Cherry Hinton East Pit Chalk Grassland and Invertebrate Monitoring

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Contents

1. Summary

At East Pit, part of Cherry Hinton Chalk Pits Nature Reserve, we have been monitoring following major re-profiling and scrub clearance which was carried out in 2009. Monitoring methods include quadrat vegetation recording, pitfall trapping for invertebrates, ant-baiting, and identification of invertebrate samples (all arthropods identified to higher taxonomic level, beetles to family, and carabid beetles, spiders and ants to species). The results of monitoring carried out between 2009 and 2015 show that chalk grassland coverage of the site has been increasing over time. Invertebrate communities have also changed as a result of management work. Overall invertebrate numbers were negatively affected in the first year after management, but seem to have stabilised thereafter. Data gathered by volunteers has made this project possible.

2. Introduction

In autumn of 2008, the Wildlife Trust purchased Cherry Hinton East Pit, part of Cherry Hinton Chalk Pits Site of Special Scientific Interest (SSSI), a site which had been unmanaged since quarrying ceased in the 1980s. The ridges and bowls left by quarrying were still present, and most of the pit had been colonised by buddleia, which was shading out the calcareous grassland species for which the SSSI was selected. Therefore, the Trust reprofiled the site and removed buddleia using heavy machinery, which returned large areas to bare chalk.

The fixed point photos in figure 1 and 2 show the effects of management work on the site.

Figure 1. 2008. Before management work.

Figure 2. 2009. Immediately after management work.

Analysis of aerial photos using remote sensing software showed that reprofiling returned a large connected central block comprising around 58% of the 8 hectare site to bare chalk.

Since the management at East Pit was so extensive, and the site is a SSSI, the Trust wanted to collect data to assess the impacts of the management work.

Lowland calcareous grassland is a UK priority habitat and a local Biodiversity Action Plan habitat for Cambridgeshire. Restoration of chalk grassland is a relatively well understood process. Monitoring of the extent of chalk grassland has been done through vegetation mapping and annual fixed point photography.

Coverage of chalk grassland vegetation has been gradually increasing since the reprofiling, as shown by annual fixed point photography.

Figure 3. 2013. Recolonisation by chalk grassland.

Chalk grassland is also important as habitat for a variety of associated fauna, in particular invertebrates. A specialist, but unquantified, survey in 2008 before reprofiling concluded that the site supported an important invertebrate assemblage (Kirby 2008). In order to assess the effects of management on both the flora and fauna of the site, Trust staff set up a survey protocol to record vegetation and invertebrates on the site. Changes in numbers and diversity of invertebrates should give an indication of not just the extent, but the quality of the newly established chalk grassland areas.

The first five years of data collected are compared here. A further two years of monitoring have been carried out, however, as there is now little bare chalk on site and sites which have been managed are harder to identify, statistical comparisons with the previous data are difficult. However, some notes on 2014 and 2015 monitoring are included in the results section.

Sampling will continue at less frequent intervals to monitor general trends.

3. Methodology

Each year from 2009 to 2015, 25 pitfall traps were set up across accessible areas of the reserve to collect a wide range of invertebrates (traps were of approximately 7cm diameter and 7.5cm depth and part filled with water and detergent). Pitfall traps were arranged in a regular grid - with each trap being separated by approximately 50 metres (sample locations identified using aerial photographs). In the field, sample points were located using handheld GPS units (*Garmin GPS 60csx*). Pitfall traps were set up at approximately the same time in May each year, and left on site for 5 days. Each time a pitfall was set up, the vegetation type in the immediate area (exposed chalk, short grass, scrub edge or dense scrub) was recorded, as well as the herb-layer vegetation height. Care was taken when setting up the pitfall traps to ensure that the top of the pitfalls were flush with the ground so invertebrates would be easily trapped.

Later in the year (late August/early September) a subset of pitfall trap locations were returned to and surveyed for ant species present, using syrup-baited traps. These sample points were chosen by randomly selecting an equal number of sites from each vegetation type. Baited traps consisted of 9 small white plastic pot lids (of approximately 4cm diameter) arranged in a grid at each location, with each pot approximately two metres apart. Each pot was baited with a small amount of golden syrup, which was wiped around the inside of the lid for ants to find. Traps were set up between 10.00 - 11.00 and monitored throughout the day until approximately 17.00 (each location revisited at least three times), to reduce the effect of sampling time on the species of ants found. Each time a site was revisited, the number of ants present in each pot was recorded and one or two removed for future identification. Care was taken to minimise disturbance to the remaining ants by not moving the traps while samples were taken.

At the same time as syrup-baited traps were set up, vegetation characteristics in the immediate area of the original pitfall trap location were recorded using quadrats. Each quadrat was 90x90cm with a cross-bar every ten centimetres. Habitat was assessed by touching a cane to the ground at each intersection (81 in total) and recording whether the cane touched bare ground, leaf litter, grass, moss or other vegetation. In addition, the species of vegetation was also recorded. If a particular species or habitat characteristic was present throughout the quadrat, a maximum score of 81 could therefore be recorded.

Invertebrates collected in the pitfall traps and ants collected using the baited traps were cleaned of debris and stored in 75% alcohol. Invertebrates collected in the pitfall traps were all identified to higher taxonomic level (order for insects and arachnids, and millipedes and centipedes to class). Additionally, beetles were identified to family level and ants (Formicidae), ground beetles (Carabidae) and spiders (Araneae) to species. A total of 6058 individual specimens were collected between 2009 and 2013. These included 21 different higher taxonomic groups, 18 beetle families, 18 ground beetle species, 44 spider species, and 11 species of ant. Initial identifications were carried out

by volunteers working under the supervision of Wildlife Trust staff. Specialist identification help was given for carabid beetles and spiders.

All sampling was done as part of a management plan for the SSSI, approved by Natural England.

3.1 Data analysis

Differences in vegetation types, heights, and composition have been summarised in tables and plotted on a series of charts.

Differences in arthropod communities have also been plotted. When comparing re-profiled with unmanaged sites, differences in arthropod abundance, ant abundance, carabid abundance, spider abundance, ant species richness, carabid species richness and spider species richness were assessed using Kruskal-Wallis tests. Differences in the same groups between years, separating managed and unmanaged sites, were also assessed using Kruskal-Wallis tests.

4. Results

4.1 Vegetation

Remote sensing analysis shows that the area of the site covered by bare chalk has decreased to 24% in 2016 (from 58% in 2010).

Sample point monitoring confirms that the average frequency of bare chalk within quadrat sample points has been decreasing over time.
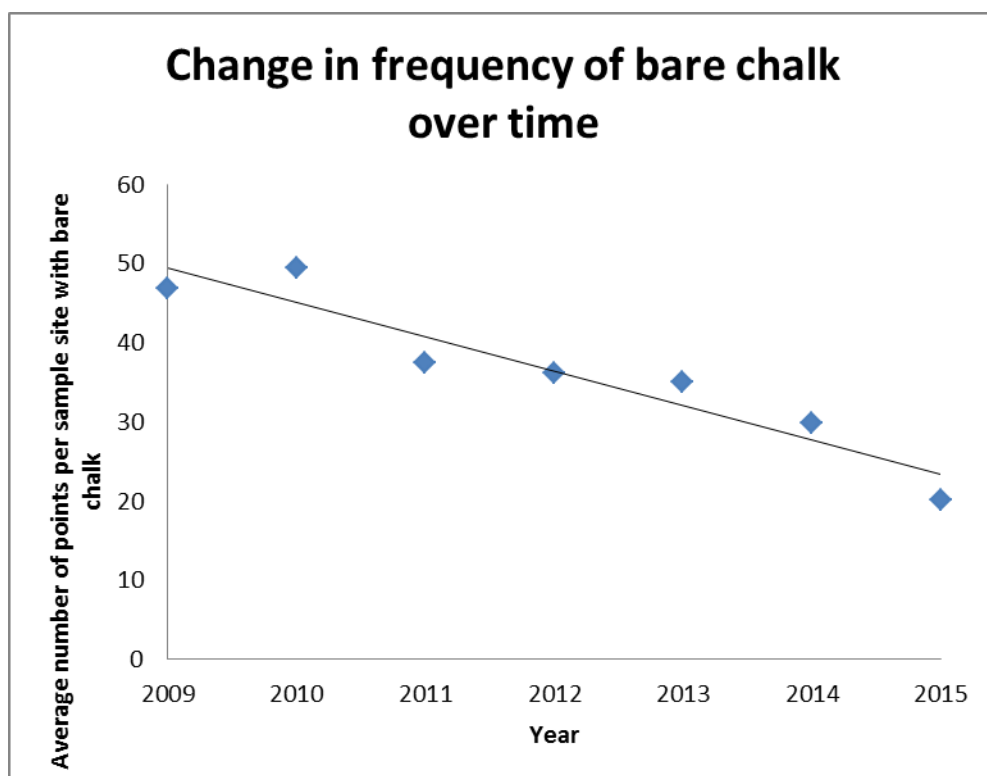
One of the objectives for the site is to increase the area of chalk grassland. Fixed point photo monitoring, and assessment by Wildlife Trust staff have shown this to be the case. The vegetation quadrats also support this conclusion, as both the diversity of plant species and the average number of chalk grassland indicator species per sample site have shown increasing trends over time.

Change in diversity of plant species over time

Change in frequency of chalk grassland indicator species over time
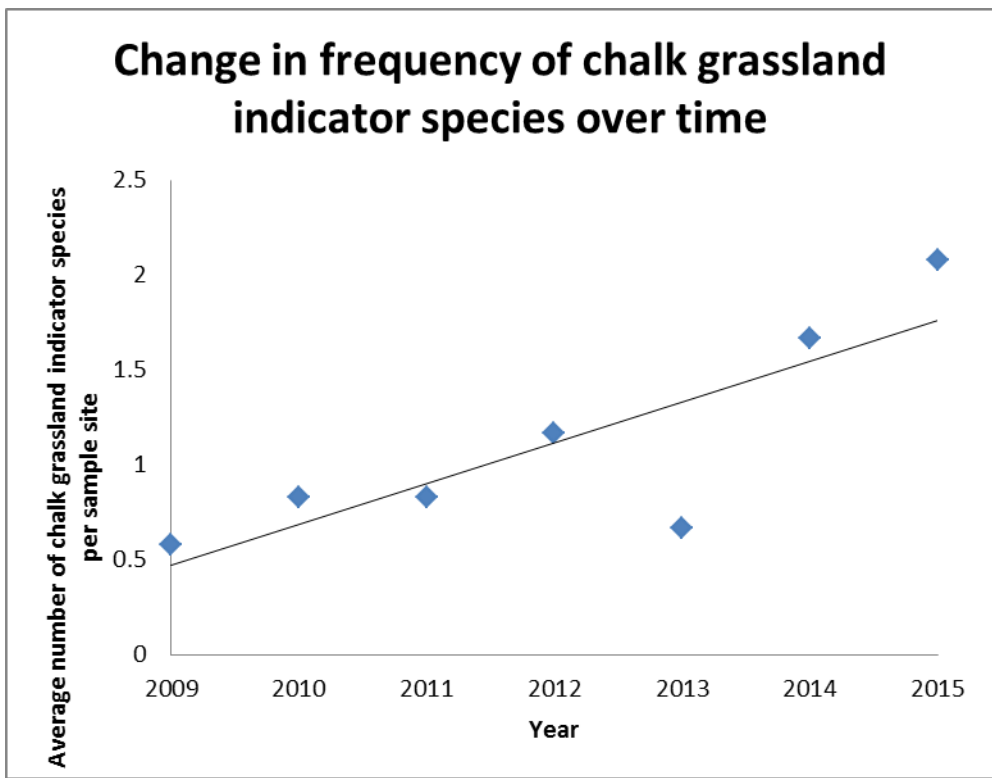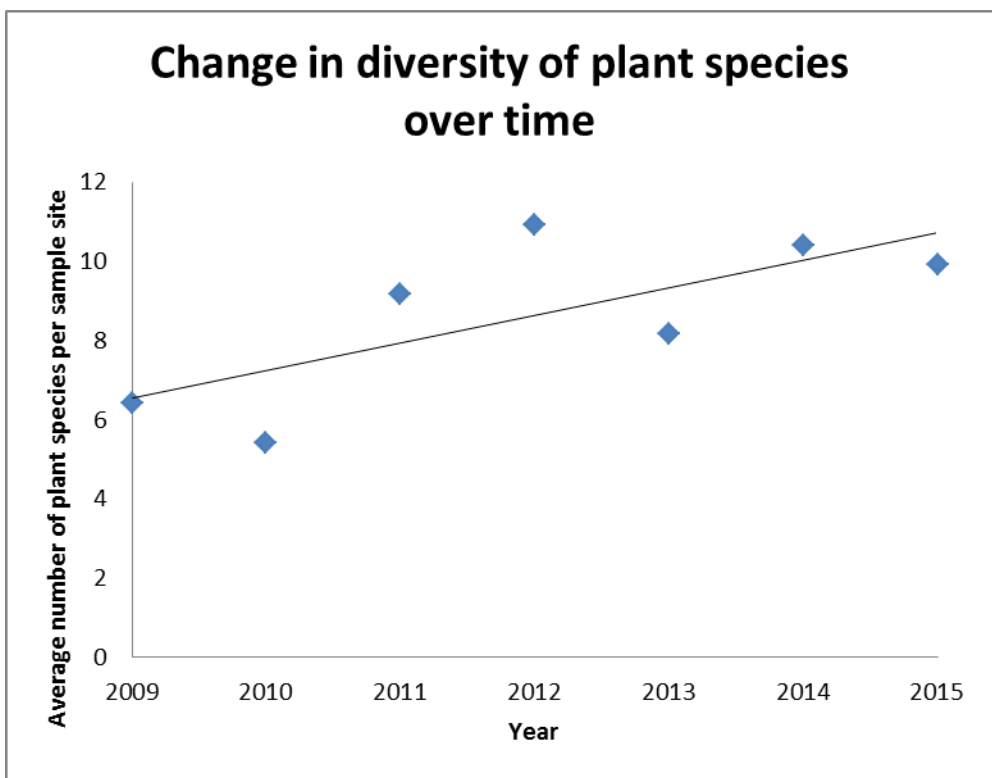
Unfortunately, the average number of undesirable species has also increased slightly over time.

Change in frequency of undesirable species over time
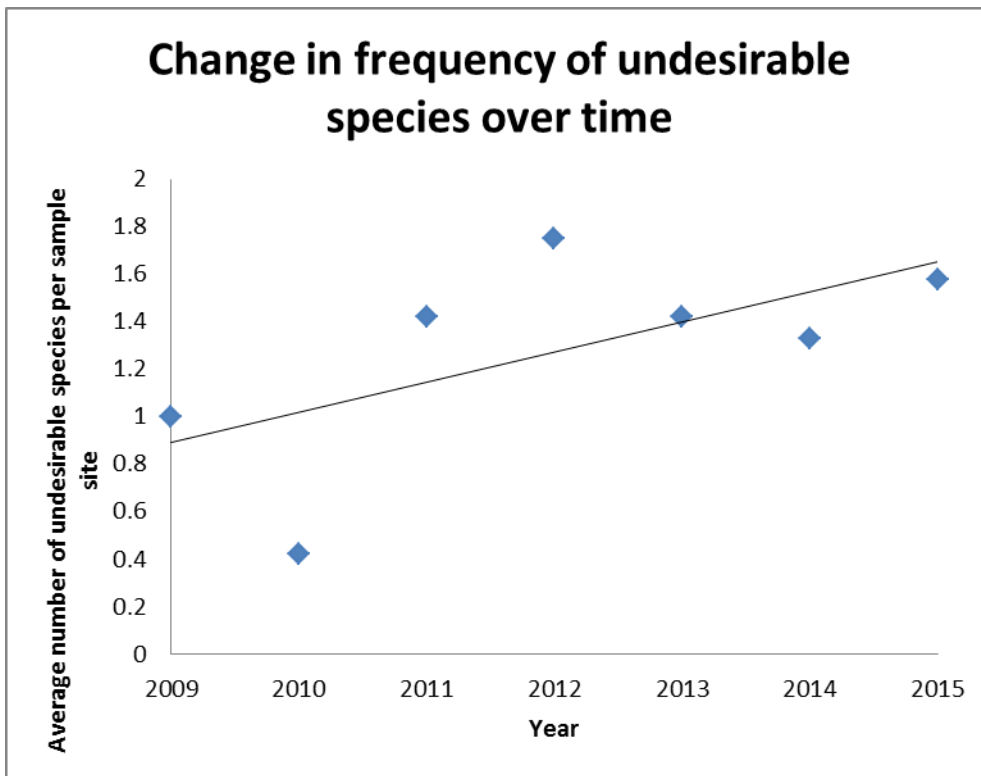
However, the particular undesirable species present have changed, with buddleia the most common prior to the re-profiling works, and bramble and dewberry most common afterwards. Clearance of buddleia initially opened up areas which allowed bramble and dewberry to expand. Control efforts were then focussed on these species.

4.2 Invertebrates

Effect of reprofiling

Overall invertebrate abundance was significantly lower for reprofiled (mean 37, range 11-137) compared with unmanaged (mean 61, range 4-275) sample sites across all years (Kruskal-Wallis chi-squared = 12.2477, df = 1, p-value = 0.0005). Numbers of invertebrates dropped across all sample sites (reprofiled and unmanaged) after 2009. The reprofiling work was only completed about a month before the initial sampling in 2009, so it may have been too early to measure the full impacts. The drop in invertebrates across the site in 2010 indicates that the impact of reprofiling was not confined to one area of the nature reserve.

Of the individual groups measured, the total abundance of ants and spiders was significantly lower at reprofiled sample sites (ants: Kruskal-Wallis chi-squared = 4.2302, df = 1, p-value = 0.05, spiders: Kruskal-Wallis chi-squared = 10.2273, df = 1, p-value = 0.001). Beetles showed no significant difference, but the mean number of beetles collected per sample site was very low.

Species richness was not significantly different between reprofiled and unmanaged sites overall for ants or beetles. However, spiders did show lower diversity at reprofiled sites (Kruskal-Wallis chi-squared = 6.7626, df = 1, p-value = 0.01).

The table below shows the number of invertebrates recorded each year at unmanaged compared with reprofiled sample sites (mean and standard error).

| Year	Unmanaged sample sites				Reprofiled sample sites			
	Total	Beetles	Ants	Spiders	Total	Beetles	Ants	Spiders
2009	121.44 ±16.10	1.88 ±0.66	17.12 ±3.77	16.81 ±4.47	50.40 ±22.28	2.20 ±0.86	31.80 ±17.55	0.40 ±0.25
2010	50.38 ±7.10	4.69 ±1.80	15.54 ±4.44	3.85 ±1.40	19.29 ±2.10	1.14 ±0.34	1.57 ±0.57	1.14 ±0.40
2011	46.77 ±4.67	2.46 ±1.45	13.38 ±2.74	7.62 ±1.21	45.80 ±10.42	2.60 ±0.81	6.40 ±2.09	5.60 ±1.81
2012	51.33 ±5.49	1.29 ±0.49	8.95 ±3.24	6.05 ±0.97	41.33 ±6.17	2.00 ±0.58	1.33 ±0.88	5.00 ±4.00
2013	43.24 ±5.13	2.38 ±0.63	6.24 ±1.54	5.19 ±0.83	35.5 ±6.74	1.75 ±0.75	4.25 ±3.92	4.5 ±1.19

Unfortunately, pitfall trapping results show that management focussed on vegetation had an early negative impact on both abundance and diversity of invertebrate fauna. However, a follow-up specialist survey in 2012 found that the total number of species and number of key species caught was slightly lower in 2012 but that the differences in these totals were "surprisingly small". The 2012 report concluded that "the pre-existing important invertebrate assemblage of East Pit has overall been minimally, if at all, damaged by management." Kirby also suggested that existing invertebrate interest should increase over time, as habitats develop.

As of 2015 monitoring, invertebrate numbers have still not recovered to levels recorded in 2009, but have remained stable.

Effect of vegetation type

The abundance, diversity, and community composition of invertebrates all differed according to vegetation type. Short vegetation and scrub/scrub edge habitats supported more invertebrates than bare chalk. For comparison purposes, scrub and scrub edge habitats have been grouped, as they are similar, and as the number of sites with dense scrub was very low.

Abundance of invertebrates in different vegetation types
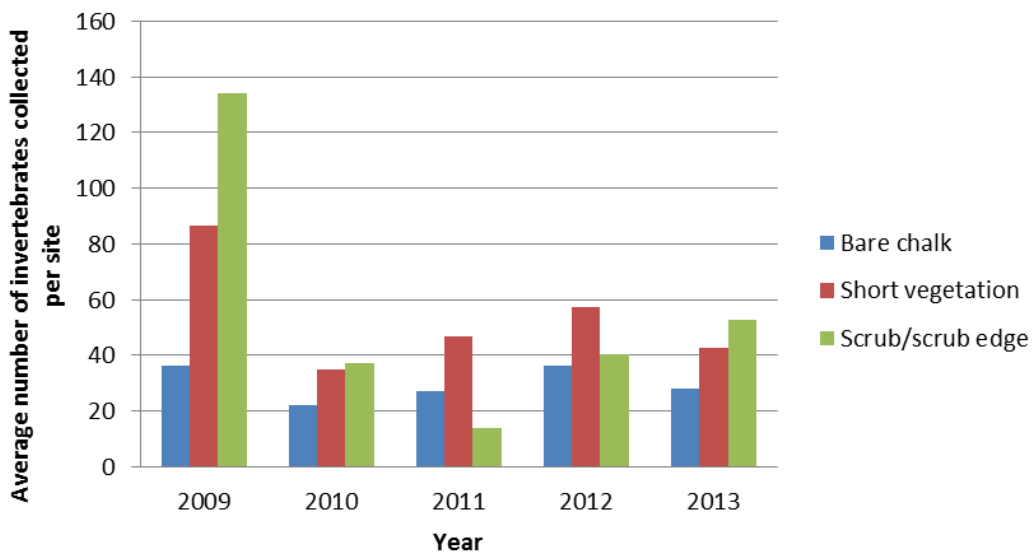
The diversity of invertebrates, represented by the number of different groups found, was also greater in short vegetation and scrub/scrub edge habitats than in bare chalk. Short vegetation, i.e. chalk grassland, has been the habitat supporting the greatest diversity of invertebrates for the last 3 years of the 5 years analysed, and diversity in this habitat has been increasing since 2010. This may be related to the increasing area and diversity of chalk grassland.

Diversity of invertebrates in different vegetation types
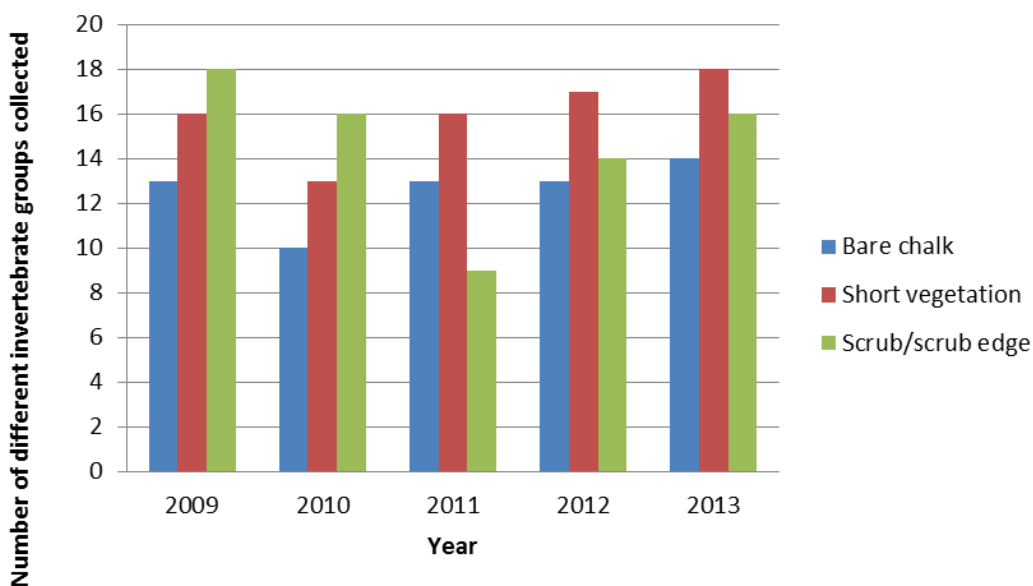
Most invertebrate groups were recorded in all habitat types, although the relative abundance varied for some groups. For example, ants, grasshoppers and crickets and

spiders were most common in short vegetation, earwigs and woodlice were most common in scrub/scrub edge habitat, and flies were most common in bare chalk.
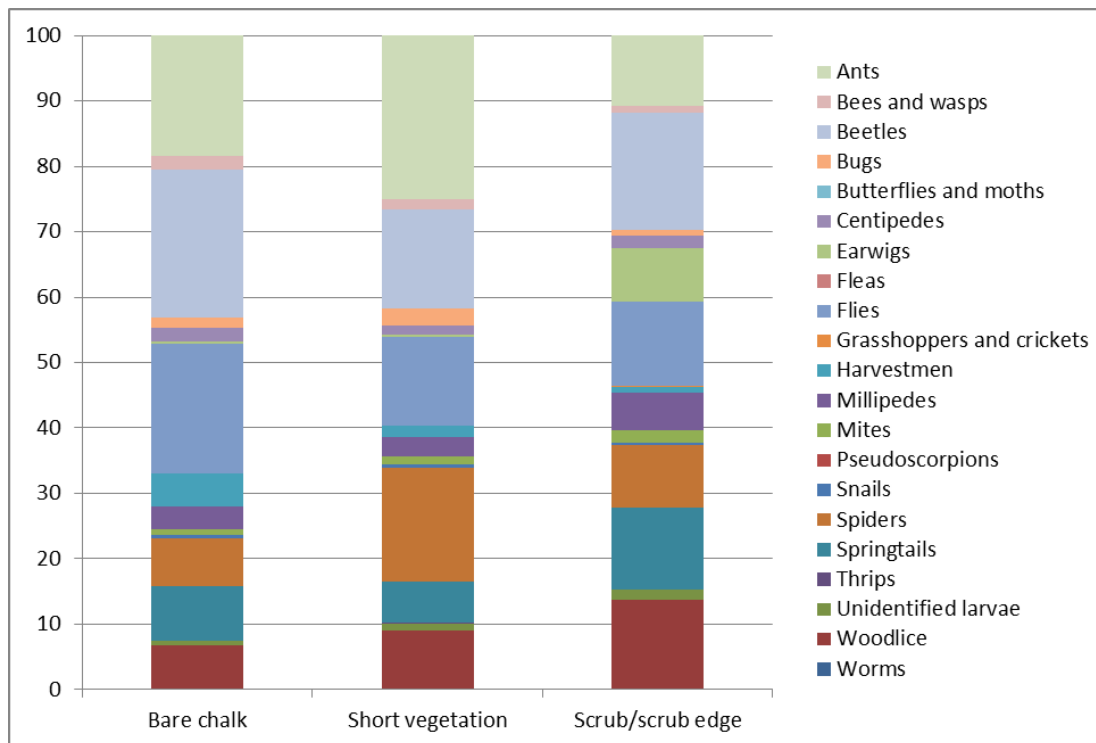
Within the groups which were identified to family and species, there were also differences between habitats. For beetles, there was a notable association of leaf beetles (Chrysomelidae) with bare chalk, and of rove beetles (Staphylinidae) with scrub/scrub edge habitats.
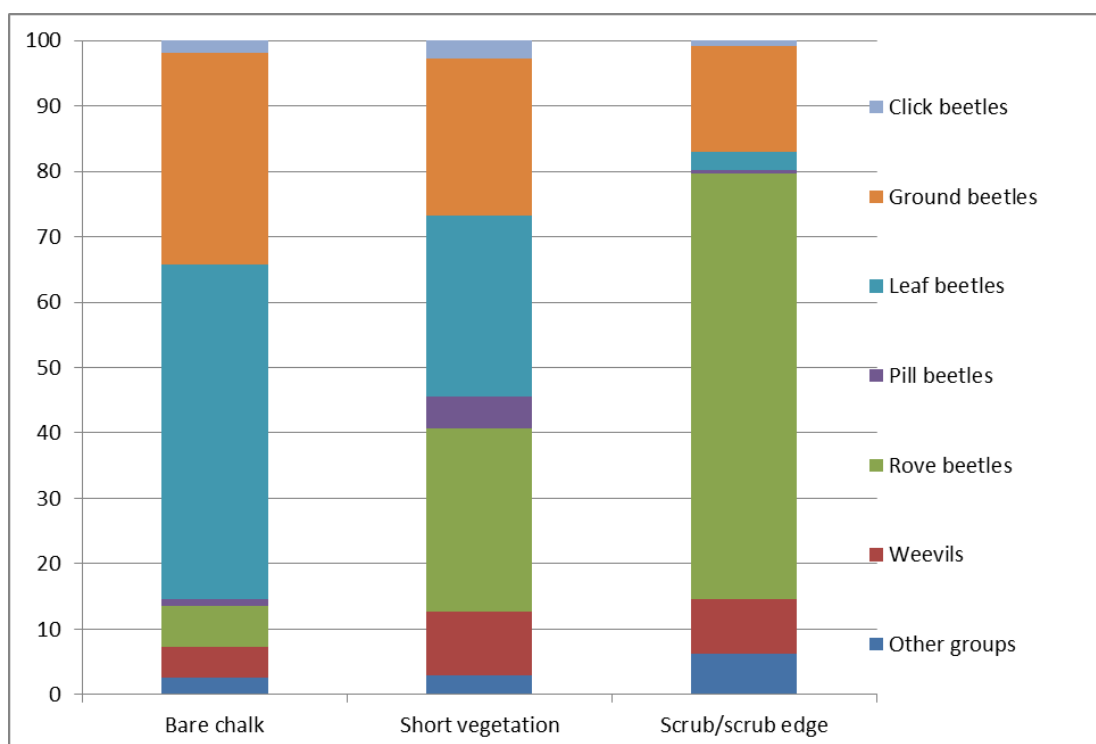

Within the ground beetles, some species also appeared to show habitat associations, such as *Nebria brevicollis* with bare ground, and *Amara tibialis* with short vegetation.

However, due to the relatively low numbers of ground beetles caught, it is difficult to say whether this is a random effect of sampling or reflects a true habitat preference.
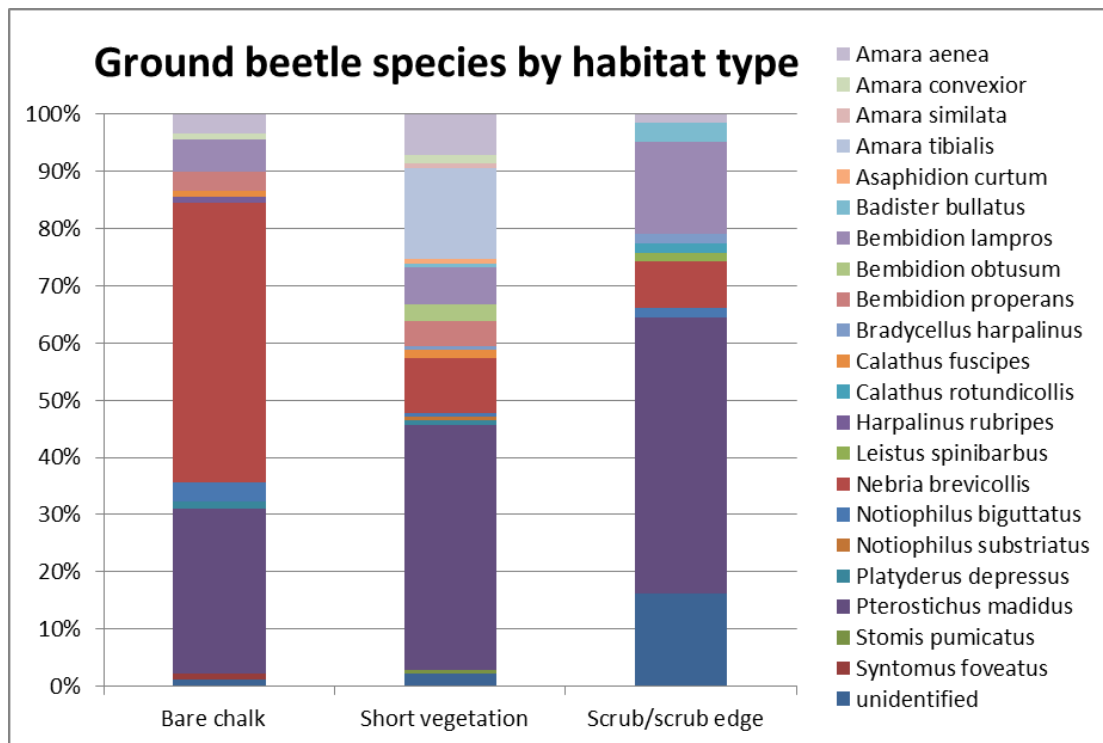
Ground beetle populations are also known to fluctuate from year to year, and there was a difference between sampling years in the species composition, which further complicates any attempts to draw conclusions about habitat preferences.
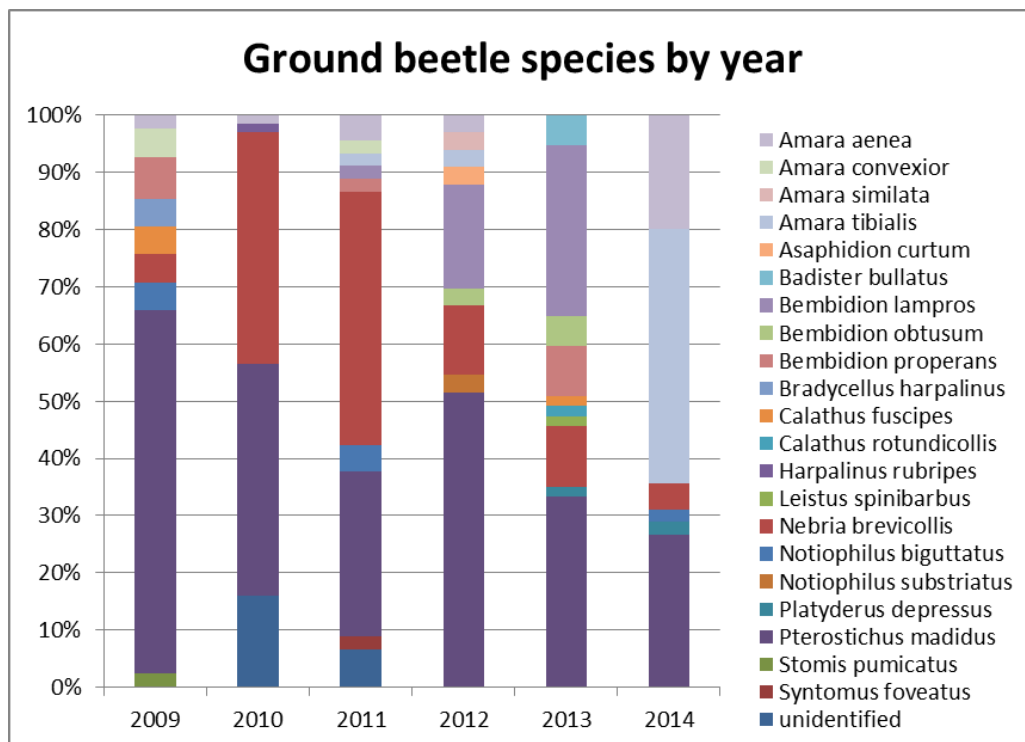
The vast majority of all ants collected were of one species; *Lasius niger*. This is one of the most common ant species in the UK, and found in almost any dry and open area. Other ant species did show some habitat associations, with *Myrmica schencki* only

found in short vegetation, *Myrmica* species generally preferring short vegetation or scrub habitats, and *Lasius* species other than *Lasius niger* most common in scrub/scrub edge.

Ant species by habitat type
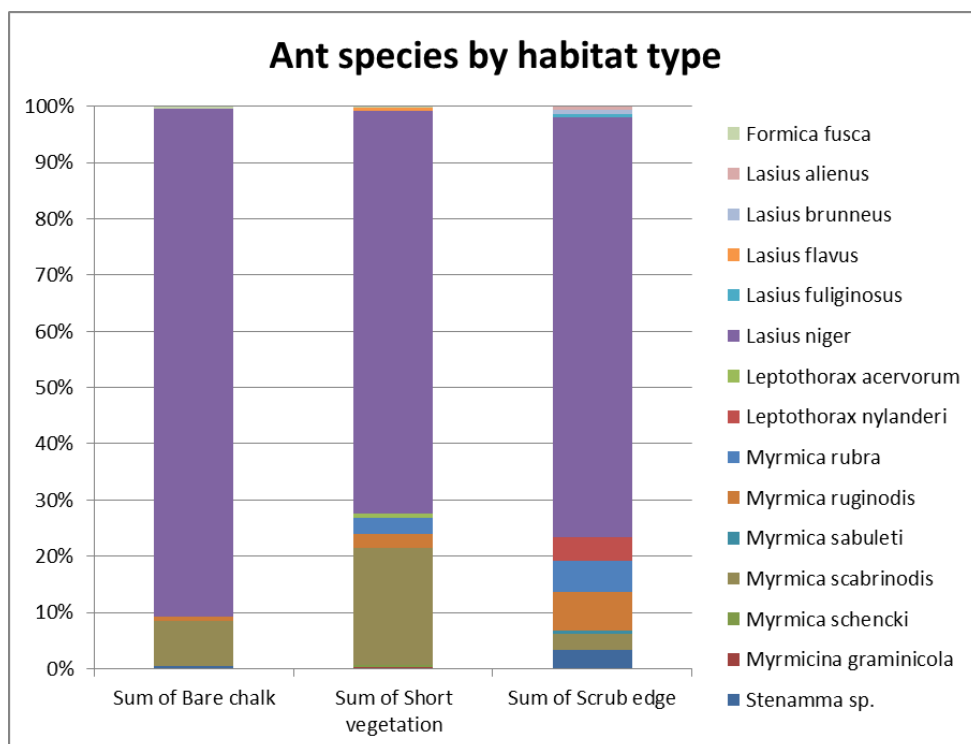
Ants showed only limited variation in species recorded between years, so differences more likely reflect true habitat preferences.

134 different species of spider have been recorded, and the mix of spider species has varied widely. The most frequent species in each habitat has varied from year to year. Some of the most common species recorded across all years have been: *Pachygnatha degeeri, Pardosa pullata, Hahnia nava, Xysticus cristatus, Pardosa palustris*, and *Alopecosa pulverulenta*.

Spider species by habitat type

Legend:
- Alopecosa pulverulenta
- Argenna subnigra
- Diplocephalus cristatus
- Diplocephalus latifrons
- Diplostyla concolor
- Drassyllus pusillus
- Dysdera crocata
- Dysdera sp.
- Enoplognatha thoracica
- Entelecara acuminta
- Erigone dentipalpis
- Erigonella hiemalis
- Euophrys frontalis
- Gonygylidium rufipes
- Hahnia nava
- Hahnia sp.
- Haplodrassus signifer
- immature/unknown
- Lepthyphantes sp.
- Lepthyphantes tenuis
- Lepthyphantes zimmermanni
- Meioneta rurestris
- Micaria pulicaria
- Micrargus herbigradus
- Monocephalus fuscipes
- Oedothorax retusus
- Ozyptilia sanctuaria
- Pachygnatha degeeri
- Panamomops sulcifrons
- Pardosa agrestis
- Pardosa amentata
- Pardosa nigriceps
- Pardosa palustris
- Pardosa prativaga
- Pardosa pullata
- Pardosa sp.
- Pelecopsis parallela
- Phrurolithus festivus
- Robertus lividus
- Stemonyphantes lineatus
- Talavera aequipes
- Trachyzelotes pedestris
- Trochosa ruricola
- Trochosa sp.
- Trochosa terricola
- Troxochrus scabriculus
- Xysticus cristatus
- Xysticus sp.
- Xysticus ulmi
- Zelotes latreillei
- Zelotis sp.
- Zora spinimana

Habitat types (x-axis): Bare chalk, Short vegetation, Scrub/scrub edge

Overall, short vegetation and scrub/scrub edge habitats support a wider range of invertebrate species than bare chalk, however, some species and groups are particularly associated with each habitat type, so to benefit invertebrates a mix of habitats should be maintained on site.

Pitfall trapping is ongoing and trends in invertebrate populations at this site will continue to be monitored.

5 Management Suggestions

The SSSI is designated for chalk grassland and chalk grassland plant species, so management should be focussed on maintaining and expanding this habitat.

To benefit invertebrates, areas of scrub/scrub edge and bare chalk habitat should also be retained.

Control of undesirable plant species should be continued.

References

Kirby, P. (2008) Cherry Hinton East Pit Invertebrate Survey. Report to the Wildlife Trust August 2008.

Kirby, P. (2012) East Pit, Cherry Hinton Invertebrate Survey. Report to the Wildlife Trust January 2013.

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