYLARK SURVEY INSTRUCTIONS

Thank you for volunteering to help with this year's Rodborough Common skylark survey. Below are instructions for completing the survey. If you have any questions about the survey method please contact the Stroud Valleys Project Officer.

Timing of Visit

- The survey should ideally be carried out between 7am and 10am between April and June. Survey date and start/finish times should be recorded on the data collection form

Weather Conditions

- Certain weather conditions should be avoided. Please do not survey during periods of heavy, persistent rain, strong winds or in poor visibility. Weather conditions should be described on the data collection form.

Walking the Transects

- There are 2 transects, designated as A and B. Full instructions of where transects start and finish can be found below.
- You should walk from north to south along the transect line, following the existing path as indicated
- Each transect is split into 4 x approximate 100m sections

Recording Sightings

- Birds to both sides of the transect line should be recorded
- The distance of birds from the path are split into 2 areas: 0-50m and 51-100m, 100m plus. Birds should be recorded in the appropriate distance band
- Birds should be recorded if they are alongside or in front of you. Birds that are seen behind you should not be recorded. Birds that are seen beyond the end of the transect should not be recorded.
- Other species of birds can be recorded if spotted, using the BTO species list provided. The primary focus however is on skylark surveying (species code S)

Returning Data

- Completed data collection forms can either be entered into a count summary sheet and emailed to the Stroud Valleys Project Officer, or else, paper forms can be provided to the Project Officer.

TRANSECT RECORDING CODES

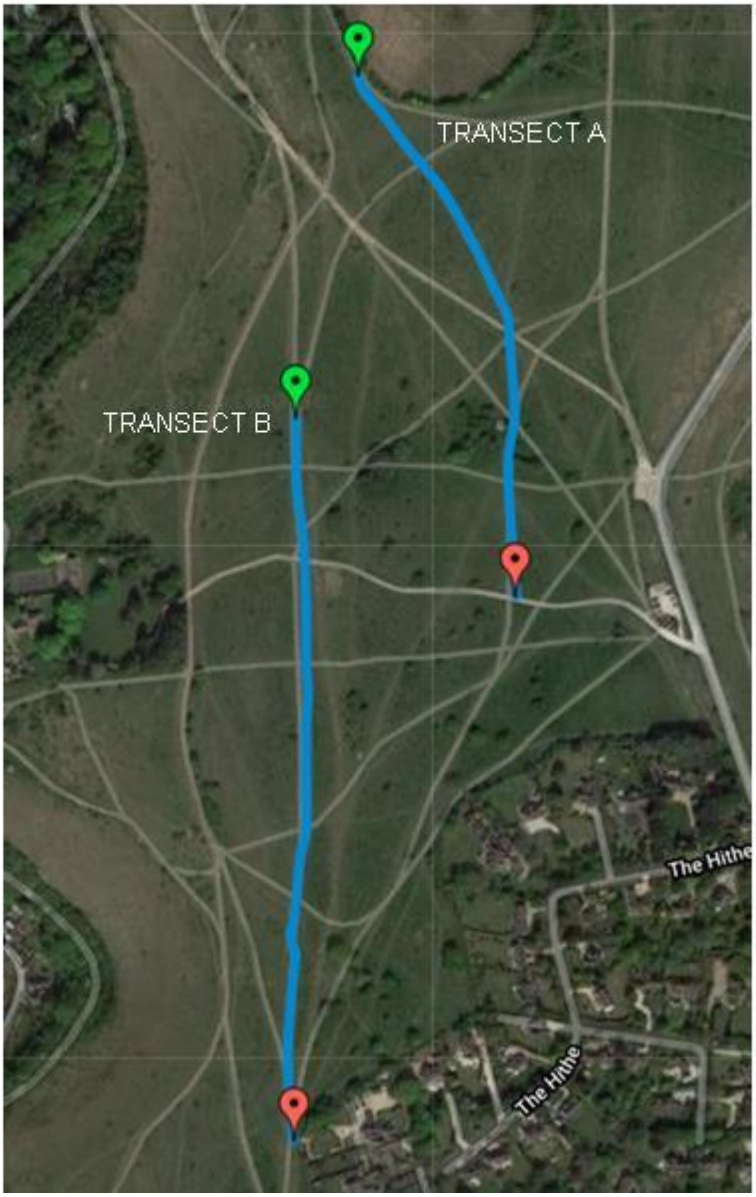
TRANSECT:	A/B	DISTANCE BAND			NORTH	DISTANCE BAND			
SECTION		100m +	51-100m	0-50m		0-50m	51-100m	100m+	
1		3W	2W	1W		1E	2E	3E	
2	WEST	3W	2W	1W	PATH	1E	2E	3E	EAST
3		3W	2W	1W		1E	2E	3E	
4		3W	2W	1W		1E	2E	3E	
					SOUTH				

FOR EXAMPLE:

A single skylark observed in Transect A, in the first section, approximately 65 metres from the east of the path would be recorded as follows:

TRANSECT	A		
SECTION	DISTANCE BAND	SPECIES CODE	NUMBER OF BIRDS
A1	2E	S	1

TRANSECT START AND FINISH POINTS



TRANSECT INSTRUCTIONS

TRANSECT A

⇒ Beginning at the gate to Rodborough Fort, keep the wall on your left and keep walking until you reach the bench dedicated to Roger and Susan Green. Turn to your right and walk 7 paces.

⇒ Stop and turn 90° to your left and follow the narrow path on a heading of 155°. Stroud is in the valley directly behind you

⇒ Proceed up a slight incline, following the path. When you reach the crest of the hill, you will be able to see the gable end of a pale house with a tall ever-green tree ahead of you. Keep heading along the path in the direction of this tree

⇒ As the narrow path you are following passes over a wider path, turn slightly to head directly towards the galvanised cattle trough.

⇒ Keep the cattle trough to your right and pass through a gap in the shrubs/trees. Take the right hand fork towards the wide gravel track.

⇒ Stop recording when you get to the gravel track

Remember to record birds ahead and along side you, to both sides of the track

TRANSECT B

⇒ From the finishing point of Transect A, turn right along the gravel track. When you reach the cattle pond (pictured), go past it and take the first track on your left. This is the start of Transect B. The stand of Scots Pines planted for Lord Baden Powell will be directly behind you.

⇒ Start recording. Follow this path straight ahead on a bearing of 185°, heading towards the houses that are surrounded by a wall (The Hithe)

⇒ There will be a slight curve in the path to the right. Keep following the path towards a standalone tree straight ahead.

⇒ When you reach this tree, take the right hand fork around it and head towards the corner of the wall ahead. Keep the galvanised cattle trough on your right hand side.

⇒ When you are parallel with the corner of the wall surrounding The Hithe, you have reached the end of transect B and should stop recording.

⇒ The village church of North Woodchester should be directly to your right

Remember to record birds ahead and along side you, to both sides of the track

Appendix 4.3 - Skylark transect section location mapping

Transect	Section	SO Reference	Distance Band	GCER Grid Ref
A	Start - Section 1	S084902 03896		59
			1L	59
			2L	74
			3L	74
			1R	59
			2R	42
			3R	42
	2	S084974 03786	1L	75
			2L	85
			3L	85
			1R	60
			2R	60
			3R	43
	3	S085010 03703	1L	76
			2L	86
			3L	86
			1R	76
			2R	61
			3R	61
	4	S085009 03617	1L	77
			2L	87
			3L	87
			1R	77
			2R	62
			3R	62
	End	S085012 03508		77
B	Start - Section 1	S084854 03647	1L	44
			2L	61
			3L	61
			1R	44
			2R	26
			3R	26
	2	S084854 03539	1L	45
			2L	62
			3L	62
			1R	45
			2R	27
			3R	27
	3	S084859 03410	1L	46
			2L	63
			3L	63
			1R	46

			2R	28
			3R	28
	4	S084848 03267	1L	47
			2L	64
			3L	64
			1R	47
			2R	29
			3R	29
	End	S084852 03108		49

Appendix 5.1 - Citizen Science Press Coverage – Stroud News and Journal

National Trust calls on Rodborough walkers to record skylarks

By Brad Young @Bradley_JYoungTrainee Reporter

A skylark photographed by Deborah Roberts

0 comment

Stroud Valleys Project, in conjunction with the National Trust, are asking residents in Stroud, Minchinhampton, Rodborough and the surrounding areas to record sightings of skylarks on Rodborough Common.

The 'citizen scientist' initiative is intended to help conservationists understand the health of the skylark population in the area.

Walkers are being invited to record sightings during April, May, and June on a smartphone app, iRecord.

The number of Skylarks has severely declined over recent decades and their ground-level nests are particularly vulnerable to dogs, walkers, and cyclists due.

Stroud Valleys Project CEO Clare Mahdiyone said: “This is why it is so important for us to understand how the skylarks on Rodborough Common are faring, and we are hoping that local people will enjoy getting involved in helping do this.”

Male skylarks are easy to spot as they undertake prolonged song flights to mark the territory surrounding their nests, which are on the ground.

Their distinctive song is a definite sign of spring and can be **heard here.**

Appendix 5.2 – Citizen science Skylark sightings

iRecord Ref	Scientific name	Common Name	Grid Reference	date
20062607	Alauda arvensis	Skylark	SO84950376	12/03/2021
20086324	Alauda arvensis	Skylark	SO85000378	21/03/2021
20122940	Alauda arvensis	Skylark	SO848036	27/03/2021
20123096	Alauda arvensis	Skylark	SO848037	27/03/2021
20219140	Alauda arvensis	Skylark	SO85210389	14/04/2021
20219158	Alauda arvensis	Skylark	SO84920348	14/04/2021
20222482	Alauda arvensis	Skylark	SO847037	14/04/2021
20227353	Alauda arvensis	Skylark	SO849037	16/04/2021
20227356	Alauda arvensis	Skylark	SO849037	16/04/2021
20227359	Alauda arvensis	Skylark	SO84970377	16/04/2021
20227376	Alauda arvensis	Skylark	SO85180380	16/04/2021
20227382	Alauda arvensis	Skylark	SO85180380	16/04/2021
20227408	Alauda arvensis	Skylark	SO851036	16/04/2021
20303849	Alauda arvensis	Skylark	SO850038	30/04/2021
20306723	Alauda arvensis	Skylark	SO849038	01/05/2021
20328072	Alauda arvensis	Skylark	SO8403	04/05/2021
20371416	Alauda arvensis	Skylark	SO85250384	09/05/2021
20371514	Alauda arvensis	Skylark	SO85250384	09/05/2021
20397889	Alauda arvensis	Skylark	SO848035	14/05/2021
20472020	Alauda arvensis	Skylark	SO8503	23/05/2021
20472111	Alauda arvensis	Skylark	SO8404	23/05/2021
20497923	Alauda arvensis	Skylark	SO851036	27/05/2021
20503678	Alauda arvensis	Skylark	SO851039	28/05/2021
20503744	Alauda arvensis	Skylark	SO84860367	28/05/2021

20503837	Alauda arvensis	Skylark	SO850038	28/05/2021
20503931	Alauda arvensis	Skylark	SO850039	28/05/2021
20518460	Alauda arvensis	Skylark	SO84860367	30/05/2021
20536157	Alauda arvensis	Skylark	SO848037	01/06/2021
20536185	Alauda arvensis	Skylark	SO84870373	01/06/2021
20536269	Alauda arvensis	Skylark	SO8402	01/06/2021
20544973	Alauda arvensis	Skylark	SO852038	02/06/2021
20561347	Alauda arvensis	Skylark	SO850036	04/06/2021
20561587	Alauda arvensis	Skylark	SO848036	04/06/2021
20626373	Alauda arvensis	Skylark	SO849034	11/06/2021
20626695	Alauda arvensis	Skylark	SO8303	11/06/2021
20626827	Alauda arvensis	Skylark	SO849035	11/06/2021
20626857	Alauda arvensis	Skylark	SO850036	11/06/2021
20664341	Alauda arvensis	Skylark	SO8503	15/06/2021
20664380	Alauda arvensis	Skylark	SO8503	15/06/2021
20695827	Alauda arvensis	Skylark	SO850039	18/06/2021
20696100	Alauda arvensis	Skylark	SO8303	18/06/2021
20696143	Alauda arvensis	Skylark	SO848033	18/06/2021
20696205	Alauda arvensis	Skylark	SO848034	18/06/2021
20696238	Alauda arvensis	Skylark	SO850036	18/06/2021
20696273	Alauda arvensis	Skylark	SO851039	18/06/2021
20706998	Alauda arvensis	Skylark	SO850033	19/06/2021
20707056	Alauda arvensis	Skylark	SO851037	19/06/2021
20707298	Alauda arvensis	Skylark	SO850037	19/06/2021
20707299	Alauda arvensis	Skylark	SO850037	19/06/2021
20707312	Alauda arvensis	Skylark	SO850035	19/06/2021

20707687	Alauda arvensis	Skylark	SO847035	19/06/2021
20773045	Alauda arvensis	Skylark	SO852038	26/06/2021

References

Part 2

Afana A (2018) Analysis of Footpath Network in Rodborough Common area. Aerial Images 1950–2017 Available at: https://www.stroud.gov.uk/media/1010344/rodboroughcommon_sac_patherosionreport_svp_dr_final_march2019_lowres.pdf (Accessed:

Barnard, Richard (2009) 'Development of an indicator of footpath erosion in Warwickshire using Plantain (*plantago s*pp)'. Coventry University, MScR Thesis

Back from the Brink (2021) *Limestone's Living Legacies*. Available at https://naturebftb.co.uk/the-projects/limestones-living-legacies/. (Accessed: 24 September 2021)

Cole D.N. (2003) 'Impacts of hiking and camping on soils and vegetation, a review.' *Journal of applied ecology* 3,2 pp. 215-224.

Hubbard C.E. (1992) revised ed J.C.E hubbard. Grasses: a guide to their structure, identification, uses and distribution in the British Isles. London: Penguin

Ignatieva M., & Konechnaya G. (2004)'Floristic investigations of Historical parks in St. Petersberg, Russia.' *Urban Habitats* 2, 174-216

Natural England (2021) *Rodborough common condition of SSSI units*. Available at: designatedsites.naturalengland.org.uk (Accessed 10 June 2021)

Rose, Francis (2006) *The wildflower key how to identify wildflowers and shrubs in Britain and Ireland*' London: Penguin

Stewart K.E.J. Bourn N.A.D. and Thomas J.A (2002) 'An evaluation of three quick methods commonly used to assess sward height in ecology.' 2002 *Journal of Applied Ecology* vol 38,5 pp1148-1154

White J., McGibbon R., & Underhill-Day J. (2012*). Impacts of Recreation to Cannock Chase SAC*. Unpublished report. Footprint Ecology.

Stroud Valleys Project (2017) *Reports on aerial and botanical surveys conducted to monitor pathway erosion on Rodborough Common (SAC)*. Available at: https://www.stroud.gov.uk/media/1010344/rodboroughcommon_sac_patherosionreport_svp_dr_final_march2019_lowres.pdf (Accessed:

Stroud Valleys Project (2017) RODBOROUGH COMMON: SPECIAL AREA OF CONSERVATION. Reports on aerial and botanical surveys conducted to monitor pathway erosion on Rodborough Common (SAC)
REPORT 2. Report on the botanical surveying of footpaths, June / July 2017 Conducted by Stroud Valleys Project

Rodwell, J. S (1992) *British plant communities vol. 3: Grasslands and montane communities*. Cambridge: Cambridge University Press

Part 4

British Trust for Ornithology (2021) *Breeding Bird Survey*. Available at: https://www.bto.org/our-science/projects/bbs.

Showler, D.A, Stewart, G.B, Sutherland, W.J & Pullin, A.S (2010), 'What is the impact of public access on the breeding success of ground-nesting and cliff-nesting birds', *Collaboration for Environmental Evidence Review*, 5-010 (SR16), available at https://www.environmentalevidence.org/wp-content/uploads/2014/07/SR16.pdf (Accessed: 10 August 2021)

Weston, M.A & Stankowich, T (2014), 'Dogs as agents of disturbance' in *Free ranging dogs and wildlife conservation*, Gompper, M. E (ed.), Oxford: Oxford University Press, pp. 94 - 116