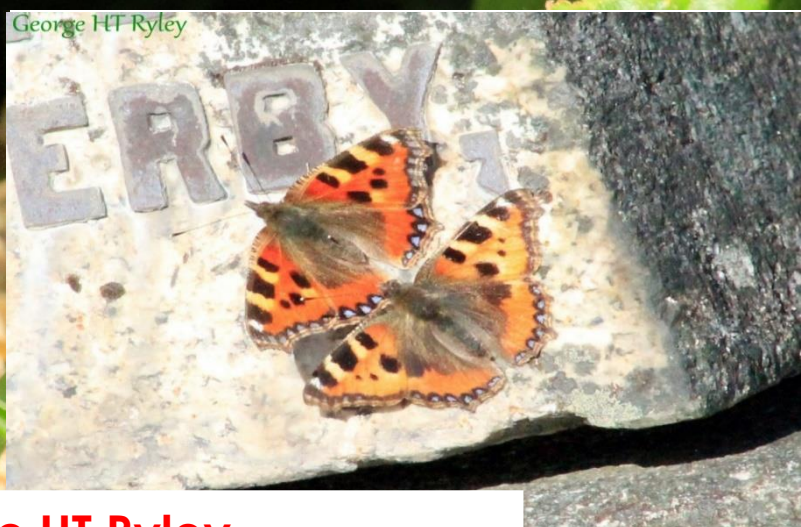
Aberystwyth Municipal Cemetery (Plascrug Cemetery)

INVERTEBRATE REPORT



BY: George HT Ryley



GEORGE RYLEY ENTOMOLOGY



This work was undertaken and delivered by George Ryley Entomology.

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Introduction

The habitats of Aberystwyth Municipal Cemetery, sometimes referred to as Plascrug or Llanbadarn Road Cemetery, have been managed according to the terms set out in the April 2010 Management Plan Report. At the time of implementation of this plan, the diversity of invertebrates occupying the cemetery was considered to be poor, with only two species of Grasshoppers (Orthoptera), 49 species of Lepidoptera – five of which were Butterflies and 44 were moths, two species of hymenoptera, which were both bumblebee species, and two species of woodlice having been recorded.

Since this time, the management plan has ushered in a sweeping change of mowing regimes to a number of grassland areas, which were allowed to grow, and effectively be treated as hay-meadows. As of the time of writing (2021), these areas have been under this management for 11 years. Meanwhile, some areas were seeded with wildflowers, which have since spread to many other parts of the cemetery, including Ox-Eye Daisies (*Leucanthemum vulgare*), Valerians (*Valeriana sp.*), and Purple Toadflax (*Linaria purpurea*).

Given the changes that have occurred botanically at the cemeteries ground level habitats since implementation of the management plan, it was decided that it was time to assess how well the management plan is functioning in its objective to encourage wildlife. This report intends to make this evaluation from the perspective of the invertebrate communities currently making their home at the cemetery.

Survey Methods and Location Details

The Cemetery and Its Habitats

The Aberystywth Municipal Cemetery occupies an area of approximately 6.75 acres and is situated along Llanbadarn Road and Plascrug Avenue. The site is owned and primarily managed by Ceredigion County Council according to the cemetery management plan and under contract for the Imperial War Graves Commission for 15 military graves.

The cemetery boasts an array of habitats operating on a number of scales. As of the invertebrate surveys conducted in this report (see Survey Tools and Approach), the perimeter habitats consisted of many hedgerows, shrubs and mature trees that were deciduous, coniferous or evergreen, but also a sparsely vegetated south facing stone wall on the northern perimeter. The internal habitats could be largely broken into two distinct areas – the former amenity grassland areas now treated as hay-meadows and the graves themselves. The grave areas offered a unique mix of habitats, ranging from sparsely vegetated to highly vegetated. These habitats offered distinct botanical, geological and microclimatological characteristics that tended to be less dominated by grasses than the hay-meadow areas. The hay-meadow areas offered large areas of mature grasslands with variations in botany and microclimate offered by differing aspects, proximity to paths, boundaries, graves, trees and other habitats and features.

Survey Tools and Approach

A total of nine surveys were conducted between March and September 2020. One survey was conducted in March to cover the emerging early Spring species. Although surveys were planned for April, these were cancelled due to the developing coronavirus pandemic. Surveys resumed in May, with two conducted to capture the late Spring species. Two were carried out in June, one in July and two in August to record the summer season species, whilst a final two were completed in September to capture the autumnal species. None were carried out earlier than March or later than September due to the relative inactivity of invertebrate communities over the late Autumn and Winter period. All of the surveys were also undertaken on days with abundant sunshine as invertebrate activity is generally at its greatest during these climatic conditions, and commenced no earlier than 10:00 AM to allow the temperatures to rise sufficiently for maximum activity.

The two primary methods of surveying employed were first-hand observations and sweep netting, and they were used across all habitats in the surveyed areas. For the habitats concerned, both methods are sufficiently effective at finding specimens on ground level, middle level and top-level parts of the terrestrial habitats, as well as low flying aerial specimens, although the sweep netting captured many specimens that would have been missed with first-hand observations alone, particularly for top and middle level terrestrial vegetation. When sweep netting in areas of open grasslands, the 'perimeter and zig-zag' method was used to cover as much area as possible. Microhabitat targeting also took place in an effort to maximise the potential species diversity, which involved looking within or under rocks, logs and other objects, as well as surveying lower areas of trees and shrubs within the survey areas. When trees and shrubs were surveyed, a sweep net was used as a branch beating and shaking implement to dislodge invertebrates residing there. Species that are field identifiable were identified during the surveys, but when this was not possible, specimens were taken away for further identification analysis.

Results

In total, 152 invertebrate species were recorded across Aberystwyth Municipal Cemetery, and of those, 74 were seemingly recorded for the first time in the cemetery grounds. As shown in figure 1 below, the 152 invertebrate species are broken down across 12 orders and classifications, with the 18 Coleoptera (Beetles and Weevils), 35 Hymenoptera (Bees, Wasps and Ants), 30 species of Hemiptera (True Bugs), 29 Diptera (Flies), and 18 Lepidoptera (Butterflies and Moths), representing the greatest proportions of recorded species. The remaining classifications were represented with only one or a handful of species were: 1 Psocopteran (Barkflies), 1 Trichopteran (Caddisflies), 4 Orthoptera

(Grasshoppers, Crickets and Allies), 1 Harvestmen (Opilliones), 1 Terrestrial Isopoda (Woodlice and allies), and 9 Terrestrial Gastropoda (Slugs and Snails).

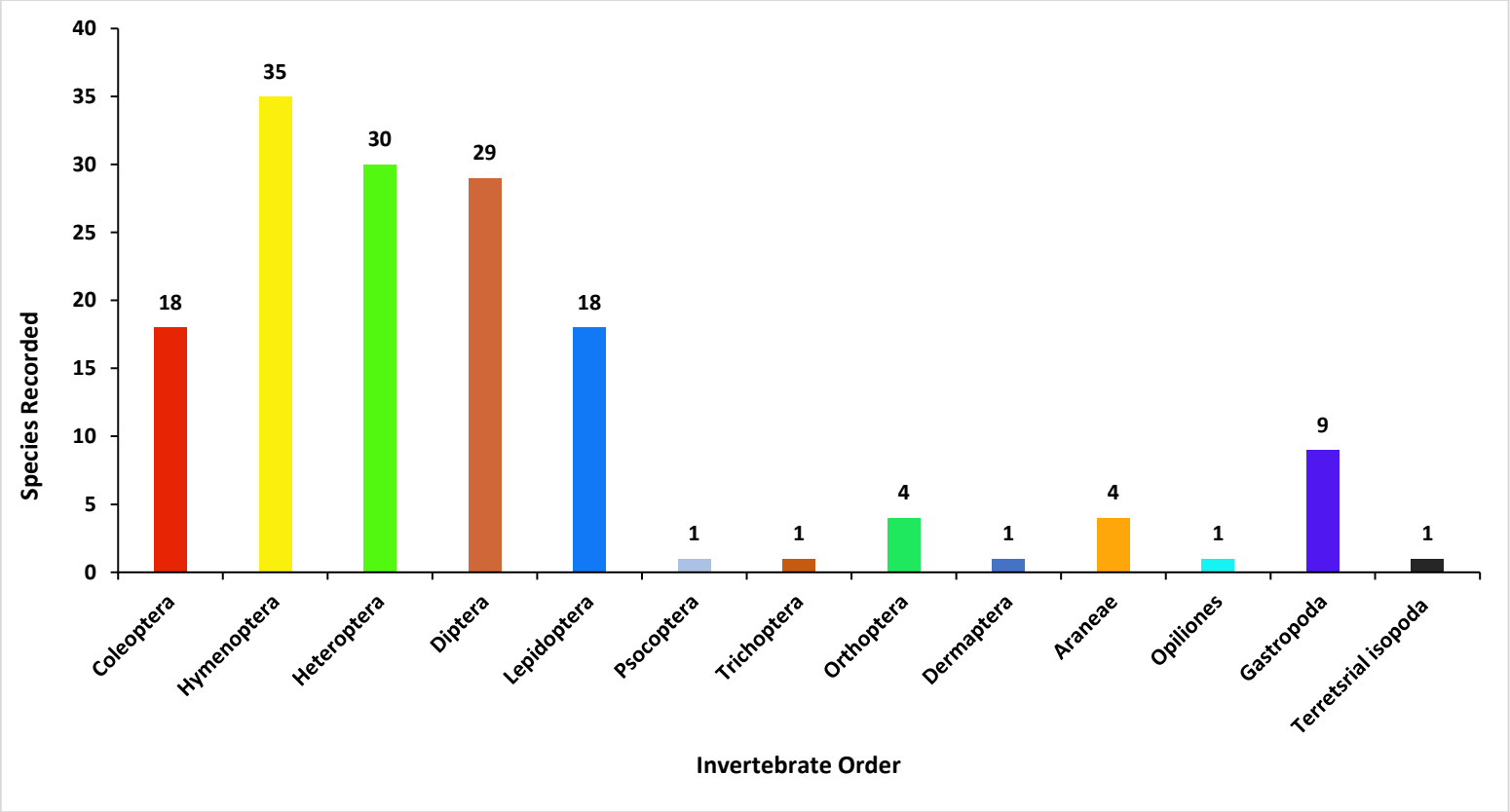

Figure 1: The total number of invertebrate species recorded by order.

Coleoptera (Beetles and Weevils)

Likely due to a lack of previous recording efforts, there do not appear to be any Coleoptera records for the cemetery prior to the implementation of the management plan. The seemingly first records were made 7-9 years after, totalling 11 species over the three year period. During the 2020 surveys, fresh records were made for all of these species, as well as uncovering the presence of 7 additional ones – increasing the known diversity by 63.6%. The species names of all the coleoptera recorded during the 2020 surveys, their family names, conservation status, population comments, and cemetery record history can be found in table one below.

Whilst there are no species of conservation concern that have been found, or any that are particularly lacking in abundance in the county of Ceredigion, the coleoptera assemblage and diversity of the assemblage at the cemetery would certainly not be supported without the actions taken by the management plan. Many of the records are typical of the dry hay-meadow habitats, such as the two species of Blister Beetles (Oedemeridae; see figure 2), the Soldier Beetle species (Cantharidae), and the infrequently recorded Welsh Chafer (*Hoplia philanthus*). There is also a notably wide variety of Ladybirds (Coccinellidae), highlighting the wide ecological niche offerings of

the site, with many hay-meadow dwellers, including the declining Two-Spotted Ladybird (*Adalia bipunctata*; see figure 2), and others, such as the Cream-Spotted Ladybird (*Calvia quatturodecimguttata*) occupying the woody boundaries and trees within the meadows.

In addition to these findings, it is almost certain that many coleoptera species have been 'missed' during the 2020 surveys, as the methods of surveys did not specifically target the order, so the actual species total for coleoptera is likely higher than reported, and the cemetery in its current state, is very much of significant conservation value for the order in the local area.

Table 1: The Complete species list of Beetles and Weevils recorded during the 2020 surveys.

Species	**Family**	**UK Conservation Or Population Status**	**Previous Cemetery Records**
Rhagonycha fulva	Cantharidae	Common and Abundant	Yes -2017, 2018 and 2019 by GHTR
Cantharis rustica	Cantharidae	Fairly Common in Southern and Central UK	No
Cantharis flavilabris	Cantharidae	Common and Abundant	No
Oedemera nobilis	Oedemeridae	Common and Abundant	Yes -2017, 2018 and 2019 by GHTR
Oedemera lurida	Oedemeridae	Common and Abundant	Yes -2017, 2018 and 2019 by GHTR
Pterostichus madidus	Carabidae	Common and Abundant	No
Dromius quadrimaculatus	Carabidae	Widespread and Fairly Common	No
Hoplia philanthus	Scarabaeidae	Fairly widespread in Southern and Central regions, but infrequently recorded	No
Adalia decempunctata	Coccinellidae	Common and Abundant	Yes - 2018 and 2019 by GHTR
Adalia bipunctata	Coccinellidae	Common and Abundant, but declining	Yes - 2017, 2018 and 2019 by GHTR
Coccinella septempunctata	Coccinellidae	Common and Abundant	Yes - 2017, 2018 and 2019 by GHTR

Subconccinella vigintiquatturodecempunctata	Coccinellidae	Common and Abundant	Yes - 2017, 2018 and 2019 by GHTR
Propylea quatturodecempunctata	Coccinellidae	Common and Abundant	Yes - 2017, 2018 and 2019 by GHTR
Harmonia axyridis	Coccinellidae	Common and Abundant	Yes - 2019 by GHTR
Calvia quatturodecimguttata	Coccinellidae	Common and Abundant	Yes - 2017, 2018 and 2019 by GHTR
Aphidecta obliterata	Coccinellidae	Common and Abundant	Yes - 2019 by GHTR
Otiorhynchus sulcatus	Curculionidae	Common and Abundant	No
Otiorhynchus singularis	Curculionidae	Common and Abundant	No

Figure 2: On the left is a female Swollen-Thighed Beetle (*Oedemera nobilis*) lacking the swollen hind legs of the male, whilst on the right is one of the recorded specimens of the Two-Spotted Ladybird (*Adalia bipunctata*).

Hymenoptera (Bees, Wasps and Ants)

Since the 2010 management plan, the diversity of Hymenoptera species recorded has now increased from two species to 35, an increase of 1650% since implementation of the management plan. When considering all records made since April 2010, the number of species found in these invertebrate surveys represents an increase of 133.33%. The species names of all the Hymenoptera recorded during the 2020 surveys, their family names, conservation status, population comments, and cemetery record history can be found in table two below.

Many of the hymenoptera species found are either notable or of local conservation importance. The Cliff Mining Bee (*Andrena thoracica*) is locally common in its restricted coastal range, so its presence at the cemetery reflects the proximity of the cemetery to the coast, and that maritime influences are ocurring. This is also highlighted by the record of the Dull-Vented Sharp-tailed Bee (*Coelioxys elongata*; see figure 3), whose previous county records were confined to the Dyfi estuary, with this being the likely first official record in the county that is south of that locality. Meanwhile, the ichneumon wasp "*Ctenichneumon panzeri*" (see figure 3), which was recorded amongst the stony graves, is likely a first for VC46 (Cardiganshire).

Many species that are generally fairly common in Wales and the wider UK, are notable here given the relative lack of previous records in Ceredigion. These include Clarke's Mining Bee (*Andrena clarkella)*, with the cemeteries record likely being the 06th for Ceredigion, *Andrena nitida* the 09th or 10th official record, and Wool Carder Bee (*Anthidium manicatum*; see figure 3*)* 06th-07th, again, highlighting the local importance of the site.

The cemetery in its state as of the 2020 surveys evidently offers the most fantastic resources for the hymenoptera, all of which recorded are important pollinator species. The abundance of flowers growing through the graves and hay meadows provides the most excellent quantities of pollen and nectar resources, whilst the stone wall and stony graves offer warm nesting sites, essentially ticking all aspects of the lifecycles of many of the species in table 2. Without the slightest of doubt, had the graves and meadows been cut and kept "tidy" as they were prior to this management plan, this rather important hymenoptera assemblage would certainly not have been supported.

Table 2: The Complete species list of Bees and Wasps recorded during the 2020 surveys.

Species	**Family**	**UK Conservation Or Population Status**	**Previous Cemetery Records**
Bombus terrestris	Apidae	Common and Abundant	Yes - 2017, 2018 and 2019 by GHTR
Bombus lapidarius	Apidae	Common and Abundant	Yes - 2017, 2018 and 2019 by GHTR
Bombus hypnorum	Apidae	Common and Abundant	Yes - 2017, 2018 and 2019 by GHTR
Bombus hortorum	Apidae	Common and Abundant	Yes - 2018 and 2019 by GHTR
Bombus lucorum agg.	Apidae	Common and Abundant	Yes - 2018 and 2019 by GHTR

Bombus pratorum	Apidae	Common and Abundant	Yes - 2018 and 2019 by GHTR
Bombus pascuorum	Apidae	Common and Abundant	Yes - 2017, 2018 and 2019 by GHTR
Andrena bicolor	Andrenidae	Common and Fairly Abundant	No
Andrena cineraria	Andrenidae	Common and Fairly Abundant	Yes - 2019 by GHTR
Andrena scotica	Andrenidae	Common and Abundant	Yes - 2019 by GHTR
Andrena fulva	Andrenidae	Common and Abundant	Yes - 2019 by GHTR
Andrena thoracica	Andrenidae	Locally Common in Coastal Localities	No
Andrena clarkella	Andrenidae	Widespread and Fairly Common	No
Andrena nitida	Andrenidae	Common and Abundant, especially in Southern Regions	No
Colletes hederae	Colletidae	Increasingly Common and Widespread	No
Anthophora plumipes	Apidae	Common	Yes - 2019 by GHTR
Halictus rubicundus	Halictidae	Fairly Common and Widespread	Yes - 2018 and 2019 by GHTR
Halictus tumulorum	Halictidae	Widespread and Common throughout much of Southern Britain	No
Lassioglossum calcetaum	Halictidae	Widespread and Fairly Common	No
Anthidium manicatum	Megachilidae	Widely Distributed throughout much of Southern England and Wales, Becoming Scarcer in the North	No
Megachile willughbiella	Megachilidae	Common	No
Megachile centuncularis	Megachilidae	Widespread, more frequently recorded in the South	No
Coelioxys elongata	Megachilidae	Locally Common, particularly in Coastal Areas and the South	No
Osmia bicornis	Megachilidae	Widespread and Fairly Frequent	No
Osmia caerulescens	Megachilidae	Widespread, more Common in the South	No
Osmia leaiana	Megachilidae	Common	No
Nomada marshamella	Apidae	Fairly Common and Widespread	No

Nomada goodeniana	Apidae	Fairly Common, Particularly in the South	No
Apis mellifera	Apidae	Common	Yes - 2017, 2018 and 2019 by GHTR
Ancistrocerus trifasciatus	Vespidae	Fairly Frequent and Widespread	No
Vespula vulgaris	Vespidae	Common	Yes - 2018 and 2019 by GHTR
Vespula germanica	Vespidae	Common, Particularly in the South	Yes - 2018 and 2019 by GHTR
Dolichovespula sylvestris	Vespidae	Locally Common and Fairly Widespread throughout Britain	No
Ctenichneumon panzeri	Ichneumonidae	Locally Common, particularly in Southern England	No
Chrysis angustula	Chrysididae	Common	No

Figure 3: On the top left is a female Wool Carder Bee (*A. manicatum*) foraging from the Purple Toadlfax (*Linaria purpurea*) allowed to grow amongst the graves. It is joined on the top right by a female Dull-Vented Sharp-Tailed Bee (*C. elongata*), who was busy looking amongst the many gaps of the stone wall, looking for the nests of its host *M. willughbiella*, which was also recorded. On the bottom left is a male Orange-Vented Leafcutter Bee (*Osmia leaiana*), whilst on the bottom right is the ichneumon wasp "*Ctenichneumon panzeri*".

Hemiptera (True Bugs)

As with the coleoptera, there do not appear to be any hemipteran records prior to the 2010 management plan, likely reflecting a lack of survey effort as well as poor habitat quality. In the years 2017-2019, 16 species were recorded, with an additional 14 from the 2020 surveys. This brings the total diversity of Hemiptera recorded at the site to 30 species – an increase of 87.5%. The species names, their family, conservation status and previous cemetery record status is in table 3 below.

Many species listed in table 3 are typical of the dry grassland community present and occur widely in grasslands that are left to grow. This includes the Common Green Shieldbug (*Palomena prasina*), Hairy Shieldbug (*Dolycoris baccarum*), the Plantbugs *Lepotopterna dolabrata* and *L. ferrugata*, as well as the froghoppers *Philaenus spumarius* and *Neophilaenus lineatus*.

Many species present and the assemblage ensembled, indicates particular conservation value, including the Bishop's Mitre Shieldbug (*Aelia accuminata*), Tortoise Shieldbug (*Eurygaster testudinaria*; see figure 4), Denticulate Leatherbug (*Coriomeris denticulatus*) and *Oncotylus viridiflavus*. The Tortoise Shieldbug record appears to be only the second one for North Ceredigion, the Denticulate Leatherbug seemingly only the second record in the entire county, for *Oncotylus virdiflavus*, only the third county record. Also, the record of *Campyloneura virgula* (see figure 4) is only the fourth for the county.

Although some species were clearly utilising the various flowers allowed to grow amongst the graves, the vast majority of species were clearly inhabiting the long grassy-haymeadows, which together with the species of conservation note, highlights the local importance of these habitats.

Table 3: The complete species list of True Bugs recorded during the 2020 surveys.

Species	**Family**	**UK Conservation or Population Status**	**Previous Cemetery Records**
Aelia accuminata	Pentatomidae	Widespread across Southern Britain	Yes, 2018 and 2019 by GHTR
Palomena prasina	Pentatomidae	Common and Widespread	Yes, 2017, 2018 and 2019 by GHTR
Dolycoris baccarum	Pentatomidae	Common and Widespread	Yes, 2017, 2018 and 2019 by GHTR
Eurygaster testudinaria	Scutelleridae	Widespread, particularly across Southern Britain	No
Pentatoma rufipes	Pentatomidae	Common and Widespread	No
Elasmucha grisea	Acanthosomatidae	Common and Widespread	No

Coreus marginatus	Coreidae	Common and Widespread, Particularly in the South	Yes, 2017, 2018 and 2019 by GHTR
Coriomerus denticulatus	Coreidae	Locally Common, Particularly in Southern Britain	No
Nabis flavomarginatus	Nabidae	Common and Widespread	Yes, 2018 and 2019 by GHTR
Nabis rugosus	Nabidae	Widespread and Fairly Frequent, particularly in Southern Britain	Yes, 2018 and 2019 by GHTR
Himacerus mirmicoides	Nabidae	Common, particularly in Southern Britain	Yes, 2019 by GHTR
Corizus hyoscyami	Rhopalidae	Locally Common, Particularly in Coastal Areas	No
Liocoris tripustulatus	Miridae	Common	Yes, 2018 and 2019 by GHTR
Lygocoris pabulinus	Miridae	Very Common	No
Stenotus binotatus	Miridae	Widespread and Very Common	Yes, 2017, 2018 and 2019 by GHTR
Closterotomus norwegicus	Miridae	Common and Widespread	Yes, 2017, 2018 and 2019 by GHTR
Campyloneura virgula	Miridae	Common and Widespread	No
Oncotylus viridiflavus	Miridae	Locally Common in Southern and Central England, and some parts of Wales	No
Stenodema calcarata	Miridae	Common	No
Stenodema laevigata	Miridae	Common	No
Plagiognathus arbustorum	Miridae	Extremely Common	No
Bryocoris pteridis	Miridae	Common and Widespread	No
Leptopterna dolabrata	Miridae	Common and Widespread	Yes, 2017, 2018 and 2019 by GHTR
Leptopterna ferrugata	Miridae	Common and Widespread	Yes, 2017, 2018 and 2019 by GHTR
Anthocoris nemorum	Cimicidae	Abundant	Yes, 2018 and 2019 by GHTR
Philaeneus spumarius	Aphrophoridae	Extremely Common	Yes, 2017, 2018 and 2019 by GHTR

Neophilaeneus lineatus	Aphrophoridae	Very Common and Widespread	Yes, 2017, 2018 and 2019 by GHTR
Aphrophora alni	Aphrophoridae	Common	Yes, 2018 and 2019 by GHTR
Idiocerus lituratus	Cicadellidae	Relatively Common and Widespread	No
Conomelus anceps	Delphacidae	Widespread and Common, particularly in Southern Britain	No

Figure 4: On the top left is the predatory plantbug "*Campyloneura virgula*", found in the grassland underneath an oak tree (of which it probably fell from), whilst on the top right is a Cinnamon Bug (*Corizus hyoscyami*), which was abundant in the meadows. The Ant Mimicking Damselbug (*Himacerus mirmicoides*) occupies the bottom left position and

was present amongst the tall wildflowers of the grave areas. It is joined on the bottom right by the Tortoise Shieldbug (*Eurygaster testudinaria*), which was found in the hay-meadows.

Diptera (True Flies)

Likewise, with the Coleoptera and Hemiptera, there do not appear to be any Dipteran records prior to 2010. Between 2010 and 2019, 13 species were recorded, and after the 2020 surveys, this increased to a total of 29 species. This represents a rise of 123.1% in species diversity. The species names, their family, conservation status and previous cemetery record status is in table 4 below.

The communities recorded can be broadly considered in two groups – pollinators and grassland specialists. The latter includes the Striped Slender Robberfly (*Leptogaster cylindrica*), The Tessellated Dancefly (*Empis tessellata*), the Broad Centurion Soldierfly (*Chloromyia formosa*), and the Dull Four-Spined Legionnaire Soldierfly (*Chorisops tibialis;* see figure 5). Such species indicate a well-established grassland with a wide variety of ecological niche opportunity, with the Broad Centurion and Striped Slender Robberfly indicating drier and sunnier areas, whilst the Dull-Four Spined Legionnaire and Tessellated Dancefly indicating damper areas. The impressively diverse pollinator group includes a wide variety of Hoverflies (*Syrphidae*) as well as the recorded Tachinid Flies and the Noon Fly (*Mesembrina meridiana*). They highlight the abundance of floral opportunities supplied by both the wider grasslands and also the flowers growing amongst the graves where many were recorded.

The Dull Four-Spined Legionnaire record is likely the seventh for North Ceredigion, whilst the Fruit Fly "*Tephritis neesii*" (see figure 5) is likely only the second in the county as a whole. Together with the above discussion on diversity, suggests a valuable conservation value to these hay-meadows and floral graves.

Table 4: The complete species list of True Flies recorded during the 2020 surveys.

Species	Family	UK Conservation or Population Status	Previous Cemetery Records
Tachina fera	Tachinidae	Common and Widespread in England and Wales	No
Eriothrix rufomaculata	Tachinidae	Fairly Common and Widespread	No
Mesembrina meridiana	Muscidae	Common and Widespread	No
Calliphora vicina	Calliphoridae	Common and Widespread	No
Leptogaster cylindrica	Asilidae	Widespread in the South	No
Empis tessellata	Empididae	Common and Widespread	No

Scathophaga stercoraria	Scathophagidae	Very Common and Widespread	Yes, 2017, 2018 and 2019 by GHTR
Tephritis neesii	Tephritidae	Widespread and Common, particularly in Southern England	No
Chorisops tibialis	Stratiomyidae	Fairly Frequent and Widespread in England and Wales	No
Chloromyia formosa	Stratiomyidae	Common and Widespread	Yes, 2018 and 2019 by GHTR
Volucella bombylans	Syrphidae	Common and Widespread	Yes, 2018 and 2019 by GHTR
Volucella pellucens	Syrphidae	Common	Yes, 2018 and 2019 by GHTR
Episyrphus balteatus	Syrphidae	Common and Widespread	Yes, 2017, 2018 and 2019 by GHTR
Platycheirus albimanus	Syrphidae	Common and Widespread	No
Epistrophe eligans	Syrphidae	Widespread, particularly in the South	No
Scaeva pyrastri	Syrphidae	Common and Widespread, particularly in the South	No
Sphaerophoria scripta	Syrphidae	Common, particularly in the South	Yes, 2018 and 2019 by GHTR
Rhingia rostrata	Syrphidae	Widespread across Southern Britain up to North Wales	No
Rhingia campestris	Syrphidae	Very Common	No
Eristalis tenax	Syrphidae	Very Common and Widespread	Yes, 2017, 2018 and 2019 by GHTR
Eristalis pertinax	Syrphidae	Common and Widespread	Yes, 2017, 2018 and 2019 by GHTR
Eristalis nemorum	Syrphidae	Frequent	Yes, 2018 and 2019 by GHTR
Eristalis horticola	Syrphidae	Widespread, but not common, even scarcer further North	Yes, 2018 and 2019 by GHTR
Helophilus pendulus	Syrphidae	Common and Widespread	Yes, 2018 and 2019 by GHTR
Helophilus hybridus	Syrphidae	Widespread, but sometimes local	Yes, 2018 and 2019 by GHTR
Myathropa florea	Syrphidae	Common and Widespread	Yes, 2017, 2018 and 2019 by GHTR

Merodon equestris	Syrphidae	Frequent	No
Sericomyia silentis	Syrphidae	Found across most of the UK, but not particularly common	No
Xylota segnis	Syrphidae	Reasonably Common	No

Figure 5: On the top left is the fruit fly "*Tephritis neesii*", which was seemingly enjoying the abundance of Ox-eye Daisies growing amongst the graves. It is joined on the right by the Dull Four Spined Legionnaire Soldierfly, which was abundant in the grassy meadows during the summer. On the bottom left is a representative specimen of the *Eriorthrix rufomaculata* recorded, whilst on the right is the Footballer Hoverfly (*Helophilus pendulus*) – one of the many recorded from this important pollinator fly family.

Lepidoptera (Butterflies and Moths)

The Lepidoptera is perhaps the order with the greatest amount of previous record information due to a number of previous moth survey efforts. Prior to 2010, the total species appeared to stand at 47, with 6 butterflies and 41 moths. A moth survey conducted in 2015 – five years after implementation of the management plan - showed the diversity had increased to 164 species – a rise of 246.9% - with 158 moths and 6 butterflies. A number of butterfly records were made between 2017 and 2019, increasing their total to 11 species and the Lepidoptera total to 169 species – an increase of 3.05% in diversity compared to 2015. The 2020 surveys mostly refreshed some of these records, but did find an additional four species to bring the Lepidoptera total to 173 – a 2.4% increase on all records to 2019 – see table 5. This means 14 butterfly species and 159 moths have now been recorded. The overall increase in diversity of this group is a great proxy for the patterns in the diversity of ecological niche availability, which have clearly increased.

In terms of the 2020 list, the species recorded suggest a healthy grassland community, with the presence of classics like the Meadow Brown (*Maniola jurtina*), Ringlet (*Aphantopus hyperantus*; see figure 6), and Small Skipper (*Thymelicus sylestris*). However, the abundance of Common Blues (*Polyommatus icarus*; see figure 6) and Six -Spot Burnets (*Zygaena filipendulae*; also in figure 6) suggest the meadows are in particularly good condition for invertebrates. Other species, such as the Speckled Wood (*Pararge aegeria*), Comma (*Polygonia c-album*) and Painted Lady (*Vanessa cardui*) highlight a further range of niches at the site as a whole, and in particular, the contrasting floral opportunities of the grave areas with the wider meadows.

Table 5: The complete species list of Butterflies and Moths recorded during the 2020 surveys.

Species	Family	UK Conservation or Population Status	Previous Cemetery Records
Aglais urticae	Nymphalidae	Widespread, declining in the South	Yes, 2018 and 2019 by GHTR
Aglais io	Nymphalidae	Widespread, with increasing range	Yes, 2018 and 2019 by GHTR
Vanessa cardui	Nymphalidae	Widespread and Common	Yes: 2009, and 2018
Vanessa atalanta	Nymphalidae	Widespread and Common	Yes, 2018 and 2019 by GHTR
Polygonia c-album	Nymphalidae	Widespread and Reasonably Common	No
Anthocharis cardamines	Pieridae	Widespread, somewhat local further North and in Scotland	No
Thymelicus sylvestris	Hesperiidae	Widespread in Southern Britain, living in discrete colonies of both small and large populations	Yes, 2018 and 2019 by GHTR

Pieris napi	Pieridae	Widespread and Common	Yes, 2017, 2018 and 2019 by GHTR
Pieris rapae	Pieridae	Widespread and Common	Yes: 2009, 2017, 2018 and 2019
Aphantopus hyperantus	Nymphalidae	Widespread and Common in the South	Yes, 2018 and 2019 by GHTR
Pararge aegeria	Nymphalidae	Widespread and Common	Yes: 2009, 2017, 2018 and 2019
Maniola jurtina	Nymphalidae	Widespread and Common	Yes: 2009, 2017, 2018 and 2019
Polyommatus icarus	Lycaenidae	Widespread and Common	Yes: 2009, 2017, 2018 and 2019
Lycaena phlaeas	Lycaenidae	Widespread and Common	No
Autographa gamma	Noctuidae	Widespread and Common, Particularly in Coastal Areas	Yes: 2008 and 2009
Agriphila tristella	Crambidae	Common	Yes, 2018 and 2019 by GHTR
Epiphyas postvittana	Tortricidae	Common	Yes: 2009 and 2015
Zygaena filipendulae	Zygaenidae	Common	No

Figure 6: On the top left is the Common grass Veneer Moth (*Agriphila tristella*), which is joined on the right by a representative specimen of the Six-Spot Burnet (*Zygaena filipendulae*). On the bottom left is a female Common Blue Butterfly (*Polyommatus icarus*), and to its right is the Ringlet (*Aphantopus hyperantus*).

Psocoptera (Barkflies) and Trichoptera (Caddisflies)

Psocoptera: The Psocopteran record made in table 6 below appears to be the first for the cemetery as a whole, which is not unprecedented given how over-looked the order is in general. *Valenzuela flavidus* (see figure 7) seemed to occupy the trees, scrub and areas of the grasslands beneath these. Despite likely being common, this is probably only the third record for VC46, and the first for North Ceredigion.

Table 6: The complete species list of Barkflies recorded during the 2020 surveys.

Species	Family	UK Conservation or Population Status	Previous Cemetery Records
Valenzuela flavidus	Caeciliusidae	Widespread and Fairly Common	No

Figure 7: The Barkfly "*Valenzuela flavidus*", exploring the mysterious and unusual world of my wrist!

Trichoptera: Normally a species group more closely associated with wet features, the lack of such habitats in the cemetery has resulted in a lacklustre showing (see table 7). This is also the case of the insect order of *Odonata* (Dragonflies and Damselflies) of which none were recorded in the surveys – although the Large Red Damselfly (*Pyrrhosoma nymphula*) has been recorded previously. Despite this, the Caddisfly species recorded (see figure 8) did occur in the damper areas of the grasslands and appears to be the first caddisfly record for the cemetery.

Table 7: The complete species list of Caddisflies recorded during the 2020 surveys.

Species	**Family**	**UK Conservation or Population Status**	**Previous Cemetery Records**
Ceraclea dissimilis	Leptoceridae	Widespread and Fairly Frequent	No

Figure 8: A side-view of the Caddisfly "*Ceraclea dissimilis*".

Orthoptera: Prior to the 2010 management plan, the only two records at the cemetery were the Meadow and Field Grasshoppers (*Chorthippus parallelus* and *C. brunneus*; see table 8). The surveys in 2020 uncovered the presence of two further orthopterans – effectively doubling the known diversity, with the Speckled Bush-Cricket (*Leptophyes punctatissima*; see figure 9) and Oak Bush-Cricket (*Meconema meridionale*; also in figure 9*)*. The former species was especially common amongst all of the wildflowers and tall herbs allowed to grow in the graves, whilst the latter was recorded from the oak trees present in the cemetery. The other two grasshopper species were common everywhere!

Table 8: The complete species list of Grasshoppers and Bush-Crickets recorded during the 2020 surveys.

Species	**Family**	**UK Conservation or Population Status**	**Previous Cemetery Records**
Chorthippus brunneus	Acrididae	Widespread and Common	Yes: 2009, 2017, 2018 and 2019
Chorthippus parallelus	Acrididae	Widespread and Common	Yes: 2009, 2017, 2018 and 2019
Leptophyes punctatissima	Tettigoniidae	Common, particularly in the Midlands and Southern England	No
Meconema meridionale	Tettigoniidae	Reasonably Widespread and Common	No

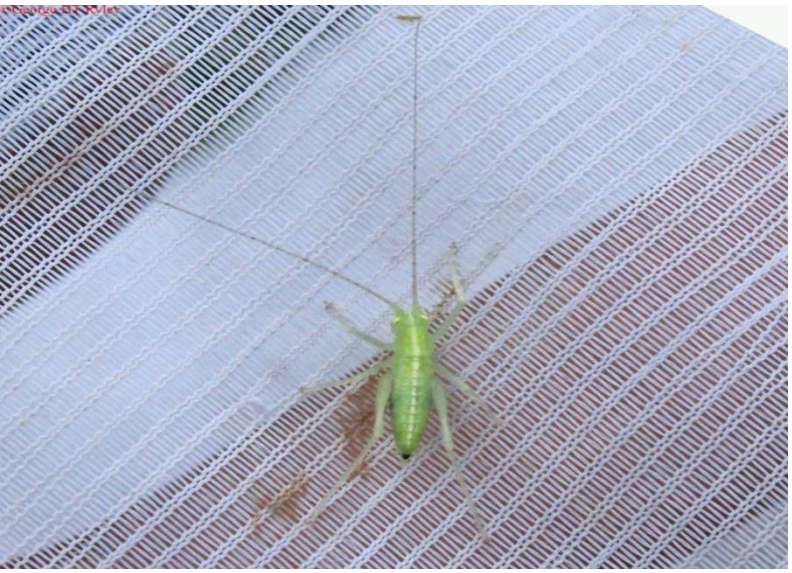

Figure 9: The two new orthopteran additions to the cemetery species list: on the left is the Oak Bush-Cricket (*M. meridionale*), and a representative specimen of the recorded Speckled Bush-Crickets (*L. punctatissima*).

Dermaptera: As with the *Psocoptera* and *Trichoptera,* the Common Earwig (*Forficula auricularia*) in table 9 appears to be the first Dermapteran record for the site, but is almost certainly present prior to these surveys. Despite being a widespread species, the Common Earwig (pictured in figure 10) occurred in abundance in all three of the main habitat types of the hay-meadows, flower-rich grave areas, as well as the trees, scrub and brush patches.

Table 9: The complete species list of Earwigs recorded during the 2020 surveys.

Species	**Family**	**UK Conservation or Population Status**	**Previous Cemetery Records**
Forficula auricularia	Forficulidae	Very Common and Widespread	Yes, 2017, 2018 and 2019 by GHTR

Figure 10: A representative specimen of recorded Common Earwigs (*F. auricularia*).

Araneae (Spiders) and Opilliones (Harvestmen)

Araneae: With seemingly no spider records prior to 2010, the first official records were made in 2018 and/or 2019. Fresh records for all three of these species were made during the 2020 surveys with the addition of *Evarcha falcarta* – effectively increasing diversity by a quarter (see table 10 and figure 11). There is a notable divide in the habitat use by the four species. The Nursery Web Spider (*Pisaura mirabilis*) and Cross Spider (*Araneus diadematus*) being the grassland specialists that they are, occurred predominantly in the hay-meadow areas. Meanwhile, the two species of jumping spider (*Salticidae*), preferring dry and sparsely vegetated areas and attracted to warmth, made full use of the stone wall and all of the stone and concrete surfaces of the graves. The low-density vegetation growing in these area also helped to ensure ample prey was attracted to the areas.

Table 10: The complete species list of Spiders recorded during the 2020 surveys.

Species	**Family**	**UK Conservation or Population Status**	**Previous Cemetery Records**
Salticus scenicus	Salticidae	Common and Widespread, particularly in the South	Yes, 2018 by GHTR
Evarcha falcata	Salticidae	Common and Widespread, particularly in the South, may be local in some areas	No
Pisaura mirabilis	Pisauridae	Common in the South, becoming more infrequent in the North	Yes, 2018 and 2019 by GHTR
Araneus diadematus	Araneidae	Common	Yes, 2018 and 2019 by GHTR

Figure 11: The top is a representative specimen of the recorded "*Evarcha falcarta*", which was joined by the Zebra Spider (*S. scenicus*) in the warmer habitats. On the bottom left is the Cross Spider (*A. diadematus*), which together with the Nursery Web Spider on the bottom right, occupied the more densely vegetated habitats.

Harvestmen: It should be noted that although one species of Harvestman was recorded, others were encountered, but not recorded due to time constraints in their identification as well as dedication of survey time to other groups. It appears that the species *Dicranopalpus ramosus agg*. (see table 11 and figure 12) was the first Harvestman record for the cemetery.

Table 11: The complete species list of Harvestman recorded during the 2020 surveys.

Species	**Family**	**UK Conservation or population Status**	**Previous Cemetery Records**
Dicranopalpus ramosus	Phalangiidae	Widespread and Common	No

Figure 12: A representative specimen of the recorded "*Dicranopalpus ramosus*" harvestman with its forked jaws.

Terrestrial Gastropoda (Slugs and Snails) and Terrestrial Isopoda (Woodlice)

Terrestrial Gastropoda: As with a number of groups discussed above, there appear to be no prior records of terrestrial Gastropoda prior to the 2010 surveys, and in this case prior to the 2020 invertebrate surveys. This is very much a reflection of under-recording of this group rather than any indication of their prior presence at the site. All the species recorded are relatively common and ubiquitous across many habitats, and widely occur in urban areas and gardens (see table 12 and figure 13). Despite this, the assemblage is very much decent and the fact that they are all ocurring together highlights the particularly wide niche availability in the habitats of the cemetery.

Table 12: The complete species list of Slugs and Snails recorded during the 2020 surveys.

Species	***Family***	***UK Conservation or Population Status***	***Previous Cemetery Records***
Arion ater agg.	*Arionidae*	*Extremely Common and Widespread*	*No*
Arion subfuscus	*Arionidae*	*Very Common and Widespread*	*No*
Deroceras reticulatum	*Agriolimacidae*	*Common and Widespread*	*No*
Deroceras invadens	*Agriolimacidae*	*Common and Increasing Range*	*No*
Arion hortensis	*Arionidae*	*Common and Widespread*	*No*
Tandonia budapestensis	*Milacidae*	*Common and Often Abundant in England and Wales*	*No*
Cepaea nemoralis	*Helicidae*	*Common and Widespread*	*No*
Cepaea hortensis	*Helicidae*	*Common and Widespread*	*No*
Cornu aspersum	*Helicidae*	*Common and Widespread*	*No*

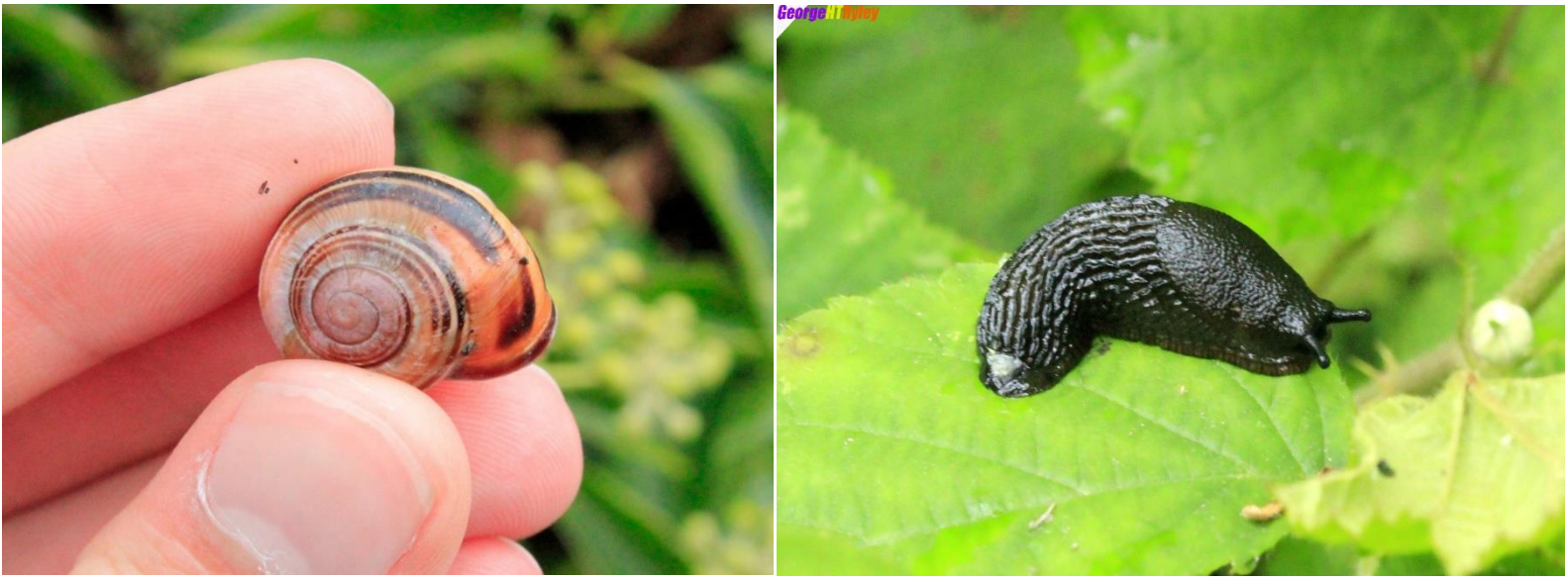

Figure 13: On the left is a Brown-Lipped Snail (*Cepaea nemoralis*), whilst on the right is a specimen of the Black Slug (*Arion ater agg.*).

Terrestrial Isopoda: Prior to 2010, two species of woodlice were recorded – *Oniscus asellus* and *Armadillium vulgare*. As seen in table 13, during the 2020 surveys only one species was recorded, which was a refreshment record of *A. vulgare*. This comparative lack of records for this group is more likely due to survey methods more than an indicator of changes in its diversity.

Table 13: The complete species list of Woodlice recorded during the 2020 surveys.

Species	Family	UK Conservation or Population Status	Previous Cemetery Records
Armadillidium vulgare	Armadillidiidae	Common and Widespread	Yes: 2009

Management Implications and Advice

Overall, the invertebrate diversity at the Aberystywth Municipal Cemetery as of the 2020 surveys can be described as no less than fantastic. As described above, the hay-meadow compartments and wildflower rich graves, together offer a rich ecological niche breadth that covers important groups, such as pollinators, as well as other invertebrates key to healthy ecosystems. Discussed more in the next section, it is certainly the case that these species lists are not exhaustive, and the true diversity is actually richer still. This can only lead to the conclusion that the current state of the habitats and the management plan implemented since 2010, are in good to excellent condition for invertebrate conservation. Whilst surrounding land was not surveyed, it is notable that habitats of the quality present in the cemetery are not ocurring in neighbouring land, which is largely urban or intensively managed grassland.

Similarly, the nearby Cefn Llan cemetery, which is kept as an amenity grassland, highlights the stark difference wildlife friendly management policy can make for local biodiversity. The increases in invertebrate diversity at the Aberystwyth Municipal Cemetery noted in the sections above, could not have possibly occurred without an improvement in habitat quality or if the hay-meadows were still managed as amenity grasslands as they are at Cefn Llan, and as they were here prior to 2010. It is therefore the recommendation of this report that the current management plan of the cemetery, largely stays enacted in its current format, bar the minor recommendations detailed below.

This means continuing to allow the grasses and various plants to grow in the hay-meadow compartments throughout the Spring and Summer seasons. With these hay-meadows, it is important that the cuts made do not occur later than the end of March or earlier than September. Traditional hay-cuts are made between late July and August, but this is not the most ideal for invertebrates, as many individuals and late season species will not have reproduced or fulfilled their lifecycle prior to the cut being made. It is also the case of ensuring that flowering plants present in the hay-meadow have the chance to finish flowering before they are cut so they can be exploited as a resource by the pollinator and wider invertebrate populations. Therefore, a cut at the end of the season in September and potentially a cut prior to the beginning of the season in early March, will have the greatest benefits for invertebrates. Continuing to make hay-cuts with collection of the cuttings will certainly benefit invertebrates in the long term through the continued removal of nutrients from the soil, allowing a greater density of floristic species.

The case is similar with the grave areas themselves. As discussed above, these support a good diversity of tall flowering plants, which occur at a density that is currently greater

than the hay-meadow areas, which due to greater nutrients, is more grass dominant. Not only does this provide a nice bit of contrast to the hay-meadows, but it also provides a valuable asset in terms of pollen and nectar provision, which is undoubtedly key to the very healthy Hymenoptera and Diptera diversity mentioned above (see figure 14). Continuing to allow plants to grow amongst the graves is therefore important to maintaining the diversity recorded in 2020, and it would have implications if management in this respect were to change.

Figure 14: The amazing floristic density and diversity amongst the graves is a key pillar of pollinator support at the cemetery.

It is recognised that some members of the public do wish to have the vegetation on and in the vicinity of their relatives graves kept short, and this can be arranged under the terms of the current management plan. However, for those graves who are not visited by loved ones, or for those loved ones who wish to allow vegetation to grow on/in the vicinity of their relatives graves, it is a wonderful legacy that their grave sites are supporting such notable and valuable invertebrate diversities and ecosystems, especially how such habitats are increasingly hard to find in the wider countryside. Allowing these wildflowers to grow unimpeded across as wide an area of the graves as possible will continue this enduring legacy of supporting healthy invertebrate and pollinator populations. As with

the hay-meadows, no cutting of this vegetation should take place from the end of March to the end of August for the same reasons as described for the hay-meadows.

The trees and scrub around the border of the cemetery, and dotted within the hay-meadows and graves, provide a valuable range of niches that the meadow and wildflower areas cannot, especially the broadleaved species. These supported a number of species across the orders and classifications recorded, including many Ladybirds (*Coccinellidae*), Weevils (*Curculionidae*), True Bugs (*Hemiptera*), and True Flies (*Diptera*). They are therefore an important part of the habitat mix and continuing their presence will continue to allow those species which require woody habitats to be present in the cemetery.

As noted, the invertebrate diversity is rich, or at least proportional to the size of the order/classification concerned, but where this is not the case is the insect order of Odonata (Dragonflies and Damselflies) as none were recorded in 2020. This is undoubtedly due to no freshwater habitats being present in the cemetery which are necessary for the nymphal and reproductive stages of Odonatan lifecycles. The cemetery could almost certainly support a wide diversity of dragonfly and damselfly species, given the ample prey opportunities provided by the hay-meadows and flower rich grave areas. Looking into providing some type of pond feature would plug this *Odonata* sized hole in the invertebrate diversity recorded and would probably boost the diversity of other invertebrates should the grassland in the vicinity of such a feature become wetter, providing a nice contrasting grassland type to the remaining drier areas. As well as Dragonflies, Damselflies and other invertebrates, such a feature would also benefit the local populations of amphibians.

Further Work

The logistics and survey methods outlined above, were chosen to capture as many of the different types of invertebrates as possible, whilst also making the most effective use of the limited time available and large area to cover in that time. Whilst they did achieve this in providing insights into each of the recorded orders and classifications, these lists could easily be expanded further with repeated surveys with the same methods. This is especially so for some groups, such as the *terrestrial Isopoda and* Gastropoda (Woodlice and Slugs and Snails), Spiders (Araneae) and Harvestmen (Opilliones*), which were not focussed on so much due to time constraints. However, all groups could* be targeted more closely with more specific survey methods, such as Pit-Fall trapping to target more Coleoptera, Terrestrial Gastropoda, and Terrestrial Isopods. Malaise and pan traps are brilliant for flying insects, notably Bees, Wasps, Hornets, all kinds of True Flies, as well as some Butterflies, Moths, and True Bugs, although these groups were relatively well covered by the methods used this time, there is probably still room for some expansion. The advantages of these more targeted methods are that they can be situated in the field for longer periods than the more observation-based methods used, and therefore capture many more individual insects through more chance encounters. It would certainly be

worthwhile employing some of these more time-intensive survey methods in the future to maximise the species lists.

Concluding Note

Since the implementation of the management plan in 2010, it is evident that the habitats at the cemetery have undergone a transformation. These 2020 surveys have found a wealth of evidence that management policies enacted as a result of that management plan have resulted in an increase in invertebrate diversity, and that the cemetery as it is currently managed is supporting invertebrate communities of local conservation importance. As this report makes clear, maintaining this management, with only the relatively minor modifications suggested, is key to sustaining this current diversity and improving it further as the habitats continue to develop. Aberystwyth Municipal Cemetery is certainly a shining example of the immense conservation potential our places of rest are.