Lullington Heath

- A long-term monitoring network report

October 2020

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Acknowledgments

This work was requested by Natural England and the long-term monitoring network team. Victoria Benstead-Hume, Ruth Oatway and Sarah Grinstead for their kind and patient help in directing the overall purpose of this project. Also for their expertise in explaining the technical ecology involved. The many anonymous volunteers who collected such a huge amount of vital data.

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Version - Report to conservation officer

Summary of findings

1. Lullington Heath is notable for its chalk grassland and heath. However, much of what probably should be chalk grassland does not classify as Calcicolous grasslands according to MAVIS (∼50%). Instead it is often made up of scrubs or rank mesotrophic grassland sub-communities.

2. There is an increase of biodiversity across all habitats over the three surveys. (Chalk grassland species per plot goes from ∼34 to ∼43). This contradicts most of the other indicators though so could be in part due to sampling error.

3. Vegetation height increases, bare soil decreases and litter increases almost uniformly across all habitats over the three surveys. Litter % cover goes from ∼0 to up to 80% in the more rank grassland habitats. This suggests insufficient grazing.

4. This trend is particularly evident in the most recent 2018 survey. The only exception to this is the higher bare soil in the high quality Calcicolous grasslands going from ∼0 to ∼1.5% in 2018. It is likely that grazing is being concentrated on the best quality grassland.

5. The set of plots which are from the high quality grassland also look to be improving from the NVC sub-community analysis. It goes from 94% CG6 (lower quality chalk grassland) down to ∼80% with the emergence of some CG2 (highest quality chalk grassland plots).

6. Part of the sub-community analysis is species number per plot and it appears this is a dominant factor in this change in NVC sub-community for grassland. The positive indicator species have fallen dramatically in 2018 (the last survey) to 12% coverage from 40% in 2014.

7. Tree and scrub coverage on chalk grassland is also increasing above target levels. Targets are <5% but have risen to 9.3% in 2018

8. The chalk grassland species composition also looks to be changing from flowering plants to grasses with a decrease in bryophytes and lichens as well.

9. Most of the indicators on the heath habitats fall well within targets with a couple of notable exceptions. Dwarf shrub cover should be between 25 - 90% but falls to 5.9% in 2018 due to a collapse in the Erica cinerea populations. There also appears to be too much Ulex europaeous after 2011 with coverage increasing above the 25% coverage targets.

10. There is a loss of almost all bryophytes and lichens in the heath habitats after 2011 and a decrease in flowering plants as a proportion of plant cover in 2018 from 0.45 to 0.35 (out of 1).

Contents

Summary of the habitats

There have been three long-term monitoring network (LTMN) surveys conducted at Lullington Heath: in 2011, 2014 and 2018. In each there should be 50 individual 2 m by 2 m plots surveyed. The positions of these should be marked so that at the next survey, the plots can be taken at the same places. In many cases, including at Lullington, the exact location of the previous survey's plot cannot be found and so an approximate location is taken using GPS coordinates. Regardless the spread of habitats across each survey should be approximately the same due to this. The 2018 Lullington survey is missing 12 plots across a range of the habitats assigned by the surveyor (Table 1).

Habitat	2011	2014	2018
Calcareous grassland	36	36	23
Dwarf shrub heath	6	6	5
Scrub	5	5	0
Broadleaved, mixed and yew woodland	3	3	0
Unassigned	0	0	10

Table 1: The number of plots in each survey, sorted by their assigned habitat.

The unassigned plots cover all plots which in previous years have been assigned as 'Scrub' and 'Broadleaved, mixed and yew woodland' suggesting there was some difficulty in surveying in these areas.

Figure 1: The surveyor assigned habitats.

When comparing the locations of these plots on a photograph of the site, it is evident that many of the plots allocated calcareous grassland are in very poor quality areas, often dominated by gorse (especially on the west side of the site). Therefore the surveyor classification habitats will not be used for analysis, as plots which are dominated by gorse cannot be compared to high quality chalk grassland.
The plots have also been assigned a National Vegetation Classification (NVC) code using MAVIS software. This uses a list of species for each 'community' along with expected frequency and cover % values. These are matched to the species in each plot along with certain other variables such as number of species and bare-ground cover % to assign a community code. These give a different spread of habitats (Table 2) Approximately 20 plots are consistently Calcicolous grasslands; the remaining plots which have been assigned Calcareous grassland by the surveyor appear to be a range of other habitats. This could be miss-assignment in the case of Mesotrophic grasslands or areas in which it is not clear whether the habitat is scrub or grassland due to change in habitat. The number of Scrub and Broadleaved, mixed and yew woodland plots drop by approximately 8 in 2018. This matches with the reduction in NVC assigned Woodlands and scrub plots. The remaining Woodlands and scrub plots are probably bordering with the grassland and so have been assigned grassland by the surveyor but have too many woodland species in them to classify as Calcicolous grasslands according to MAVIS (this would be worth investigating). Finally, the Heath plots are reasonably consistent across both methods of habitat identification.

Habitat	2011	2014	2018
Calcicolous grasslands	17	19	20
Woodlands and scrub	13	12	5
Heathes	7	4	4
Mesotrophic grasslands	7	9	2
Calcifugous grasslands	3	1	0
Vegetation of open habitats	3	0	4
Shingle, sandline and sand-dune	0	1	0
Maritime cliff	0	4	3

Table 2: The number of plots in each survey, sorted by their NVC calculated community.

The main two habitats of interest on Lullington Heath are calcicolous grasslands and heaths and as such these will be focused upon. However, it is worth noting that the large number of mesotrophic grassland habitats are from rank grassland sub-communities, typical of over fertilisation and under-grazing.
It could be misleading to use the NVC community assignments for analysis as MAVIS will only allocate the plots which are doing well as high quality communities. Grouping them together just means that the lower quality plots are being ignored. This could be an issue if there is a decrease in the high quality communities as the results in the analysis would indicate positive changes in conditions. However, this would only be because the low quality habitats were being dropped each time. However, at Lullington the number of Calcicolous grasslands does not really change over time and so the communities are reasonable to compare over time.

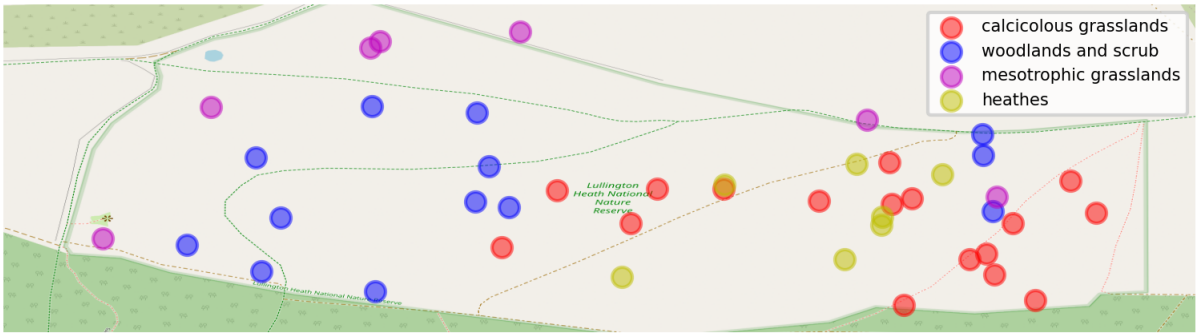

Figure 2: 2011

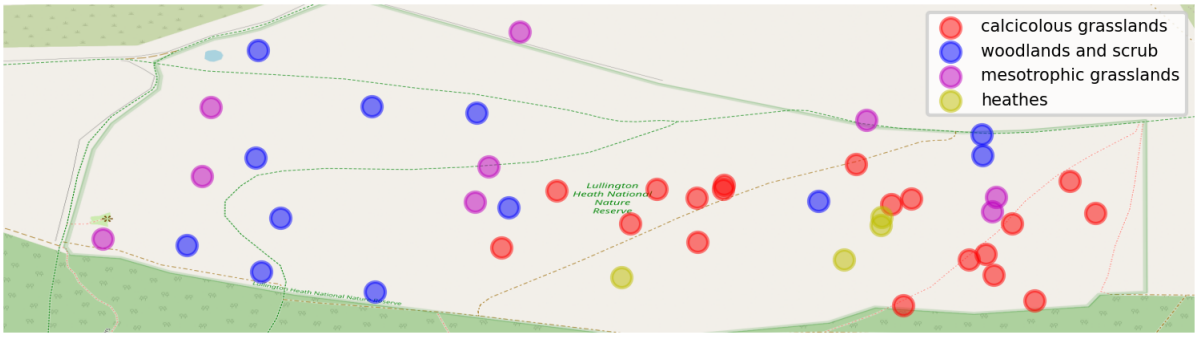

Figure 3: 2014

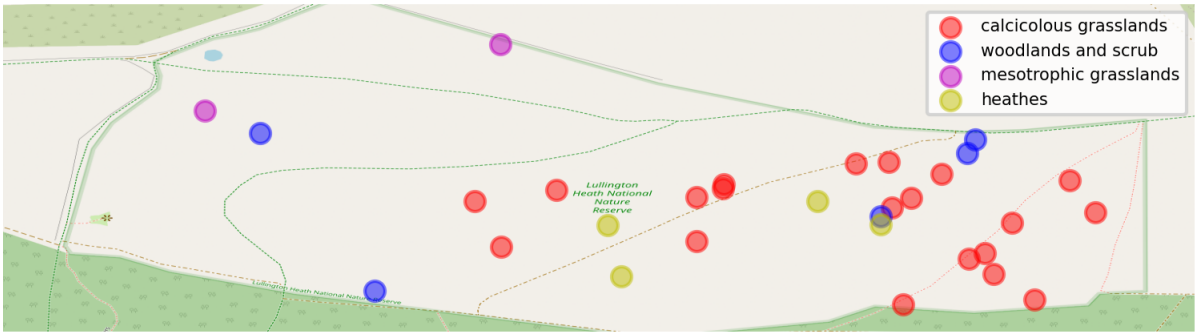

Figure 4: 2018

Figure 5: The NVC assigned communities.

Summary of the site

In each plot, a variety of data is collected. Firstly the plot is divided into 25 equal squares and the presences of each species in recorded as well as sward height, and any physical characteristics such as bare ground or litter. For each species and physical characteristic a % cover of the whole plot is estimated. TO represent this data, the plots have been divided into their NVC community assignments, and only communities which have a consistent number of plots in each survey are shown.

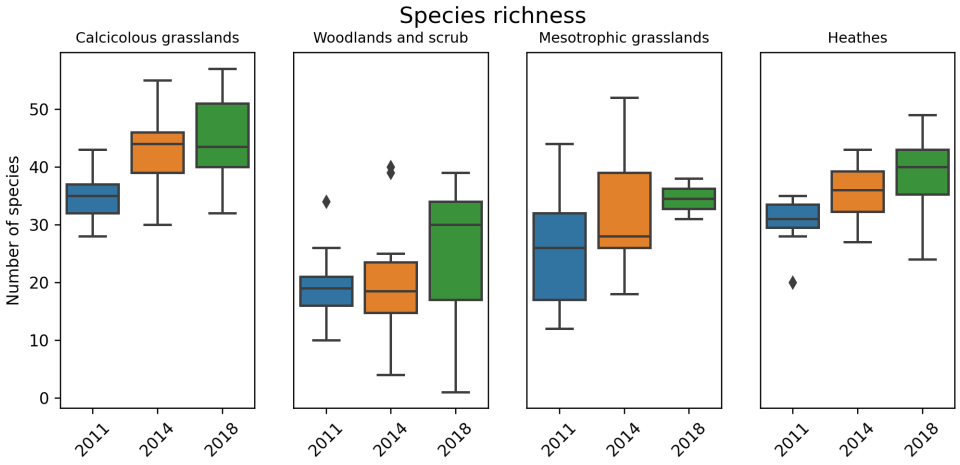

Figure 6: Number of different species in the each plot disregarding frequency and cover

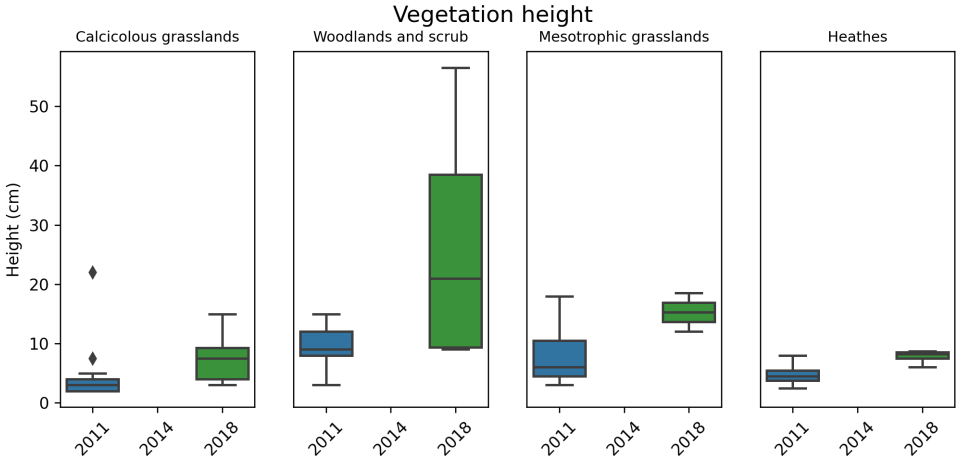

Figure 7: The heights of the vegetation in each NVC community. For each plot the median height across all 25 subplots is taken to represent the height of the plot.

Unfortunately there seems to be some issue in the data collection for plant height as in 2014, many of the plots are recorded as over 1 m high. This is true even in grassland assigned by both MAVIS and the surveyor. The recording method is by placing a heavy disc on the sward and letting it drop to rest. Unless, the grassland was incredibly dense, 1 m high does not seem possible. The data for vegetation height in 2014 has therefore been discarded. It is probable that the vegetation height was higher than usual though. This is speculative but the total cover % of the each plot from plants was much higher that year which suggests higher and denser vegetation.
The decrease in bare soil and increase in litter suggests a lack of grazing.

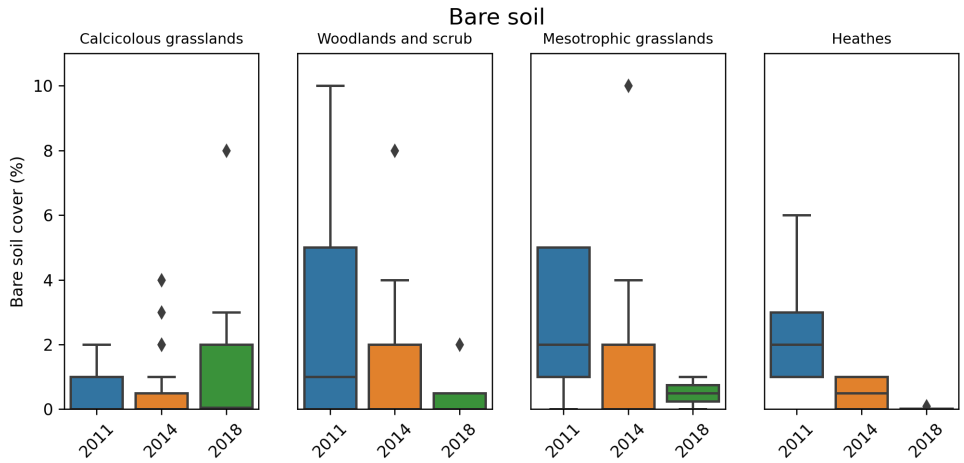

Figure 8: The surveyor's estimation of how much of each plot is taken up with bare soil. All plots are included for each NVC community and the distribution is shown.

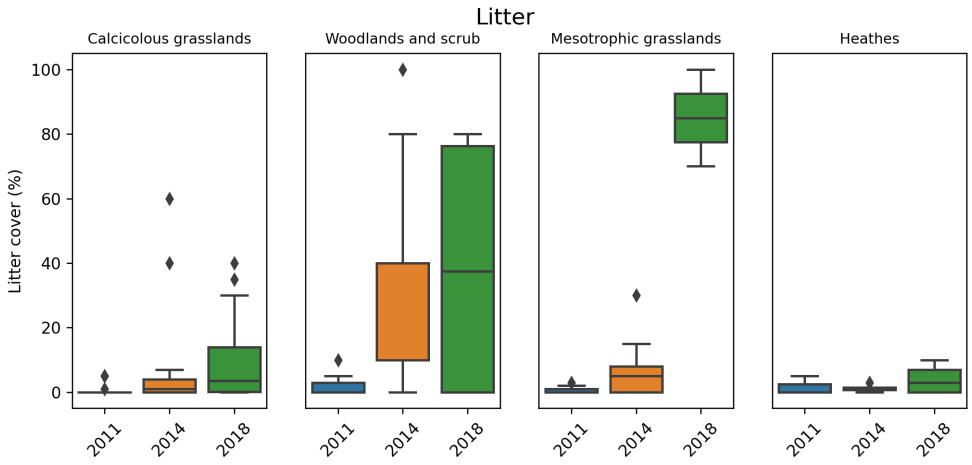

Figure 9: The surveyor's estimation of how much of each plot is taken up with litter. All plots are included for each NVC community and the distribution is shown.

Chalk grassland habitat

The following is data for only the 17, 19 and 20 plots that were classified as NVC community Calcicolous grasslands in the years 2011, 2014 and 2018 respectively. There are more plots classified as Calcareous grassland by the surveyor and it is likely that many of these are treated as chalk grassland for habitat management purposes. However, it is not clear that they can compared due to the possibility of different conditions or locations.

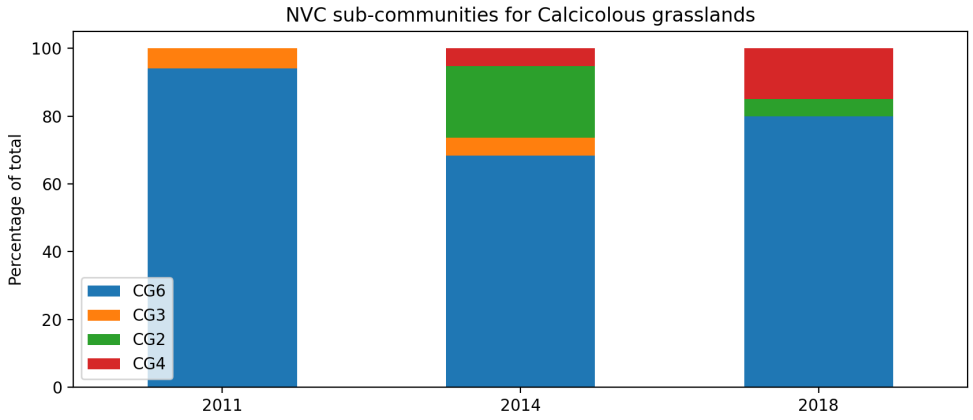

Figure 10: The change in Calcicolous grasslands sub-communities as assigned by MAVIS.

These sub-communities are have a different expected frequency and cover for each individual species and so to some extent the change in assignment indicates a change in the cover of certain indicator species. The other factor is number of species with CG2 expecting the highest biodiversity and CG6 the lowest.
CG2 Festuca ovina - Avenula pratensis
- Species-rich grassland widely distributed principally over southern lowland calcareous formations, with regional differences showing up as sub-communities.
CG3 Bromus erectus grassland
- Distribution follows that of the species and so this community is especially frequent over the Chalk, Jurassic Limestone (Oolite) and Magnesian Limestone (Permian).
CG4 Brachypodium pinnatum grassland
- Frequent on the Cretaceous chalk and Jurassic limestone in England.
CG6 Avenula pubescens grassland.
- Occurs in scattered localities over a variety of lowland limestone areas but is nowhere extensive, being a product of little or no grazing of grasslands over moist, mesotrophic calcareous soils on flat or gently-sloping sites. Most of these areas have been converted to arable.

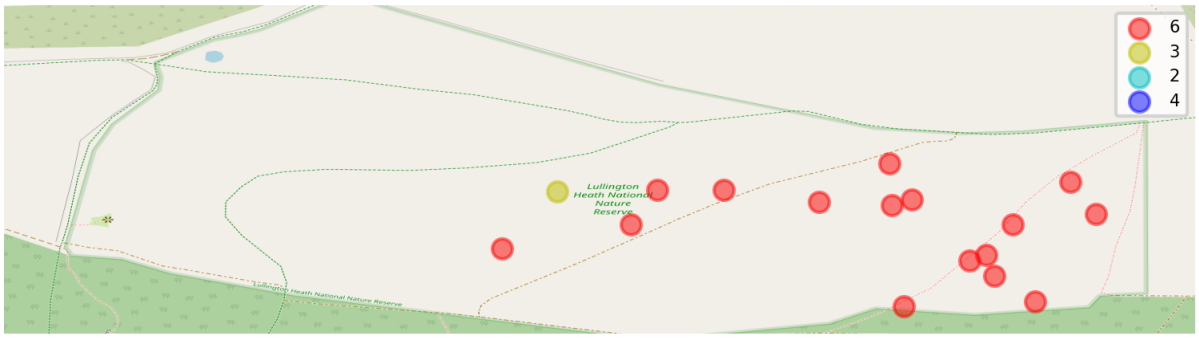

Figure 11: 2011

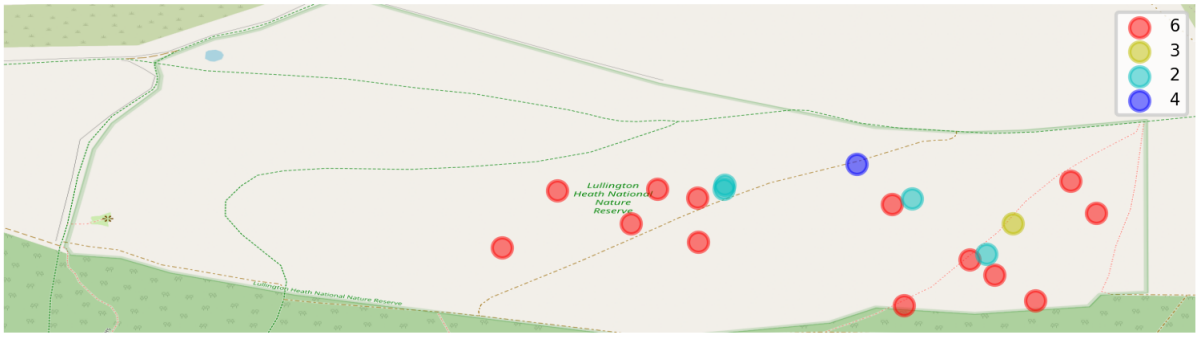

Figure 12: 2014

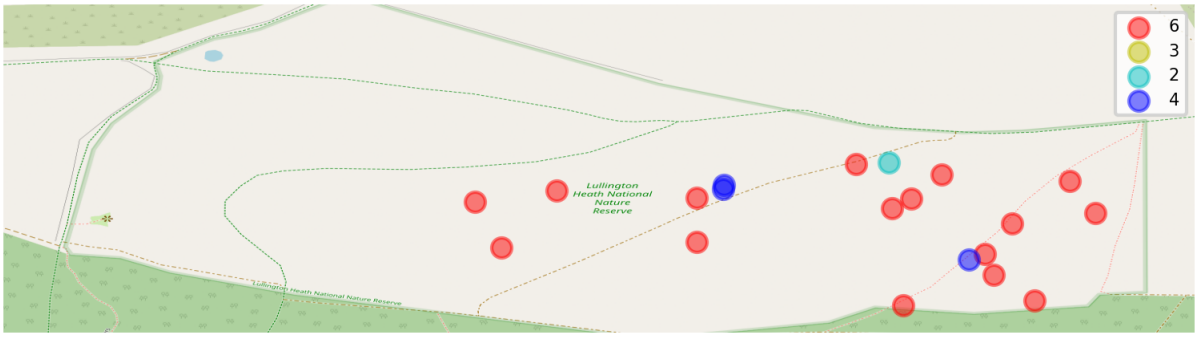

Figure 13: 2018

Figure 14: The NVC assigned Calcicolous grasslands sub-communities.

Each of these sub-communities have different positive and negative species indicators as well as a range of other indicator factors. All Calcicolous grassland plots were grouped together and investigated for cover of indicator species. The positive and negative indicator species can be grouped differently across the sub-communities (CG2/3/4/5/6). The comparison of the site with the targets is shown in Table 3.

	2011	2014	2018	Target
C2 positive indicators	6f 3o	7f 3o	5f 4o	At least 4 spp. frequent and 3 occasional
C3/4/5 positive indicators	7f 5o	9f 3o	6f 5o	At least 3 spp. frequent and 4 occasional
C2/3/4/5 negative indicators	0.9	1.4	0.9	<5%
C2 negative indicators	3.5	1.2	3.5	<10%
C3/4/5 negative indicators	0.2	0.9	0.2	<10%
Tree and scrub	5.3	7.3	9.3	<5%
Non-graminae	75.2	110.0	57.3	40 - 90%

Table 3: The mean percentage cover % in the Calcicolous grasslands plots. The total % cover of each plot is over 100% and is typically around 150%. *f = frequent (found in over 60% of the plots). o = occasional (found in between 20 - 60% of the plots)

For both the Calcicolous grassland positive indicator lists, the tagets of a certain number of frequent and occasional species are comfortably met (Figure 15). There is a lot of fluctuations in the negative indicator species with little overall trend. Tree and scrub increases over the target and could be another indication of insufficient grazing.

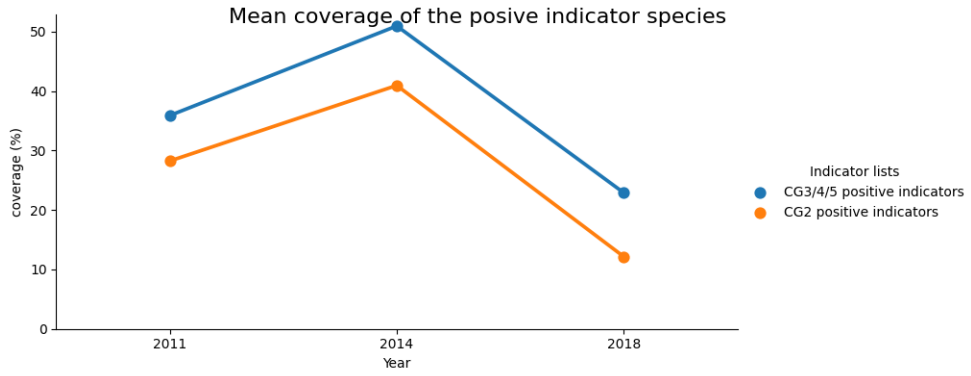

Figure 15: The number of frequent and occasionally occurring positive indicators does not show how much coverage of each plot there is. Here the mean coverage the indicator species is shown.

For the plant types, proportions of the plants have been used due to a systematic higher total % cover in the 2014 survey. The cover is expected to be above 100% but in the case of the 2014 survey it is so much higher than in 2011 and 2018 with little evidence of there being more height for overlap, or of more bare soil in the other surveys. Therefore to see how plant type composition changes over time, proportion of plant cover is used for Figure 16.

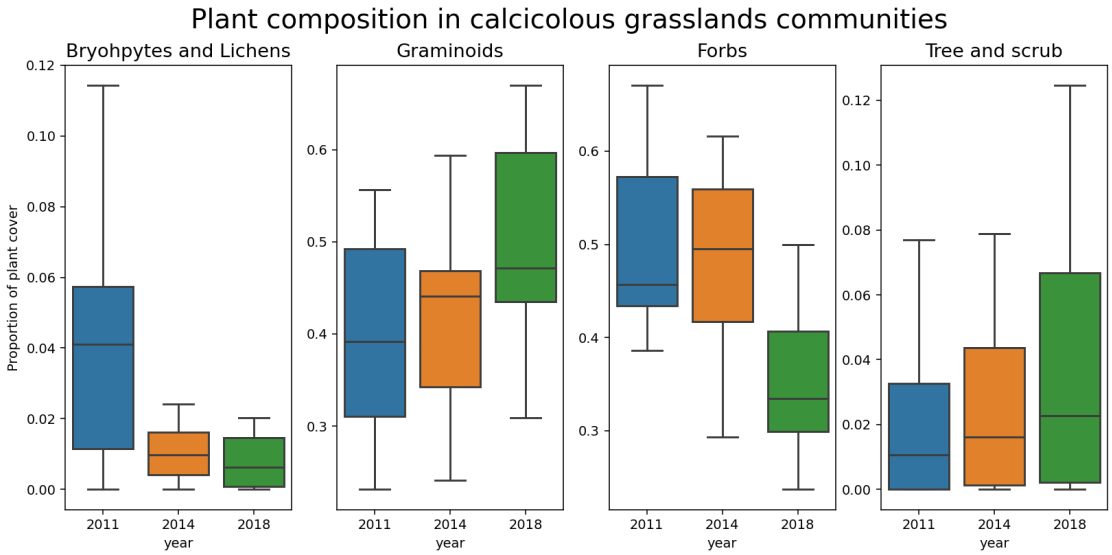

Figure 16: These are the proportions of plant cover so that each plot total plant cover is summed to 1 with 1 meaning total plant cover. This ignores fluctuations in total % cover due to bare ground and overlapping plants. The y-axis is not consistent across all plots.

Heath habitat

The heath habitat on Lullington is made up of three different sub-communities: H6, H7 and H8. There are only 7 plots in 2011 and 4 plots in 2014 and 2018 so the data is more susceptible to anomalous results. It is notable that the Heath sub-commmunity expected at Lullington is H2 which is chalk heath and this is not present at all.

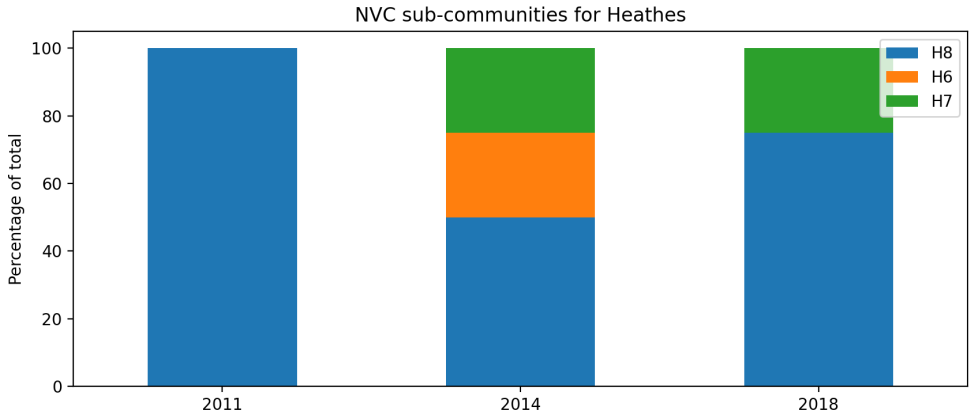

Figure 17: The change in Heath sub-communities as assigned by MAVIS.

H8 Calluna vulgaris Ulex gallii heath
- Floristically this is a diverse community. Erica tetralix, Molinia caerulea and Agrostis curtisii are typically lacking from this community. This community is found on free-draining, generally acid to circumneutral soils. For a full description, see appendix
H7 Calluna vulgaris Scilla verna heath
In this heath, sub-shrubs are a consistent feature, though they are not always obvious. The canopy is typically very short, rarely over 20 cm. This community occurs over a wide variety of moderately base-poor soils on the less exposed parts of maritime cliffs
H6 Erica vagans Ulex europaeus heath
The most obvious feature is a mixed canopy of sub-shrubs in which Erica vagans and Ulex europaeus are the usual co-dominants. The canopy is generally 30-60 cm high. It is typically found on quite base-rich but calcium-poor soils and on steep slopes

	2011	2014	2018	Target
Bryophytes and lichens	2.9	0.3	1.0	Cover % maintained or increased
Ulex and Genista spp.	14.9	37.0	27.0	Cover <50%, with Ulex europaeus <25%
Dwarf shrubs	25.9	31.3	5.9	25 - 90 %
Graminoids	4f 4o	5f 6o	7f 8o	At least 1 frequent and 2 occasional
Forbs	14f 19o	19f 16o	18f 13o	At least 2 species occasional
Tree and scrub	3.6	9.5	6.5	<15 %
Exotic species	0	0	0	<1%
Herbaceous species	1	1	0.5	<1%
Bracken	0	0	0	< occasional

Table 4: The mean percentage cover % in the heath plots. The total % cover of each plot is over 100% and is typically around 150%. *f = frequent (found in over 60% of the plots). o = occasional (found in between 20 - 60% of the plots)

There are a range of positive and negative indicators for Heath communities and each are appropriate for all three sub-communities present. These are shown in Table 4. Along with the mean percentage across all heath plots in each survey, the targets are displayed. These are general targets for the NVC sub-communities rather than specific targets for Lullington Heath.
The only Ulex or Genista spp. is Ulex europaeus so while <50% of the cover is from Ulex and Genista spp., the target of <25% cover form Ulex europaeus is not met in 2014 and 2018. It should be noted that the total cover % in 2014 is typically much larger than in 2011 or 2018. This makes the reduction in Bryophytes and Lichens that year particularly notable. The herbaceous plant category contains species such as ragwort, nettle and thistles. The biggest fail of a target is the dramatic reduction in dwarf shrub coverage in 2018. This is entirely due to a complete collapse of Erica cinerea (Figure 18).

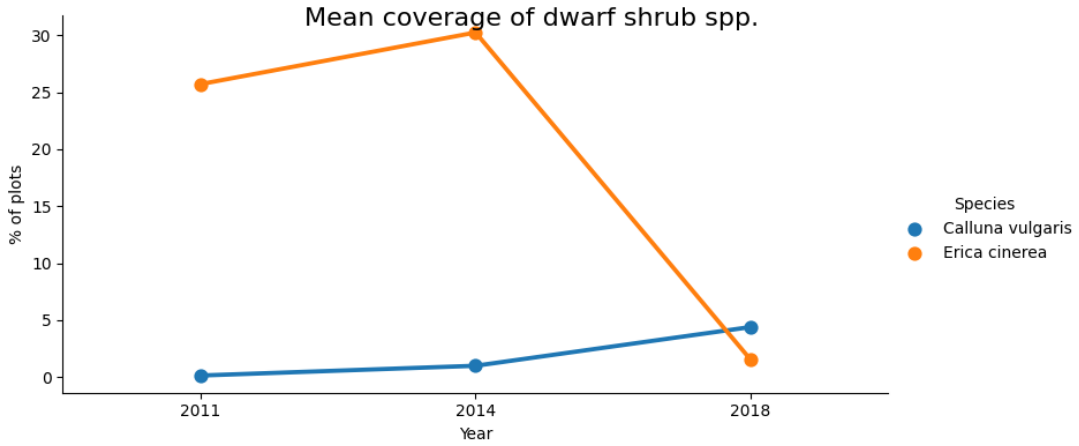

Figure 18: The mean percentage of just the Dwarf shrub spp. in the heath plots.

Again, due to the much larger total cover % in the 2014 survey, it is difficult to compare the change in plant composition with cover % alone. For this reason the proportion of plant cover is used for Figure 19. As with the chalk grassland, the grasses increase in the last survey with a concordant decrease in the flowering plants. We also see an almost complete loss of bryophytes and lichens past 2011.

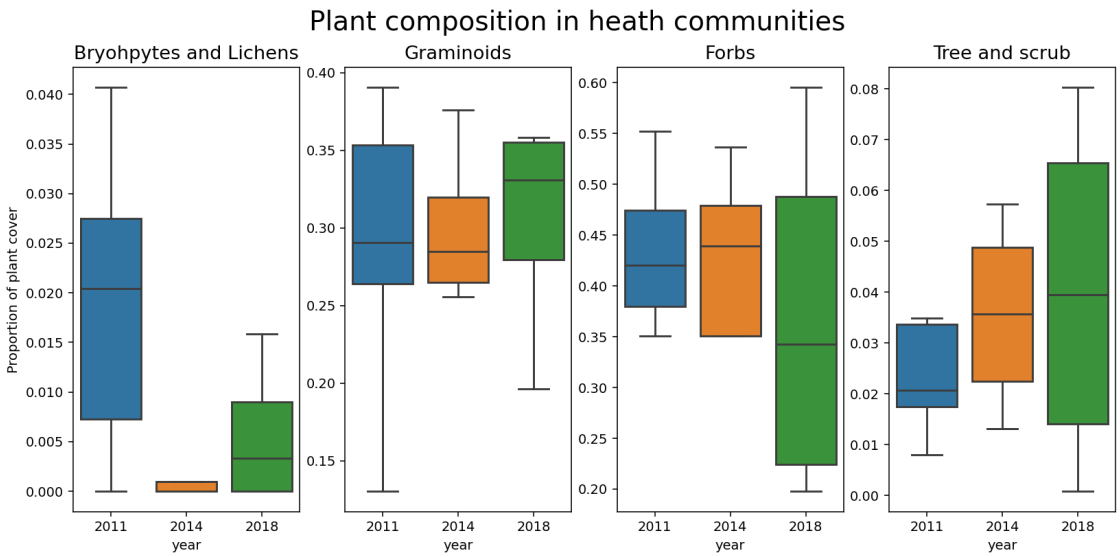

Figure 19: These are the proportions of plant cover so that each plot total plant cover is summed to 1 with 1 meaning total plant cover. This ignores fluctuations in total % cover due to bare ground and overlapping plants. The y-axis is not consistent across all plots.

Heath NVC community descriptions

H8 Calluna vulgaris Ulex gallii heath
Floristically this is a diverse community with only three constants overall, namely Calluna vulgaris, Erica cinerea and Ulex gallii. Erica tetralix, Molinia caerulea and Agrostis curtisii are typically lacking from this community. Often the three constant sub-shrubs are co-dominant, but proportions are variable and where E. cinerea is reduced Vaccinium myrtillus can appear. On disturbed ground U. europaeus may be abundant and both Pteridium aquilinum and Rubus fruticosus agg. may appear in the heath. Typically sub-shrub cover is high and herbs are sparse, but often the bushes are separated by grassy runnels, a feature accentuated by grazing. The most frequent grasses are Agrostis capillaris and Festuca ovina with A. canina ssp. montana, F. rubra, Anthoxanthum odoratum and Danthonia decumbens occasional to frequent. Deschampsia flexuosa and Nardus stricta are much more patchy in their occurrence. There is often some Potentilla erecta and Galium saxatile, and much more occasionally Teucrium scorodonia and Polygala serpyllifolia. Additional herbs are characteristic of particular sub-communities. In general bryophytes and lichens are not numerous or diverse. There may be some Hypnum cupressiforme and Dicranum scoparium, and Rhytidiadelphus squarrosus and Pleurozium schreberi are more occasional. In more open situations, or on burned or disturbed bare ground, mosses such as Campylopus paradoxus, Polytrichum piliferum or P. juniperinum can become abundant along with lichens species such as Cladonia impexa and C. squamosa. This community is found on free-draining, generally acid to circumneutral soils, in the warm oceanic regions of lowland Britain. It can be found over a wide range of arenaceous sedimentaries and acid igneous and metamorphic rocks as well as on silty and sandy superficials like loess and aeolian sands. The superficial pH underneath this community is usually from 3.5 to 4.5. It occurs throughout south-western England and Wales, on the Isle of Man and, more sporadically, in the southern Pennine fringes and the East Anglian coast. Local climatic and edaphic conditions influence floristic variation; grazing by rabbits, sheep or cattle, and sometimes burning (which is normally an accidental occurrence), affect physiognomy and composition. The community is maintained against succession to woodland in most situations by grazing and burning, although in some situations exposure to the wind prevents the establishment of woody invaders such as Betula spp. and Quercus spp. Much former heath has been improved for agriculture and it now often survives as patches on marginal grazing land.
H7 Calluna vulgaris Scilla verna heath
In this heath, sub-shrubs are a consistent feature, though they are not always obvious. The canopy is typically very short, rarely over 20 cm, and sometimes when grazed forming a mat only 2-3 cm high. The cover of woody plants is rarely continuous. Even where sub-shrubs are more extensive, they are commonly penetrated by herbs. Calluna vulgaris is the most frequent sub-shrub and the commonest dominant, though on dry soils it is accompanied by Erica cinerea. On wetter soils the latter is much reduced and E. tetralix and/or Empetrum nigrum ssp. nigrum are the usual associates. No other woody species occurs frequently throughout, although Ulex gallii is occasional. Among herbaceous associates grasses are often important. Festuca ovina is the most frequent grass species, though F. rubra is also common. Also common and a constant is Holcus lanatus, often with Dactylis glomerata on drier soils or Danthonia decumbens on moister ground. In wetter, northern heaths Agrostis capillaris and Anthoxanthum odoratum can become very common, but Molinia caerulea is infrequent. There are a variety of other herbs. Most distinctive among the constants are Plantago maritima and Scilla verna. Other common and constant species are Plantago lanceolata, Potentilla erecta, Lotus corniculatus, Thymus praecox and Hypochoeris radicata, the latter of which tends to favour drier soils. Anthyllis vulneraria also favours drier soils as do Euphrasia species. Other species are more characteristic of particular sub-communities. In contrast cryptogams are few and never show high cover. Among the mosses only Hypnum cupressiforme s.l. is moderately frequent and Frullania tamarisci, the commonest hepatic, is infrequent. Several Cladonia species are occasional. This community occurs over a wide variety of moderately base-poor soils on the less exposed parts of maritime

cliffs all around the coast of Britain except to the east and south between Durham and Dorset. The single most distinctive difference between the habitat of this kind of heath and the habitats of other sub-shrub communities is the input of salt spray generated by breaking waves and carried inland by the wind. The floristic and structural variation in this community is influenced by the climatic and edaphic differences both throughout the considerable geographic range of the community and over particular stretches of cliff. Grazing also affects the composition and appearance of the vegetation and probably contributes to maintaining it against successional change. However, over much of its range this vegetation can be considered a climatic climax as exposure to even small amounts of salt spray hinders the invasion of woody invaders.

H6 Erica vagans Ulex europaeus heath

This community is a distinctive type of sub-shrub vegetation, but rather variable in floristics and structure. The most obvious feature is a mixed canopy of sub-shrubs in which Erica vagans and Ulex europaeus are the usual co-dominants. The canopy is generally 30-60 cm high but in exposed situations may be not more than 10 cm high. Two other constant sub-shrubs, Ulex gallii and E. cinerea, can also be abundant although the former may be suppressed in dense stands. Calluna vulgaris is not frequent and has generally low cover. In contrast to the Erica vagans Schoenus nigricans heath (H5) community, E. tetralix is only occasional and confined to wetter soils (see sub-community H6d) with several preferential associates. The only herbaceous associates common throughout are Carex flacca, Potentilla erecta and Polygala vulgaris. The most common and distinctive herbs of this community are Viola riviniana, Filipendula vulgaris, Stachys betonica, Hypochoeris radicata, Agrostis canina ssp. montana, Dactylis glomerata and Scilla verna. Most of these species are found in recently burned stands but become more scattered and reduced in number as the vegetation and litter increase. On shallower soils, especially when grazed, a rich short herb layer is maintained with several additional species including Festuca ovina, Thymus praecox, Lotus corniculatus, Galium verum, Jasione montana, Danthonia decumbens and Brachypodium sylvaticum. Immediately after burning, diversity is increased, with ephemerals including Aira caryophyllea and Centaurium erythraea. Continued burning and the dense shade and litter of older stands inhibit bryophytes and lichens, which as a result are uncommon. This community is confined to the Lizard in Cornwall where it is characteristic of free-draining brown earths that are usually quite base-rich but calcium-poor and fairly oligotrophic. It is found on soils similar to that of H5 with a pH of generally between 5 and 7, but which are more free-draining. Therefore it is typically found on the steeper, shedding slopes around coves and on the cliff tops of the headlands. Although it is mainly coastal in distribution it is not strictly speaking a maritime heath and is replaced on slopes which are exposed to salt spray by Calluna vulgaris Scilla verna heath (H7). Edaphic variation and local differences in the warm oceanic climate strongly influence floristic diversity, but treatments, especially burning, and to a lesser extent grazing, also have a marked effect on composition and physiognomy of the vegetation. However, the progression to scrub and woodland in the absence of these treatments would probably be slow due to the lack of seed parents and the poor quality of the soil. Preferential cultivation of the more fertile soils developed over gabbro and schists means that the community survives most extensively over serpentine.