

Haddon Estate
A Saproxylic Invertebrate Assessment

A report for:
Penny Anderson Associates

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By:
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1 Introduction

- 1.1 The aim was to undertake an assessment of invertebrates associated with deadwood (saproxylic invertebrates) on the Haddon Estate in Derbyshire. The purpose of the assessment was to provide a baseline to the site's entomological status using known indices such as the nationally recognized Saproxylic Quality Index (SQI), in order to make a judgement on the current state of the site and whether it requires intervention measures to increase the quality of its deadwood resources, for which the site is nationally renowned.

Previous surveys

- 1.2 The site does not appear to have been rigorously sampled with regard to its saproxylic fauna prior to this 2018 survey, as it is not listed on the national SQI ranking.
- 1.3 Some piecemeal surveying has been undertaken. The only other survey that has been located was undertaken by local entomologists, Eccles and Maynard (2014). No species lists have been obtained at the time of reporting, however information is potentially forthcoming that will be forwarded when it arrives.
- 1.4 Both the Derbyshire and Nottinghamshire Entomological Society and Sorby Invertebrate Group have been contacted regarding any previous dedicated surveys of the site, and based on those conversations, to the best of the author's knowledge, there have been no other surveys undertaken.

Site location and designation

- 1.5 The Haddon Estate, which encompasses Haddon Hall, is located to the south-east of Bakewell, Derbyshire at OS grid reference SK235664.
- 1.6 It is a historic grade 1 registered parkland covering an area of 62 hectares, and the overall study area comprises 186 hectares.

Site description

- 1.7 The site is located on a south-westerly facing hillside with the river Wye at the toe of the slope.
- 1.8 It comprises a formal hall and immediate grounds, but the majority of the land is woodland, parkland, and pasture, grazed by beef cattle.
- 1.9 The tree-dominated parkland areas are largely contained on the south-westerly facing slope. The tree composition ranges from oaks (*Quercus* spp.) and ash (*Fraxinus excelsior*) to limes (*Tilia* spp.) and maples (*Acer* spp.) including sycamore (*A. pseudoplatanus*).
- 1.10 The grassland sward is unimproved though relatively poor in botanical diversity. There are areas of hawthorn scrub (*Crataegus monogyna*) dominating sections of the slope as dense, continuous stands but also as more scattered stands.

2 Fieldwork

Fieldwork methodology

Scoping visit

- 2.1 A scoping visit was undertaken on 12 July by Andy Jukes and Andy Grayson to determine key areas likely to produce the best results from survey work and also to identify key trees that would be accessible for trap installation.
- 2.2 From this scoping event, a series of broad and specific locations were identified for further, detailed survey work.

Full survey

- 2.3 The site was visited on seven separate occasions to undertake the sampling of deadwood and veteran trees. The methods used were in line with those laid out in Drake *et al.* (2007).

Active survey methods

- Beating – tree branches were bashed to dislodge any arboreal species living, resting, or mating on the branches or leaves of trees.
- Sweeping – branches, where foliage was present, were swept to contribute to the beating, as sweeping collects an overlapping range of invertebrates, which includes more winged and flighty invertebrates. Ground flora beneath the canopy, and nectar and pollen resources were also swept for foraging invertebrates.
- Grubbing – this was undertaken on the trunks of trees, deadwood, and cavities, under loose bark, and on ground surfaces.
- Destructive searches – only limited splitting of deadwood was undertaken at the site in the search for hiding beetles.
- Sieving – this was undertaken where there was an aggregation of cavity heart rot material. Sieving was partly undertaken on site, and material collected and taken away to be sieved at a later date.

Table 1 Survey locations

Code	Broad survey areas	Grid reference
13	the 'Veteran Ash Tree' and grassland to its south	SK 22960 67105
14	parkland in Area 1a [eastern half]	SK 23515 66646
15	parkland immediately west of Haddon Hall	SK 23485 66405
	Sampling at specific tree trunks	
17	at trunk of oak in Area 1a [Code 3 tree]	SK 23643 66615
18	at trunk of dead ash in Area 2a [Code 10 tree]	SK 23603 66303
19	at trunk of dead ash in Area 2a [Code 11 tree]	SK 23914 66239
20	at trunk of dead hawthorn near Haddon Hall	SK 23505 66413

¹ Drake, C.M., Lott, D.A., Alexander, K.N.A., and Webb, J. (2007) *Surveying Terrestrial and Freshwater Invertebrate for Conservation Evaluation*. Natural England, Peterborough.
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Passive survey methods – flight interception traps

- 2.4 Flight interception traps are an effective method for recording elusive saproxylic species that are sometimes difficult to record by other means. To supplement the survey work, 12 flight interception traps were used on trees with significant amounts of decay, most often positioned in front of a rot hole or rotting trunk surface.
- 2.5 Each trap's contents were emptied and solution refreshed during each visit or as required.

Table 2 Trap-location details

Code	Vane trap location notes	Grid reference
1	on the veteran ash (<i>F. excelsior</i>) tree	SK 22940 67173
2	on a lime (<i>Tilia</i> spp.) tree [Area 1a]	SK 23670 66622
3	oak [Area 1a]	SK 23643 66615
4	on oak (<i>Quercus</i> spp.) near Haddon Hall	SK 23539 66443
5	on the 'Mother Oak' [Area 2a]	SK 23630 66326
6	on the 'Mother Oak' [Area 2a]	SK 23630 66326
7	on ash tree [Area 1a]	SK 23431 66681
8	on sycamore (<i>A. pseudoplatanus</i>)? [Area 1a]	SK 23464 66616
9	on sycamore [Area 1a]	SK 23575 66485
10	dead ash tree near River Wye [Area 2a]	SK 23603 66303
11	on dead ash near cattle shed [Area 2a]	SK 23914 66239
12	on ash near cattle shed [Area 2a]	SK 23966 66258

Survey dates

- 2.6 Full sampling was undertaken on the following dates:

Date	Weather conditions	Min.	Max.
12 July 2018	Hot and humid, mainly hazy sunshine	23°C	26°C
24 July 2018	Hot and humid, full sunshine, or light clouds	25°C	27°C
10 August 2018	Sunshine and showers, then warm and sunny	16°C	18°C
20 August 2018	Mainly thin overcast, hot, and humid	23°C	26°C
29 August 2018	Initially thin overcast, becoming hot and sunny	19°C	23°C
13 September 2018	Very warm and sunny, with cloudy periods	17°C	21°C
9 October 2018	Very warm and sunny	16°C	22°C



Photograph 1: Typical installation location of the flight interception trap.
© Andy Jukes (2018)

3 Results summary

- 3.1 There are 290 species recorded from the site surveys. The full list of species recorded is provided in Appendix III, and the species of conservation importance are listed in Table 3.

Table 3 Species of importance

Scientific name	Vernacular name	UK Status	Habitat preferences and species notes
<i>Aderus populneus</i>	a beetle	Nationally Scarce	Larvae in red heartwood rot of a range of broadleaved trees including oaks (<i>Quercus</i> spp.), limes (<i>Tilia</i> spp.), and planes (<i>Acer</i> spp.)
<i>Cryptarcha strigata</i>	a beetle	Notable b	Found in wood pasture and broadleaved woodland, occurring in sap runs and under bark of ash and oak
<i>Cryptophagus micaceus</i>	a beetle	Red Data Book K	Associated with ancient broadleaved woodland where it is found in the nests of wasp, especially hornets (<i>Vespa crabro</i>). Recorded also from ash and fungi in beech
<i>Dacne rufifrons</i>	a beetle	Data Deficient	Associated with bracket fungi and rotting broadleaved wood
<i>Dolichovespula media</i>	median wasp	Nationally notable A (more common now than this status suggests)	A wood edge species of social wasp; not scarce or threatened and due to be downgraded in the upcoming bee and wasp status review
<i>Dolichovespula saxonica</i>	Saxon wasp	Red Data Book K* (more common now than this status suggests)	A wood edge species of social wasp; not scarce or threatened and due to be downgraded in the upcoming bee and wasp status review
<i>Ectemnius ruficornis</i>	a solitary wasp	Notable b* (more common now than this status suggests)	Nests in deadwood in sunny isutatins and forages for prey items (large hoverflies) in surrounding grassland and scrub fringes. The adult wasps feed on flowers such as umbellifers
<i>Enicmus brevicornis</i>	a beetle	Notable	Recorded from under the bark of broadleaved trees
<i>Lasiommata megera</i>	wall butterfly	Nationally Threatened; NERC Act Section 41 priority species	Associated with dry sites, particularly with parched areas of ground, rocky exposures, and patchy bare ground. Larvae feed on a range of grasses including

			cock's-foot (<i>Dactylis glomerata</i>). A much declined species, particularly at inland sites.
<i>Lonchaea corusca</i>	a fly	Notable; provisionally Nationally Scarce	Ecology largely unknown
<i>Mallota cimbiciformis</i>	a hoverfly	Nationally Scarce	Larvae develop in water-filled rot holes, and the adults forage for nectar and pollen from summer flowers such as bramble
<i>Orchesia micans</i>	a beetle	Nationally Scarce	Broadleaved woodland and parkland with bracket fungi including <i>Polyporus hispidus</i> on ash
<i>Quedius aetolicus</i>	a beetle	Notable a	Ancient woodland and parkland where it has been found from squirrel nests, under bark, and in fungi
<i>Quedius brevicornis</i>	a beetle	Notable b	Ancient woodland and parkland where it has been found from owl nests, in hornet nests under bark, and in fungi
<i>Quedius trunciolca</i>	a beetle	Notable b	Associated with broadleaved woodland and wood pasture; occurs in damp decaying wood mould in hollow trees
<i>Sciophila interrupta</i>	a fungus gnat	Locally Rare*; Nationally Scarce	Has been reared from <i>Hydrum</i> fungi and appears to feed on fungal spores

* More common than the status suggests and will be downgraded in any upcoming status review.

- 3.2 The most up-to-date information and species reviews are used in the assessment. Where there is no up-to-date review, Pantheon (Webb *et al.*, 2017³) is used.
- 3.3 Species ecology and habitat preferences were taken from Recorder 6.

³ Webb, J., Heaver, D., Lott, D., Dean, H.J., van Breda, J., Curson, J., Harvey, M., Gurney, M., Roy, D.B., van Breda, A., Drake, M., Alexander, K.N.A., and Foster, G. (2017) *Pantheon – Database Version 3.7.4*. [online] Available at: <http://www.brc.ac.uk/pantheon/> [Accessed on 28 May 2017].

4 Results analysis

- **Methods of analysis**

Site Quality Score (SQS) and SQI

- 4.1 The SQS is a broad index for all woodland types for the British mainland from temperate to boreal habitat types. The SQS is a total score of all the species recorded from the site. Each national designation (Red Data Book, Nationally Scarce through to common species) receives a different level of score. The system is not reliant on exhaustive sampling of a site but more useful for singular surveys or a limited range of closely related surveys unlike the Index of Ecological Continuity (IEC), which uses all known species data to a point in history (1950).

Fowles *et al.* (1999³) scoring for SQS is:

- 32 – RDB 1
- 32 – RDB 2
- 24 – RDB 3
- 16 – RDB ‘K’
- 16 – NS A
- 8 – NS B
- 4 – Regional NS/very local
- 2 – Local
- 1 – Common

- 4.2 The SQI is calculated by dividing the SQS score by the total number of species in the qualifying lists and then multiplying by 100. The greater the species list, the more robust and accurate the SQI is.

Summary of SQS and SQI:

SQS = sum of all rarity scores

$$SQI = \frac{SQS}{\text{number of species}} \times 100$$

IEC

- 4.3 The IEC is an index based on the presence of a suite of beetle species that have a high fidelity to old growth forests, which are largely the wood pastures and parklands. It deals specifically with temperate forest species and not boreal forest species, which are catered for in other scoring systems, such as the SQI. The IEC scoring system is not based on a singular recording event or survey but can be an accumulated total from a number of years’ survey work. The threshold for when records are not admissible is pre-1950.

- 4.4 Alexander (2010⁴) suggests the following thresholds in determining national importance:

- >80 = internationally (European) significant
- 25–80 = nationally significant
- 15–24 = regionally significant

³ Fowles, A.P., Alexander, K.N.A., and Key, R.R. (1999) The saproxylic Quality Index: evaluating wooded habitats for conservation of deadwood Coleoptera. *The Coleopterist* 8: 121–141.

⁴ Alexander, K.N.A. (2011) *A Review of the National Importance and Current Condition of the Saproxylic Invertebrates Assemblages at Birklands and Bilhaugh Sites of Special Scientific Interest (SSSIs) Sherwood Forest, Nottingham*. Natural England Commissioned Reports, NECR072.

Pantheon

- 4.5 Tables 2 and 3 have been generated using the Pantheon software package. Pantheon is an analytical tool developed by Natural England and the Centre for Ecology & Hydrology (CEH) to assist invertebrate nature conservation in England. Site data in the form of species lists can be imported into Pantheon, which then analyses the species within the lists, assigning them to habitats and resources. Pantheon also consigns the most up-to-date national status to the species where it is available.
- 4.6 Pantheon is also capable of other outputs such as Specific Assemblage Types (SATs). See Table 3.
- 4.7 A SAT is characterized by stenotopic species (those that can only withstand a narrow range of environmental conditions). SATs are therefore more tightly defined than ‘habitats’ or ‘resources’ and sit within a parent habitat or Broad Assemblage Type (BAT). More than one SAT can sit within a parent BAT.

Example:

BAT: F2 – grassland and scrub matrix

SAT: F211 – herb-rich dense sward

F212 – dense scrub

- 4.8 The information obtained from Pantheon can then be used to assign quality to sites and their features, assist in management decisions, and also facilitate requirement for further surveys, where required and appropriate.
- 4.9 For more information on this new resource, see <http://www.brc.ac.uk/pantheon/>.
- 4.10 Not all species of importance are expressed in the following tables, as they do not form part of the Pantheon analysis and/or their specific requirements are not yet fully understood.

Table 4 Site-resource usage table (taken from Webb *et al.*, 2017)

Broad biotope	Habitat	No. of species	SQI	No. of species with conservation status	Conservation status
tree-associated	decaying wood	71	148	11	<i>Aderus populneus</i> : NS <i>Cryptophagus micaceus</i> : RDB K <i>Dacne rufifrons</i> : DD <i>Enicmus brevicornis</i> : N <i>Orchesia micans</i> : NS <i>Cryptarcha strigata</i> : Nb <i>Quedius aetolicus</i> : Na <i>Quedius brevicornis</i> : Nb <i>Quedius truncicola</i> : Nb <i>Lonchaea corusca</i> : N; pNS <i>Mallota cimbiciformis</i> : NS <i>Ectemnius ruficornis</i> : Nb*
open habitats	tall sward and scrub	66	100	1	<i>Ectemnius ruficornis</i> : Nb*
tree-associated	shaded woodland floor	32	100	–	–
tree-associated	arboreal	25	100	2	<i>Dolichovespula media</i> : Na* <i>Dolichovespula saxonica</i> : RDBK*
open habitats	short sward and bare ground	8	100	1	<i>Lasiommata megera</i> : S41

Broad biotope	Habitat	No. of species	SQI	No. of species with conservation status	Conservation status
wetland	marshland	8	100	–	–
wetland	peatland	8	100	–	–
wetland	running water	5	100	–	–
tree-associated	wet woodland	3	100	–	–
wetland	wet woodland	3	100	–	–

* More common than the status suggests and will be downgraded in any upcoming status review.

Table 5 SAT table (taken from Webb *et al.*, 2017)

Broad biotope	Habitat	SAT	SAT code	No. of associated species	No. of species with conservation status	SAT Status
tree-associated	decaying wood	bark and sapwood decay	A212	31	4	Favourable
open habitats	–	scrub edge	F001	15	2	Favourable
tree-associated	decaying wood	heartwood decay	A211	9	5	Favourable
open habitats	–	rich flower resource	F002	11	–	Unfavourable
tree-associated	decaying wood	fungal fruiting bodies	A213	6	2	Unfavourable
open habitats	short sward and bare ground	open short sward	F112	2	1	Unfavourable
open habitats	short sward and bare ground	bare sand and chalk	F111	1	–	Unfavourable
wetland	running water	seepage	W126	1	–	Unfavourable

Table 6 Quality scores

IEC status	9
IEC ranking	Regional (English midlands) = joint 59
SQI	417.9

Table 7 Saproxyllic associates usage table based on 2018 survey (generated using Pantheon)

Diptera associates	saproxyllic	No. of species	Totals
Fungal associates		5 diptera	15
		10 coleoptera	
Sapwood and bark decay		9 diptera	26
		17 coleoptera	

Diptera associates	saproxylic	No. of species	Totals
Heart rot		3 diptera	12
		9 coleoptera	
Wood decay in soil		1 diptera	1

5 Discussion

Caveats

- 5.1 The survey was only undertaken in July to October 2018. This is a late start to a survey, particularly when the focus was to evaluate the saproxylic resource. The main invertebrate season begins in April and finishes in September/October, and consequently all of the spring and early summer fauna could not be evaluated.
- 5.2 The summer of 2018 was exceptionally hot and dry, and as a consequence, invertebrate activity has been noticeably reduced, resulting in reduced catches and therefore data from which to evaluate a site's status.

Habitat scores and totals

- 5.3 Haddon Estate does not appear on any of the national ranking lists for SQI or IEC, and so this survey provides a baseline set of data.
- 5.4 Because of how the IEC score and ranking are calculated, being able to use cumulative species lists from up to 50 years old, and with many other notable sites being sampled over multiple occasions, Haddon Estate, being only sampled once, currently has a low ranking based on its saproxylic beetle resource, and so its current value is underplayed.
- 5.5 It is expected that through further survey, including visits during the spring and early summer periods, a much higher ranking will be achieved.
- 5.6 Using the ISIS SAT analysis, it can be seen that the key assemblages A212 (bark and sapwood decay) and the high-value heartwood decay (A211) assemblages reach favourable conditions: A212 = 31 species (threshold = 19 species); and A211 = 12 species (threshold = 6 species). This highlights the value of the sites to saproxylics, and again, if further visits were to be undertaken in spring and early summer, these values would increase significantly.
- 5.7 The A212 is particularly rich with species and, given the abundance and volume of this material noted during the survey visits, was not unexpected at this site.
- 5.8 Despite reaching favourable status, however, the heartwood decay assemblage only recorded nine species of fidelity. This is in part due to the late season survey period and hot summer, but it does also highlight the lack of substantial heartwood rot currently present across the site in any large quantity. This lack of resource may require addressing in order to elevate the opportunities to species.
- 5.9 It is suggested that through further targeted work during other optimal months (April–June), these values would however increase.

Habitat and management

- 5.10 The broad habitat at Haddon Estate is that of low-intensity cattle-grazed slopes beneath a loose tree canopy and widely spaced mature and veteran trees. There are also areas of more closely approximated trees and evidence of replanting amongst the existing trees, but also in new parkland areas.
- 5.11 There does not appear to be significant management of the parkland including the potentially damaging practice of sectioning up of felled timbers with felled trees left *in situ*. This type of non-intervention is to be encouraged.



Photograph 2: new planting amongst existing parkland. © Andy Jukes (2018).



Photograph 3: Newly planted trees adjacent to existing parkland. © Andy Jukes (2018).

- 5.12 Deadwood is prevalent across the site with large-volume material such as fallen tree trunks and boughs in different areas and in varying states of decay. The material is also in a range of situations from shade to partial sun. This is a strong resource at the site, and continuity of it is encouraged for species requiring dead wood.



Photograph 4: Fallen deadwood (ash), fractured into large pieces and left *in situ*: a strong resource for deadwood nesting bees and wasps along with various beetle species. © Andy Jukes (2018).

- 5.13 As the site is managed through grazing by large stock animals (cattle), it will be important to monitor the regeneration of trees and continue planting new saplings on a rolling cycle of replenishment. It is advised that the collection and growing on of saplings or seeds from the on-site resource of trees also be undertaken to ensure the local genetic provenance of the estate's trees is safeguarded for the future.
- 5.14 Scrub edge (SAT code: F001), particularly flowering scrub, is plentiful across the site with strong resources in both the east and west, and as the SAT analysis states, it is in a favourable status. This is dominated by hawthorn (*C. monogyna*) complemented by an apple (*Malus domestica* agg.) orchard on the south-eastern side of the Hall. There are few other flowering scrub species, however, to lengthen the flowering period of this resource. Bramble (*Rubus fruticosus* agg.), however, is present in the south-eastern side of the site, but the grazing of cattle inhibits this and other flowering plants, other than the hawthorn.
- 5.15 As the ground flora is predominately grazed grassland, some areas may not present a significantly abundant resource of flowering plants throughout the seasons from April through to autumn. This aspect of the site may require addressing through altered grazing patterns and time frames or temporary fencing to enable parts of the grassland to flower.

Tree condition and suitability

- 5.16 There appears to be a reasonable continuity in age ranges of trees with the exception of very old heartwood rot decay trees, as highlighted in the lack of heartrot decay in the SAT analysis, many of the trees being mature to over mature trees that are only just beginning to show signs of significant decay. In some instances, these mature trees may be too close to one another and may require selective thinning to promote flagship trees. Any felling would complement the deadwood resource of the site.
- 5.17 Felling does not have to be wholesale to a stump but felled to retain a monolith, or encouraging rapid decline would be of greater value to invertebrates.



Photograph 5: Foreground – Large open grown mature ash tree with large volume lateral limbs. Background – closely grown ash trees that would benefit from thinning to enable an open growth form to develop in retained specimens. © Andy Jukes (2018).

- 5.18 There are also some woodland areas, primarily at the north-western end of the site, that could contribute to the saproxylic resource, and these would benefit from some interventions to promote the development of old and veteran trees through selective thinning and/or haloing of key trees.

Site summary

- 5.19 The site is a large parkland with tens of trees that are of very high value to saproxylic invertebrates. The current quality of the trees and fallen deadwood resource is potentially high.
- 5.20 The features of greatest value are the high abundance of water-filled rot holes, dead and dying branches, and trunks of trees. The overall decay resource does not appear to be in an optimal state, however, owing to the comparatively young age of a large number of the trees. It appears that the site will significantly increase in value in the future as more resources come ‘online’ and able to support more robust populations of species, in particular those associated with heartwood rot.
- 5.21 The site has a current IEC of 9. This low figure belies the true status of the site. Factors influencing this low score relate to the incomplete season’s worth of surveying, able to be undertaken at the site (July–October) but also owing to the hot and dry period in June to early August that caused significant issues with recording invertebrates across the whole of the UK during 2018. As mentioned previously, the use of cumulative lists to calculate the IEC can also be taken into consideration, so as this site only has one incomplete season’s worth of data to use, it does not fare well against other more well-studied wood pasture sites in the region.
- 5.22 The management of the site appears to be relaxed, and as such there are no major negative issues pertaining to the site that require immediate cessation. The site, however, would benefit from some modifications to accommodate a greater range of flowering plants, including a wider range of scrub species (this can include orchard species such as plum and apples) and some selective thinning of trees in order to promote the optimal growth form required to develop saproxylic features and start to generate a greater resource of heartwood rot decay.

6 Recommendations

Flowers

- 6.1 There is likely to be an overall lack of grassland flowers on the site, largely owing to the grazing pressure from the cattle, albeit low-intensity grazing. To remedy a possible reduction in grassland flowers, it is suggested that initiatives be taken to enable some areas of the site to develop grassland or ruderal flowering patches. To do this, fenced off areas are suggested; even temporary, electric-fenced areas that can be rotated around the parkland would be of benefit.
- 6.2 Flowering scrub is a strong feature at the site, but it is dominated by a single species – hawthorn. This group of plants is highly prized by invertebrates, as the plants produce high densities of flowers, making them productive nectaring locations for many invertebrates, including saproxylic beetles and flies. It is suggested that a strategy be put into place to start to diversify the scrub feature through planting of appropriate scrub features at key locations. The scrub is optimally planted near key areas of trees.
- 6.3 Species to consider are:
 - blackthorn (*Prunus spinosa*) – early spring blossom and good structure;
 - apples (*Malus domestica* agg.) – spring blossom and develops red heartwood rot as it becomes veteran;
 - plums (*Prunus domestica* spp.) – spring blossom and produces red heartwood rot at a comparatively young age;
 - rowan (*Sorbus aucuparia*) – late spring/early summer blossom;
 - field maple (*Acer campestre*) – late spring/early summer blossom;
 - dog rose (*Rosa canina* agg.) – summer blossom;
 - elderberry (*Sambucus nigra*) – summer blossom;
 - honeysuckle (*Lonicera periclymenum*) – high summer;
 - ivy (*Hedera helix*) – late summer and autumn blossom and hibernacula.

Thinning and haloing

- 6.4 There are a few locations across the estate where tree thinning, both young and mature, would benefit the retained specimens.
- 6.5 Any tree thinning does not have to be wholesale and can be undertaken with interventions including retaining any trunks as monoliths or felled and finished using coronet cuts to produce a more natural-looking feature.
- 6.6 Where required, haloing around existing key trees should also be undertaken; this may be most appropriately undertaken in the woodland areas of the estate rather than the parkland trees.

Deadwood

- 6.7 Material resulting from tree maintenance should not be felled into logs but retained in as large a volume as possible to avoid rapid desiccation.
- 6.8 To have greatest value, any felled trees or limbs, regardless of diameter, should be left *in situ* wherever possible. If the felled material is impeding access, it can be manoeuvred so that it does not cause any obstruction, and only sectioning of the material undertaken as an absolute last resort.

Ways in which to produce deadwood when thinning or felling unwanted specimens (veteranization)

Monoliths

- 6.9 To increase the value of any tree felling, consider leaving tall deadwood trunks, as previously mentioned. Where possible, felling should try to replicate natural standing deadwood including the use of coronet cuts.

Tree manipulation through surgery

- 6.10 Deadwood can also be created artificially on healthy trees, where safe to do so, in order to increase the deadwood resource on the site. This can be undertaken in any situation, although trees in partial sunlight or full sun develop a richer resource of invertebrates than those in cool shade.

The techniques include:

- Ring-barking – this can be undertaken on a trunk of the tree to induce total tree dieback or on major limbs to create deadwood in the canopy. It can be undertaken on many trees in the park, including those along the avenues.
- Shattering (or coronet cutting) – jagged and shattered cuts made during tree felling allow fungi in much more easily than with a clean cut. This will increase the opportunities for fungi and the subsequent fungi-related invertebrates, and should be considered during all operations.

Recruitment of new trees

- 6.11 It is suggested that a plan be developed, if there is not already one in operation, to recruit new trees through natural regeneration; if this is not possible owing to stock grazing, then the collection and growing on of saplings/seeds are suggested.

Further survey work

- 6.12 It is suggested that more seasonally appropriate survey work be undertaken at the site to fully evaluate the site's saproxylic beetles and fly resources. Any survey should also include another group that is synonymous with deadwood, namely the deadwood nesting bees and wasps (aculeate Hymenoptera) of which Haddon Estate may possess a significant resource.

7 References and bibliography

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8 Appendices

- *Appendix I: Red Data Book definitions.*
- *Appendix II: International Union for Conservation Nature definitions.*
- *Appendix III: Survey results.*
- *Appendix IV: Site photographs.*

Appendix I: Red Data Book definitions

Red Data Book category 1 (RDB 1) – Endangered

Species that are known or believed to occur as only a single population within one 10-km square of the National Grid.

Red Data Book category 2 (RDB 2) – Vulnerable

Species declining throughout their range or in vulnerable habitats.

Red Data Book category 3 (RDB 3) – Rare

Species that are estimated to exist in only 15 or fewer post-1970 10-km squares. This criterion may be relaxed where populations are likely to exist in over fifteen 10-km squares but occupy small areas of especially vulnerable habitat.

Nationally Notable (Scarce) category A (NS A) – Notable A

Taxa that do not fall within the RDB category but that are nonetheless uncommon in Great Britain and thought to occur in 30 or fewer 10-km squares of the National Grid or, for less well-recorded groups, between eight and 20 vice counties.

Nationally Notable (Scarce) category B (NS B) – Notable B

Taxa that do not fall within the RDB category but that are nonetheless uncommon in Great Britain and thought to occur in 31–100 10-km squares of the National Grid or, for less well-recorded groups, between eight and 20 vice counties.

Nationally Notable (Scarce) (N) – Notable

Species that are estimated to occur within the range of 16–100 10-km squares. The subdividing of this category into Notable A and Notable B has not been attempted for many species in this part of the review.

Appendix II: International Union for Conservation Nature definitions

REGIONALLY EXTINCT (RE) A taxon is Extinct when there is no reasonable doubt that the last individual has died. In this review, the last date for a record is set at 50 years before publication.

CRITICALLY ENDANGERED (CR) A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered.

ENDANGERED (EN) A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered.

VULNERABLE (VU) A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable.

NEAR THREATENED (NT) A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered, or Vulnerable now, but is close to qualifying for, or is likely to qualify for, a threatened category in the near future.

LEAST CONCERN (LC) A taxon is of Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable, or Near Threatened. Widespread and abundant taxa are included in this category.

DATA DEFICIENT (DD) A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate.

NOT EVALUATED (NE) A taxon is Not Evaluated when it has not yet been evaluated against the criteria.

Appendix III: Survey results

Survey locations

Code	Broad survey areas	Grid reference
13	the 'Veteran Ash Tree' and grassland to its south	SK 22960 67105
14	parkland in Area 1a [eastern half]	SK 23515 66646
15	parkland immediately west of Haddon Hall	SK 23485 66405
	Sampling at specific tree trunks	
17	at trunk of oak in Area 1a [Code 3 tree]	SK 23643 66615
18	at trunk of dead ash in Area 2a [Code 10 tree]	SK 23603 66303
19	at trunk of dead ash in Area 2a [Code 11 tree]	SK 23914 66239
20	at trunk of dead hawthorn near Haddon Hall	SK 23505 66413

Trap-location details

Code	Vane trap location notes	Grid reference
1	on the veteran ash (<i>F. excelsior</i>) tree	SK 22940 67173
2	on a lime (<i>Tilia</i> spp.) tree [Area 1a]	SK 23670 66622
3	oak [Area 1a]	SK 23643 66615
4	on oak (<i>Quercus</i> spp.) near Haddon Hall	SK 23539 66443
5	on the 'Mother Oak' [Area 2a]	SK 23630 66326
6	on the 'Mother Oak' [Area 2a]	SK 23630 66326
7	on ash tree [Area 1a]	SK 23431 66681
8	on sycamore (<i>A. pseudoplatanus</i>)? [Area 1a]	SK 23464 66616
9	on sycamore [Area 1a]	SK 23575 66485
10	dead ash tree near River Wye [Area 2a]	SK 23603 66303
11	on dead ash near cattle shed [Area 2a]	SK 23914 66239
12	on ash near cattle shed [Area 2a]	SK 23966 66258

Species list

Only species with a national status have been annotated. All others are common or local species. Some cells are intentionally left blank.

Species	Family	Order	Conservation status	Larval feeding guild	Habitat
<i>Aderus populneus</i>	Aderidae	Coleoptera	NS	xylophagous	decaying wood
<i>Anobium punctatum</i>	Anobiidae	Coleoptera		xylophagous	decaying wood
<i>Ptilinus pectinicornis</i>	Anobiidae	Coleoptera		xylophagous	decaying wood
<i>Aphodius (Acrossus) rufipes</i>	Aphodiidae	Coleoptera		coprophagous	tall sward and scrub
<i>Aphodius (Melinopterus) sphacelatus</i>	Aphodiidae	Coleoptera		coprophagous	tall sward and scrub
<i>Betulapion simile</i>	Apionidae	Coleoptera		herbivore	arboreal
<i>Ceratapion (Ceratapion) gibbirostre</i>	Apionidae	Coleoptera		herbivore	tall sward and scrub
<i>Cantharis nigra</i>	Cantharidae	Coleoptera		predator	tall sward and scrub
<i>Rhagonycha fulva</i>	Cantharidae	Coleoptera		predator	tall sward and scrub
<i>Dromius quadrimaculatus</i>	Carabidae	Coleoptera		predator	arboreal; decaying wood
<i>Pterostichus (Steropus) madidus</i>	Carabidae	Coleoptera		predator	tall sward and scrub
<i>Longitarsus luridus</i>	Chrysomelidae	Coleoptera		herbivore	tall sward and scrub

Species	Family	Order	Conservation status	Larval feeding guild	Habitat
<i>Oulema obscura</i>	Chrysomelidae	Coleoptera		herbivore	tall sward and scrub
<i>Phratora laticollis</i>	Chrysomelidae	Coleoptera			arboreal
<i>Cis boleti</i>	Ciidae	Coleoptera		fungivore	decaying wood
<i>Coccinella septempunctata</i>	Coccinellidae	Coleoptera			
<i>Harmonia axyridis</i>	Coccinellidae	Coleoptera			
<i>Cryptophagus micaceus</i>	Cryptophagidae	Coleoptera	RDB K		decaying wood
<i>Cryptophagus scanicus</i>	Cryptophagidae	Coleoptera		fungivore	decaying wood
<i>Dryocoetes villosus</i>	Curculionidae	Coleoptera		xylophagous	decaying wood
<i>Euophryum confine</i>	Curculionidae	Coleoptera		saprophagous	decaying wood
<i>Hylesinus crenatus</i>	Curculionidae	Coleoptera		xylophagous	decaying wood
<i>Hylesinus varius</i>	Curculionidae	Coleoptera		xylophagous	decaying wood
<i>Orchestes (Salius) fagi</i>	Curculionidae	Coleoptera		herbivore	arboreal
<i>Scolytus intricatus</i>	Curculionidae	Coleoptera		xylophagous	decaying wood
<i>Anthrenus (Helocerus) fuscus</i>	Dermestidae	Coleoptera			
<i>Dacne bipustulata</i>	Erotylidae	Coleoptera		fungivore	decaying wood
<i>Dacne rufifrons</i>	Erotylidae	Coleoptera	DD (European)	fungivore	decaying wood
<i>Cartodere (Aridius) bifasciata</i>	Latridiidae	Coleoptera			
<i>Cartodere (Aridius) nodifer</i>	Latridiidae	Coleoptera			
<i>Corticarina minuta</i>	Latridiidae	Coleoptera			
<i>Corticarina similata</i>	Latridiidae	Coleoptera			
<i>Corticarina gibbosa</i>	Latridiidae	Coleoptera			
<i>Enicmus brevicornis</i>	Latridiidae	Coleoptera	Notable	fungivore	decaying wood
<i>Enicmus transversus</i>	Latridiidae	Coleoptera			
<i>Orchesia micans</i>	Melandryidae	Coleoptera	NS	fungivore	decaying wood
<i>Mycetophagus multipunctatus</i>	Mycetophagidae	Coleoptera		fungivore	decaying wood
<i>Mycetophagus piceus</i>	Mycetophagidae	Coleoptera		fungivore	decaying wood
<i>Cryptarcha strigata</i>	Nitidulidae	Coleoptera	Nb	saprophagous	decaying wood
<i>Eपुरaea (Eपुरaea) melina</i>	Nitidulidae	Coleoptera			
<i>Glischrochilus (Librodor) hortensis</i>	Nitidulidae	Coleoptera		saprophagous	decaying wood
<i>Glischrochilus (Librodor) quadriguttatus</i>	Nitidulidae	Coleoptera		saprophagous	decaying wood
<i>Meligethes aeneus</i>	Nitidulidae	Coleoptera			
<i>Soronia grisea</i>	Nitidulidae	Coleoptera		saprophagous	decaying wood
<i>Oedemera (Oedemera) nobilis</i>	Oedemeridae	Coleoptera		herbivore	tall sward and scrub
<i>Salpingus planirostris</i>	Salpingidae	Coleoptera		predator	decaying wood
<i>Salpingus ruficollis</i>	Salpingidae	Coleoptera		predator	decaying wood
<i>Prionocyphon serricornis</i>	Scirtidae	Coleoptera		saprophagous	decaying wood
<i>Anaspis (Anaspis) maculata</i>	Scraptiidae	Coleoptera		predator	decaying wood
<i>Anaspis (Anaspis) regimbarti</i>	Scraptiidae	Coleoptera		predator	decaying wood
<i>Amischa analis</i>	Staphylinidae	Coleoptera			tall sward and scrub

Species	Family	Order	Conservation status	Larval feeding guild	Habitat
<i>Amischa nigrofusca</i>	Staphylinidae	Coleoptera			tall sward and scrub
<i>Anotylus tetracarinatus</i>	Staphylinidae	Coleoptera		predator	tall sward and scrub
<i>Bessobia monticola</i>	Staphylinidae	Coleoptera		unknown	decaying wood
<i>Dalotia coriaria</i>	Staphylinidae	Coleoptera		saprophagous	shaded woodland floor
<i>Dropephylla ioptera</i>	Staphylinidae	Coleoptera		predator	decaying wood
<i>Dropephylla koltzei</i>	Staphylinidae	Coleoptera			
<i>Hapalaraea pygmaea</i>	Staphylinidae	Coleoptera		predator	arboreal
<i>Haploglossa villosula</i>	Staphylinidae	Coleoptera		predator	decaying wood
<i>Lithocharis nigriceps</i>	Staphylinidae	Coleoptera			
<i>Quedius (Microsaurus) aetolicus</i>	Staphylinidae	Coleoptera	NA	predator	decaying wood
<i>Quedius (Microsaurus) brevicornis</i>	Staphylinidae	Coleoptera	Nb	predator	decaying wood
<i>Quedius (Microsaurus) cruentus</i>	Staphylinidae	Coleoptera			
<i>Quedius (Microsaurus) mesomelinus</i>	Staphylinidae	Coleoptera		predator	decaying wood
<i>Quedius (Microsaurus) truncicola</i>	Staphylinidae	Coleoptera	Nb	predator	decaying wood
<i>Siagonium quadricorne</i>	Staphylinidae	Coleoptera			decaying wood
<i>Tachyporus nitidulus</i>	Staphylinidae	Coleoptera		predator	tall sward and scrub
<i>Xylodromus concinnus</i>	Staphylinidae	Coleoptera		predator	decaying wood
<i>Tetratoma fungorum</i>	Tetratomidae	Coleoptera		fungivore	decaying wood
<i>Forficula auricularia</i>	Forficulidae	Dermaptera			
<i>Sylvicola fenestralis</i>	Anisopodidae	Diptera		saprophagous	
<i>Sylvicola punctatus</i>	Anisopodidae	Diptera		saprophagous	
<i>Delia platura</i>	Anthomyiidae	Diptera			
<i>Dilophus febrilis</i>	Bibionidae	Diptera		herbivore	tall sward and scrub
<i>Calliphora vicina</i>	Calliphoridae	Diptera		necrophagous	
<i>Cynomya mortuorum</i>	Calliphoridae	Diptera			
<i>Lucilia caesar</i>	Calliphoridae	Diptera		saprophagous	
<i>Pollenia pediculata</i>	Calliphoridae	Diptera		parasitoid	
<i>Chironomus plumosus</i>	Chironomidae	Diptera			
<i>Cricotopus annulator</i>	Chironomidae	Diptera			
<i>Cricotopus bicinctus</i>	Chironomidae	Diptera			
<i>Prodiamesa olivacea</i>	Chironomidae	Diptera			
<i>Clusiodes albimanus</i>	Clusiidae	Diptera		saprophagous	decaying wood
<i>Chrysotus gramineus</i>	Dolichopodidae	Diptera		saprophagous	marshland; running water
<i>Dolichopus festivus</i>	Dolichopodidae	Diptera		predator	marshland
<i>Dolichopus plumipes</i>	Dolichopodidae	Diptera		predator	marshland
<i>Dolichopus trivialis</i>	Dolichopodidae	Diptera		saprophagous	marshland; running water

Species	Family	Order	Conservation status	Larval feeding guild	Habitat
<i>Dolichopus wahlbergi</i>	Dolichopodidae	Diptera		predator	running water; shaded woodland floor; wet woodland
<i>Xanthochlorus galbanus</i>	Dolichopodidae	Diptera			
<i>Suillia flavifrons</i>	Heleomyzidae	Diptera		fungivore	
<i>Suillia ustulata</i>	Heleomyzidae	Diptera		fungivore	shaded woodland floor
<i>Drapetis ephippiata</i>	Hybotidae	Diptera		predator	
<i>Dicranomyia chorea</i>	Limoniidae	Diptera		saprophagous	running water; shaded woodland floor; tall sward and scrub
<i>Dicranomyia modesta</i>	Limoniidae	Diptera		saprophagous	marshland; peatland
<i>Limonia nubeculosa</i>	Limoniidae	Diptera		fungivore	decaying wood; shaded woodland floor
<i>Ormosia lineata</i>	Limoniidae	Diptera		saprophagous	running water; shaded woodland floor; wet woodland
<i>Lonchaea corusca</i>	Lonchaeidae	Diptera	Notable; pNS	saprophagous	decaying wood
<i>Eudasyphora cyanella</i>	Muscidae	Diptera		coprophagous	shaded woodland floor
<i>Graphomya maculata</i>	Muscidae	Diptera			decaying wood; marshland; peatland; shaded woodland floor; wet woodland
<i>Helina depuncta</i>	Muscidae	Diptera		saprophagous	shaded woodland floor
<i>Helina evecta</i>	Muscidae	Diptera		saprophagous	shaded woodland floor
<i>Hydrotaea irritans</i>	Muscidae	Diptera			
<i>Mesembrina meridiana</i>	Muscidae	Diptera			
<i>Musca autumnalis</i>	Muscidae	Diptera			
<i>Mydaea urbana</i>	Muscidae	Diptera			shaded woodland floor
<i>Neomyia viridescens</i>	Muscidae	Diptera			
<i>Phaonia angelicae</i>	Muscidae	Diptera			
<i>Phaonia errans</i>	Muscidae	Diptera			
<i>Phaonia pallida</i>	Muscidae	Diptera		fungivore; predator	shaded woodland floor
<i>Phaonia tuguriorum</i>	Muscidae	Diptera			shaded woodland floor
<i>Phaonia valida</i>	Muscidae	Diptera			
<i>Polietes lardarius</i>	Muscidae	Diptera		fungivore	shaded woodland floor
<i>Stomoxys calcitrans</i>	Muscidae	Diptera			
<i>Mycetobia pallipes</i>	Mycetobiidae	Diptera		saprophagous	decaying wood
<i>Acnemia nitidicollis</i>	Mycetophilidae	Diptera			
<i>Brevicornu nigrofusum</i>	Mycetophilidae	Diptera			
<i>Cordyla crassicornis</i>	Mycetophilidae	Diptera			
<i>Exechia fusca</i>	Mycetophilidae	Diptera		fungivore	shaded woodland floor
<i>Exechiopsis intersecta</i>	Mycetophilidae	Diptera			
<i>Leia fascipennis</i>	Mycetophilidae	Diptera			
<i>Monoclona rufilatera</i>	Mycetophilidae	Diptera			
<i>Mycetophila abiecta</i>	Mycetophilidae	Diptera			
<i>Mycetophila alea</i>	Mycetophilidae	Diptera			
<i>Mycetophila autumnalis</i>	Mycetophilidae	Diptera			
<i>Mycetophila cingulum</i>	Mycetophilidae	Diptera			
<i>Mycetophila curviseta</i>	Mycetophilidae	Diptera			

Species	Family	Order	Conservation status	Larval feeding guild	Habitat
	dae				
<i>Mycetophila marginata</i>	Mycetophili dae	Diptera		fungivore	decaying wood; shaded woodland floor
<i>Mycetophila ocellus</i>	Mycetophili dae	Diptera		fungivore	decaying wood
<i>Mycetophila ornata nomen nudum</i>	Mycetophili dae	Diptera		fungivore	decaying wood
<i>Mycetophila pictula</i>	Mycetophili dae	Diptera			
<i>Mycetophila pumila</i>	Mycetophili dae	Diptera			shaded woodland floor
<i>Mycetophila signatoides</i>	Mycetophili dae	Diptera			
<i>Mycetophila stylata</i>	Mycetophili dae	Diptera			
<i>Mycetophila tridentata</i>	Mycetophili dae	Diptera		fungivore	decaying wood
<i>Mycetophila trinotata</i>	Mycetophili dae	Diptera		fungivore	decaying wood
<i>Mycetophila unicolor</i>	Mycetophili dae	Diptera			
<i>Phronia conformis</i>	Mycetophili dae	Diptera			
<i>Phronia notata</i>	Mycetophili dae	Diptera			
<i>Phronia tenuis</i>	Mycetophili dae	Diptera			
<i>Sciophila interrupta</i>	Mycetophili dae	Diptera	(LR); NS		
<i>Synapha vitripennis</i>	Mycetophili dae	Diptera			shaded woodland floor
<i>Trichonta melanura</i>	Mycetophili dae	Diptera		fungivore	decaying wood
<i>Trichonta vitta</i>	Mycetophili dae	Diptera			
<i>Zygomia kiddi</i>	Mycetophili dae	Diptera			
<i>Opomyza germinationis</i>	Opomyzidae	Diptera		herbivore	tall sward and scrub
<i>Callomyia amoena</i>	Platyezidae	Diptera		fungivore	decaying wood
<i>Trichomyia urbica</i>	Psychodidae	Diptera			
<i>Sarcophaga haemorrhoides</i>	Sarcophagidae	Diptera		parasitoid	tall sward and scrub
<i>Sarcophaga subvicina</i>	Sarcophagidae	Diptera		nectivore	
<i>Scathophaga stercoraria</i>	Scathophagidae	Diptera		predator	tall sward and scrub
<i>Dichetophora obliterated</i>	Sciomyzidae	Diptera		parasitoid	
<i>Chorisops tibialis</i>	Stratiomyidae	Diptera		saprophagous	tall sward and scrub
<i>Pachygaster leachii</i>	Stratiomyidae	Diptera		saprophagous	shaded woodland floor
<i>Sargus bipunctatus</i>	Stratiomyidae	Diptera		fungivore;saprophagous	shaded woodland floor
<i>Sargus iridatus</i>	Stratiomyidae	Diptera		saprophagous	shaded woodland floor
<i>Baccha elongata</i>	Syrphidae	Diptera		predator	shaded woodland floor
<i>Cheilosia pagana</i>	Syrphidae	Diptera		herbivore	shaded woodland floor
<i>Cheilosia proxima</i>	Syrphidae	Diptera		herbivore	tall sward and scrub
<i>Cheilosia scutellata</i>	Syrphidae	Diptera		fungivore	shaded woodland floor
<i>Epistrophe grossulariae</i>	Syrphidae	Diptera		predator	arboreal
<i>Episyrrhus balteatus</i>	Syrphidae	Diptera		predator	tall sward and scrub
<i>Eristalis arbustorum</i>	Syrphidae	Diptera		saprophagous	peatland

Species	Family	Order	Conservation status	Larval feeding guild	Habitat
<i>Eristalis intricarius</i>	Syrphidae	Diptera		saprophagous	peatland
<i>Eristalis pertinax</i>	Syrphidae	Diptera		saprophagous	peatland
<i>Eristalis tenax</i>	Syrphidae	Diptera		saprophagous	peatland
<i>Eupeodes corollae</i>	Syrphidae	Diptera		predator	tall sward and scrub
<i>Eupeodes latifasciatus</i>	Syrphidae	Diptera		predator	tall sward and scrub
<i>Eupeodes luniger</i>	Syrphidae	Diptera		predator	short sward and bare ground; tall sward and scrub
<i>Ferdinandea cuprea</i>	Syrphidae	Diptera		saprophagous	decaying wood
<i>Leucozona glaucia</i>	Syrphidae	Diptera		predator	shaded woodland floor
<i>Leucozona lucorum</i>	Syrphidae	Diptera			shaded woodland floor
<i>Mallota cimbiciformis</i>	Syrphidae	Diptera	NS	saprophagous	decaying wood
<i>Melanostoma mellinum</i>	Syrphidae	Diptera		predator	tall sward and scrub
<i>Melanostoma scalare</i>	Syrphidae	Diptera		predator	tall sward and scrub
<i>Meliscaeva auricollis</i>	Syrphidae	Diptera		predator	shaded woodland floor
<i>Meliscaeva cinctella</i>	Syrphidae	Diptera		predator	arboreal
<i>Myathropa florea</i>	Syrphidae	Diptera		saprophagous	decaying wood
<i>Platycheirus albimanus</i>	Syrphidae	Diptera		predator	
<i>Platycheirus granditarsus</i>	Syrphidae	Diptera		predator	marshland; peatland
<i>Platycheirus manicatus</i>	Syrphidae	Diptera		predator	tall sward and scrub
<i>Rhingia campestris</i>	Syrphidae	Diptera		coprophagous	tall sward and scrub
<i>Scaeva pyrastris</i>	Syrphidae	Diptera		predator	tall sward and scrub
<i>Syritta pipiens</i>	Syrphidae	Diptera		saprophagous	tall sward and scrub
<i>Syrphus ribesii</i>	Syrphidae	Diptera		predator	
<i>Volucella pellucens</i>	Syrphidae	Diptera		predator	shaded woodland floor
<i>Xylota segnis</i>	Syrphidae	Diptera		saprophagous	decaying wood
<i>Xylota sylvarum</i>	Syrphidae	Diptera		saprophagous	decaying wood
<i>Haematopota pluvialis</i>	Tabanidae	Diptera		predator	peatland
<i>Eriothrix rufomaculata</i>	Tachinidae	Diptera			
<i>Siphona geniculata</i>	Tachinidae	Diptera			
<i>Tachina fera</i>	Tachinidae	Diptera			
<i>Voria ruralis</i>	Tachinidae	Diptera			
<i>Philophylla caesio</i>	Tephritidae	Diptera		herbivore	shaded woodland floor; tall sward and scrub
<i>Tipula fascipennis</i>	Tipulidae	Diptera		herbivore	shaded woodland floor
<i>Tipula paludosa</i>	Tipulidae	Diptera		herbivore	tall sward and scrub
<i>Acanthosoma haemorrhoidale</i>	Acanthosomatidae	Hemiptera		herbivore	arboreal
<i>Anthocoris confusus</i>	Anthocoridae	Hemiptera		predator	arboreal
<i>Anthocoris nemoralis</i>	Anthocoridae	Hemiptera		predator	arboreal
<i>Anthocoris nemorum</i>	Anthocoridae	Hemiptera			
<i>Temnostethus (Montandoniella) pusillus</i>	Anthocoridae	Hemiptera			
<i>Aphrophora alni</i>	Aphrophoridae	Hemiptera			
<i>Neophilaenus lineatus</i>	Aphrophoridae	Hemiptera		herbivore	tall sward and scrub
<i>Philaenus spumarius</i>	Aphrophoridae	Hemiptera			

Species	Family	Order	Conservation status	Larval feeding guild	Habitat
<i>Aguriahana stellulata</i>	Cicadellidae	Hemiptera		herbivore	arboreal
<i>Alebra albostriella</i>	Cicadellidae	Hemiptera		herbivore	arboreal
<i>Allygus mixtus</i>	Cicadellidae	Hemiptera		herbivore	tall sward and scrub
<i>Allygus modestus</i>	Cicadellidae	Hemiptera		herbivore	tall sward and scrub
<i>Lamprotettix nitidulus</i>	Cicadellidae	Hemiptera		herbivore	arboreal
<i>Cixius nervosus</i>	Cixiidae	Hemiptera			arboreal
<i>Scolopostethus affinis</i>	Lygaeidae	Hemiptera		herbivore	short sward and bare ground
<i>Blepharidopterus angulatus</i>	Miridae	Hemiptera			arboreal
<i>Campyloneura virgula</i>	Miridae	Hemiptera		herbivore	arboreal
<i>Deraeocoris (Deraeocoris) flavilinea</i>	Miridae	Hemiptera			
<i>Deraeocoris (Knightocapsus) lutescens</i>	Miridae	Hemiptera		herbivore	arboreal
<i>Heterotoma planicornis</i>	Miridae	Hemiptera		herbivore	tall sward and scrub
<i>Leptopterna dolabrata</i>	Miridae	Hemiptera		herbivore	tall sward and scrub
<i>Neolygus viridis</i>	Miridae	Hemiptera		herbivore	arboreal
<i>Orthops (Orthops) basalis</i>	Miridae	Hemiptera			
<i>Pinalitus cervinus</i>	Miridae	Hemiptera		herbivore	arboreal
<i>Stenodema (Stenodema) laevigata</i>	Miridae	Hemiptera		herbivore	tall sward and scrub
<i>Derephysia (Derephysia) foliacea</i>	Tingidae	Hemiptera			arboreal
<i>Tingis (Tingis) cardui</i>	Tingidae	Hemiptera		herbivore	tall sward and scrub
<i>Apis mellifera</i>	Apidae	Hymenoptera			
<i>Bombus hortorum</i>	Apidae	Hymenoptera		nectivore	tall sward and scrub
<i>Bombus lapidarius</i>	Apidae	Hymenoptera		nectivore	tall sward and scrub
<i>Bombus pascuorum</i>	Apidae	Hymenoptera		nectivore	tall sward and scrub
<i>Bombus terrestris</i>	Apidae	Hymenoptera		nectivore	tall sward and scrub
<i>Bombus vestalis</i>	Apidae	Hymenoptera		nectivore	short sward and bare ground
<i>Chrysis impressa</i>	Chrysididae	Hymenoptera			decaying wood
<i>Hylaeus (Hylaeus) communis</i>	Colletidae	Hymenoptera		nectivore	tall sward and scrub
<i>Hylaeus (Spatulariella) hyalinatus</i>	Colletidae	Hymenoptera		nectivore	decaying wood
<i>Crabro cribrarius</i>	Crabronidae	Hymenoptera		parasitoid	short sward and bare ground
<i>Crossocerus (Ablepharipus) podagricus</i>	Crabronidae	Hymenoptera		parasitoid	decaying wood
<i>Crossocerus (Blepharipus) annulipes</i>	Crabronidae	Hymenoptera		parasitoid	decaying wood
<i>Crossocerus (Blepharipus) cetratus</i>	Crabronidae	Hymenoptera		parasitoid	decaying wood
<i>Ectemnius (Clytochrysus) cavifrons</i>	Crabronidae	Hymenoptera		parasitoid	decaying wood
<i>Ectemnius (Clytochrysus) ruficornis</i>	Crabronidae	Hymenoptera	[Nb]	parasitoid	decaying wood; tall sward and scrub
<i>Ectemnius (Hypocrabro) continuus</i>	Crabronidae	Hymenoptera		parasitoid	decaying wood
<i>Ectemnius (Metacrabro) cephalotes</i>	Crabronidae	Hymenoptera		parasitoid	decaying wood
<i>Passaloecus corniger</i>	Crabronidae	Hymenoptera		parasitoid	decaying wood
<i>Pemphredon (Pemphredon) lugubris</i>	Crabronidae	Hymenoptera		parasitoid	decaying wood
<i>Rhopalum (Corynopus) coarctatum</i>	Crabronidae	Hymenoptera		parasitoid	tall sward and scrub
<i>Rhopalum (Rhopalum) clavipes</i>	Crabronidae	Hymenoptera		parasitoid	decaying wood

Species	Family	Order	Conservation status	Larval feeding guild	Habitat
<i>Stigmus solskyi</i>	Crabronidae	Hymenoptera		parasitoid	decaying wood
<i>Andricus kollari</i>	Cynipidae	Hymenoptera			
<i>Lasius flavus</i>	Formicidae	Hymenoptera			short sward and bare ground
<i>Myrmica rubra</i>	Formicidae	Hymenoptera		predator	tall sward and scrub
<i>Myrmica ruginodis</i>	Formicidae	Hymenoptera		predator	shaded woodland floor
<i>Myrmica scabrinodis</i>	Formicidae	Hymenoptera		predator	tall sward and scrub
<i>Lasioglossum (Evylaeus) calceatum</i>	Halictidae	Hymenoptera		nectivore	short sward and bare ground
<i>Megachile (Megachile) centuncularis</i>	Megachilidae	Hymenoptera		nectivore	decaying wood
<i>Megachile (Megachile) ligniseca</i>	Megachilidae	Hymenoptera		nectivore	decaying wood
<i>Anoplius (Anoplius) nigerrimus</i>	Pompilidae	Hymenoptera		parasitoid	short sward and bare ground
<i>Dipogon (Deuteraenia) subintermedius</i>	Pompilidae	Hymenoptera		parasitoid	decaying wood
<i>Dolichovespula (Dolichovespula) media</i>	Vespidae	Hymenoptera	[Na]	predator	arboreal
<i>Dolichovespula (Pseudovespula) saxonica</i>	Vespidae	Hymenoptera	[RDB K]	predator	arboreal
<i>Dolichovespula (Pseudovespula) sylvestris</i>	Vespidae	Hymenoptera		predator	arboreal
<i>Vespa crabro</i>	Vespidae	Hymenoptera		predator	decaying wood; shaded woodland floor
<i>Vespula (Paravespula) germanica</i>	Vespidae	Hymenoptera		predator	tall sward and scrub
<i>Vespula (Paravespula) vulgaris</i>	Vespidae	Hymenoptera		predator	tall sward and scrub
<i>Oniscus asellus</i>	Oniscidae	Isopoda			
<i>Porcellio scaber</i>	Porcellionidae	Isopoda			
<i>Tachypodoiulus niger</i>	Julidae	Julida			
<i>Catocala nupta</i>	Erebidae	Lepidoptera		herbivore	arboreal
<i>Epirrhoe alternata</i>	Geometridae	Lepidoptera		herbivore	tall sward and scrub
<i>Thymelicus sylvestris</i>	Hesperiidae	Lepidoptera		herbivore	tall sward and scrub
<i>Favonius quercus</i>	Lycaenidae	Lepidoptera		herbivore	arboreal
<i>Lycaena phlaeas</i>	Lycaenidae	Lepidoptera		herbivore	tall sward and scrub
<i>Apamea monoglypha</i>	Noctuidae	Lepidoptera		herbivore	tall sward and scrub
<i>Autographa gamma</i>	Noctuidae	Lepidoptera		herbivore	
<i>Noctua pronuba</i>	Noctuidae	Lepidoptera		herbivore	tall sward and scrub
<i>Aglais io</i>	Nymphalidae	Lepidoptera		herbivore	tall sward and scrub
<i>Aglais urticae</i>	Nymphalidae	Lepidoptera		herbivore	tall sward and scrub
<i>Aphantopus hyperantus</i>	Nymphalidae	Lepidoptera		herbivore	tall sward and scrub
<i>Lasiommata megera</i>	Nymphalidae	Lepidoptera	NT; Section 41 Priority Species	herbivore	short sward and bare ground
<i>Maniola jurtina</i>	Nymphalidae	Lepidoptera		herbivore	tall sward and scrub
<i>Pararge aegeria</i>	Nymphalidae	Lepidoptera		herbivore	tall sward and scrub
<i>Polygonia c-album</i>	Nymphalidae	Lepidoptera		herbivore	tall sward and scrub
<i>Pyronia tithonus</i>	Nymphalidae	Lepidoptera		herbivore	tall sward and scrub
<i>Vanessa atalanta</i>	Nymphalidae	Lepidoptera		herbivore	
<i>Vanessa cardui</i>	Nymphalidae	Lepidoptera		herbivore	

Species	Family	Order	Conservation status	Larval feeding guild	Habitat
<i>Pieris brassicae</i>	Pieridae	Lepidoptera		herbivore	
<i>Pieris napi</i>	Pieridae	Lepidoptera		herbivore	
<i>Pieris rapae</i>	Pieridae	Lepidoptera		herbivore	
<i>Aeshna cyanea</i>	Aeshnidae	Odonata		predator	marshland
<i>Chorthippus brunneus</i>	Acrididae	Orthoptera		herbivore	tall sward and scrub
<i>Omocestus viridulus</i>	Acrididae	Orthoptera		herbivore	tall sward and scrub
<i>Cepaea (Cepaea) nemoralis</i>	Helicidae	Pulmonata		herbivore	tall sward and scrub
<i>Cornu aspersum</i>	Helicidae	Pulmonata		herbivore	tall sward and scrub
<i>Eristalis interruptus</i>					

Appendix IV: Site photographs.



Tall, thin ash trees in woodlands. Some selective felling, ring-barking, etc. would greatly enhance the overall value of the woodlands © Andy Jukes (2018).



The ‘Mother Oak’ – one of the most significant oak trees on the estate with significant heartwood rot and accompanying features, including desiccating timbers left *in situ*. © Andy Jukes (2018).



Scattered scrub-dominated slopes – a near-optimal resource that could be elevated further through an increased diversity of scrub species. © Andy Jukes (2018).



Recently fallen ash tree monolith. This was a highly productive feature for deadwood nesting bees and wasps. © Andy Jukes (2018).



Location of *Mallota cimbiciformis* (a Nationally Scarce hoverfly) – three individuals were recorded from this tree seepage feature. © Andy Jukes (2018).