An invertebrate survey of Coill Eoin, St John's Wood, Co Roscommon

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Cover photo: Brown Snail *Zenobiella subrufescens* © K.N.A. Alexander.

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Executive Summary

An invertebrate survey of St John's Wood has identified a rich and varied assemblage consistent with a large area of ancient semi-natural woodland. The wood has proven to be of especial nature conservation interest for the following assemblage types:

- Wood-decay (saproxylic) invertebrates, with at least 18% of the Irish fauna and suggestive of ancient woodland conditions;
- Canopy invertebrates, especially moths, beetles, bugs and spiders;
- Ground layer invertebrates, especially beetles and spiders;
- Fungus associates, especially fungus gnats.

The recent initiative of opening up part of the ride network has already begun to attract in a wider variety of pollinating insects. Also, returning part of the wood to an active coppice-cutting regime has substantially increased the use made of these areas – which are acting as temporary glades - by wood-decay and even shade-demanding species. The results suggest that these species are at least tolerant of such active management, and with some of the wood-decay species actually favoured.

Overall, a total of 823 invertebrate species have been identified in St John's Wood during 2010, and this is by no means comprehensive. These include six previously overlooked native species and four species recently assessed as of Irish Red List status.

- The mollusc fauna is characteristic of pristine ancient woodland and includes three Irish Red List Vulnerable species: English Chrysalis Snail *Leiostyla anglica*, Ash-black Slug *Limax cinereoniger*, and Brown Snail *Zenobiella subrufescens*.
- The most species-rich group is the Lepidoptera (Butterflies and moths) with 239 species recorded, including a small willow-feeding moth *Ancylis diminutana*, which has previously been overlooked in Ireland.
- This is closely followed by the two-winged flies, with 233 species recorded. These include 65 species of fungus gnat, of which four have previously been overlooked in Ireland, including the globally rare *Docosia morioniella*, known from just three other European countries.
- The beetle fauna is also notably species-rich, and includes Ireland's only known population of the willow weevil *Acalyptus carpini* and rare wood-decay species such as *Tetratoma ancora* and *Dorcatoma dresdensis*.
- The Near Threatened Irish Red List species the Large Red-tailed Bumblebee *Bombus lapidarius* was noted, although probably more associated with the fen fringe than the woodland itself.
- Spiders are also of significant interest, especially canopy-living species which include three notable finds: *Nigma puella*, *Anelosimus vittatus*, and *Philodromus albidus*.
- The barkfly fauna associated with epiphytes on the tree trunks is also species-rich.
- True bugs include the rare *Orius laticollis*.

- Butterflies are also of interest, with Cryptic Wood White *Leptidea juvernica,* Brimstone *Gonepteryx rhamni,* Holly Blue *Celastrina argiolus,* and Silver-washed Fritillary *Argynnis paphia.*

Conservation management recommendations include the need to carefully manage the coppice products in order to optimise its value for wood-decay invertebrates, and to control the development of holly, ivy and bramble, preferably through carefully managed livestock grazing. The high level of invertebrate conservation interests identified implies that a well-targeted monitoring protocol should be progressed, in order to inform conservation management. The suggested protocol combines expert targeted fieldwork with standardised trapping and sampling.

A small number of the more notable discoveries appear to be focused on the north-western half of the wood, beyond the dividing wall, and it is recommended that this area remain in minimum intervention management.

Acknowledgements

The contract was set up by Judit Kelemen, NPWS North Midlands Regional Manager; the day to day operation of the contract was managed by the Conservation Ranger, Niall Cribbon.

The main Lepidoptera recording was carried out by Ken Bond. Specialist identification support was sub-contracted to Peter Chandler (Diptera) and Paul Lee (Arachnida and Myriapoda), while Roy Anderson (Coleoptera: Staphylinidae) and Mike Morris (Coleoptera: Curculionidae) also determined a few additional species. Martin Cawley and Myles Nolan provided useful background information on the Irish spider fauna. Howard Fox provided information on lichens and fungi. My wife Janet Lister provided botanical, technical and logistical support.

Mel Conway (GIS Unit, NPWS, Dublin) provided access to the Ordnance Survey 3rd edition Six-Inch-to-the-Mile series mapping – a OSI 3rd party licence was agreed for its use on the invertebrate survey.

Introduction

Background

Ancient woodlands and their features

The expression 'ancient woodland' refers to land that has been continuously under tree cover since 1600. It does not imply the original natural forest cover of postglacial Ireland nor does it imply that it has not been exploited by people. Exploitation is an integral part of the history of virtually all ancient woods – some of their ecological characteristics are actually a consequence of exploitation (Rackham 1995). While relatively easy to define, ancient woodland can be much more difficult to demonstrate on a particular site. Secondary woodland - and especially ancient secondary woodland – can be a particular problem, arising from the abandonment of previously cleared land as a result of factors such as warfare, famine and disease.

Roscommon was the second most wooded county in Ireland (6% woodland cover) at the time of the *Civil Survey of Ireland* 1654-6, after County Clare (7%) (Rackham 1995). Rackham states that St John's Wood and the nearby Rindoon Wood were 'vaguely mentioned in the Civil Survey of 1656'. John Brown's maps of Connaught produced in 1584 show this area as treeless, in contrast with a large part of south Roscommon being shown as being wooded along the eastern edge (Perrin & Daly 2010). The interpretation of historic maps is fraught with problems, however, as it is important to be aware of the intention of the map-maker at the time – if the map-maker had no particular interest in an area then it would have been given minimal attention. Also, a common problem experienced in Britain is that different surveyors applied different criteria – a surveyor might map an area of recently cut-over coppice as either un-wooded rough ground or as woodland. The present woodland lay-out is almost exactly as mapped by the Ordnance Survey in 1837. Perrin & Daly (2010) include St John's Wood as 'ancient woodland'. Rackham (1995) states that St John's Wood and Rindoon Woods are the best preserved ancient woods known to him in Ireland, and may well be to Ireland what the classic coppice-wood of the Bradfield Woods (Suffolk) is to England. He refers to them as a coppiced version of a rain forest, with their moss-festooned tree trunks and boughs.

St John's Wood – designations and basic layout

St John's Wood is located on the western shore of Lough Ree and is included within the Lough Ree candidate Special Area of Conservation, which is also a Special Protection Area and a proposed National Heritage Area. It is stated to be one of the most important woodlands in Ireland; it is recognised as the largest and most natural woodland in the Midlands.

The woodland occupies 110ha and has developed over Carboniferous Limestone overlain by sandy clay, with acid soils in places (Rackham 1995). As already mentioned, the ride network appears more or less exactly as shown on the 1837 OS map – albeit currently very overgrown in places - and 26 compartments have been recognised by NPWS (Figure 1). The terrain is very gently undulating, with damp hollows. Ownership history has been complex, with compartments having been in separate ownership for many years, and with consequent very different management histories – the cutting of trees and shrubs appears to have been *ad hoc*. The NPWS has been purchasing compartments from local people but the wood is not yet fully owned by them. Until the recent NPWS initiative to restore active woodland management, the wood was last coppiced in about 1920 (Rackham 1995).

A key feature of the wood is the large and high dividing wall which splits the wood into two more or less equal halves. The main access point is in the southern landward corner. The south-eastern half of the wood is enclosed by an old and now derelict wall, of a stature more comparable with local field boundaries. At present just one ride crosses through the dividing wall, although there is another gap in the wall, currently overgrown. The special high wall across the wood is suggestive of medieval deer park enclosure walls in England, and may imply that this half of the wood was reserved for some special purpose – perhaps for the local lord's use or that of a religious establishment. The south-eastern half of the woodland was mainly used for coppice, whereas the north-western woodland was less intensively exploited (J. Kelemen, pers. comm.). A few small walled enclosures are shown on the 1837 map and there are also a few ruined buildings within the wood – the use made of these is not known at present. The western area of Cpt 2 has obvious ridge and furrow, and has apparently been cleared for cultivation in the past.

The structure of the wood is typical coppice with standards, but many large oaks are reported to have been felled and removed after a change in ownership in 1917 (Kelly & Fuller, 1988). There were originally grazing rights within the near woodland – 13 cattle for half of the year, but this right has not been exercised for some time (J. Kelemen, pers. comm.). The largest oak noted in 2010 has a girth of 3.32m suggesting an age of around 175 years (based on data held by John White)– it stands close to the main access track inside Cpt 2 (M99765586). Five other standards were also measured and range in girth from 1.01 to 2.46m (see Appendix 1). Kelly & Fuller (1988) comment that no large oaks now survive but this is clearly not correct. The larger measured trees are at the upper size range typical for such a woodland situation – oaks growing under woodland conditions do not normally survive into an ancient condition due to canopy competition, although well-spaced standards in a coppice situation may be expected to live out their natural life span if left uncut.

Oak is the predominant standard tree but there are also ash, crab apple and yew standards. The old coppice is dominated by hazel, but also includes ash, oak, goat willow, wych elm, wild cherry, Irish whitebeam and probably others. Holly, hawthorn, spindle, downy birch, bird cherry, buckthorn,

guelder rose and rowan are also present. The ground flora is species-rich and there is a luxuriant bryophyte cover over the soil, rocks, trees and shrubs. The fringing flood-prone woodland zone is dominated by young ash poles with occasional old alders in the pockets of wet woodland which penetrate into the main woodland. Drier fringes have thorn thicket of Blackthorn with buckthorn and hawthorn. Non-native tree and shrub species are virtually absent – only a few sycamore were noted during the 2010 exploration. O'Donoghue (2005) provides more detailed information on the vegetation of the wood.

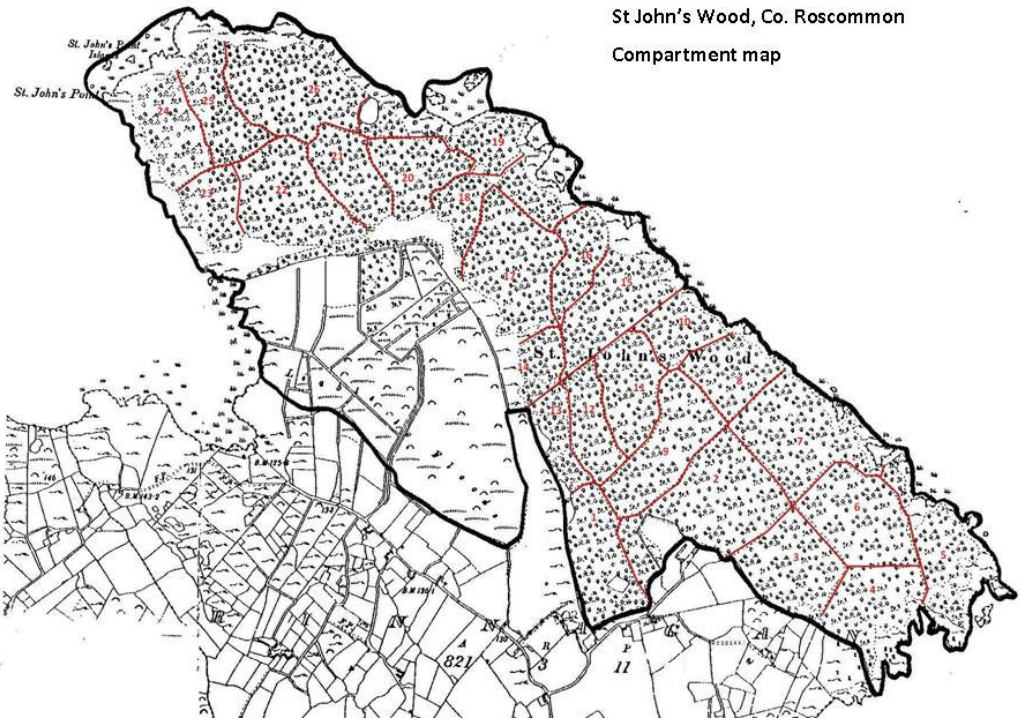

Figure 1: Map of St. John's Wood, Co Roscommon showing the NPWS management compartments

While superficially feeling very uniform in structure and composition, careful documentation demonstrates considerable variation across the site (see Appendix 1). The north-western half also appears to have moister and deeper soils in general, in contrast to shallower, stonier and drier soils in the south-eastern half – as noted during the setting up of the pitfall traps (2.3).

An active management regime resumed in 2005. Two one acre plots have been cut over each year, in Cpts 7, 8 and 9. The sections of the ride network which provides access to these compartments have also received cutting either side, to increase light levels and to link with the outside of the wood to provide access for bees and butterflies. The north-western half of the woodland is being considered

for non-intervention management. Pony grazing is planned and Cpt 8 has been fenced for this purpose.

The 2010 invertebrate survey

The author was contracted to carry out a survey of invertebrates; the overall objective is to assess the invertebrate fauna of the woodland in order to assist nature conservation site management decisions. The specific aims of the survey are:

- To assess the impacts of current woodland management practices, such as coppicing, ride creation or non-intervention, on invertebrate assemblages;
- To identify ecological differences (if any) between the western and eastern halves of the wood – the more intensive management history may be significant;
- To identify if pollinating insects associated with Narrow-leaved Helleborine *Cephalanthera longifolia* occur in the wood;
- To suggest a monitoring protocol using invertebrate species/groups to assess potential changes to the ecological status of the woodland – simple, repeatable methods are needed;
- To identify important invertebrate assemblages using the woodland, indicating species habitat requirements (if any).

Methodology

Timing of visits & weather experienced

Many invertebrates are most readily identifiable to species level in the full grown, adult stage; identification keys for the immature stages are much less available. Invertebrates are also mostly relatively short-lived and many have annual life cycles. This means that at any particular time of year only a proportion of the species present will be readily available in an identifiable stage. An invertebrate survey therefore needs to be based on a series of visits across the field season. With the adult stage of many insects being only available for periods of a few weeks, the standard approach tends to be for monthly visits across the field season. This is however relatively labour-intensive and costly. A compromise was therefore adopted:

- five sampling visits were scheduled;
- flight traps were used to enable sampling to continue between visits;
- each visit was of three days duration, to enable direct sampling and management of the traps, and to target the direct sampling to the better days.

Trapping between visits also ensured that sampling took place during periods of weather particularly suitable for invertebrate activity – in Ireland there is a high probability of extended periods of poor weather which could easily coincide with the planned visits. The dates of the five visits (see Table 1) were targeted at the main annual peaks in invertebrate activity.

Moth recording was carried out as a separate exercise and the methodology is described in section 3.2.6.

Table 1 Dates of general sampling visits in 2010 and the weather experienced

Dates	Targets of visit	Weather experienced
April 12-14	Familiarisation with wood layout Selection of trapping stations and setting traps General sampling, especially early spring flower-visiting insects	Warm sunshine each day but bitterly cold northerly breeze
May 10, 12 & 13	Sampling first half of late spring peak in invertebrate activity	Warm sunshine each day but increasingly cold northerly breeze; clouded over on 13th
June 7-10	Sampling second half of late spring peak in invertebrate activity	Very unsettled, predominantly dense misty cloud and heavy showers; last morning bright and sunny but cold northerly breeze
August 5-8	Sampling high summer invertebrate activity	Unsettled, generally wet; brighter on 5th and 8th
October 6-8	Sampling autumn invertebrate activity Closing down trapping stations	Unsettled at first, but mostly bright and sunny

Trapping stations

The basic approach taken was to set up some permanent trapping stations across the wood – bearing in the mind the specific objectives of the contract - and to supplement these samples with basic walkover type surveying. Trapping involved both pitfall traps (see 2.4) and flight interception traps (see 2.5), while walkover surveying (2.7) utilised sweep-netting, beating, hand-searching and direct observation techniques. A suction sampler was also used when conditions were suitable (2.6).

The wood was explored on foot on the first day of the field survey in order to identify suitable trapping stations where both pitfall-trapping and flight interception trapping would take place. Eight trapping stations were selected, with four each side of the central dividing wall, and with the four on the south-eastern side split between recently cut-over coppice and long-abandoned coppice. This would enable comparisons to be made between the less disturbed north-western half of the wood and the more disturbed south-eastern part (4 trapping stations each), as well as between recent coppice-cutting and long-abandoned coppices (2 trapping stations each). The selection of compartments was influenced by ease of access along the main track network – the lough water level was very high in April and access into the far south-east in particular was not practical, while the tracks into the outer-lying areas on the west side and north of the dividing wall were often overgrown and too difficult to discern.

A line of five pitfall traps and a single flight interception trap were placed at each trapping station, producing a total of 40 pitfall traps and 8 flight traps. The total numbers of traps operated were chosen for practicality, to suggest rather than demonstrate relationships. More intensive studies would be more time demanding, but would hopefully be informed by the results of these field trials. Pitfall traps are conventionally operated in lines in order to minimise trap interference – one trap intercepting the potential catch of the others. Studies typically use between five and ten traps per line.

The trapping stations were more or less paired, to reduce the amount of time required to maintain and empty the traps. Each station of each pair was sited in neighbouring woodland compartments. The compartments with this trapping arrangement are detailed in Table 2. The vegetation immediately around these trapping stations is noted in Appendix 1.

Figure 2: Trapping station area in recently cutover coppice of Cpt 9, April 2010

Table 2 Location of general trapping stations by compartment number and Irish OS grid reference

N.B. GPS readings were taken from the access point on the ride for uncut compartments

Cpt	Grid Ref	NW woodland	SE woodland	
		Uncut coppice	Cut over coppice	Uncut coppice
2	N000559			*
3	N000559			*
7	N000562		Plot 2/2007	
9	M998561		Plot 1/2008	
15	M995564	*		
17	M995564	*		
21	M989568	*		
26	M989568	*		

Pitfall trapping

Pitfall-trapping is an effective means of catching fast-moving, ground-active invertebrates, notably active predators such as ground beetles (Carabidae), rove beetles (Staphylinidae) and spiders. Many of these invertebrates are mainly active after nightfall and live at relatively low density – they are difficult to find by sampling in daylight.

The pitfall traps used were standard wide-mouthed glass jam-jars with 6cm diameter openings and 9cm depth. These were dug vertically into the soil and set with their mouths at soil surface level so that invertebrates active across the soil surface would fall in and be unable to climb out. This type of trap is easy to close and leave in place between trapping sessions merely by turning the jar upside down in the pit.

Five traps were used and laid out in lines, at an average of 3m apart – the gap varied according to the presence of any obstructions such as tree stems. With the danger of not being able to re-find the traps in mind, each trap was marked with a 450mm plant support stick and each of the five sticks linked by brightly coloured baler twine. Trapping locations were marked on site maps, recorded using a handheld GPS, and a note made of the compass bearing away from the track as well as of any other local features such as distinctive trees or stumps.

The traps were opened on the first day of each sampling visit and closed on the last, providing two to four days when live-trapping could take place. On the April visit they were checked daily in order to

assess i) the quantity of trapped invertebrates (which were then removed) and ii) any interference by wild animals. The removed invertebrates were either identified in the field (where this was considered reliable) and then released close by, or taken off-site for examination under a microscope. The released invertebrates were placed at least a metre from any trap, to reduce the probability of recapture. The April visit demonstrated that trapping successfully captured a good range of invertebrates in such a short space of time. Two of the traps showed signs of disturbance – soil being dug away from one side – but both remained firmly in the ground. The most likely animal causing this disturbance was thought to be pine marten – the wood is known to be well-used by these animals.

The digging in of the traps revealed that the soil depth appeared generally greatest in the north-western locations and decreased south-eastwards. Soil stoniness also increased to the south-east. The traps in Cpts 21 and 26 also appeared to be in somewhat moister soils, especially in comparison with those in the south-eastern half of the wood.

Flight interception trapping

The flight interception traps are of a standardised construction:

- Four 2l plastic drinks bottles, with windows cut in sides, and bases screwed into wooden base, the windows facing outwards;
- Wooden bases hung from an available horizontal tree branch – at 1-1.5m above ground level - using baler twine, with bottles hanging upside down beneath;
- The upside-down bottle tops filled with preservative solution (commercial antifreeze 50/50 with tap-water, plus a little washing up liquid to reduce surface tension) which can then be drained through the plastic cap.

These were set up to operate between each of the sampling visits, with captured invertebrates killed and preserved in the solution. The traps were emptied and re-set during each visit. Each trap was placed near the end of each pitfall line, at the end away from the access track and deeper into the compartment.

Flight traps of this construction were chosen in preference to Malaise traps as the latter traps have a reputation for killing large volumes of flying insects which then become a logistical problem to sort and identify. The position of Malaise traps also has a major influence on catch size and composition. The bottle flight traps are multidirectional and so do not suffer from this complication. No studies comparing the two types of traps have been carried out but it appears that Malaise traps are better at capturing large strongly-flying insects such as hoverflies.

Figure 3: Flight interception trap in position in Cpt 7, April 2010

Suction sampling

As already mentioned, pitfall-trapping targets fast-moving, ground-living, predatory invertebrates. The ground-living invertebrates on which they mostly feed are relatively slow-moving and live amongst the accumulations of dead vegetation and other debris. Many are small and cryptically coloured, and therefore difficult to record by eye. The best ways of sampling these are either by using suction devices or by extracting them from bagged samples of the debris. The latter is very time-consuming and so suction samplers are preferable.

Suction sampling has been a standard methodology in invertebrate studies for many years but the equipment has until recently been very cumbersome and expensive, and the approach not widely used as a result. However Stewart & Wright (1995) drew attention to the newly available, relatively lightweight, petrol-driven suction 'Blow and Vac' machines being marketed for the domestic garden market. These can be modified for invertebrate sampling merely by securing a net bag into the suction tube. Once samples have been taken, the machine is turned off and the net bag removed and emptied either into a white tray for sorting in the field or into a plastic bag, sealed and taken away for sorting later.

The technique was applied during the May visit to document the ground-dwelling invertebrates around each trapping station. The approach adopted was to carry out five suction sessions within each trapping station, with each session aiming to sample a square of leaf litter 0.5m by 0.5m. Loose surface debris was first cleared out of the way, to avoid excessive fouling of the suction head. The samples were sorted in the field using a deep white tray (a butcher's 'liver tray' was used) and voucher specimens retained in alcohol tubes.

Conditions during the June and August visit were too wet for practical use of the suction sampler – wet nets and wet specimens are very difficult to deal with and the technique becomes too inefficient to proceed. The October weather conditions were unsettled but one morning was judged sufficiently dry and further samples were taken along a transect through Cpts 1 and 9, sampling from closed canopy, cutover coppice with shade from standard trees, and un-shaded cutover coppice.

Hand-searching for wood-decay and epiphyte fauna

The recommended standard approach for surveying wood-decay (saproxylic) and epiphyte invertebrates (Drake *et al* 2007) is to make a series of visits across the field season during which as wide a variety of available niches as possible are investigated using the standard hand techniques of beating, sweeping and panning (sorting through accumulations of debris within tree cavities), supplemented by direct observation. These methods will catch different elements of the assemblage so all are needed to collect an adequate range of the beetles (Coleoptera), flies (Diptera) and aculeate Hymenoptera that are the key saproxylic groups, as well as epiphyte groups such as barkflies (Psocoptera).

A survey strategy will necessarily depend on what one encounters when one arrives on site, and may be modified by what one finds as one explores the site – determining a detailed strategy in advance is not therefore sensible. The investigation of a site is perhaps better termed 'prospecting' - searching for opportunities. The basic features that need to be investigated are:

- Large old tree trunks of living trees, especially those with well-lit sunny areas, and both rough-barked and smooth-barked examples – the latter are better for adult Dolichopodidae and Hybotidae flies, but the former are better for barkflies (Psocoptera):
    - Inspection for active invertebrates, *e.g.* resting Diptera or hunting spiders, which may be captured directly into a tube, pooted, or netted;
    - Inspection of any sap-runs or other wet fluxes for visible insects, collection of any larvae for rearing;
    - Inspection of any exit holes which may gives clues to identity of inhabitants, including hole shape and size, and watch for secondary occupation by aculeates (digger wasps and bees);
    - Bark cavities:
        - Older trees may develop large cavities within the bark and beneath it, and these may be detected by knocking for hollow sounds or judged by eye; sections of bark may need to be pulled off to record spiders, etc;
    - Trunk cavities – rot-holes:

        - These are best investigated using emergence traps set across the opening or rearing from samples of wet debris, as most of the contents will be in the larval stage (Diptera predominantly), but flight interception trapping close to tree trunks is also a good way of sampling this specialist fauna;
    - Trunk cavities – hollowing:
        - Direct investigation of white-rotten or red-rotten decayed wood;
        - Examination of any accumulations of wood mould using panning (as in gold-panning, with material sorted by size category in a tray through agitation and tossing) or sieving techniques.
        - Accessing pockets of decay debris within the interior of hollowed trunks by placing a net in the base of the hollow and probing the interior above with a beating stick or net pole;
- Aerial dead branches on living trees:
    - Beating or tapping over a net, etc; high summer and autumn are important times for specialist beetles of this habitat; epiphyte associated invertebrates are recorded in the same way;
    - Sections of branch, with or without fruiting fungi, can be taken away for rearing purposes;
- Aerial live branches:
    - Beating over a net, etc, to capture resting adults after emergence from saproxylic habitats or in cop;
- Standing dead trunks (snags and monoliths):
    - Much as for live trunks above, but often with better access to decay and cavities; standing dead hazel stems are especially good for specialist beetles; aculeates are most likely to be found on dead trunks as they will be less shaded in general and a greater range of cavities will be available for nesting; warmth-loving species also favour dead trunks;
- Fallen trunks and boughs:
    - General investigation, breaking into loose and soft material;
    - Turning over to inspect the moister undersides (always placing back as found);
- Fruiting fungi:
    - Inspection for active insects & netting any disturbed by the surveyor;
    - Tapping over net, etc;
    - Inspection for insect exit holes;
    - Breaking a representative sample open & checking for larvae which might be taken for rearing;
- Targeted beating of blossom on flowering trees & shrubs, especially hawthorn, elder, holly, etc;
- Field layer beneath or close to trees & shrubs:
    - Sweep-netting low over field layer & beneath the aerial foliage;
    - Inspection of any flowers, *e.g.* hogweed, bramble, etc.

The St John's Wood survey attempted to cover all or most of these activities. The requirements for blossom mean that late spring visits are needed to coincide with the peak in hawthorn flowering, and hopefully high summer visits will coincide with elder and holly blossom. The high summer visit will also enable work with fruiting of the heartwood decay fungus *Laetiporus sulphureus* and other earlier bracket fungi, while autumn visits will hopefully coincide with fruiting of *Fistulina hepatica* and other later fungi.

Other invertebrates

The basic approach outlined above also applies to other invertebrate assemblages. Canopy-living invertebrates are most readily found by beating tree and shrub foliage over a net, while field layer species are found by using a sweep-net. Direct observation is also important with both assemblages, particularly looking for feeding signs such as holes in leaves – many species feed in a characteristic way, leaving recognisable damage. Leaf-mining and gall-forming invertebrates are often best recorded using the characteristic mines and galls. Targeted searching for specific food plants is also a useful approach.

Anticipating the behaviour of certain invertebrates also improves the range of species that are findable. Many woodland insects are sun-loving and may be found by carefully approaching any sheltered sun-spots. Blossom attracts many insects – not just saproxylics, especially where it too is in sunshine. When inactive, invertebrates typical use refugia out of view and out of the way of potential predators, and can be found by turning over rocks, logs and other debris. These techniques are all necessarily *ad hoc*, and involve site exploration and investigation of features as they are encountered. The techniques are not readily quantifiable and repeatable, as they depend so much on site condition at the time.

Moth-recording

The main invertebrate survey did not target moths. This was undertaken separately by Ken Bond. Full details of the records have been sent to the NBDC and only a summary of the main findings included here. Two types of purpose-built moth light-traps were operated across the field season and the trapping was supplemented by field observations during the daylight hours. Up to 3 light-traps were used per night on the site, consisting of a Skinner type Mercury-vapour trap, and two 15W Actinic traps. The positioning of the moth traps was changed across the season in order to sample different areas. The work programme is detailed in Table 3.

The gap between mid-June and the end of July was largely the result of unfavourable weather, and this period must still be considered in need of further sampling. On each occasion daytime fieldwork involved observation of day-flying species and larval stages, and special attention was paid to leaf-mining species occurring on trees and shrubs in the autumn. Trapping locations were within woodland, in the southern section of the wood, or on the margin of the wetland west of the wood at grid reference M996563.

Table 3 Timing and locations of moth recording activities

Date	M.V. (Skinner) trap	Actinic (15W) trap	Daytime

			searching
10 April	M999563	West margin M994563	10 April
20 May	M999563	West margin M994563 & SE part M999562	20 May
18 June	West margin M996563	East N001561	
31 July	N001560	Lakeshore M999565	31 July
1 August			1 August
14 August	West margin M994563	N001560	14 August
24 September	West margin M996563		24 September
12 October		SE part M999562 & west margin M996563	12 October

Specimens that could not be determined with certainly on site were taken for later identification, usually by means of preparing a permanent genitalia slide; as indicated in the Systematic List (Appendix 2).

Although an attempt was made to cover the entire woodland area evenly, it was not possible to sample or use light-trapping in the more northerly parts of the wood, due to difficulty of access.

Results

In this section the findings will be reported and discussed firstly on a taxonomic grouping basis (3.2), high-lighting the groups which have proved to be of significant interest. Groups lacking interesting species from this survey will be summarised. The key species found will be discussed in some detail, in terms of their conservation status and known ecology. The following section (3.3) will take an ecological perspective, assessing the findings in terms of the various invertebrate assemblages present and attempting to identify any patterns in distribution across the wood which have become apparent, e.g. in relation of past and present woodland management activities. The full species list from the survey is presented as Appendix 2. All the records gathered in this survey have been submitted to the NPWS and also the National Biodiversity Data Centre, Waterford, from which they are publicly accessible.

Taxonomic analysis and species status

The invertebrate survey of St John's Wood aimed to target certain key taxonomic groups. For other groups only a few casual observations were made. Table 4 summarises the numbers of species found in each taxonomic group and identifies groups which were not considered.

Table 4 Invertebrate groups investigated and numbers of species identified

*Groups discussed in more detail in the following sections

Taxonomic group	Total species recorded
Annelida (earthworms)	Not investigated
Mollusca (snails & slugs)*	20
Chilopoda (centipedes)	3
Diplopoda (millipedes)	10
Isopoda (woodlice)	4
Araneae (spiders)*	57
Opiliones (harvestmen)	11
Pseudoscorpiones (false scorpions)	1
Gall mites	1 – not fully investigated
Thysanura (bristletails)	1
Collembola (springtails)	Not investigated
Dermaptera (earwigs)	1

Psocoptera (barkflies)*	17
Heteroptera (shieldbugs, plant bugs, etc)*	39
Auchenorrhyncha (leafhoppers, etc)	14 – incomplete coverage
Sternorrhyncha (aphids, scales, etc)	Not investigated
Thysanoptera (thrips)	Not investigated
Neuroptera (lacewings)	1
Butterflies*	10
Larger moths*	133
Microlepidoptera*	96
Diptera (true flies)*	231
Symphyta (sawflies)	8 – incomplete coverage
Parasitica (small wasps)	Not investigated
Aculeata (ants, bees & wasps)*	12
Coleoptera (beetles)*	153
Total number of invertebrates identified	823

Although the 2010 survey work was a detailed investigation, it cannot be considered comprehensive. There is considerable scope for finding additional species even in the better-studied groups. Complete survey coverage is not achievable – extensively-studied sites in Britain such as Monks Wood (Cambridgeshire) and Wytham Woods (Oxfordshire) continue to have additional species found in them, and including long overlooked species as well as new arrivals. A site species list will always be dynamic. An estimate for the current species-richness of invertebrates in St John's Wood is most likely in the range of 1000 to 1500 species – a detailed study of the Hymenoptera alone would be expected to add another 200 species at least. The very detailed and extensive Ecological Survey of Wytham Woods (Elton 1966) identified about 3800 species of animal (includes birds and mammals), although the potential fauna in that part of southern England is far greater than could be expected anywhere in Ireland.

Snails and slugs (Mollusca)

The highlights of the wood's mollusc fauna are three species which are included in the Irish Red List (Byrne *et al* 2009) as Threatened (Vulnerable):

- *Leiostyla anglica* English Chrysalis Snail

- *Limax cinereoniger* Ash-black Slug
- *Zenobiella subrufescens* Brown Snail.

These three are all typical of ancient semi-natural woodland situations – requiring permanently humid and undisturbed situations - but may also occur individually in other relatively undisturbed semi-natural situations. The presence of three such species does however strongly suggest ancient woodland conditions.

English Chrysalis Snail is a near endemic to Ireland and Britain. It has an Atlantic western European distribution and Ireland is the global centre (Kerney & Cameron 1979; Kerney 1999) – it was however described as new to science from England, hence its specific name. Outside of Ireland, it is widely known across northern and western Britain but otherwise only known from a few places in western France, Spain, Portugal and Algeria. It is still widespread in suitable places on neutral to base-rich soils across Ireland but the distribution is showing some decline (Byrne *et al* 2009). Suitable situations include woodland, marshes and sea cliffs; it is an indicator species for ancient woodland in lowland England but, with increasingly oceanicity, it is also able to live outside of woodlands in the far west (Kerney & Cameron 1979). Live snails were found to be plentiful amongst leaf litter in Cpts 21 and 26. They were only detected by suction sampling. Its presence in these two samples but none of the others may suggest that it is confined to the far north-west of the wood for some reason - the soils in these areas do appear moister and deeper than elsewhere (see pitfall trapping section, 2.4) and presumably less disturbed by woodland management practices. Further, more detailed survey work would be needed to clarify the distribution of this snail across the wood.

Ash-black Slug is primarily a species of ancient woodlands although has been reported from a small number of sea cliff sites in the west of Ireland (Kerney 1999). It is active only when air humidity is very high, and especially after nightfall, retreating under logs or loose bark on tree trunks under drier conditions. It appears to favour epiphytic growth for feeding as it is most often encountered climbing tree trunks. It is genuinely rare and very localised in Ireland, and has become increasingly scarce in the Republic but apparently less so in Northern Ireland (Byrne *et al* 2009). It has not previously been reported from County Roscommon. The species is tolerant of traditional woodland management practices such as coppice and wood-pasture. Interestingly the species was only found by hand-searching in recently cut areas during the 2010 survey: one slug each in Cps 5 and 8. It may be expected at low density throughout the wood.

Figure 4: Ash-black Slug *Limax cinereoniger* in Cpt 8

Brown Snail is another Atlantic western European species, largely confined to Ireland, Britain and coastal regions of western France (Kerney & Cameron 1979; Kerney 1999). Like English Chrysalis Snail it is a good indicator of ancient woodland in lowland England but, with increasing oceanicity, it may also be found in ancient hedgerows, on sea cliffs and occasionally in marshes in the west. The species occurs amongst ground litter and field layer vegetation, also climbing up into shrubs and even onto the trunks of live trees. It is tolerant of traditional woodland management practices but can be eliminated through heavy grazing of the field layer. Live snails were found frequently and widely across St John's Wood, by beating shrub foliage over a net and by sweep-netting through the field layer, while suction sampling of leaf litter produced mainly empty shells. It has readily colonised the coppice coups and could be found on re-growth from the cut stools.

A total of 20 species of land snail and slug were found within St John's Wood. There remain a few additional snail species which are widespread in Irish woodlands and which could conceivably also be present here – Prickly Snail *Acanthinula aculeata* (Near Threatened in Ireland), Dwarf Snail *Punctum pygmaeum* and Chrystal Snail *Vitrea crystallina* are all very small and could conceivably have been overlooked. The list of slug species is also surprisingly short, with Dusky Slug *Arion subfuscus* a particularly surprising omission from the list as this species is characteristic of relatively undisturbed semi-natural situations. The general lack of slugs in the wood may have been due to recent weather

factors, particularly the long dry spring and the unusually cold and prolonged winter which preceded it. With additional recording the final total of woodland molluscs here might rise to 25, possibly more.

A noticeable feature of the wood is the complete absence of species characteristic of disturbance caused by people. A large number of species have become established in Ireland through human activity and these include species which typically colonise woodlands. The fauna currently has a pristine quality.

Spiders (Araneae)

A total of 57 species of spider were found in the wood. Spider assemblages are better studied in Britain than in Ireland, and in a British context this spider list is a very typical woodland assemblage. However, the data set does include the most northern Irish records for *Nigma puella* and *Anelosimus vittatus*, and only the fifth Irish record for *Philodromus albidus*, all arboreal species. This does suggest a significant interest for specialist arboreal spiders. This confirms the findings of the PLANFORBIO project (R. Martin, pers. comm.) which has found very high species richness in St John's Wood for both canopy spiders and beetles, in relation to the other native woodlands sampled. Their full results are not yet published so it is not possible to say to what extent their list overlaps with the 2010 data.

Assessment of the current Irish status of spiders is difficult due to the substantial amount of data which has been forthcoming in recent years, much still unpublished (Cawley 2009), and which includes 40 species added to the Irish list since the last full review of the fauna (Helsdingen 1996). To what extent these reflect long overlooked natives or recent arrivals remains unclear and Irish spider experts have not yet published an analysis of the changes.

The most significant finds from the 2010 recording in St John's Wood appear to be the following (Table 5).

Table 5 The most significant spider species found in St John's Wood during 2010, with main habitat associations and location where found

Species	Main habitat	St John's Wood
Agyneta ramosa (Linyphiidae)	Leaf litter; [only recently added to Irish list (Cawley 2009), although from 16 counties, this the first for Co Roscommon]	Cpts 9, 17 & 21: 6 males from suction samples
Anelosimus vittatus (Theridiidae)	Arboreal; constructs scaffold webs on bushes, trees and tall plants generally.	Cpt 9: female knocked from hazel foliage
Ceratinella scabrosa (Linyphiidae)	leaf litter	Cpts 3 & &: 2 females in suction samples
Kaestneria dorsalis (Linyphiidae)	mainly on shrubs	Cpt 7: male in flight trap
Misumena vatia (Thomisidae)	wood edge [at northern edge of Irish range in County Roscommon]	One swept in NW part of wood
Nigma puella (Dictynidae)	mainly on shrubs [recently added to Irish List (Cawley, 2009) from eight counties, this the first for Co Roscommon]	Cpt 9: male from canopy beating
Pachygnatha listeri (Tetragnathidae)	undergrowth in woodlands, especially ancient ones; St John's Wood contributes only the 7th Irish county known to support this species	Cpt 7: 2 males in suction sample; Cpts 1 & 9: male and female swept from hazel regrowth in cut-over coups
Philodromus albidus (Philodromidae)	tree canopy, especially oak [recently added to Irish List (Cawley, 2009) from Counties Cork, Galway and Sligo]	Cpt 9: 2 females from hazel regrowth
Tapinocyba insecta (Linyphiidae)	leaf litter in undisturbed ancient woods and fens	Cpt 15: male in pitfall trap

Barkflies (Psocoptera)

Barkflies are an important group to survey in any situation with trees as they are primarily epiphyte specialists and there is a degree of association with habitat continuity. A total of 17 species were identified, mainly through sweep-netting and beating of aerial branches. There appear to be about 42 species which are thought to be native to Ireland (Smithers *et al* 1999), so the St John's Wood list represents less than half of the Irish fauna. As epiphyte associates however, well-lit tree trunks provide more suitable habitat, and dense closed-canopy woodland may be expected to be relatively species-poor. Comparable data is available only for Northern Ireland parklands where the site lists for what are regarded as the best quality sites present ranged from 16 to 23 species (Alexander *et al* 2007). This suggests therefore that the St John's Wood list is likely to be relatively species-rich for a woodland situation.

The most interesting of the species found are three of the larger species: *Atlantopsocus personatus*, *Loensia fasciata* and *Trichadenotecnum sexpunctatum*.

The two Irish species of *Atlantopsocus* were originally described from the Atlantic islands of the Azores, Madeira and the Canary Islands (Lienhard 1998). *A. personatus* was added to the Irish list relatively recently (Fahy 1967), possibly suggesting a recent arrival, and by the time of the most recent full review (Smithers *et al* 1999) it had been found right across the southern half of Ireland, as far north as Counties Galway and Westmeath. Although it has been considered to be an introduction to Ireland, it has a globally restricted range - and an oceanic Atlantic one - and so is of some conservation interest here. Single individuals were taken on two occasions in the flight trap in Cpt 7. The other species, *A. adustus* was found in four of the Northern Ireland parklands in 2006 (Alexander *et al* 2007; Alexander & Saville 2009). The relationships between the two species in Ireland remain unclear.

Loensia fasciata appears to be very localised in Ireland. It was first reported in 1910 from County Wexford but was not reported subsequently until it was found in two parklands in Northern Ireland in 2006 (Alexander *et al* 2007). St John's Wood is therefore only the third modern report from Ireland as a whole. A single individual was taken in the flight trap in Cpt 7. The wings are distinctively banded and it is not therefore a species to be readily overlooked.

Trichadenotecnum sexpunctatum was first found in Ireland in 2006, in four Northern Ireland parklands (Alexander *et al* 2007). As a strongly marked species it seems unlikely that it had been overlooked so it is either a genuine Irish rarity or a recent arrival. One was knocked from hazel foliage on the wood edge, Cpt 14.

The true Irish status of these barkflies is difficult to assess as the group is studied by very few people. The limited data available does suggest that *A personatus* is a clear case of a recent arrival but the other two species are conceivably genuinely rare and localised natives. Even if the data may suggest recent arrivals, this may actually reflect natural range expansion in response to global climate change. The

strong south-westerly weather patterns could easily have carried the *Atlantopsocus* species naturally into Ireland – the first discoveries of *A personatus* came from Counties Cork, Limerick and Kerry. Barkflies are regularly found in studies of aphids being carried in high level air currents.

Figure 5: Barkfly *Psococerastis gibbosa* on mossy branch in St John's Wood

True Bugs (Hemiptera)

A total of 53 species of true bug were identified. Emphasis was placed on the Heteroptera of which 39 species were identified, the rest being Auchenorrhyncha (mainly leaf hoppers) - no Sternorrhyncha (aphids, jumping plant lice, whitefly, scales, etc) were identified, although aphids and plant lice are certainly present in the wood. As with the spiders, this fauna is very much typical for a large area of broadleaved woodland in Ireland.

The pirate bug *Orius laticollis* is probably the most significant find as this species was first recognised as occurring in Ireland only in 1999 and 2000 when it was found in two localities in County Clare (Aukema *et al* 2006). It is most often found on willow foliage in permanently humid conditions. One was taken in the flight trap operated within Cpt 7.

A few other tree canopy species found in St John's Wood are also rarely recorded in Ireland and may be genuinely uncommon. The plant bugs (Miridae) are a very neglected group, and yet there is good identification literature available. *Miris striatus* is a large and distinctive plant bug with relatively few

Irish records; it lives in the canopy of broad-leaved trees and shrubs, feeding on soft-bodied insects such as aphids and moth caterpillars. Both *Psallus flavellus* and *Psallus wagneri* were first reported in Ireland by Alexander & Foster (1999) and no records have been published subsequently. These original records came from Northern Ireland so it would seem likely that both are widespread in Ireland but overlooked. The former feeds on the foliage of ash, the latter on oak. The genus *Psallus* can be very difficult to identify to species level and often requires dissection – samples taken from regrowth in the coups of Cpts 7 and 9 were taken for dissection and *P. wagneri* found to be plentiful here. One further species is worthy of special mention, *Phytocoris reuteri*, as it too has rarely been reported in Ireland – Massee (1958) was the first to notice its presence, from Belfast and County Armagh, but there have been no further Irish records (B. Nelson, pers. comm.). It was taken in the flight traps in Cpts 7 and 15 during the 2010 studies, and also knocked from a live hazel on the fen edge to Cpt 14. It feeds on soft-bodied invertebrates such as aphids, small caterpillars and barkflies.

Moths and butterflies (Lepidoptera)

The Lepidoptera of St John's Wood were surveyed in parallel to the main invertebrate survey, by Ken Bond . Casual observations were also made during the main survey. In total 239 species of Lepidoptera were recorded, including 10 butterfly species

BUTTERFLIES

The most interesting butterfly species noted in the wood are as follows:

- Cryptic Wood White *Leptidea juvernica* (this is the name for the common Irish wood white, previously known as Réal's Wood White *Leptidea reali*)
- Brimstone *Gonepteryx rhamni*
- Holly Blue *Celastrina argiolus*
- Silver-washed Fritillary *Argynnis paphia*

These were mainly seen along the open sunny rides of the south-eastern parts of the wood and along the outside margins.

Cryptic Wood White is relatively widespread in Ireland, but - despite its common name - is not actually a woodland species. It is a species of rough native vegetation in open sunny situations, the larvae feeding on meadow vetchling and bird's-foot trefoil (Thompson & Nelson 2006). It was widely seen along the newly opened ride network in the south-east section of the wood, and these may provide the open conditions it needs for breeding.

Brimstone is a characteristic species of scrubby land on limestone and has a patchy distribution in central Ireland - central Roscommon is at the northern edge of its current range. Its larvae feed on the leaves of buckthorn, a plant which occurs widely along the thorny margins of St John's Wood.

Holly Blue has formerly been most widespread in the southern counties but the population has expanded in recent decades (B. Nelson, pers. comm.). The larvae of the first brood feed on the flowers and developing fruits of female holly trees, the second brood developing on the flowers of ivy. The species will therefore mainly be breeding around the woodland margins at present but may be expected to spread into the interior as the open ride network develops.

Silver-washed Fritillary is closely tied to mature broad-leaved woodland with sunny rides and glades. The larvae feed on woodland violets. It is assumed that this butterfly has colonised St John's Wood since the ride network has been opened up, although it is feasible that it hung on around the woodland margins. Butterflies were seen in small numbers in the cut-over areas of Cpts 8 and 9.

A total of ten species of butterfly were seen in the wood during the year. Purple hairstreak *Neozephyrus quercus* was discovered in St John's Wood in 2005. It is an arboreal species, the adults spending virtually all their time in the canopy of oak, the sole food-plant. Green Hairstreak *Callophrys rubi* is the main candidate for an overlooked resident species – the larvae would be feeding on gorse or birch around the woodland margins. It is also feasible that the wood may become colonised by certain browns once the opened-up ride network begins to stabilise, especially Ringlet *Aphantopus hyperantus* which favours luxuriant growth of grassy vegetation along woodland rides.

MICROMOTHS

The total number of micro-moths found during 2010 reached 96 species. One, the tortricid *Ancylis diminutana* is new to the Irish list; the larva feeds on the foliage of willows *Salix* spp in wetland situations, spinning a leaf into a pod in which it lives. A single female was taken by the Skinner trap operated on the western margin of the wood at M996563. There are also a number of species which are rare in Ireland, the buckthorn-feeders being prominent among these: most notably the tortrix *Phtheochroa sodaliana*, which was only known previously from Ballyeighter Wood, Co. Clare, and *Stigmella catharticella*, not previously known from County Roscommon. The larvae of the former develops in the berries, while the latter mines the leaves – neither are known to use alder-buckthorn as an alternative host.

Additional Microlepidoptera of note were:

- *Coleophora striatipennella*, whose case-bearing larva feeds on *Stellaria* and *Cerastium* spp.;
- *Teleiodes wagae,* otherwise known only from limestone areas of the west and one site in Offaly (foodplants birch and hazel.);
- *Apotomis turbidana*, a local species feeding on birch.

Table 6. Additional species of Lepidoptera recorded from St John's Wood in earlier surveys

Species	Year recorded
Anthophila fabriciana	1999
Depressaria daucella	2000
Drymonia ruficornis	2000
Ectoedemia occultella	2000
Endrosis sarcitrella	2000
Nematopogon schwarziellus	2000
Phyllonorycter blancardella	1999 & 2000
Phyllonorycter cydoniella	1999
Phyllonorycter rajella	1999
Phylloporia bistrigella	1999
Pieris rapae	2005
Psychoides filicivora	1999

LARGER MOTHS

The total number of maco-moths found reached 133 species. These include a number of species which are rare in Ireland, with buckthorn-feeders again prominent: the Dark Umber *Philereme transversata* and The Tissue *Triphosa dubitata*; these are new to the County Roscommon moth list. The larvae of the latter can also feed on the foliage of alder-buckthorn.

Also noteworthy is the record of several Orange Moth *Angerona prunaria*, a rare species in Ireland, and not otherwise known this far north. The larvae feed on the foliage a wide variety of field layer plants, trees and shrubs, in both woodland and heathland situations.

The Sprawler *Asteroscopus sphinx* is another rare species in Ireland; it is known from just a few records from south Clare to Co Armagh (B. Nelson, pers. comm.) The larvae are arboreal, feeding on the leaves of various broad-leaved trees, and found in a wide variety of situations.

Other local or scarce Macrolepidoptera species recorded were:

- *Acronicta alni* (Alder Moth), a scarce species not previously recorded from Co. Roscommon or adjacent areas;
- *Craniophora ligustri* (The Coronet), a species largely confined to limestone districts of the west; foodplant ash.

- *Dicallomera fascelina* (Dark Tussock), a species only known from a restricted area of the Irish midlands and a small area in the north of Co. Armagh.
- *Diloba caeruleocephala* (Figure of Eight), a local, mainly midland species, whose larva is reported to feed on hawthorn, blackthorn and apple.
- *Eupithecia valerianata* (Valerian Pug), a very local and mainly western species.
- *Eupsilia transversa* (The Satellite), another very local species whose larva is reported to feed on a wide range of deciduous trees.
- *Hypena crassalis* (Beautiful Snout), a species largely confined to mature woodland sites, and not previously recorded from Co. Roscommon or the adjacent midland counties, foodplant bilberry, growing in sheltered woodland habitats.
- *Ligdia adustata* (Scorched Carpet), a widespread but local species whose foodplant is spindle.

The western margin of the woodland, adjoining St John's Fen, not surprisingly exhibited the greatest abundance and number of species. It is probable that night-flying moths favour this type of habitat, as well as the wider rides, in preference to closed woodland.

A few generally abundant Irish species were notably absent, *viz*. *Spilosoma lubricipeda* (White Ermine) and *Mesapamea secalis* (Common Rustic) [dissections revealed only *M. didyma* on this site]; while otherwise abundant species such as *Apamea monoglypha* (Dark Arches) and *Agrotis exclamationis* (Heart & Dart) were scarce, clearing indicating a weak or absent association with deciduous woodland.

Two-winged flies (Diptera)

Altogether 231 species of Diptera have been identified from samples taken in the wood. Of these, 65 species were fungus gnats (Bolitophilidae, Ditomyiidae, Keroplatidae, Mycetophilidae) and these include four species not previously recorded in Ireland. The results from St John's Wood have been analysed in Alexander and Chandler (2011)

The most significant record is of *Docosia morionella* (Mycetophilidae), of which there is only one previous record from the British Isles region, a female found in 1906 at Logie in the north of Scotland. The species is rare in Europe and was only otherwise known from the type locality in Austria until one was found in a survey of the Monegros region in central Spain in 1991. The biology is not known but its habitat is assumed to be native woodland; other members of the genus have been reared from fungi or bird nests (Falk & Chandler 2005). A single male was taken in the flight trap in Cpt 15.

The other three fungus gnat species new to Ireland are *Allodia pistillata* (a male in the flight trap in Cpt 17), *Brevicornu nigrofuscum* (in all except one of the flight traps) and *Exechia cincta* (numerous in the flight trap in Cpt 7) The only rearing records for these species are of *A. pistillata* from a cup fungus *Peziza* species and of *E. cincta* from the agaric *Hygrophoropsis aurantiaca*. This particular agaric toadstool is common in conifer woodland on acidic soils, but also occurs rarely in broad-leaved woodland on calcareous soils, where it is associated with elder. *Brevicornu* spp develop in soft

terrestrial fungi. The first two are widespread throughout Britain while *E. cincta* is recorded increasingly widely in southern England and Wales.

One other fungus gnat found, *Anatella ankeli*, has few previous Irish records (two in the ancient woods of County Wicklow plus a site in County Cork) and only two records in Britain – an ancient wood on limestone in Somerset and a wooded gully in East Ross. The species is thought to develop in soft fungi, generally where fruiting on decaying wood. Single males were found in the flight traps in Cpts 7, 15, 17.

Most of the flies recorded are however common and widespread species, although some, particularly the saproxylic species, are of local occurrence in Ireland. The more significant species from a conservation aspect are:

- *Cerotelion striatum* (a fungus gnat, Keroplatidae) larvae associated with fungi fruiting from the underside of lying decaying wood; few Irish records; one male taken in the flight trap in Cpt 3
- *Dictenidia bimaculata* (a crane fly, Tipulidae) larvae develop in decaying wood of relatively large items, such as major boughs and trunks; uncommon and localised in Ireland – only 11 other sites known; two reared from larvae beneath bark on fallen bough of an oak standard on the lough-ward edge of Cpt 8;
- *Mycetobia pallipes* (Mycetobiidae) larvae feed on decomposing sap in sap-runs or beneath the bark on tree trunks; best known in Ireland from the Killarney oakwoods and Glengarriff Woods; a female taken in the flight trap in Cpt 15;
- *Neoitamus cyanurus* (a robber fly, Asilidae) larvae develop in the soil; adults feed to a considerable extent on slow-flying moths; usually in ancient oak woodland, where it favours resting on sun-lit tree and shrub foliage along rides and glades; the only robber fly which occurs inland in Ireland; mainly known the south and east; a male in the flight trap in Cpt 17;
- *Oedalea tibialis* (a dance fly, Hybotidae) larvae develop in decaying wood; uncommon and localised in Ireland; a female in the flight trap in Cpt 17;
- *Phaonia mystica* (Muscidae) larvae in decaying wood; known from several parts of Ireland; a female in the flight trap in Cpt 9;
- *Seioptera vibrans* (a picture-winged fly, Ulidiidae) adults arboreal, on tree foliage, especially in damp woodlands; few Irish records (Speight & Chandler, 1983); a female in the flight trap in Cpt 9;
- *Symmerus annulatus* (a fungus gnat, Ditomyiidae) larvae develop in rotting timber; few Irish records; a male in the flight trap in Cpt 3.

It is especially striking that the majority of these species were found as just a single individual taken in the flight traps.

Figure 6: A *Medetera* sp (Dolichopodidae) on a well-lit holly trunk in the cutover Cpt 9

Typical woodland hoverflies are also a good feature of the wood, with two species of particular note as widespread but localised species in Ireland. St John's Wood had a noticeably strong population of *Ferdinandea cuprea* in 2010. This is widely scattered in Ireland (Speight 2008) and more or less confined to areas of long-established woodland. Larvae are associated with the sap of wounds on trunks of broad-leaved trees (Stubbs & Falk 2002) and so the recent coppice cutting may be directly responsible for the present frequency of hoverflies. Adults were noticed sunning on tree trunks and re-growth foliage on many occasions in Cpts 8 and 9, while a female was also taken in the flight trap in Cpt 9.

Figure 7 Hoverfly *Ferdinandea cuprea* in St John's Wood

Portevinia maculata is also closely tied to long-established woodlands, where there are large areas of ramsons *Allium ursinum* – the larvae develop in the bulbs. The adult hoverflies sun on the leaves of ramsons in the dappled sunlight of relatively dense woodland. The hoverflies were seen widely – in Cpts 21, 22 and 26, and along the main ride between Cpts 1 and 2.

Bees and wasps (Hymenoptera)

Very few Aculeate Hymenoptera were found in St John's Wood during this study and this result is very significant. The majority of bees, wasps and ants are warmth-loving species and closed-canopy woodland is inimitable to them. The recent history of lack of active woodland management would have resulted in any species present being lost to the interior and confined to the margins. The recent return to active management has increased structural variety in the vegetation and allowed greater sun penetration. It is early days yet, but the aculeates may be expected to increase in both species-richness and abundance with time. Only twelve species could be detected in the course of the 2010 investigations, and these were all found along the newly opened-up ride network in the south-eastern part of the wood and/or around the woodland margins.

One species noted along the sheltered sunny edge to the fen adjoining Cpt 14, the bee *Anthophora plumipes*, is not currently on the Irish list. Unfortunately a voucher specimen was not retained – this is an almost ubiquitous species over much of lowland England (Edwards & Broad 2006) and its absence from the Irish list was not appreciated at the time. A female of what appeared to be this species was seen visiting flowers on a number of occasions during the April visit – it is primarily a species of early spring. The lack of a voucher means that the record must remain provisional until it can be confirmed in future seasons.

A single queen of Large Red-Tailed Bumblebee *Bombus lapidarius* was also noted during the same visit, this time along the open ride between Cpts 1 and 2. This species is listed as Near Threatened in the Irish Red List (Fitzpatrick *et al* 2006) as the Irish population is declining through habitat loss. It is primarily a species of open habitats and the single queen was presumably only exploring the ride system from a population centred close by.

All of the other ten species observed have been assessed as being of Least Concern in the Red List. Nonetheless, a few of these are worthy of further comment in having patchy and localised distributions within Ireland.

Only two solitary bee species were found along the ride network and these are both widespread species *Andrena haemorrhoa* and *A. subopaca*, although two species of bee parasite were also present: the homeless bee *Nomada leucophthalma* and the wasp fly *Myopa testacea*. High levels of parasite loading is considered to be a sign of a high quality assemblage and so the presence of two parasites with such a

restricted host assemblage suggests that these species are colonising the wood from a high quality assemblage living close by – perhaps on the adjoining fen. The *Nomada* is a cleptoparasite (cuckoo) of *Andrena* bees although the known hosts are *A. clarkella* and *A. apicata*. It is listed as Vulnerable in the Red Lists of many other European countries and so merits monitoring in Ireland. It is known to be attracted to blossom of plants such as barren strawberry, bilberry, dandelion and sallow (Edwards & Telfer 2001). The *Myopa* is also attracted to blossom, with known flowers including ramsons, hawthorn, blackthorn, spindle, dandelion and umbellifers (Smith 1959 & 1961). The host bees are not documented but may include either *Andrena* or *Bombus* species, or even a social wasp (Vespidae).

The opening up of the woodland has also attracted in a number of stem-nesting solitary wasps, all found in the areas of coppice re-growth. *Crossocerus capitosus* mainly nests in the pith of cut stems of living ash, and it stocks the nest with various Diptera and jumping plant bugs (Psylloidea) (Richards 1980). *Rhopalum clavipes* nests in the stems of a wide range of plants including ash, bramble and elder, either excavating a cavity or making use of existing cavities such as abandoned beetle borings. It stocks its nests with a range of small Diptera such as fungus gnats, together with bugs and barkflies.

The other solitary wasp noted is a mason wasp *Ancistrocerus oviventris*. Like the other wasps, this is an aerial nester, but builds a mud daub structure on the surface of a wall. The nest is stocked with moth caterpillars, usually tortricids (Edwards 1998).

Beetles (Coleoptera)

The beetle fauna of St John's Wood has proven to be of considerable interest for species which feed in the canopy of trees and shrubs, and also for wood-decay species. There is also some interest in ground-living species.

The most significant find is of the weevil *Acalyptus carpini* (Curculionidae) as this has never been reported from Ireland before. Two specimens were taken while sweep-netting close to the lough shore in Cpt 10 and close to the ride along the south side. The larvae of this weevil inhabit the female catkins of various willows *Salix* spp, and in Britain it is known from fens and bogs rather than woodlands. It is assumed that the species is an overlooked native in Ireland.

Further canopy weevils of interest were also found. *Polydrusus pilosus* was added to the Irish list from County Kildare (O'Mahony 1935) and has only been found once since, in Northern Ireland a few years ago (M.G. Morris, pers. comm.). It may be genuinely rare in Ireland as other active recorders have failed to detect it. The adults feed on the foliage of a wide variety of trees but especially conifers, while the larvae are root-feeders. One was taken by the flight trap in Cpt 7. *Polydrusus mollis* is more widespread but still very local in Ireland and perhaps more associated with ancient woodlands. It was found to be numerous on hazel re-growth in the recently cutover areas.

Canopy soldier beetles (Cantharidae) are also of considerable interest, with St John's Wood being one of notably few Irish woodlands known to support populations of all three of *Podabrus alpinus*, *Cantharis pellucida* and *Malthodes guttifer*. While these species have been reported individually from a wide range of sites, woods with all three are exceptional. These are predatory beetles, feeding on other insects amongst tree foliage. The larvae of the *Malthodes* may preferentially live on tree trunks, specialising on passing insects, or be saproxylic. A single *P. alpinus* was taken in the flight trap in Cpt 26, while *C. pellucida* was found on ash foliage in Cpt 9. *M guttifer* was taken in the flight trap in Cpt 7.

The specialist beetle fauna of decaying wood (saproxylic) has proved to be surprisingly rich in St John's Wood. Given the history of exploitation for timber products, this fauna might be expected to be of limited interest. However, the size of the wood and its history of multiple ownership appear to have enabled a relatively species-rich assemblage to persist. Traditional woodland management may even actually favour certain species (see section 3.3.1).

The recent studies of the PLANFORBIO project (R. Martin, pers. comm.) have found very high species richness in St John's Wood for both canopy spiders and beetles, in relation to the other native woodlands sampled (only Brownstown Wood in Co. Kilkenny was higher for beetles). The three rarities they found in St John's Wood were the soldier beetle *Malthodes guttifer*, the false darkling beetle *Orchesia minor* and the shining fungus beetle *Tetratoma ancora*. Unfortunately the full details of their findings are not yet published. *M guttifer* (see preceding paragraph) and *T ancora* were both also found here in 2010.

Tetratoma ancora appears to be genuinely rare in Ireland – it has only so far been reported from Counties Down and Derry (Alexander 2009) and the PLANFORBIO work only found it here (Martin *et al* 2010). During 2010 it was found in the flight traps in Cpts 2, 9 and 26, suggesting a large population. It is most readily found on standing dead hazel stems in ancient semi-natural woodlands where it feeds on wood-decay fungi.

Orchesia minor is also a rarity although the PLANFORBIO studies found it in five counties (Donegal, Fermanagh, Leitrim, Roscommon and Tipperary). It was previously only known from Counties Antrim, Down, Fermanagh and Kerry (Alexander 2009). It too is best known from dead hazel stems but may also be found on a wide range of broadleaves on small dead stems and twigs. It was sought in St John's Wood during the 2010 studies but only *O. undulata* found on dead hazel stems – in Cpts 3, 7 and 8. The latter is another uncommon species in Ireland.

The rarest wood-decay beetle found during the 2010 survey is however the anobiid *Dorcatoma dresdensis*. This is a long-established but overlooked old growth relict species in Ireland, only otherwise known from the ancient parkland trees of Crom Castle in County Fermanagh (Alexander 2009). The larvae develop in bracket fungi of the genus *Inonotus* - in this case *I. radiatus* fruiting from

standing dead alder stems - and occupied brackets were found towards the lough edge in Cpts 19 and 24. The larvae were originally assumed to be of the more widespread *Orchesia micans*, but samples were kept for rearing and proved to be the *Dorcatoma*.

Four species of longhorn beetles (Cerambycidae) were found during 2010: *Alosterna tabacicolor*, *Grammoptera ruficornis*, *Pogonocherus hispidulus* and *Rhagium bifasciatum*. *P. hispidulus* is the rarest of these, apparently previously known only from five counties – Kerry, Wicklow, Armagh, Down and Antrim. It appears to develop in aerial dead branches and stems of a wide variety of broad-leaved trees and shrubs but is probably best known from hazel and apple. *A tabacicolor* is best known from southern counties but has been reported from as far north as Counties Fermanagh, Sligo and Down. It develops in old moist decaying stumps. The adults of many longhorn beetles are attracted to blossom for nectar and pollen, but *P hispidulus* is unusual in not being found at blossom.

A wide range of other apparently rare or uncommon saproxylic beetles were also found – many are small species and readily overlooked:

Euplectus piceus (Pselaphidae – short-winged mould beetles) A rare species in Ireland and previously only known from an old record from the Killarney oakwoods; one under bark on large fallen oak branch beneath standard oak on lough side of Cpt 8; another in flight trap in Cpt 9; Habitat is large items of decaying wood, where found beneath loose bark and in decaying wood beneath;

Bibloporus bicolor (Pselaphidae – short-winged mould beetles) A rare species in Ireland and previously only known from two old records – the Killarney oakwoods and Powerscourt demesne; one from flight trap in Cpt 9; Habitat much as for preceding species;

Stenichnus bicolor (Scydmaenidae – stone beetles) A rare species in Ireland and previously only known from an old record in County Cork; one in flight trap in Cpt 3; Lives beneath loose bark on deadwood and in the moist crumbly rotten wood beneath, where feeds on mites; favours the moister conditions of the west;

Homalota plana (Staphylinidae – rove beetles) A rare species in Ireland and previously only known from the Killarney oakwoods area and one site in County Armagh; a few found beneath bark on the fallen oak bough by Cpt 8; Feeds on detritus and fungi beneath loose bark on large items of deadwood;

Agathidium nigripenne (Leiodidae) A rare species in Ireland and only previously reported from northern counties – Mayo, Donegal, Armagh and Derry; taken in numbers in the flight traps in Cpts 15, 21 and 26; also found with *Daldinia* fungus on the collapsed tree across the ride between Cpts 19 and 20; Associated with wood-decay fungi on lying rotting wood in moist situations;

Cerylon ferrugineum (Cerylonidae) Scarce in Ireland and only previously reported from Counties Kerry, Galway, Sligo, Tyrone; taken in flight traps in Cpts 3 and 15; Feeds on fungal hyphae and spores beneath bark on deadwood within a few years of death;

Cis festivus (Ciidae, a minute tree fungus beetle) A scarce species in Ireland, only previously reported from seven counties; one knocked from standing dead hazel stem in Cpt 8; Develops in the fruit bodies of small encrusting fungi on standing deadwood, especially on hazel stems;

Magdalis carbonaria (Curculionidae, weevils) first identified as Irish when Halbert (1922) discovered it in Powerscourt Deerpark, County Wicklow in 1919. It was not reported again until Alexander (1997) rediscovered it elsewhere in that county. The author has also found it in County Derry (unpublished). The beetle bores into dead logs, large branches and trunks of birch; one was found on the log stack at the lower end of the ride between Cpts 8 and 10;

Acalles roboris (Curculionidae, weevils) The rarest of the *Acalles* spp, known previously only from Counties Kerry, Carlow and Wicklow; found in the flight trap in Cpt 15 and on ivy by the wood entrance; Larvae develop in dead twigs, particularly of oak.

The ground beetles sampled by pitfall-trapping proved to be a very typical assemblage from broad-leaved woodland. The most interesting find is the uncommon *Badister sodalis* as this is a speciality of marshy woodlands on eutrophic watersides (Anderson *et al* 2000). Single individuals were pitfall trapped in Cpts 15 and 21. The frequency of the ground weevil *Barypithes araneiformis* is also of interest as this is an uncommon species, previously known from only eight vice counties (Morris, 1993). Its biology is little known but it is usually found in leaf litter. It is widespread in St John's Wood, and was found by suction sampling in Cpts 3, 7, 9, 17, 21 and 26 – it was missing only from the samples taken in Cpts 2 and 15.

Good (2002) reported on his studies of Staphylinidae and Carabidae in the nearby Rindoon Wood, but his methodologies and timing are too different to that used in St John's Wood to provide a basis for direct comparisons. The ground beetle fauna found by him, however, is broadly similar to that found in St John's Wood.

Ecological analysis

St John's Wood lies on limestone bedrock. Soils are however mostly deep – greater than 9cm (see pitfall trapping methodology, 2.3) – and the influence of the limestone limited as a result. The main

consequence of the limestone bedrock is that there are no permanent freshwater situations available within the wood, only temporary muddy pools in hollows and rut-puddles along the rides – no streams or seepages. The fluctuating water levels in the lough mean that marginal areas of the woodland are periodically inundated for extended periods of time. Those seasonally flooded areas were relatively poorly studied as the trapping stations were established at a time of exceptionally high flooding of the wood and were necessarily established on the highest and driest areas. The wood is essentially a dry one, albeit surrounded by lough and fen.

Wood-decay invertebrates (saproxylics)

Saproxylic invertebrates are the only assemblage to have been analysed at a whole Ireland level (Alexander 2002); 615 Irish saproxylics were known at that time, although this figure has increased slightly since then. A total of 112 invertebrate species were recorded in St John's Wood during the study in 2010 – this represents about 18% of the total Irish fauna. The only comparative work readily accessible is a survey of the best Northern Ireland parkland sites in 2006 which found 200 saproxylic invertebrate species across the six study sites (Alexander *et al* 2007). The species composition found by these two studies has very limited overlap, reflecting the very different nature of ancient woodland saproxylics from those of historic parklands. Both types of site are rich in species that are likely to be relicts of Ireland's old growth. The key differences are the large old open-grown form trees of the parklands and the combination of younger tree growth and denser shadier conditions of St John's Wood.

This high percentage of the total saproxylic invertebrate fauna is very typical for ancient woodlands, wood pastures and historic parklands. Elton (1966) commented that 'dying and dead wood provides one of the two or three greatest resources for animal species in a natural forest' and 'if fallen timber and slightly decayed trees are removed the whole system is gravely impoverished of perhaps more than a fifth of its fauna. Hammond (1993) has demonstrated that in one of the top British sites for saproxylic beetles (Richmond Park, London) about a quarter of the beetle species present are wood dependent. While St John's Wood – with is history of management as coppice with standards – would not be expected to be as rich as this, it is clearly of considerable importance for saproxylic invertebrates in an Irish context.

Table 7 presents the full list of saproxylic invertebrates found during 2010. The eight trapping stations offer more or less standardised recording effort and therefore enable direct comparisons of species-richness across the wood. The species totals vary from 11 to 47, although six of the eight were all in the range of 11 to18 species, with Cpts 7 and 9 outstanding for their high species-richness. This is an interesting result as these two trapping stations were the two recently cut-over coppices. There is no

suggestion that the more accessible south-eastern half of the wood (trapping stations 2, 3, 7, and 9) is any different in species-richness of saproxylics to the north-western half (trapping stations 15, 17, 21 and 26). The key factor influencing species –richness in saproxylic invertebrates appears to be active management.

Table 7 Full list of saproxylic invertebrates found in St John's Wood during 2010, organised by compartment number and trapping station (the numbers in the cells are the compartment numbers, to aid visual scanning of the data)

*Notable species

Species	Compartment numbers								
	2	3	7	9	15	17	21	26	Other
Coleoptera									
Anobiidae									
Anobium punctatum			7						
*Dorcatoma dresdensis**									19, 24
Grynobius planus	2		7	9	15		21	26	
Ochina ptinoides			7					26	
Ptilinus pectinicornis				9					
Cantharidae									
Malthinus flaveolus				9					8
*Malthodes guttifer**			7						
Malthodes marginatus			7						5
Cerambycidae									
*Alosterna tabacicolor**								26	
Grammoptera ruficornis			7	9		17			8
*Pogonocherus hispidulus**				9					
Rhagium bifasciatum					15				
Cerylonidae									
*Cerylon ferrugineum**		3			15				
Cerylon histeroides									8, 11
Ciidae									
Cis boleti			7						
*Cis festivus**									8
Octotemnus glabriculus	2						21		13, 19, 20
Cryptophagidae									
Cryptophagus dentatus agg									

Species	Compartment numbers								
	2	3	7	9	15	17	21	26	Other
Cryptophagus scanicus			7						11
Curculionidae									
Acalles ptinoides		3					21		
*Acalles roboris**					15				1
Euophryum confine			7						
*Magdalis carbonaria**									8
Elateridae									
Denticollis linearis									
Latridiidae									
Aridius nodifer		3			15			26	1, 11, 19, 20
Leiodidae									
*Agathidium nigripenne**					15		21	26	19, 20
Anisotoma humeralis		3		9			21		11
Lucanidae									
Sinodendron cylindricum									8
Melandryidae									
*Orchesia undulata**		3	7						8
Nitidulidae									
Epuraea melanocephala		3							
Glischrochilus hortensis									8
Pselaphinae									
Bibloporus bicolor				9					
*Euplectus piceus**				9					8
Ptiliidae									
Ptinella cavelli	2								
Salpingidae									
Rhinosimus planirostris									1
Rhinosimus ruficollis			7						
Scolytinae									
Trypodendron domesticum									8
Scraptiidae									
Anaspis frontalis				9					8
Anaspis rufilabris		3	7	9					
Scymaenidae									
*Stenichnus bicolor**		3			15				

Species	Compartment numbers								
	2	3	7	9	15	17	21	26	Other
Staphylinidae									
Atrecus affinis									8
Gyrophaena affinis	2	3				17		26	
*Homalota plana**									8
Quedius mesomelinus		3							
Tetratomidae									
*Tetratoma ancora**	2			9				26	
Diptera									
Anisopodidae									
Sylvicola cinctus	2			9		17	21	26	
Clusiidae									
Clusia flava			7			17			
Clusiodes sp			7						
Dolichopodidae									
Medetera abstrusa			7						8
Medetera impigra				9					
Medetera muralis				9					
Sciapus platypterus		3	7	9	15		21	26	
Drosophilidae									
Drosophila subobscura				9		17			
Hirtodrosophila cameraria				9					
Hybotidae									
*Oedalea tibialis**						17			
Tachypeza nubila			7	9			21		8
Lauxanaiidae									
Peplomyza litura			7						
Pseudolyciella stylata			7						
Muscidae									
Helina pertusa			7	9					
*Phaonia mystica**				9					
Phaonia pallid				9					
Phaonia rufiventris			7						
Mycetobiidae									
*Mycetobia pallipes**					15				
Opetiidae									

Species	Compartment numbers								
	2	3	7	9	15	17	21	26	Other
Opetia nigra						17	21		
Pallopteridae									
Palloptera ustulata			7						
Scatopsidae									
Apiloscatopse scutellata			7						
Syrphidae									
*Criorhina berberina**									22
*Ferdinandea cuprea**				9					8
Myathropa florea									8
Xylota segnis	2		7	9					1
Sciarioidea									
Bolitophila occlusa						17			
*Symmerus annulatus**		3							
*Cerotelion striatum**		3							
Macrocera stigma			7						
Macrocera stigmoides			7						
Macrorrhyncha flava			7						
Orfelia fasciata		3							
Acnemia nitidicollis	2		7	9		17		26	
Allodia grata			7						
*Anatella ankeli**			7		15	17			
Ectrepesthoneura hirta			7	9					
Exechia fusca			7						
Exechia parva			7						
Monoclona rufilatera						17			
Mycetophila cingulum			7						
Mycetophila fungorum						17			
Mycetophila ornata				9					
Mycomya annulata			7		15	17		26	
Mycomya cinerascens		3	7	9		17			
Phronia braueri								26	
Phronia conformis			7						
Phronia nitidiventris						17			
Phronia tenuis	2		7			17			
Polylepta guttiventris			7	9			21		

Species	Compartment numbers								
	2	3	7	9	15	17	21	26	Other
Saigusaia flaviventris				9					
Tetragoneura sylvatica			7		15				
Leptosciarella rejecta			7						
Trichosia morio									
Zygoneura sciarina								26	
Tipuloidea									
Austrolimnophila ochracea		3	7	9	15	17		26	8
Epiphragma ocellare		3	7	9	15	17			8
Neolimonia dumetorum			7						
Rhipidia maculata	2		7	9				26	
*Dictenidia bimaculata**									8
Tipula irrorata			7						
Tipula scripta	2	3	7	9	15			26	
Hymenoptera: Sphecidae									
Crossocerus capitosus									
Rhopalum clavipes									
Rhopalum coarctatum									
Diplopoda									
Proteroiulus fuscus							21	26	8, 22
Cylindroiulus punctatus				9	15		21		22
Mollusca									
*Limax cinereoniger**									5, 8
Total saproxylic species	11	18	47	34	16	18	12	17	30
Total notable species (*)	1	5	2	6	5	2	1	3	11

Focusing on the more notable finds rather than species-richness provides a different perspective. This time the range is from 1 to 6 species. Each trapping station produced a minimum of one species of particular conservation interest, with Cpt 9 producing the maximum total of 6 notable species, and Cpts 3 and 15 a total of 5 notable species. This data appears to merely suggest that the woodland is equally interesting across the site, with no evidence that one half is more interesting for saproxylic invertebrates than the other, nor are the cut-over coppices better for the more interesting species. The inference is that cutting coppice increases the abundance of the more widespread saproxylic invertebrates that are active in the area. This is very understandable as coppice cutting will result in

the release of large volumes of volatile organic chemicals characteristic of exposed sap and dead wood – it also results in large stacks of cut timber being left on site and exposure of the retained standard trees to increased light levels on their trunks. The data from the present study suggests that coppicing attracts and concentrates a large range of saproxylic invertebrates into the area from neighbouring stands of trees.

Direct investigation of the stacked coppice wood resulted in the discovery of a number of saproxylic beetles which were otherwise not detected in the wood in 2010. The stack along the ride between Cpts 10 and 8, and derived from cutting Cpt 8, was the best in this respect. The rare birch deadwood weevil *Magdalis carbonaria* was observed here, as were the ambrosia beetle *Trypodendron domesticum* and the sap beetle *Glischrochilus hortensis*. The beetle *Cerylon histeroides* was only found in a fallen birch trunk in Cpt 8 and stacks of wood along the main ride on the southern edge of Cpt 11. These species are all uncommon across Ireland and confined mostly to the better quality sites, although *Magdalis carbonaria* has only been found in a very small number of sites. None of these were taken in the flight traps – the most likely explanation appears to be that the stacks of cut timber act as honey-pots for these species but that their actual abundance on site is relatively low, so low that the probability of blundering into a flight trap is very low.

The stands of old 'stored' hazel coppice have special interest for a number of notable deadwood beetles. Of greatest interest is the presence of the rare shining fungus beetle *Tetratoma ancora*, which appears to have a substantial population suggested by its presence in flight traps operated in Cpts 2, 9 and 26. This species is best known from aerial dead hazel stems in old hazel stands, where the larvae feed on the decay fungi. These dead hazel poles also provide habitat for species such as the minute tree fungus beetle *Cis festivus* and the beetle *Orchesia undulata*. It is also typical habitat for another rare beetle *Orchesia minor*, found here by the PLANFORBIO project by fogging a few years ago.

Despite the lack of strong evidence for any species being particularly associated with the less disturbed north-western half of the wood rather than the more accessible south-eastern section, a few species were only found beyond the large wall: the beetles *Dorcatoma dresdensis** (Cpts 19 & 24), *Alosterna tabacicolor** (Cpt 26), *Rhagium bifasciatum* (Cpt 15), *Agathidium nigripenne** (Cpts 15, 19, 20, 21 & 26), and the flies *Oedalea tibialis** (Cpt 17), *Mycetobia pallipes** (Cpt 15), *Opetia nigra* (Cpts 17 and 21), *Bolitophila occlusa* (Cpt 17), *Monoclona rufilatera* (Cpt 17), *Mycetophila fungorum* (Cpt 17), *Phronia braueri* (Cpt 26), *P. nitidiventris* (Cpt 17), and *Zygoneura sciarina* (Cpt 26). Many of these were of only a single individual and so not necessarily of any significance. However, the beetle *Agathidium nigripenne* was found across a number of compartments, and is known in Britain to favour relatively undisturbed and shady woodlands (Alexander, 2002). *Dorcatoma dresdensis* was developing in the bracket fungus *Inonotus radiatus* fruiting on standing dead alder stems, and Cpts 19 and 24 held the greatest

concentration of habitat found in the wood in 2010. These two notables may therefore be genuinely associated with the relatively undisturbed north-western half of the wood.

The same approach also demonstrates that a large number of saproxylic invertebrates were only found in the more disturbed south-eastern half of the wood. Amongst the notable species are: the beetles *Malthodes guttifer* (Cpt 7), *Pogonocherus hispidulus* (Cpt 9), *Cis festivus* (Cpt 8), and *Orchesia undulata* (Cpts 3, 7 and 8), and the flies *Phaonia mystica* (Cpt 9), *Ferdinandea cuprea* (Cpt 8 and 9), *Symmerus annulatus* (Cpt 3), and *Cerotelion striatum* (Cpt 3), and ash-black slug *Limax cinereoniger*. These were again mostly single specimens. However, the longhorn beetle *Pogonocherus hispidulus* was taken in the flight trap in Cpt 9 and an individual seen on hazel re-growth along an adjacent ride, suggesting that this species is responding to the active management. The hoverfly *Ferdinandea cuprea* was also regularly seen sunning in cutover areas. Ash-black slug *Limax cinereoniger* was only found in cut-over coppices. In contrast the beetle *Orchesia undulata* was found on standing dead hazel poles in the uncut compartments, together with the minute tree fungus beetle *Cis festivus*. These two species were only found during an additional targeted search – unsuccessful - for *Orchesia minor*; the search was only carried out in Cpts 3, 7 and 8.

A group of other species may be more strongly associated with the larger and more varied timber provided by the standard trees within the coppices. Examination of a single fallen main branch collapsed beneath the standard oak between the cut-over area of Cpt 8 and the lough revealed a very interesting assemblage of saproxylics, mostly species not detected elsewhere in the wood: larvae of the cranefly *Dictenidia bimaculata* and adult beetles of *Euplectus piceus* and *Homalota plana*. These are all notable species in Ireland. *E. piceus* was also taken in the flight trap in Cpt 9. The well-lit tree trunks also provide ideal display and hunting grounds for the dolichopodid flies of the genus *Medetera*, which were found to be numerous in the cut-over sections of Cpts 7, 8 and 9, but not found elsewhere in the wood.

Figure 8. The fallen oak main branch in Cpt 8 which yielded larvae of the rare cranefly *Dictenidia bimaculata* and two rare beetle species

In conclusion, this analysis suggests that:

- all compartments of the wood have significant interest for saproxylic species;
- the less disturbed woodland beyond the wall does appear to have some special additional interest;
- the stands of old 'stored' hazel coppice have special interest for a number of notable deadwood beetles;
- recent cutting of sections of the old coppices has significantly increased the abundance of saproxylic invertebrates active within those parts of the wood;
- the stacks of cut timber are acting as honey-pots for specialist invertebrates;
- the old standard trees support a different suite of saproxylic species to the coppiced trees and shrubs.

Epiphyte associated invertebrates

St. John's Wood is known to be an interesting site for lichens. The standard ash trees would normally be a key focus for epiphytic lichens but the trunk flora of the remaining trees is sparse due to selective felling in the last 50 years or so (H. Fox, pers. comm.). The lichen highlights of St. John's Wood include *Heterodermia obscurata* on willow and *Pannaria conoplea* (on hazel, status unclear, not seen since early 1990s). The latter lichen has been seen in one spot in a wood on the east side of Lough Ree, so it still persists in the general area. The current closed canopy conditions across most of the wood also limit light levels on trunks, with the consequence that mosses tend to be favoured over lichens.

A total of 28 trunk specialist invertebrates were recorded in St John's Wood during 2010 – specialist feeders on the epiphytic algae, mosses and lichens, as well as specialist predators. These are dominated by barkflies which are amongst the more diverse of the grazing and browsing invertebrates – see 3.2.4. A total of 17 species of barkfly were identified in the wood in 2010. There appear to be about 42 species which are thought to be native to Ireland, so the St John's Wood list represents about 40% of the Irish fauna. As epiphyte associates however, well-lit tree trunks provide more suitable habitat, and dense woodland may be expected to be relatively species-poor. Comparable data is available only for Northern Ireland parklands where the site lists ranged from 16 to 23 species (Alexander *et al* 2007). This suggests therefore that the St John's Wood list is likely to be relatively species-rich for a woodland situation.

Comparisons across the wood are problematic with the barkflies as many were found by sweep-netting and canopy beating, and these techniques were not carried out in a standardised manner across the site – for practical reasons. However, the three most interesting species - *Atlantopsocus personatus*, *Loensia fasciata* and *Trichadenotecnum sexpunctatum* – were all found in the well-lit situations provided by the cutover coppice areas and/or the woodland margins. A female *Atlantopsocus* sp and the single *Loensia fasciata* were both taken in the flight trap operated in Cpt 7, while a male *A. personatus* and a *T. sexpunctatum* were both swept from hazel foliage along the woodland edge by the fen (Cpt 14). Clearly well-lit situations are favoured by the more interesting barkfly species known from the wood.

The other main group of grazers and browsers is the molluscs. The wood was found to be supporting a very characteristic assemblage of common and widespread trunk molluscs.

Three moth species with epiphytic larvae are also present: common footman *Eilema lurideola*, Least Black Arches *Nola confusalis*, and the pyralid *Eudonia mercurella*.

Just two species of specialist predatory bugs were found in association: *Phytocoris reuteri* and *Temnostethus gracilis*. The latter is a widespread species in Ireland (Halbert 1935), while the former appears to be much less well-known. Other predatory invertebrates active on the tree trunks include the harvestman *Megabunus diadema* and the spider *Drapetisca socialis*.

The main conclusion from the epiphyte fauna is that increasing the light levels within the wood – by coppice cutting and ride widening – will favour the fauna and draw more species into the interior of the wood from their refugia on the woodland margins.

Canopy foliage invertebrates

Canopy sampling presents practical difficulties as it is largely inaccessible to the standard entomological techniques of hand held nets and direct observation. These necessarily bias the data

towards the more accessible tree and shrub foliage – in cutover coppices and along rides and the woodland margins. The PLANFORBIO project (Martin *et al* 2010) avoided this problem by using canopy fogging, but this is a labour-intensive methodology and involves the use of knock-down chemicals, making in outside the scope of the budget for the 2010 project. Moths with arboreal larvae are of course taken by light trapping and so are better recorded. The flight traps operated in 2010 provide a standardised approach but tend to produce rather small catches of true foliage invertebrates – they are nonetheless the only source of standardised data for comparisons across the wood.

A total of 210 invertebrate species were found which specialise in feeding on the living parts of trees and shrubs – the foliage, buds, flowers and seeds. While abundance of most of these species appeared relatively low during direct sampling – partly due to poor weather conditions during the key part of the year - the flight trapping was able to demonstrate the broad species-richness of this fauna and the light traps demonstrated the species-richness of the moth fauna. The dominant invertebrate groups are the moths with 138 species recorded, followed by plant-feeding beetles and bugs, plus predatory spiders.

A single moth species was found which had previously been overlooked as an Irish species, the tortricid *Ancylis diminutana*, a species with larvae feeding on the foliage of willows *Salix* spp. Further special interest is provided by the buckthorn associated moths, which include four species which appear to be rare in Ireland: Dark Umber *Philereme transversata*, The Tissue *Triphosa dubitata*, the tortrix *Phtheochroa sodaliana* and the nepticulid *Stigmella catharticella*. The spindle fauna is also well-represented, with Scorched Carpet *Ligdia adusta*, Spindle Ermine *Yponomeuta cagnagella*, and the less widespread Spindle Ermine *Y. plumbella* was particularly prominent during 2010. Leaf-mines of a micro-moth were noted on Irish Whitebeam leaves but could not be identified.

The canopy beetle fauna of St John's Wood was also found to be of considerable interest. The highlight was the discovery of an overlooked population of the willow weevil *Acalyptus carpini*, a species not previously reported from anywhere in Ireland. A total of 13 species of canopy weevil was found, including another Irish rarity, *Polydrusus pilosus*, and a substantial population of the uncommon *P. mollis*. Canopy living soldier beetles were also found to be of considerable interest, with two notable finds: *Podabrus alpinus* and *Cantharis pellucida*. Table 8 lists the canopy beetle species, distinguishing between those captured in flight traps and those found by other means.

Table 8 Canopy beetles, with compartment details

Species	Compartments								
	2	3	7	9	15	17	21	26	others
Cantharidae									

Species	Compartments								
	2	3	7	9	15	17	21	26	others
*Cantharis pellucida**									cut areas
*Podabrus alpinus**								26	
Rhagonycha lignosa									14 & open rides
Chrysomelidae									
Chalcoides aurea									cut areas
Pyrrhalta viburni									widely
Coccinellidae									
Adalia 10-punctata						17			5
Curculionidae									
*Acalyptus carpini**									10
Archarius pyrrhoceras		3							15
Liophloeus tessulatus									7, 8
Otiorhynchus singularis									12, 15
Phyllobius argentatus		3	7						
Phyllobius roboretanus			7					26	
Phyllobius viridiaeris			7						
*Polydrusus mollis**									cut areas
*Polydrusus pilosus**			7						
Polydrusus pterygomalis									17
Polydrusus tereticolllis									15
Rhamphus pulicarius									cut areas
Strophosoma melanogramma									
Total species	0	2	4	0	0	1	0	2	11
Notable species			1					1	3

Figure 9: Ivy weevil *Liophloeus tessulatus* in St John's Wood

The flight trap captures are of low numbers and do not provide any useful information on location across the wood. The notable species were found both sides of the dividing wall.

The canopy bugs are detailed in Table 9.

Table 9 Canopy bugs, with compartment details

Species	Compartments								
	2	3	7	9	15	17	21	26	others
Acanthosomatidae									
Acanthosoma haemorrhoidale									7, 9
Elasmostethus interstinctus									9
Anthocoridae									
Anthocoris confusus		3							
*Orius laticollis**			7						
Miridae									
Campyloneura virgule									cut rides
Cyllecoris histrionicus			7						16
Harpocera thoracica									cut rides
Lygocoris contaminatus			7						
Malacochloris chlorizans									cut rides
*Miris striatus**									cut rides
Orthotylus prasinus									cut rides
Orthotylus tenellus									cut rides
Pinalitus cervinus									cut rides
*Psallus flavellus**									cut rides
Psallus haematodes									cut rides
Psallus lepidus			7						
Psallus quercus			7						
Psallus variabilis	2								
Psallus varians			7	9					
*Psallus wagneri**			7						cut rides
Rhabdomiris striatellus									cut rides
Pentatomidae									
Pentatoma rufipes			7						
Troilus luridus									cut rides
Cercopidae									
Aphrophora alni			7			17			8, 9
Cicadellidae									
Alebra albostriella				9	15				
Alnetoidea alneti									9
Empoasca vitis				9					
Lamprotettix nitidulus			7	9					
Ribautiana tenerrima									cut rides
Ribautiana ulmi									cut rides

Species	Compartments								
	2	3	7	9	15	17	21	26	others
Total species	1	1	10	4	1	1	0	0	19
Notable species			2						2

The flight trap data suggest that the two cut-over coppice areas are richer in canopy bug species than the other compartment areas, with the trap in Cpt 7 particularly species-rich and the only one generating species of particular interest. Cpt 7 is actually the most diverse in terms of the range of tree and shrub species present (see 2.2.2), and – of course – the flight trap lay above canopy level here as the area had been cut over two years previously. Otherwise there is no evidence for any difference in canopy bugs between the two halves of the wood.

The analysis of the spider data (3.2.3) found that the most interesting records - *Nigma puella*, *Anelosimus vittatus* and *Philodromus albidus* - are all arboreal species. This does suggest a significant interest for specialist arboreal spiders. This confirms the findings of the PLANFORBIO project (R. Martin, pers. comm.) which has found very high species richness in St John's Wood for both canopy spiders and beetles, in relation to the other native woodlands sampled. The three more interesting species were all found by beating and sweep-netting the re-growth (mainly hazel) in Cpt 9. Examination of the other arboreal spider records demonstrates this sampling bias further as *Cyclosa conica* was only found by beating yew foliage where the tree had been opened up in Cpt 9, while *Anyphaena accentuata* was only found by beating hazel re-growth, also in Cpt 9.

Spiders and harvestmen are both captured while actively scrambling through the canopy, while spiders may also be captured while ballooning – some spiders are aeronauts, spinning trails of silk which catch the air currents. Although the flight trap data is rather thin (Table 10) it does suggest that the range of species and abundance does not vary much across the wood, although there is some suggestion that spider abundance is greater in the cutover coppices (Cpts 7 and 9) and that harvestmen are more numerous in the more disturbed half of the wood.

Table 10 Flight trap data for spiders and harvestmen

Species Identification	Compartment numbers							
	2	3	7	9	15	17	21	26
Spiders								
Clubionidae								

Species Identification	Compartment numbers							
	2	3	7	9	15	17	21	26
Clubiona comta			1			1		
Clubiona sp.	1				1		2	
Linyphiidae								
Gongylidium rufipes	1						1	
Kaestneria dorsalis			1					
Lepthyphantes obscurus	1							
Neriene peltata	2		3	2	2	4	2	5
Tenuiphantes sp.						1		
Tetragnathidae								
Metellina mengei	1	1	4	1			2	
Metellina merianae				1				
Metellina segmentata					1			
Pachygnatha clercki			1					
Tetragnatha montana		2	3	1	2			
Tetragnatha sp.			5	1				
Theridiidae								
Enoplognatha ovata				1				1
Paidiscura pallens			1					
Theridion sp.							1	
Total spiders	6	3	19	7	6	6	8	6
Total spider species	5	2	7	5	4	3	5	2
Harvestmen								
Leiobunum rotundum			1	2				1
Leiobunum sp.					1		1	2
Nelima gothica	1			1	1			1
Mitopus morio	2	1		1	1			2
Platybunus triangularis	3	1	3		1	1		
Total harvestmen	6	2	4	4	4	1	1	6
Total species	3	2	2	3	4	1	1	3

The most interesting species found by the flight traps were *Kaestneria dorsalis* (Cpt 7) and *Clubiona comta* (Cpts 7 and 17). *K. dorsalis* is a local money spider species favouring open woodland conditions,

while *C. comta* is also a local species in Ireland with no known preference for either open or closed canopy conditions. The thin data does actually reflect their known habits.

In conclusion, this analysis suggests that:

- The tree and shrub canopy is rich in beetles, bugs and spiders;
- There are no obvious differences between the fauna either side of the dividing wall;
- The cutover coppice of Cpt 7 was notably species-rich in canopy bugs and also includes species of special conservation interest; it is thought that this reflects the particular species-richness of the trees and shrubs here rather than the management.

Field layer invertebrates

INTRODUCTION

The field layer invertebrate fauna was found to be especially species-rich, with 146 species identified which are thought to be most strongly associated with this aspect of the woodland. This assemblage type has difficulties in definition, however, as many characteristic Diptera in particular have adults active in the field layer but their larvae develop in the upper layers of the soil and/or amongst decaying leaf litter.

This assemblage splits into species with a requirement for:

- tree and shrub canopy overhead - shade or dapple shade;
- shelter – ride and glade specialities which may also occur in other well-sheltered situations;
- relatively high humidity, provided by canopy protection and/or soil permanently moist;
- or combinations of the above.

Many do not share these additional requirements and occur both inside and outside woodlands, wherever their particular needs are met. Some are characteristic of disturbed ground vegetation and 'weedy' vegetation.

The proportions between the above sub-assemblages are clearly very relevant to the situation at St John's Wood, where coppice cutting has resumed, rides are being opened up, and light levels are increasing within the shelter provided by the trees and shrubs. Disturbance is also increasing along the ride network in the opened-up areas, while localised soil disturbance and compaction in the cut areas provides opportunities for 'weed' plants to become established. The proportions between these various assemblages will change over time and may provide a useful monitoring tool for the impact of changing woodland management.

SHADE-DEMANDING SPECIES

True shade demanding species appear to be relatively few – just 22 species were identified during the general survey (Table 11), while one moth species may also come into this assemblage type.

Table 11 Distribution of shade-demanding invertebrates by woodland compartment

Species	Compartments								
	2	3	7	9	15	17	21	26	others
Spiders									
Labulla thoracica								26	11
*Neriene peltata**	2	3	7	9	15	17	21	26	
*Pachygnatha listeri**			7	9					1
Diptera									
Bibionidae									
Bibio nigriventris		3							
Drymomyzidae									
Neuroctena anilis						17			
Empididae									
Phyllodromia melanocephala					15				
Heleomyzidae									
Suillia pallida									
Lauxanaiidae									
Meiosimyza rorida		3		9					
Minettia inusta			7						
Minettia longipennis			7		15	17			
Sciomyzidae									
Pherbellia dubia									
Syrphidae									
Cheilosia antiqua									
*Portevinia maculata**	2						21	26	1, 22
Craneflies									
Limonia nubeculosa	2		7			17	21		8
Ormosia nodulosa			7						13
Tasiocera fuscescens		3		9	15	17		26	
Nephrotoma flavipalpis			7						
Nephrotoma quadrifaria				9					
Tipula submarmorata	2	3	7	9	15				
Tipula varipennis			7	9					
Bugs									
Metatropis rufescens									1

Species	Compartments								
	2	3	7	9	15	17	21	26	others
Snails									
*Zenobiella subrufescens**	2	3	7	9	15			26	5, 11, 12, 14
Total species	5	6	10	8	6	5	3	5	7
Notable species	3	2	3	3	2	1	2	3	3

The data for the shade-demanding species demonstrates that these species are actually mostly tolerant of the temporary opening up of the canopy. Species–richness and notable species show no pattern of distribution across the wood with the exception only that Cpt 7, and to a lesser extent Cpt 9, proved to be the most species-rich. This would appear to demonstrate that the shade-demanding Diptera in particular are actively moving through areas of cutover coppice within their overall shady environment. Presumably this movement is more directed than typically found in the closed canopy areas, increasing the flight interception probability.

The one moth species which is characteristic of shady or semi-shady conditions is the Beautiful Snout *Hypena crassalis*; its larvae feed on bilberry foliage but it is primarily found in woodland situations and hardly ever on heaths and moors.

SPECIES OF SHELTERED WOODLAND RIDES AND GLADES

The assemblage of characteristic woodland species which are found especially in glades, rides and wood edge is fairly restricted at present. This assemblage is particularly difficult to define but provides a useful means of discussing a range of woodland species which would clearly be favoured by ride management and coppice cutting. Twelve species seem to best fit this category (Table 12).

Table 12 Species characteristic of open sheltered woodland rides and glades

Species	Locations
Spiders	
Misumena vatia	Ride 1-2
Diptera	
Agromyzidae	
Amauromyza labiatarum	Rides 2– 7 and 8-10
Chromatomyia primulae	Well-lit lough-side areas of Cpts 5 & 19
Asilidae	
Neoitamus cyanurus	Flight trap in Cpt 17
Stratiomyiidae	
Microchrsya cyaneiventris	Ride 1-2
Microchrysa polita	Cut-over area of Cpt 9
Sargus iridatus	Rides 1-2 and 7-8
Syrphidae	
Platycheirus scutatus	Ride 1-2
Hemiptera	
Cixius cunicularius	Cpts 9 & 15
Dicyphus stachydis	Rides 2– 7 and 8-10
Eupteryx stachydearum	Rides 2– 7 and 8-10
Butterflies	
Leptidea juvernica	Throughout sunnier ride network

The most interesting find amongst these species is the robber fly *Neoitamus cyanurus*. A single male was taken by the flight trap in Cpt 17. Despite being a large and attractive insect this is an elusive species, and the record really just reflects its presence in the wood as a whole rather than an association with a particular area or canopy structure there at the time.

The hoverfly *Platycheirus scutatus* is one of many favoured by increasing light levels in the wood, but this is a particular species of woodland margins. Like others of the genus the larvae feed specifically on aphids, using those feeding in field layer vegetation as well as shrubs and it is a common and widespread species in Ireland (Speight 2008).

The three soldier flies (Stratiomyiidae) are an attractive feature of sunny woodland rides and the larger *Sargus iridatus* was conspicuously frequent along the opened-up rides and cutover coppices.

Figure 10: Soldier fly *Sargus iridatus* (Stratiomyidae) on well-lit hazel leaf alongside ride in cutover part of St John's Wood

The two leaf-mining flies (Agromyzidae) are tied to their respective foodplants – *Amauromyza labiatarum* on hedge woundwort *Stachys sylvatica* and *Chromatomyia primulae* on primrose *Primula vulgaris*. Interestingly the latter leaf-miner appears to be currently of very restricted occurrence in the wood, being noticeably absent along the ride network and only noticed in a few better-lit areas of wooded lough-side. This species may be expected to expand as the cutting regime continues. The patches of hedge woundwort also support the specialist bugs *Dicyphus stachydis* and *Eupteryx stachydearum*. These three woundwort insects were found wherever light levels enabled the host plant to grow tall, and may also be expected to expand within the wood as coppicing and ride management continues.

Three moth species may also fit here as they are confined to both woodland and hedgerow situations, which suggests that shelter is more important than shade:

- Sharp-angled Carpet *Euphyia unangulata*
  - Larvae on stitchwort;
- Small fan-footed Wave *Idaea biselata*
  - Larvae on withered leaves of various broadleaved herbs;
- Flame Carpet *Xanthorhoe designata*
  - Larvae on various crucifers.

One of the consequences of active management is the establishment of 'weed' vegetation in areas cleared of vegetation. Such plants are actually very valuable at present in contributing to the availability of flowers for flower-visiting insects (see next section). They also bring with them non-woodland invertebrates. Noticeable in 2010 were:

- Spear thistle lacebug *Tingis cardui*
- The thistle fruit fly *Xyphosia miliaria*
- The ragwort hoverfly *Cheilosia bergenstammi*
- Dock Leaf Beetle *Gastrophysa viridula*

The hoverfly *Cheilosia bergenstammi* is an interesting find as it is normally a very localised species. The larvae develop in the stem base of Common Ragwort while the adult is found at the flowers.

POLLINATION

A particular objective of the invertebrate survey is to identify if pollinating insects associated with Narrow-leaved Helleborine *Cephalanthera longifolia* occur in the wood. This is a very rare and legally protected plant in Ireland, associated with damp woods and scrub (eg Webb, 1977), and is known to occur within the Lough Ree SAC (J. Kelemen, pers. comm.). Although only known from a single casual record in the wood it is hoped that it may colonise in due course from a known regular side close by. It is mainly pollinated by small bees but the range of species has not been identified - *Halictus* spp have been identified visiting the flowers in other countries within its range (Proctor *et al*, 1996). Sawflies are also known to visit its flowers. The flowers provide no nectar and insects are presumed to be attracted by the scent and the 'pseudo-pollen' of the papillose yellow ridges on the lip. Flowering occurs in May and June.

The opened up ride network in the south-eastern part of the wood was found to be full of insect life in the early part of the field season, and especially with pollinating insects – hoverflies, bees, sawflies, butterflies, etc. Hoverflies were especially numerous including *Melanostoma*, *Platycheirus* and *Eristalis* species. Small bees were however scarce and only two species were identified *Andrena haemorrhoa* and *A. subopaca*. It is unclear whether the helleborine is entirely dependent on *Halictus* bees or whether the closely related *Lasioglossum* species may also be involved, or indeed other bee species. Bees in both of these genera are widespread in Ireland – Fitzpatrick *et al* (2006) list two species of *Halictus* and eleven of *Lasioglossum* - and may be expected to colonise the wood in due course, as the vegetation of the open ride network develops. *Halictus rubicundus* is described as extremely common in Ireland, while *H. tumulorum* is widely distributed but thought to be becoming increasingly scarce.

Flowers are less evident in the second half of the season, a typical situation for woodlands. Spear thistle and ragwort in the cutover coppices were found to be a notable attraction to flower-visiting insects at this time, and it was here that butterflies and other insects were being attracted. Silver-

washed Fritillary *Argynnis paphia* and the widespread longhorn beetle *Grammoptera ruficornis* were amongst the species noted.

In conclusion, it is very apparently that the programme of opening up of the rides and cutting sections of coppice has been very successful in increasing the availability of blossom in these areas and that the flower-visiting insect fauna has responded significantly.

WETLAND SPECIES

The species detected within the woodland include many which are known to be wetland specialists and it is very clear that many lough shore and open fen insects penetrate well into the woodland. At least 20 of the species recorded are more lough-side than woodland species, although the distinction becomes meaningless with wet woodland species. Of the more interesting species noted the weevil *Thryogenes festucae* was actually swept along the lough-side zone while sampling for wood-edge invertebrates. This is thought to be a *Scirpus* associate, the larvae developing in the stems, and so should not be regarded as a St John's Wood species, but rather a Lough Ree one. It is described as rare and very local in Ireland (Morris 2002).

Ground layer invertebrates

LEAF LITTER FAUNA

Ground-living invertebrates are one of the major ecological groupings within the woodland, with 118 species detected during 2010. This assemblage was targeted by both suction sampling and pitfall-trapping, and so a good representation of the species may be expected to have been found. Data generated from the eight trapping stations enables the faunal composition to be analysed across the wood in terms of location and management regime.

The spider list is 23 species in total, although the largest concentrations of species were found in Cpts 7 (15) and 26 (11) (Table 13). The twinned trapping stations of these two were also amongst the higher catches: Cpt 9 (8) and Cpt 21 (9). Thus the most disturbed (recently cutover) and least disturbed areas of the wood were the most species-rich in ground-living spiders. There is substantial overlap in the species composition, so the differences may not be significant. The species found in Cpt 26 but not in 7 are: *Walckenaeria cuspidata* (Cpt 26 only, a single male), *Centromerus dilutus* (Cpt 26 only, a single female) and *Tenuiphantes alacris* (Cpts 2, 15, 17 & 26; 4 females, 3 males). The last two are more associated with humid woodlands and so may prefer undisturbed canopy conditions. Only one species was only found in the two cutover areas of Cpts 7 and 9 (*Pardosa amentata*) while *Dicymbium nigrum* was only found in Cpt 7. The wolf spider *P. amentata* is a speciality of open, unshaded habitats,

especially where humid, and has presumably temporarily colonised the cut areas from the lough shore – it was present in the cut areas in substantial numbers. The money spider *D. nigrum* is a ubiquitous species and so its restriction is presumably only apparent. Two further species were only taken in the less disturbed woodland on the north-western side of the dividing wall – *Palliduphantes pallidus* and *Tapinocyba insecta*. The former is an uncommon although widespread species, but *T. insecta* is particularly associated with undisturbed humid situations such as ancient woodlands and old fens. It may be that this species is restricted to the north-western woodland, although only a single male was found (Cpt 15). The other spider species all occurred in both shaded and cutover areas.

Table 13 Distribution of ground dwelling spiders

Species	Compartments								
	2	3	7	9	15	17	21	26	Others
Dysderidae									
Harpactea hombergi									11
Linyphiidae									
Ceratinella scabrosa		3	7						
Walckenaeria acuminata			7						
Walckenaeria cuspidata								26	
Dicymbium nigrum s.l.			7						
Dicymbium tibiale		3	7				21	26	
Tapinocyba insecta					15				
Monocephalus fuscipes		3	7	9	15	17	21	26	
Diplocephalus latifrons			7					26	
Diplocephalus picinus			7		15				
Agyneta subtilis	2		7	9		17	21	26	
Agyneta ramosa				9		17	21		
Microneta viaria	2	3	7	9	15	17		26	
Centromerus dilutus								26	
Diplostyla concolor		3					21		
Tenuiphantes alacris	2				15	17		26	
Tenuiphantes tenuis		3	7						
Tenuiphantes zimmermanni		3	7	9	15		21	26	
Tenuiphantes flavipes			7				21		
Tenuiphantes tenebricola	2	3	7	9	15			26	
Palliduphantes ericaeus			7				21	26	
Palliduphantes pallidus							21		

Species	Compartments								
	2	3	7	9	15	17	21	26	Others
Lycosidae									
Pardosa amentata			7	9					
Total species	4	8	15	8	7	5	9	11	

Fourteen species of ground beetle (Carabidae) were detected using the pitfall traps, with between 3 and 7 species being taken per trapping station. No pattern in distribution is apparent – the cutover areas held the same range of species as the closed canopy areas. Only one species was found exclusively on the north-western side of the dividing wall – *Badister sodalis*. This is an uncommon speciality of damp areas with abundant leaf-litter within woodland on clay soils (Luff, 1998), and Anderson *et al* (2000) associate it primarily with waterside woodlands in Northern Ireland. Single individuals were pitfall trapped in Cpts 15 and 21.

Table 14 Distribution of ground beetles

Species	2	3	7	9	15	17	21	26	others
Abax parallelepipedus	2	3	7	9	15	17	21	26	
Badister sodalis					15		21		
Carabus granulatus				9					
Carabus nemoralis	2		7	9	15	17	21	26	
Leistus fulvibarbis		3						26	
Loricera pilicornis	2					17			1
Nebria brevicollis	2	3		9	15	17	21	26	
Notiophilus biguttatus	2			9	15				
Ocys harpaloides	2						21		8, 16
Paranchus albipes									24
Pterostichus gracilis									
Pterostichus madidus		3		9	15	17		26	
Pterostichus melanarius								26	
Pterostichus niger	2	3	7	9	15	17	21	26	
Total species	7	5	3	7	7	6	6	7	

The only other group of ground-dwelling invertebrates which appears to show any significant pattern is the molluscs. The Irish Red List (Vulnerable) species English Chrysalis Snail *Leiostyla anglica* was present in small numbers in the suction samples taken from the trapping stations in Cpts 21 and 26, but not found anywhere else. This is a species of undisturbed humid environments.

Two pyralid micro-moth species recorded have larvae which feed on mosses growing over the soil surface: *Eudonia truncicolella* and *Scoparia ambigualis*.

In conclusion, some tentative conclusions arise from the ground fauna:

- The relatively undisturbed woodland beyond the dividing wall appears to support a few species of money spider, a ground beetle and a snail which have not been found in the more disturbed woodland;
- The opening up of the canopy in the re-coppiced areas has drawn in temporary populations of an open ground wolf spider, presumably from the lough shore.

FUNGI ASSOCIATES

The remaining large assemblage not yet discussed is the insects which develop in fungi, especially the fruit bodies. The fungi of St John's Wood have not yet been separately assessed for conservation

interest but casual observations made during the invertebrate survey strongly suggest a rich and diverse mycota and including rarities. Two notable fungal discoveries were made during the final visit: Hazel Gloves *Hypocreopsis rhododendri* and the spindle bracket *Phylloporia ribis*. The former was only previously known in Ireland from the Burren and The Gearagh Nature Reserve, County Cork, The latter is only known from up to five Irish collections, including Muckross in the Killarney National Park (H. Fox, pers. comm.). These in themselves suggest a site of major mycological interest, but the fungus insect fauna also suggests an unusually rich and varied mycota. The discovery of 65 species of fungus gnat, including four not previously reported from Ireland is a notable result (Table 15) – the species believed to be primarily saproxylic are included in the Table to provide a full review of the group and also because the ecology of many species is not well known.

Table 15 Distribution of fungus gnats

** species new to the Irish list

*other notable finds

Species	Ecology	2	3	7	9	15	17	21	26
Bolitophilidae									
Bolitophila occlusa	saproxylic						17		
Ditomyiidae									
*Symmerus annulatus**	saproxylic		3						
Keroplatidae									
*Cerotelion striatum**	saproxylic		3						
Isoneuromyia semirufa			3					21	
Macrocera stigma	saproxylic			7					
Macrocera stigmoides	saproxylic			7					
Macrorrhyncha flava	saproxylic			7					
Neoplatyura nigricauda				7					
Orfelia fasciata	saproxylic		3						
Pyratula zonata				7					
Mycetophilidae									
Acnemia nitidicollis	saproxylic	2		7	9		17		26
Allodia grata	saproxylic			7					
*Allodia pistillata***							17		
Allodia truncate		2							
*Anatella ankeli**	saproxylic			7		15	17		
Brevicornu auriculatum				7					
Brevicornu griseicolle					9				

Species	Ecology	2	3	7	9	15	17	21	26
*Brevicornu nigrofuscum***		2	3	7	9		17	21	26
Cordyla crassicornis		2	3	7			17		
Cordyla fasciata			3			15			
Cordyla fissa				7					
Cordyla flaviceps									26
Cordyla murina			3	7					
Cordyla semiflava				7		15			
Cordyla sp. near *murina* (not yet officially named)				7					
*Docosia morionella***	?					15			
Ectrepesthoneura hirta	saproxylic			7	9				
*Exechia cincta***				7					
Exechia fusca	saproxylic			7					
Exechia nigroscutellata				7					
Exechia parva	saproxylic			7					
Exechia parvula						15			
Exechia spinuligera			3						
Exechiopsis clypeata							17		
Exechiopsis leptura								21	
Exechiopsis subulata				7					
Leia winthemii				7	9			21	
Monoclona rufilatera	saproxylic						17		
Mycetophila alea								21	
Mycetophila cingulum	saproxylic			7					
Mycetophila curviseta				7			17		
Mycetophila edwardsi				7	9				
Mycetophila fungorum	saproxylic						17		
Mycetophila ichneumonea							17	21	26
Mycetophila ornata	saproxylic				9				
Mycetophila signatoides				7					
Mycetophila sordid				7					
Mycetophila subsigillata									26
Mycomya annulata	saproxylic			7		15	17		26
Mycomya cinerascens	saproxylic		3	7	9		17		
Mycomya nitida							17		
Phronia braueri	saproxylic								26

Species	Ecology	2	3	7	9	15	17	21	26
Phronia conformis	saproxylic			7					
Phronia nitidiventris	saproxylic						17		
Phronia notata				7					
Phronia signata				7					
Phronia tenuis	saproxylic	2		7			17		
Polylepta guttiventris	saproxylic			7	9			21	
Rymosia bifida					9				
Rymosia fasciata				7					
Saigusaia flaviventris	saproxylic				9				
Sciophila fenestella				7					
Stigmatomeria crassicornis				7					
Synapha vitripennis						15			
Tetragoneura sylvatica	saproxylic			7		15			
Total species		5	10	38	11	8	16	7	7
Notable species		1	3	3	1	2	3	1	1

The distribution of the fungus gnat species is strongly skewed by the catch of 38 species in the flight trap in the cutover area of Cpt 7. The other flight traps only managed between 5 and 16 species. This is difficult to explain with the available information but it may be that large oak standards opened up from the surrounding coppice may act as foci for assembling fungus gnats – and maybe other insects too. This was the only trapping station where the trap was placed up against the trunk of a large tree; the others were all attached to smaller trees, mostly hazel.

Notable fungus gnat species were fairly evenly spread across the wood, with from 1 to 3 in each trapping station. The rarest species *Docosia morionella* was found on the north-western side of the dividing wall (Cpt 15) and one other previously unrecorded species, *Allodia pistillata*, was also only found there (Cpt 17). The third new species, *Exechia cincta* was only found in Cpt 7, while the fourth species *Brevicornu nigrofuscum* was found in all the trapping stations with Cpt 15 the only exception. No meaningful pattern emerges.

Conclusions & Recommendations

Main conclusions, including impacts of recent programme of active management

A total of 825 invertebrate species have been identified in St John's Wood. These include six or seven previously overlooked native species and four species recently assessed as of Irish Red List status.

The highlights of the wood's invertebrate fauna are:

- A pristine ancient woodland fauna, including three mollusc species which are included in the Irish Red List (Byrne *et al*, 2009) as Threatened (Vulnerable):
    - *Leiostyla anglica* English Chrysalis Snail;
    - *Limax cinereoniger* Ash-black Slug ;
    - *Zenobiella subrufescens* Brown Snail;
- a notably rich fauna of two-winged flies (Diptera), especially of fungus gnats with 65 species, of which four have previously been overlooked in Ireland:
    - *Docosia morioniella* is a global rarity, known from just three other European countries;
    - *Allodia pistillata*, *Brevicornu nigrofuscum* and *Exechia cincta*, all new to the Irish list;
    - other notable Diptera include the cranefly *Dictenidia bimaculata* and the robber fly *Neoitamus cyanurus;*
- a notably rich beetle fauna, especially:
    - canopy-living species, including the weevil *Acalyptus carpini*, not previously reported in Ireland, as well as Irish rarities such as *Polydrusus pilosus*;
    - wood-decay species, including rare species such as *Tetratoma ancora* and *Dorcatoma dresdensis;*
- a notably rich moth fauna, especially:
    - canopy-living species, including one micro-moth *Ancylis diminutana*, not previously reported in Ireland, as well as rare buckthorn associates;
- the Near Threatened Irish Red List species the large red-tailed bumblebee *Bombus lapidarius*, although probably more associated with the fen fringe that the woodland itself;
- significant interest for spiders, especially canopy-living species:
    - the most northern Irish records for *Nigma puella* and *Anelosimus vittatus*, and
    - only the fifth Irish record for *Philodromus albidus*;
- a species-rich assemblage of barkflies, including the uncommon *Atlantopsocus personatus*, *Loensia fasciata* and *Trichadenotecnum sexpunctatum*;
- a rich assemblage of bugs including the uncommon species *Orius laticollis*, *Miris striatus, Psallus flavellus*, *P. wagneri* and *Phytocoris reuteri*;
- a rich woodland edge and woodland butterfly fauna, including Cryptic Wood White *Leptidea juvernica,* Brimstone *Gonepteryx rhamni,* Holly Blue *Celastrina argiolus,* and Silver-washed Fritillary *Argynnis paphia.*

Ecologically, the most significant assemblages are:

- wood-decay, supporting at least 112 invertebrate species (about 18%) of the total Irish saproxylic fauna and suggestive of ancient woodland conditions;
    - all compartments of the wood have significant interest for saproxylic species;
    - the old standard trees appear to support a different suite of saproxylic species to the coppiced trees and shrubs;
- the tree and shrub canopy is rich in moths, beetles, bugs and spiders:

    - there are no obvious differences between the fauna either side of the dividing wall;
    - the cutover coppice of Cpt 7 was notably species-rich in canopy bugs and also includes species of special conservation interest; it is thought that this reflects the particular species-richness of the trees and shrubs here rather than the management;
- the ground layer fauna is also species-rich, with 116 species identified in 2010:
    - Fungi associated insects are especially species-rich.

The assemblage of characteristic woodland species which are found especially in glades, rides and wood edge is however fairly restricted, reflecting the long period of neglect of woodland management.

The north-western half of the woodland, which is thought to be less disturbed from coppicing, does appear to have some special additional interest, supporting a few species of money spider, a ground beetle and a snail which have not been found in the more disturbed south-eastern half of the woodland.

But also the stands of old 'stored' hazel coppice throughout the woodland have special interest for a number of notable wood-decay beetles.

The impacts of cutting have been to:

- significantly increase the abundance of saproxylic invertebrates active within those parts of the wood; in particular:
    - the stacks of cut timber are acting as honey-pots for specialist invertebrates;
- favour the epiphyte fauna, by the increasing light levels within the wood and this may be expected to draw more species into the interior of the wood from their refugia on the woodland margins;
- increase the frequency of shade-demanding species, demonstrating that these species are actually mostly tolerant of the temporary opening up of the canopy and are actively moving across the temporarily open areas;
- draw in a range of open-ground and flower-visiting insects into both the ride network and the cutover coppice areas.

Management implications

The current woodland management programme, initiated in 2005, appears to be being very successful with regard to invertebrate conservation objectives. The following sections provide information on specific management actions and the ecological dynamics of the woodland.

RIDE-CUTTING

The opening up of the ride network of the near woodland has produced a very noticeable response from invertebrates. The open sunny and sheltered conditions appear to have increased flight activity both of woodland insects and non-woodland insects which have been attracted into the wood from the surrounding landscape. This is especially noticeable along the entrance ride, between Cpts 1 and 2.

COPPICE-CUTTING

The opening up of small patches within the woodland compartments has similarly stimulated considerable invertebrate activity. The flight interception traps set within two of these coppice plots demonstrated the increased flight activity within these sheltered sunny temporary glades. The two traps produced larger catches than any of the traps placed in the uncut compartments. Interestingly both wood-decay (saproxylic) insects and shade-demanding species were caught in larger numbers in these new glades than in the dark shady old coppices. The increased activity of wood-decay insects presumably reflects the attractiveness of the freshly exposed sap and newly dead timber – the organic volatile chemicals released provide important cues to flying insects and saproxylic insects are especially sensitive to these chemicals. The stacks of cut wood in particular act as honey-pots for these insects, and uncommon beetles were noted in association.

The cutting of the coppice trees and shrubs also increases light levels around the trunks of the standards left behind. This benefits the epiphyte invertebrate assemblage as well as invertebrates which favour sunny tree trunks for display and hunting. These trees also appear to support a range of wood-decay invertebrates which require larger timber, including rare and uncommon species. Standing dead and fallen trunks and branches from these trees should be left in situ wherever feasible. Even where this deadwood is not in a situation where it can be kept – eg across a ride - ideally it should be displaced (with minimal cutting) in preference to cutting and removal.

The cut wood from the coppicing activity attracts a large number of specialist wood decay invertebrates. If it is to be removed from site or turned into charcoal then it should either be:

- removed immediately it has been cut,
- left stacked for 1-2 years to season, until the bark has loosened significantly.

Rapid removal minimises the number of specialist invertebrates that will be removed with it, and lost to the reserve. However, the second option, enables the specialist invertebrates to breed in the wood and to have largely moved on by the time it is removed or turned into charcoal. There is now good scientific evidence that longhorn beetles in particular have high preference for sun-exposed wood located near the ground (Vodka *et al* 2009). The larvae of these species develop in the cambial layer of freshly dead wood and the resulting adults will have emerged and gone in search of more freshly dead wood by the time the seasoning process has completed. A good indication that these species will have moved on is when the bark begins to loosen and fall away from the wood – this usually takes about a year with the size classes of timber being produced through coppicing. The more interesting species noted at the stacks of cut timber in St John's Wood all prefer fresh sappy wood, and will similarly have bred and moved on after the first year of seasoning.

Any wood stacks left to decay naturally for more than 1 or 2 years will provide habitat for other invertebrates, but increasingly the fauna tends towards that of soil and decaying vegetation. The more

notable invertebrates found in St John's Wood appear to be those of early wood-decay rather than late-decay. While it would undoubtedly be beneficial to invertebrates to leave some wood stacks to decay naturally, the justification is not strong. A natural woodland structure will provide plenty of habitat for such species within the volume of decaying wood available without artificially increasing it through management. The same might be said of the species exploiting the fresh stacks, but these particular species are favoured by the open sunny conditions created by coppice-cutting – conditions notably poorly represented in the unmanaged woodland compartments.

HOLLY, IVY AND BRAMBLE

A trend seems very apparent in holly development across the wood, with some areas currently having an understory thicket. Older hollies seem quite scarce. This suggests that holly dominance is a relatively recent phenomenon. The most likely cause for this change is the exclusion of livestock – holly is very palatable and livestock grazing would tend to keep it to a low level. The local prevalence of bramble and ivy is also suggestive of a lack of grazing in recent years – these are also very palatable to livestock. Ivy is becoming a conservation issue by increasingly dominating both ground flora and epiphytes.

A woodland on the opposite bank of Lough Ree provides an instructive contrast. Culnagore Wood (N0258) has a broadly similar composition and structure to St John's Wood, with oak standards and old hazel coppice, plus a species-rich ground flora. It is open to grazing and browsing by cattle with the result that holly, ivy and bramble are currently sparse throughout. A preliminary investigation of its invertebrate fauna also found a broadly similar fauna to St John's Wood, including the grazing-tolerant Red List brown snail *Zenobiella subrufescens* and the uncommon ramsons hoverfly *Portevinia maculata*. The grazing levels are probably a little on the high side, but this wood clearly demonstrates the potential benefits of grazing to woodland structure and composition.

LONG-TERM DYNAMIC OF TREE AND SHRUB SPECIES

The predominant woody plant species in St John's Wood are oak and hazel. Both are well-known as light-demanding species when it comes to natural regeneration and their current dominance is most likely due to the management history of the wood. Interestingly, O'Donoghue (2005) reports finding saplings of both in her study area - oak saplings were shown as either 'rare' or absent, and hazel 'frequent' to 'abundant'. No detail is provided. It would have been useful to know precisely how many sapling oak were found. The frequency of hazel saplings is also unexpected and merits comment – the distribution pattern in relation to the better-lit wood edges would have been instructive. It may be that the lakeside situation provides sufficient light in the woodland fringes to

enable hazel regeneration to succeed. She goes on to comment on the vast amounts of regenerating holly and ash in the understory.

It is the present author's opinion that - in the absence of active management - the woodland would change in composition in the longer term, towards virtual extinction of oak and hazel (in the centre at least), and dominance by holly in the drier centre and ash around the damper margins. This would have considerable impact on the invertebrate fauna and almost certainly reduce its conservation interest significantly. The current oak-hazel structure suggests sufficient browsing by large herbivores in the past to reduce the proportion of the more palatable ash and holly, perhaps aided by selective human management favouring the more desirable oak and hazel timber and wood products.

The dynamics of oak and hazel in St John's Wood merit a more detailed study before minimum intervention or non-intervention are fully adopted as management protocols for the woodland beyond the dividing wall.

MINIMUM- OR NON-INTERVENTION MANAGEMENT

Minimum and non-intervention management regimes have become very popular in conservation woodlands in recent decades but the ecological theory behind these approaches remains debatable. It is notable that such proposals almost invariably come from plant ecologists, whereas most lichen and invertebrate ecologists favour greater intervention in order to maintain light levels appropriate to their interests.

The underlying ecological theory is not clear-cut. While post-glacial sub-fossil pollen data have been interpreted as indicating more-or-less closed canopy forest conditions, and sub-fossil invertebrate assemblages have been interpreted to support this hypothesis, other interpretations of the same data are also possible and justifiable. The sub-fossil invertebrate data is, in fact, more suggestive of extensive open-structured woodland – in Ireland as well as Britain.

The key point that needs to be made is that there is no irrefutable case for minimum- or non-intervention based on sub-fossil data. This topic remains an academic debate.

However, there is a better case for minimum intervention to provide a basis for studying the impacts of intervention management. St John's Wood is part of the historic cultural landscape of this part of Ireland and one which has the potential to provide useful information about local land-use history. It appears to have a long history of woodland management, and there is reason to consider that management has been more intensive in the south-eastern half than the north-western half, as delimited by the dividing high stone wall. While the recent coppicing appears to have had strong

beneficial impacts on the woodland invertebrate fauna, there is some suggestion that the far woodland supports a few species which depend on relatively low levels of disturbance. The 2010 invertebrate survey provides some support for the north-western half of the woodland to be managed under a minimum-intervention regime – in the short term at least.

Monitoring recommendations

A wide range of interesting invertebrates have been found in St John's Wood during 2010. The reserve is clearly of considerable conservation interest for its invertebrates. Ideally this interest merits a monitoring strategy, especially with the levels of active management which have been initiated since the wood became a reserve. A monitoring strategy needs to be informed both by the ecology of the key interests and the methodologies which have proved effective in detecting them.

Table 16 draws out the most significant invertebrate species found during 2010 and the techniques which resulted in their detection.

Table 16 Sampling techniques which revealed the more notable invertebrates

Key species	Hand search	Sweep net	Beating	Flight trap	Pitfall trap	Suction sampler
English Chrysalis Snail						+
Ash-black Slug	+					
Brown Snail	+	+	+			
Fungus gnats				+		
Canopy weevils		+	+			
Wood-decay beetles	+			+		
Bees	+					
Canopy spiders		+	+			
Barkflies	+	+	+			

The most productive techniques are hand-searching and the use of nets for sweeping and beating. Unfortunately these techniques are difficult to quantify and cannot sensibly be repeated in a standard way. This has been recognised by Natural England in developing their Invertebrate Species and Habitat information System (ISIS) for Common Standards Monitoring, and the recommended approach is for a suitably experienced and expert person to spend a standard amount of time in targeted searching within defined areas of habitat (Drake *et al* 2007). This can be supplemented by the

use of trapping techniques to provide more objective data. The flight traps and suction sampler both produced important supplementary data in St John's Wood, detecting important species which might otherwise have been overlooked. The pitfall traps in contrast resulted in the detection of far fewer significant species.

The contract for the present study required a simple, repeatable monitoring protocol. It is therefore suggested that the Natural England approach be adopted:

- expert invertebrate ecologists will need to be contracted to carry out targeted searches for key species and assemblages identified by the 2010 survey;
    - the breadth of taxonomic groups involves suggests that subcontracting some identification work is likely to be necessary;
- the searches should be guided by the seasonality of those target organisms;
    - ideally a minimum of three visits across the field season;
- repeat visits will enable flight trapping to be used to supplement the data;
    - identification of the Diptera is likely to need to be sub-contracted;
- the compartments used for the 2010 survey proved productive and focusing on these would make good use of this baseline;
- the return cycle would need to be determined by NPWS as part of their wider monitoring strategy for nature reserves;
- suitable weather conditions is an especially important factor for invertebrate survey and needs to be built into the protocol.

The bee assemblage of interest in the wood depends on drawing bees in from the surrounding landscape. This suggests that a study of the bee fauna of the wider landscape would be worthwhile and would better inform the monitoring protocol.

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Appendix 1 Vegetation surrounding trapping stations

Cpt no	Coppice cycle	Standard trees	Coppice trees	Saplings	Scramblers	Ground cover
2	Stored coppice, medium age	Oak gbh 1.30m, 1.28m 1.01m	Hazel, ash; goat willow (R)	Holly (A) Hawthorn (O)	*Rubus* & *Hedera* (F)	Litter/moss (co-D): *Eurhynchium* (A), *Brachythecium* (O), *Thamnobryum* (O), *Arum* (R), ash seedlings (LF)
3	Stored coppice, medium age	Oak gbh 1.92m [tag 55] 2.44m [tag 54] & young ash	Hazel, ash	Holly (A)	*Rubus* & *Hedera* (F)	Leaf litter (D), bluebell (O), *Eurhynchium* (O), *Arum* (O), *Dryopteris dilatata* (O), *Anemone* (O)
7	Coppice Plot 2/2007 cut three winters back	Oak gbh 2.46m & young birch	A: hazel, buckthorn, rowan, cherry, holly, hawthorn, goat willow, whitebeam	O: yew, rowan, holly, birch	*Rubus*, *Lonicera* & *Hedera* (F)	Moss (D): *Eurhynchium* (A), *Rhytidiadelphus* (LF), *Thuidium* (O); *Hypericum pulchrum* (O-LF), *Carex sylvatica* (O), *Cirsium vulgare* (O), *Primula vulgaris* (F), *Viola riviniana* (O), *Potentilla sterilis* (LF), *Veronica chamaedrys* (O), *Fragaria vasca* (LF), *Arum* (O); rowan seedlings (LF)
9	Coppice	Oak, ash,	Hazel, ash	Holly (F);	*Lonicera*,	Moss (D):

Cpt no	Coppice cycle	Standard trees	Coppice trees	Saplings	Scramblers	Ground cover
	Plot 2/2009 cut last winter	hawthorn, crab, yew		blackthorn (R)	*Rubus*, *Hedera* all frequent	*Eurhynchium, Thuidium, Brachythecium; Rhytidiadelphus, Thamnobryum*; *Arum* (O), *Cirsium vulgare* (O), *Taraxacum officinale* (LF); ash seedlings (LF)
15	Old coppice	oak	Oak, holly: hazel (R); NB hazel appears to be declining; no ash at all	Holly (A)	*Rubus* (O), *Lonicera* (O), *Hedera* (F)	Leaf litter (D); 10-15% cover mosses: *Polytrichum formosum, Thuidium, Eurhynchium;* *Dryopteris dilatata* (O), *Luzula* *sylvatica* (LA), *Vaccinium myrtillis* (O)
17	Old coppice	oak	Hazel, ash	Holly (O); hawthorn (R)	*Rubus* (LF), *Hedera* (F), *Lonicera* (R)	Leaf litter (D); moss (LF) *Rhytidiadelphus* (LF), *Eurhyncchium* (LF), *Thuidium* (O), *Thamnobryum*; *Arum* (O), *Oxalis acetosa* (O), *Dryopteris dilatata* (LA), ash seedlings (LA)
21	Old coppice	Oak, crab, holly	Hazel		*Lonicera* (O), *Hedera* (F), *Rubus* (R)	*Allium* (D), *Ranunculus ficaria* (O), *Anemone* (O), sanicle (R), *Oxalis* (O), *Polytrichum* *setiferum* (O); *Eurhynchium* (D) *Rhytidiadelphus* (O)
26	Old coppice	oak	Hazel, ash	Holly (R)	*Hedera* (A), *Rubus* (R),	*Allium* (LA),

Cpt no	Coppice cycle	Standard trees	Coppice trees	Saplings	Scramblers	Ground cover
					Lonicera (R)	*Polytrichum setiferum* (O), *Arum* (O), *Dryopteris pseudomas* (R); *Eurhynchium* (D), *Rhytidiadelphus* (F), *Dryopteris dilatata* (O)

Appendix 2 Full list of invertebrates recorded 2010

Species within groups are organised alphabetically by family, except Lepidoptera which are organised by Bradley & Fletcher number, and spiders which are ordered taxonomically.

Family	**Species**	**Assemblage**
MOLLUSCS		
Agriolimacidae	*Deroceras reticulatum*	ground layer
Arionidae	*Arion ater* agg	ground layer
Carychiidae	*Carychium tridentatum*	ground layer
Clausilidae	*Balea heydeni*	epiphyte
	Clausilia bidentata	epiphyte
Cochlicopidae	*Cochlicopa lubrica*	ground layer
Discidae	*Discus rotundatus*	ground layer
Euconulidae	*Euconulus fulvus* seg	ground layer
Helicidae	*Cepaea nemoralis*	field layer
Hygromiidae	*Zenobiella subrufescens*	field layer
Lauriidae	*Lauria cylindracea*	X
	Leiostyla anglica	ground layer
Limacidae	*Lehmannia marginata*	epiphyte
	Limax cinereoniger	saproxylic
Oxychilidae	*Aegopinella nitidula*	ground layer
	Oxychilus alliarius	ground layer
	Oxychilus draparnaudi	ground layer
Vertiginidae	*Columella aspera*	field layer
	Columella edentula	field layer
Vitrinidae	*Vitrina pellucida*	ground layer
CENTIPEDES		
Geophilidae	*Geophilus truncorum*	field layer
Lithobiidae	*Lithobius borealis*	ground layer
	Lithobius variegatus	ground layer
MILLIPEDES		
Blaniulidae	*Proteroiulus fuscus*	saproxylic
Craspedosomatidae	*Nanogona polydesmoides*	ground layer

Family	**Species**	**Assemblage**
Glomeridae	*Glomeris marginata*	ground layer
Julidae	*Brachyiulus pusillus*	ground layer
	Cylindroiulus punctatus	saproxylic
	Ophyiulus pilosus	ground layer
	Tachypodoiulus niger	ground layer
Polydesmidae	*Brachydesmus superus*	ground layer
	Polydesmus coriaceus	ground layer
	Polydesmus inconstans	ground layer
WOODLICE		
	Oniscus asellus	ground layer
	Philoscia muscorum	ground layer
	Porcellio scaber	ground layer
	Trichoniscus pusillus agg	ground layer
SPIDERS		
Dysderidae	*Harpactea hombergi*	ground layer
Theridiidae	*Anelosimus vittatus*	arboreal
	Theridion sp	arboreal
	Paidiscura pallens	arboreal
	Enoplognatha ovata s.l.	field layer
Linyphiidae	*Ceratinella scabrosa*	ground layer
	Walckenaeria acuminata	ground layer
	Walckenaeria cuspidata	ground layer
	Dicymbium nigrum s.l.	ground layer
	Dicymbium tibiale	ground layer
	Dismodicus bifrons	field layer
	Gongylidium rufipes	field layer
	Oedethorax sp	field layer
	Tapinocyba insecta	ground layer
	Monocephalus fuscipes	ground layer
	Savignia frontata	field layer
	Diplocephalus latifrons	ground layer
	Diplocephalus picinus	ground layer
	Porrhomma pygmaeus	general
	Agyneta subtilis	ground layer

Family	Species	Assemblage
	Agyneta ramosa	ground layer
	Microneta viaria	ground layer
	Centromerus dilutus	ground layer
	Bathyphantes gracilis	field layer
	Bathyphantes nigrinus	field layer
	Kaestneria dorsalis	arboreal
	Diplostyla concolor	ground layer
	Drapetisca socialis	epiphyte
	Labulla thoracica	field layer
	Tenuiphantes alacris	ground layer
	Lepthyphantes obscurus	arboreal
	Tenuiphantes tenuis	ground layer
	Tenuiphantes zimmermanni	ground layer
	Tenuiphantes flavipes	ground layer
	Tenuiphantes tenebricola	ground layer
	Palliduphantes ericaeus	ground layer
	Palliduphantes pallidus	ground layer
	Linyphia triangularis	field layer
	Neriene peltata	field layer
Tetragnathidae	*Tetragnatha montana*	arboreal
	Pachygnatha clercki	field layer
	Pachygnatha listeri	field layer
	Metellina mengei	field layer
	Metellina segmentata	field layer
	Metellina merianae	field layer
Araneidae	*Larinioides cornutus*	field layer
Araneidae	*Araniella cucurbitina*	arboreal
	Cyclosa conica	arboreal
Lycosidae	*Pardosa amentata*	ground layer
Dictynidae	*Dictyna* sp	
	Nigma puella	arboreal
Amaurobiidae	*Amaurobius similis*	cavities
Anyphaenidae	*Anyphaena accentuata*	arboreal
Clubionidae	*Clubiona compta*	arboreal
	Clubiona lutescens	field layer
Philodromidae	*Philodromus albidus*	arboreal

Family	**Species**	**Assemblage**
Thomisidae	*Misumena vatia*	field layer
HARVESTMEN		
Leiobunidae	*Leiobunum blackwalli*	field layer
	Leiobunum rotundatum	arboreal
	Nelima gothica	field layer
Nemastomatidae	*Nemastoma bimaculatum*	ground layer
Phalangiidae	*Lacinius ephippiatus*	field layer
	Megabunus diadema	epiphyte
	Mitopus morio	field layer
	Oligolophus tridens	field layer
	Paroligolophus agrestis	field layer
	Phalangium opilio	field layer
	Platybunus triangularis	ground layer
FALSE SCORPIONS		
Neobisiidae	*Neobisium muscorum*	ground layer
GALL MITES		
	Eriophyes convolvens	arboreal
BRISTLETAILS		
	Dilta hibernica	ground layer
EARWIGS		
Forficulidae	*Forficula auricularia*	field layer
BARKFLIES		
Caeciliusidae	*Caecilius fuscopterus*	epiphyte
	Valenzuela burmeisteri	epiphyte
	Valenzuela flavidus	epiphyte
Ectopsocidae	*Ectopsocus briggsi*	epiphyte
Elipsocidae	*Elipsocus hyalinus*	epiphyte
Lepidopsocidae	*Pteroxanium kelloggi*	epiphyte
Mesopsocidae	*Mesopsocus unipunctatus*	epiphyte
Peripsocidae	*Peripsocus didymus*	epiphyte

Family	**Species**	**Assemblage**
	Peripsocus subfasciatus	epiphyte
Philotarsidae	*Philotarsus parviceps*	epiphyte
Psocidae	*Atlantopsocus personatus*	epiphyte
Psocidae	*Loensia fasciata*	epiphyte
	Metylophorus nebulosus	epiphyte
	Psococerastis gibbosa	epiphyte
	Trichadenotecnum sexpunctatum	epiphyte
Stenopsocidae	*Graphopsocus cruciatus*	epiphyte
	Stenopsocus immaculatus	epiphyte
HETEROPTERA		
Acanthosomatidae	*Acanthosoma haemorrhoidale*	arboreal
	Elasmostethus interstinctus	arboreal
Anthocoridae	*Anthocoris confusus*	arboreal
	Anthocoris nemorum	field layer
	Orius laticollis	arboreal
	Orius niger	field layer
	Temnostethus gracilis	epiphyte
Berytidae	*Metatropis rufescens*	field layer
Miridae	*Campyloneura virgula*	arboreal
	Closterotomus norvegicus	field layer
	Cyllecoris histrionicus	arboreal
	Dicyphus errans	field layer
	Dicyphus stachydis	field layer
	Harpocera thoracica	arboreal
	Lygocoris contaminatus	arboreal
	Lygocoris pabulinus	field layer
	Malacocoris chlorizans	arboreal
	Miris striatus	arboreal
	Monalocoris filicis	field layer
	Orthotylus prasinus	arboreal
	Orthotylus tenellus	arboreal
	Phytocoris reuteri	epiphyte
	Pinalitus cervinus	arboreal
	Psallus flavellus	arboreal
	Psallus haematodes	arboreal

Family	**Species**	**Assemblage**
	Psallus lepidus	arboreal
	Psallus quercus	arboreal
	Psallus variabilis	arboreal
	Psallus varians	arboreal
	Psallus wagneri	arboreal
	Rhabdomiris striatellus	arboreal
	Stenodema laevigata	field layer
Pentatomidae	*Dolycoris baccarum*	field layer
	Palomena prasina	field layer
	Pentatoma rufipes	arboreal
	Troilus luridus	arboreal
Saldidae	*Saldula saltatoria*	wetland
Tingidae	*Acalypta sp*	ground layer
	Tingis cardui	field layer
LEAFHOPPERS		
Cercopidae	*Aphrophora alni*	arboreal
Cercopidae	*Philaenus spumarius*	field layer
Cicadellidae	*Alebra albostriella*	arboreal
	Alnetoidea alneti	arboreal
	Empoasca vitis	arboreal
	Eupteryx stachydearum	field layer
	Lamprotettix nitidulus	arboreal
	Macrosteles sexnotatus	field layer
	Ribautiana tenerrima	arboreal
	Ribautiana ulmi	arboreal
Cixiidae	*Cixius cunicularius*	field layer
	Cixius nervosus	field layer
	Cixius similis	field layer
Delphacidae	*Javesella pellucida*	field layer
LACEWINGS		
Neuroptera	*Chrysopidia ciliata*	arboreal
MOTHS & BUTTERFLIES		
Hepialidae	*Hepialus humuli*	field layer
	Hepialus fusconebulosa	field layer

Family	Species	Assemblage
Nepticulidae	*Ectoedemia albifasciella*	arboreal
	Ectoedemia heringi	arboreal
	Stigmella aurella	field layer
	Stigmella lemniscella	x
	Stigmella plagicolella	arboreal
	Stigmella salicis	arboreal
	Stigmella floslactella	arboreal
	Stigmella anomalella	arboreal
	Stigmella catharticella	arboreal
	Stigmella oxyacanthella	arboreal
	Stigmella nylandriella	arboreal
	Stigmella magdalenae	arboreal
	Stigmella crataegella	arboreal
	Stigmella microtheriella	arboreal
Incurvariidae	*Incurvaria masculella*	arboreal
Lyonetiidae	*Lyonetia clerkella*	arboreal
	Bucculatrix cidarella	arboreal
Gracillariidae	*Caloptilia stigmatella*	arboreal
	Gracillaria syringella	arboreal
	Parornix anglicella	arboreal
	Parornix devoniella	arboreal
	Deltaornix torquillella	arboreal
	Callisto denticulella	arboreal
	Phyllonorycter quercifoliella	arboreal
	Phyllonorycter oxyacanthae	arboreal
	Phyllonorycter sorbi	arboreal
	Phyllonorycter spinicolella	x
	Phyllonorycter salicicolella	arboreal
	Phyllonorycter coryli	arboreal
Gracillariidae	*Phyllonorycter ulmifoliella*	arboreal
	Phyllonorycter nicellii	arboreal
Yponomeutidae	*Yponomeuta cagnagella*	arboreal
	Yponomeuta plumbella	arboreal
	Pseudoswammerdamia combinella	Arboreal
	Prays fraxinella	Arboreal
	Ypsolopha dentella	Arboreal

Family	Species	Assemblage
	Ypsolopha scabrella	Arboreal
	Ypsolopha parenthesella	Arboreal
	Ypsolopha ustella	Arboreal
Schreckensteiniidae	*Schreckensteinia festaliella*	Arboreal
Coleophoridae	*Coleophora gryphipennella*	Arboreal
	Coleophora lusciniaepennella	x
	Coleophora deauratella	field layer
	Coleophora albicosta	field layer
	Coleophora glaucicolella	field layer
Oecephoridae	*Carcina quercana*	Arboreal
	Agonopterix arenella	field layer
Gelechiidae	*Metzneria metzneriella*	field layer
	Teleiodes wagae	Arboreal
	Hypatima rhomboidella	Arboreal
Blastobasidae	*Blastobasis adustella*	X
Cochylidae	*Phtheochroa sodaliana*	Arboreal
Tortricidae	*Pandemis corylana*	Arboreal
	Pandemis cerasana	Arboreal
	Pandemis heparana	Arboreal
	Archips podana	Arboreal
	Syndemis musculana	Arboreal
	Clepsis senecionana	field layer
	Clepsis spectrana	field layer
	Tortrix viridana	arboreal
	Acleris laterana	arboreal
	Acleris aspersana	field layer
	Acleris variegana	arboreal
	Acleris emargana	arboreal
	Celypha lacunana	field layer
	Hedya pruniana	arboreal
	Hedya nubiferana	arboreal
	Apotomis turbidana	arboreal
	Apotomis betuletana	arboreal
	Bactra lancealana	field layer
	Ancylis diminutana	arboreal
	Epinotia ramella	arboreal

Family	Species	Assemblage
	Epinotia nisella	arboreal
	Epinotia tenerana	arboreal
	Epinotia brunnichiana	arboreal
	Rhopobota naevana	arboreal
	Zeiraphera isertana	arboreal
	Epiblema trimaculana	arboreal
Tortricidae	*Eucosma cana*	field layer
	Cydia ulicetana	field layer
	Cydia fagiglandana	arboreal
Pyralidae	*Chrysoteuchia culmella*	field layer
	Crambus pascuella	field layer
	Agriphila selasella	field layer
	Agriphila straminella	field layer
	Agriphila tristella	field layer
	Scoparia ambigualis	epiphyte
	Eudonia truncicolella	ground layer
	Eudonia mercurella	epiphyte
	Paraponyx stratiotata	wetland
	Nymphula stagnata	wetland
	Opsibotys fuscalis	field layer
	Udea lutealis	field layer
	Udea prunalis	field layer
	Phycita roborella	arboreal
Pterophoridae	*Emmelina monodactyla*	field layer
Pieridae	*Leptidea juvernica*	field layer
	Gonepteryx rhamni	arboreal
	Pieris brassicae	field layer
	Pieris napi	field layer
	Anthocharis cardamines	field layer
Lycaenidae	*Celastrina argiolus*	arboreal
Nymphalidae	*Aglais urticae*	field layer
	Inachis io	field layer
	Argynnis paphia	field layer
Saturnidae	*Pararge aegeria*	field layer
Drepanidae	*Falcaria lacertinaria*	arboreal
	Drepana falcataria	arboreal

Family	Species	Assemblage
Thyatiridae	*Habrosyne pyritoides*	arboreal
	Ochropacha duplaris	arboreal
	Achlya flavicornis	arboreal
Geometridae	*Alsophila aescularia*	arboreal
	Jodis lactearia	arboreal
	Scopula immutata	field layer
	Idaea biselata	field layer
	Idaea dimidiata	field layer
	Orthonama vittata	field layer
	Xanthorhoe designata	field layer
	Xanthorhoe ferrugata	field layer
	Epirrhoe alternata	field layer
	Anticlea badiata	arboreal
	Lampropteryx suffumata	field layer
	Ecliptopera silaceata	field layer
	Chloroclysta siterata	arboreal
	Chloroclysta citrata	arboreal
	Chloroclysta truncata	arboreal
	Thera britannica	arboreal
Geometridae	*Electrophaes corylata*	arboreal
	Hydriomena furcata	arboreal
	Triphosa dubitata	arboreal
	Philereme transversata	arboreal
	Euphyia unangulata	field layer
	Epirrita christyi	arboreal
	Epirrita autumnata	arboreal
	Eupithecia valerianata	field layer
	Eupithecia pygmaeata	field layer
	Eupithecia vulgata	field layer
	Eupithecia tripunctaria	field layer
	Eupithecia nanata	field layer
	Eupithecia abbreviata	arboreal
	Eupithecia dodoneata	arboreal
	Chloroclystis v-ata	field layer
	Gymnoscelis rufifasciata	field layer
	Lobophora halterata	arboreal

Family	Species	Assemblage
	Trichopteryx carpinata	arboreal
	Pterapherapteryx sexalata	arboreal
	Acasis viretata	arboreal
	Abraxas grossulariata	arboreal
	Lomaspilis marginata	arboreal
	Ligdia adustata	arboreal
	Chiasmia clathrata	field layer
	Plagodis pulveraria	arboreal
	Plagodis dolabraria	arboreal
	Opisthograptis luteolata	arboreal
	Ennomos quercinaria	arboreal
	Ennomos alniaria	arboreal
	Selenia dentaria	arboreal
	Selenia lunularia	arboreal
	Odontopera bidentata	arboreal
	Crocallis elinguaria	arboreal
	Colotois pennaria	arboreal
	Angerona prunaria	arboreal
	Biston strataria	arboreal
	Agriopis marginaria	arboreal
	Erannis defoliaria	arboreal
	Alcis repandata	arboreal
	Ectropis crepuscularia	arboreal
	Cabera pusaria	arboreal
	Cabera exanthemata	arboreal
	Lomographa temerata	arboreal
	Campaea margaritata	arboreal
	Perconia strigillaria	field layer
Sphingidae	*Laothoe populi*	arboreal
	Deilephila elpenor	field layer
Notodontidae	*Cerura vinula*	arboreal
	Notodonta dromedarius	arboreal
Notodontidae	*Notodonta ziczac*	arboreal
	Pheosia gnoma	arboreal
	Ptilodon capucina	arboreal
	Pterostoma palpina	arboreal

Family	Species	Assemblage
	Diloba caeruleocephala	arboreal
Lymantriidae	*Dicallomera fascelina*	field layer
	Calliteara pudibunda	arboreal
Arctiidae	*Eilema lurideola*	epiphyte
	Spilosoma luteum	x
	Diaphora mendica	field layer
Nolidae	*Nola confusalis*	epiphyte
Noctuidae	*Agrotis exclamationis*	field layer
	Ochropleura plecta	field layer
	Noctua pronuba	field layer
	Noctua comes	x
	Noctua janthe	x
	Lycophotia porphyrea	field layer
	Diarsia dahlii	x
	Diarsia rubi	field layer
	Xestia xanthographa	field layer
	Cerastis rubricosa	field layer
	Lacanobia oleracea	x
	Melanchra pisi	x
	Orthosia cerasi	arboreal
	Orthosia incerta	arboreal
	Orthosia munda	arboreal
	Orthosia gothica	x
	Mythimna pudorina	field layer
	Asteroscopus sphinx	arboreal
	Lithophane socia	arboreal
	Lithophane ornitopus	arboreal
	Xylena vetusta	x
	Xylocampa areola	arboreal
	Allophyes oxyacanthae	arboreal
	Blepharita adusta	field layer
	Eupsilia transversa	arboreal
	Agrochola lota	arboreal
	Agrochola macilenta	arboreal
	Xanthia icteritia	arboreal
	Acronicta alni	arboreal

Family	**Species**	**Assemblage**
	Acronicta rumicis	field layer
	Craniophora ligustri	arboreal
	Amphipyra pyramidea	arboreal
	Cosmia trapezina	arboreal
	Apamea monoglypha	field layer
	Apamea sordens	field layer
	Oligia fasciuncula	field layer
	Mesapamea didyma	field layer
	Chortodes pygmina	field layer
Noctuidae	*Hydraecia micacea*	field layer
	Celaena haworthii	field layer
	Celaena leucostigma	field layer
	Protodeltote pygarga	field layer
	Deltote uncula	field layer
	Colocasia coryli	arboreal
	Diachrysia chrysitis	field layer
	Euclidia glyphica	field layer
	Scoliopteryx libatrix	arboreal
	Rivula sericealis	field layer
	Hypena crassalis	field layer
	Herminia grisealis	arboreal
FLIES		
Tipuloidea		
Limoniidae	*Austrolimnophila ochracea*	saproxylic
	Cheilotrichia cinerascens	
	Dicranomyia modesta	
	Epiphragma ocellare	saproxylic
	Erioconopa trivialis	
	Limonia nubeculosa	field layer
	Molophilus griseus	
	Molophilus pleuralis	
	Neolimonia dumetorum	saproxylic
	Ormosia nodulosa	field layer
	Rhipidia maculata	saproxylic
	Tasiocera fuscescens	field layer

Family	**Species**	**Assemblage**
Pediciidae	*Tricyphona immaculata*	
Tipulidae	*Dictenidia bimaculata*	saproxylic
	Nephrotoma flavipalpis	field layer
	Nephrotoma quadrifaria	field layer
	Tipula irrorata	saproxylic
	Tipula oleracea	field layer
	Tipula scripta	saproxylic
	Tipula submarmorata	field layer
	Tipula varipennis	field layer
Sciaroidea		
Bolitophilidae	*Bolitophila occlusa*	saproxylic
Ditomyiidae	*Symmerus annulatus*	saproxylic
Keroplatidae	*Cerotelion striatum*	saproxylic
	Isoneuromyia semirufa	
	Macrocera stigma	saproxylic
	Macrocera stigmoides	saproxylic
	Macrorrhyncha flava	saproxylic
	Neoplatyura nigricauda	
	Orfelia fasciata	saproxylic
	Pyratula zonata	
Mycetophilidae	*Acnemia nitidicollis*	saproxylic
	Allodia grata	saproxylic
Mycetophilidae	*Allodia pistillata*	
	Allodia truncata	
	Anatella ankeli	saproxylic
	Brevicornu auriculatum	
	Brevicornu griseicolle	
	Brevicornu nigrofuscum	
	Cordyla crassicornis	
	Cordyla fasciata	
	Cordyla fissa	
	Cordyla flaviceps	
	Cordyla murina	
	Cordyla semiflava	
	Cordyla sp. near murina	
	Docosia morionella	?

Family	Species	Assemblage
	Ectrepesthoneura hirta	saproxylic
	Exechia cincta	
	Exechia fusca	saproxylic
	Exechia nigroscutellata	
	Exechia parva	saproxylic
	Exechia parvula	
	Exechia spinuligera	
	Exechiopsis clypeata	
	Exechiopsis leptura	
	Exechiopsis subulata	
	Leia winthemii	
	Monoclona rufilatera	saproxylic
	Mycetophila alea	
	Mycetophila cingulum	saproxylic
	Mycetophila curviseta	
	Mycetophila edwardsi	
	Mycetophila fungorum	saproxylic
	Mycetophila ichneumonea	
	Mycetophila ornata	saproxylic
	Mycetophila signatoides	
	Mycetophila sordida	
	Mycetophila subsigillata	
	Mycomya annulata	saproxylic
	Mycomya cinerascens	saproxylic
	Mycomya nitida	
	Phronia braueri	saproxylic
	Phronia conformis	saproxylic
	Phronia nitidiventris	saproxylic
	Phronia notata	
	Phronia signata	
	Phronia tenuis	saproxylic
	Polylepta guttiventris	saproxylic
	Rymosia bifida	
	Rymosia fasciata	
	Saigusaia flaviventris	saproxylic
Mycetophilidae	*Sciophila fenestella*	

Family	**Species**	**Assemblage**
	Stigmatomeria crassicornis	
	Synapha vitripennis	
	Tetragoneura sylvatica	saproxylic
Sciaridae	*Bradysia nitidicollis*	
	Bradysia pectoralis	
	Bradysia placida	
	Claustropyga abblanda	
	Corynoptera flavicauda	
	Corynoptera forcipata	
	Corynoptera irmgardis	
	Leptosciarella fuscipalpa	
	Leptosciarella pilosa	
	Leptosciarella rejecta	saproxylic
	Phytosciara flavipes	
	Schwenckfeldina carbonaria	
	Trichosia confusa	
	Trichosia morio	saproxylic
	Zygoneura sciarina	saproxylic
Other families		
Agromyzidae	*Amauromyza labiatarum*	field layer
	Chromatomyia aprilina	arboreal
	Chromatomyia primulae	field layer
	Phytomyza ilicis	arboreal
Anisopodidae	*Sylvicola cinctus*	saproxylic
	Sylvicola punctatus	ground layer
Anthomyiidae	*Hylemya vagans*	
	Paradelia intersecta	
	Pegomya pulchripes	
Asilidae	*Neoitamus cyanurus*	field layer
Bibionidae	*Bibio nigriventris*	field layer
	Dilophus febrilis	field layer
Calliphoridae	*Pollenia angustigena*	
	Pollenia rudis	
Ceratopogonidae	*Ceratopogon grandiforceps*	
	Culicoides sp	
Chloropidae	*Chlorops hypostigma*	

Family	**Species**	**Assemblage**
	Tricimba cincta	fungi
Clusiidae	*Clusia flava*	saproxylic
	Clusiodes sp	saproxylic
Conopidae	*Myopa testacea*	field layer
Dolichopodidae	*Chrysotus gramineus*	
	Dolichopus popularis	
	Medetera abstrusa	saproxylic
	Medetera impigra	saproxylic
	Medetera muralis	saproxylic
	Rhaphium caliginosum	
Dolichopodidae	*Sciapus platypterus*	saproxylic
Drosophilidae	*Drosophila phalerata*	fungi
	Drosophila subobscura	saproxylic
	Hirtodrosophila cameraria	saproxylic
Drymomyzidae	*Neuroctena anilis*	field layer
Empididae	*Dolichocephala oblongoguttata*	
	Empis aestiva	
	Empis chioptera	field layer
	Empis digramma	field layer
	Empis lutea	field layer
	Empis stercorea	field layer
	Empis tessellata	field layer
	Empis trigramma	field layer
	Hilara maura	
	Phyllodromia melanocephala	field layer
	Rhamphomyia albohirta	
Fanniidae	*Fannia rondanii*	
Heleomyzidae	*Heteromyza sp.*	
	Suillia pallida	field layer
	Suillia parva	
	Tephrochlamys flavipes	fungi
Hybotidae	*Oedalea tibialis*	saproxylic
	Platypalpus longicornis	field layer
	Platypalpus major	field layer
	Platypalpus pallidiventris	field layer
	Tachypeza nubila	saproxylic

Family	Species	Assemblage
Lauxanaiidae	*Meiosimyza rorida*	field layer
	Minettia inusta	field layer
	Minettia longipennis	field layer
	Peplomyza litura	saproxylic
	Pseudolyciella stylata	saproxylic
Lonchaeidae	*Lonchaea chorea*	ground layer
Lonchopteridae	*Lonchoptera lutea*	ground layer
Muscidae	*Helina depuncta*	
	Helina evecta	
	Helina impuncta	ground layer
	Helina pertusa	saproxylic
	Lispe tentaculata	
	Mesembrina meridiana	
	Phaonia angelicae	
	Phaonia mystica	saproxylic
	Phaonia pallida	saproxylic
	Phaonia rufiventris	saproxylic
	Phaonia subventa	fungi
	Polietes lardarius	ground layer
Mycetobiidae	*Mycetobia pallipes*	saproxylic
Opetiidae	*Opetia nigra*	saproxylic
Opomyzidae	*Opomyza germinationis*	field layer
Pallopteridae	*Palloptera umbellatarum*	field layer
Pallopteridae	*Palloptera ustulata*	saproxylic
Phoridae	*Phora atra*	
Psilidae	*Chamaepsila persimilis*	field layer
	Chamaepsila rosae	
Psychodidae	*Boreoclytocerus ocellaris*	
	Pericoma cognata	
	Philosepedon humeralis	
	Psychoda cinerea	
	Psychoda phalaenoides	
Ptychopteridae	*Ptychoptera albimana*	ground layer
Rhagionidae	*Rhagio lineola*	
	Rhagio scolopaceus	
	Rhagio tringarius	

Family	Species	Assemblage
Scathophagidae	*Chaetosa punctipes*	
	Scathophaga stercoraria	
	Spaziphora hydromyzina	
Scatopsidae	*Apiloscatopse scutellata*	saproxylic
Sciomyzidae	*Pherbellia dubia*	field layer
	Pherbellia ventralis	
	Trypetoptera punctulata	field layer
Sepsidae	*Sepsis punctum*	
Sphaeroceridae	*Copromyza equina*	
	Copromyza nigrina	
	Crumomyia fimetaria	
	Crumomyia nitida	
	Lotophila atra	
Stratiomyidae	*Microchrysa cyaneiventris*	field layer
	Microchrysa polita	field layer
	Sargus iridatus	field layer
Syrphidae	*Cheilosia albitarsis*	field layer
	Cheilosia antiqua	field layer
	Cheilosia bergenstammi	field layer
	Cheilosia impressa	field layer
	Criorhina berberina	saproxylic
	Eristalis intricarius	field layer
	Eristalis pertinax	field layer
	Eristalis tenax	field layer
	Ferdinandea cuprea	saproxylic
	Helophilus pendulus	field layer
	Leucozona glaucia	field layer
	Melanostoma scalare	field layer
	Meliscaeva cinctella	
	Myathropa florea	saproxylic
	Neoascia tenur	field layer
	Platycheirus albimanus	field layer
	Platycheirus scutatus	field layer
	Portevinia maculata	field layer
	Rhingia campestris	field layer
	Syrphus ribesii	

Family	**Species**	**Assemblage**
Syrphidae	*Volucella pellucens*	
	Xylota segnis	saproxylic
Tephritidae	*Xyphosia miliaria*	field layer
Trichoceridae	*Trichocera annulata*	ground layer
Ulidiidae	*Seioptera vibrans*	field layer
BEES & WASPS		
Sawflies		
Argidae	*Arge gracilicornis*	field layer
	Arge ustulata	arboreal
Tenthredinidae	*Athalia cordata*	field layer
	Fenusa ulmi	arboreal
	Monophadnoides rubi	field layer
	Selandria serva	field layer
	Strongylogaster macula	field layer
	Tenthredo ferruginea	field layer
Bees		
Apidae	*Andrena haemorrhoa*	field layer
	Andrena subopaca	field layer
	Anthophora plumipes	field layer
	Bombus lapidarius	field layer
	Bombus lucorum	field layer
	Bombus pascuorum	field layer
	Bombus terrestris	field layer
	Nomada leucophthalma	field layer
Wasps		
Eumenidae	*Ancistrocerus oviventris*	field layer
Sphecidae	*Crossocerus capitosus*	saproxylic
	Rhopalum clavipes	saproxylic
	Rhopalum coarctatum	saproxylic
BEETLES		
Anobiidae	*Anobium punctatum*	saproxylic
	Dorcatoma dresdensis	saproxylic
	Grynobius planus	saproxylic
	Ochina ptinoides	saproxylic

Family	Species	Assemblage
	Ptilinus pectinicornis	saproxylic
Byrrhidae	*Cytilus sericeus*	ground layer
Cantharidae	*Cantharis cryptica*	field layer
	Cantharis figurata	field layer
	Cantharis pellucida	arboreal
	Malthinus flaveolus	saproxylic
	Malthodes guttifer	saproxylic
	Malthodes marginatus	saproxylic
	Podabrus alpinus	arboreal
	Rhagonycha fulva	field layer
	Rhagonycha lignosa	arboreal
	Rhagonycha limbata	field layer
Carabidae	*Abax parallelepipedus*	ground layer
	Badister sodalis	ground layer
Carabidae	*Carabus granulatus*	ground layer
	Carabus nemoralis	ground layer
	Dromius linearis	field layer
	Dromius quadrimaculatus	epiphyte
	Leistus fulvibarbis	ground layer
	Loricera pilicornis	ground layer
	Nebria brevicollis	ground layer
	Notiophilus biguttatus	ground layer
	Ocys harpaloides	ground layer
	Paranchus albipes	ground layer
	Pterostichus gracilis	ground layer
	Pterostichus madidus	ground layer
	Pterostichus melanarius	ground layer
	Pterostichus niger	ground layer
Cerambycidae	*Alosterna tabacicolor*	saproxylic
	Grammoptera ruficornis	saproxylic
	Pogonocherus hispidulus	saproxylic
	Rhagium bifasciatum	saproxylic
Cerylonidae	*Cerylon ferrugineum*	saproxylic
	Cerylon histeroides	saproxylic
Chrysomelidae	*Aphthona nonstriata*	field layer
	Chalcoides aurea	Arboreal

Family	Species	Assemblage
	Galerucella lineola	Arboreal
	Galerucella tenella	field layer
	Gastrophysa viridula	field layer
	Pyrrhalta viburni	Arboreal
Ciidae	*Cis boleti*	Saproxylic
	Cis festivus	Saproxylic
	Octotemnus glabriculus	Saproxylic
Coccinellidae	*Adalia 10-punctata*	Arboreal
	Coccinella 7-punctata	field layer
	Propylea 14-punctata	field layer
Cryptophagidae	*Cryptophagus dentatus* agg	saproxylic
	Cryptophagus scanicus	saproxylic
Curculionidae	*Acalles ptinoides*	saproxylic
	Acalles roboris	saproxylic
	Acalyptus carpini	arboreal
	Archarius pyrrhoceras	arboreal
	Barypithes araneiformis	ground layer
	Euophryum confine	saproxylic
	Leiosoma deflexum	field layer
	Liophloeus tessulatus	arboreal
	Magdalis carbonaria	saproxylic
	Otiorhynchus singularis	arboreal
	Phyllobius argentatus	arboreal
	Phyllobius roboretanus	arboreal
	Phyllobius viridiaeris	arboreal
	Polydrusus mollis	arboreal
	Polydrusus pilosus	arboreal
Curculionidae	*Polydrusus ptetygomalis*	arboreal
	Polydrusus tereticolllis	arboreal
	Rhamphus pulicarius	arboreal
	Sciaphilus asperatus	field layer
	Sitona lepidus	field layer
	Strophosoma melanogramma	arboreal
	Thryogenes festucae	field layer
Elateridae	*Athous haemorrhoidalis*	field layer
	Dalopius marginatus	field layer

Family	Species	Assemblage
	Denticollis linearis	saproxylic
	Selatosomus incanus	field layer
Hydrophilidae	*Anacaena globulus*	ground layer
	Cercyon melanocephalus	field layer
	Cryptopleurum minutum	ground layer
	Enochrus coarctatus	ground layer
	Helophorus brevipalpis	ground layer
Latridiidae	*Aridius nodifer*	saproxylic
	Latridius minutus	ground layer
Leiodidae	*Agathidium nigripenne*	saproxylic
	Anisotoma humeralis	saproxylic
	Catops morio	ground layer
	Catops nigricans	ground layer
	Catops nigrita	ground layer
	Choleva agilis	ground layer
	Choleva angustata	ground layer
	Nargus velox	ground layer
	Sciodrepoides watsoni	ground layer
Lucanidae	*Sinodendron cylindricum*	saproxylic
Melandryidae	*Orchesia undulata*	saproxylic
Nitidulidae	*Cychramus luteus*	fungi
	Epuraea melanocephala	saproxylic
	Glischrochilus hortensis	saproxylic
Pselaphidae	*Bibloporus bicolor*	saproxylic
	Bryaxis puncticollis	ground layer
	Euplectus piceus	saproxylic
Ptiliidae	*Ptenidium nitidum*	ground layer
	Ptinella cavelli	Saproxylic
	Acrotrichis grandicollis	Field layer
Salpingidae	*Rhinosimus planirostris*	Saproxylic
	Rhinosimus ruficollis	Saproxylic
Scirtidae	*Cyphon padi*	field layer
Scolytinae	*Trypodendron domesticum*	Saproxylic
Scraptiidae	*Anaspis frontalis*	Saproxylic
	Anaspis rufilabris	Saproxylic
Scydmaenidae	*Stenichnus bicolor*	saproxylic

Family	Species	Assemblage
Silphidae	*Silpha atrata*	ground layer
Staphylinidae	*Anthobium unicolor*	ground layer
	Atrecus affinis	saproxylic
	Bisnius fimetarius	ground layer
	Gyrohypnus angustatus	ground layer
	Gyrophaena affinis	saproxylic
	Habrocerus capillaricornis	ground layer
	Homalota plana	saproxylic
	Ischnosoma splendidum	ground layer
	Lathrobium brunnipes	
	Lesteva heeri	
	Lesteva longoelytrata	
	Megarthrus depressus	ground layer
	Ocypus olens	ground layer
	Olophrum piceum	ground layer
	Othius punctulatus	ground layer
	Philonthus marginatus	ground layer
	Philonthus politus	ground layer
	Quedius curtipennis	ground layer
	Quedius fumatus	ground layer
	Quedius mesomelinus	saproxylic
	Quedius semiobscurus	ground layer
	Sepedophilus immaculatus	ground layer
	Sepedophilus nigripennis	ground layer
	Staphylinus erythropterus	ground layer
	Stenus bimaculatus	
	Stenus brunnipes	
	Stenus cicindeloides	
	Stenus flavipes	
	Stenus impressus	
	Stenus juno	
	Stenus latifrons	
	Stenus pusillus	
	Stenus similis	ground layer
	Tachinus rufipes	ground layer
	Tachyporus obtusus	ground layer

Family	**Species**	**Assemblage**
	Tachyporus pusillus	ground layer
	Tachyporus tersus	ground layer
	Tasgius globulifer	ground layer
	Xantholinus linearis	ground layer
Tetratomidae	*Tetratoma ancora*	saproxylic