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A review of the saproxylic invertebrate assemblages at Birklands & Bilhaugh Sites of Special Scientific Interest

Sherwood Forest, Nottinghamshire

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Foreword

Natural England commission a range of reports from external contractors to provide evidence and advice to assist us in delivering our duties. The views in this report are those of the authors and do not necessarily represent those of Natural England.

Background

This report presents the first comprehensive review and evaluation of the saproxylic (wood-decay) invertebrate assemblage of Birklands and Bilhaugh SSSI and Birklands West and Ollerton Corner SSSI in Sherwood Forest in Nottinghamshire. Together these are recognised as one of the most significant localities for this fauna in Britain.

This review of past and current survey data was required to validate and support the assessment of the condition of the assemblages undertaken using the Common Standards Monitoring approach.

It looks for any apparent decline or significant changes to the species composition of the assemblage of special interest and the overall quality of the fauna over time. It also evaluates the wood-decay fauna of these SSSIs against other UK sites and places the assemblages in their national context.

The findings of the review will be used to consider the implications for future conservation management of the SSSIs and National Nature Reserve.

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Further information
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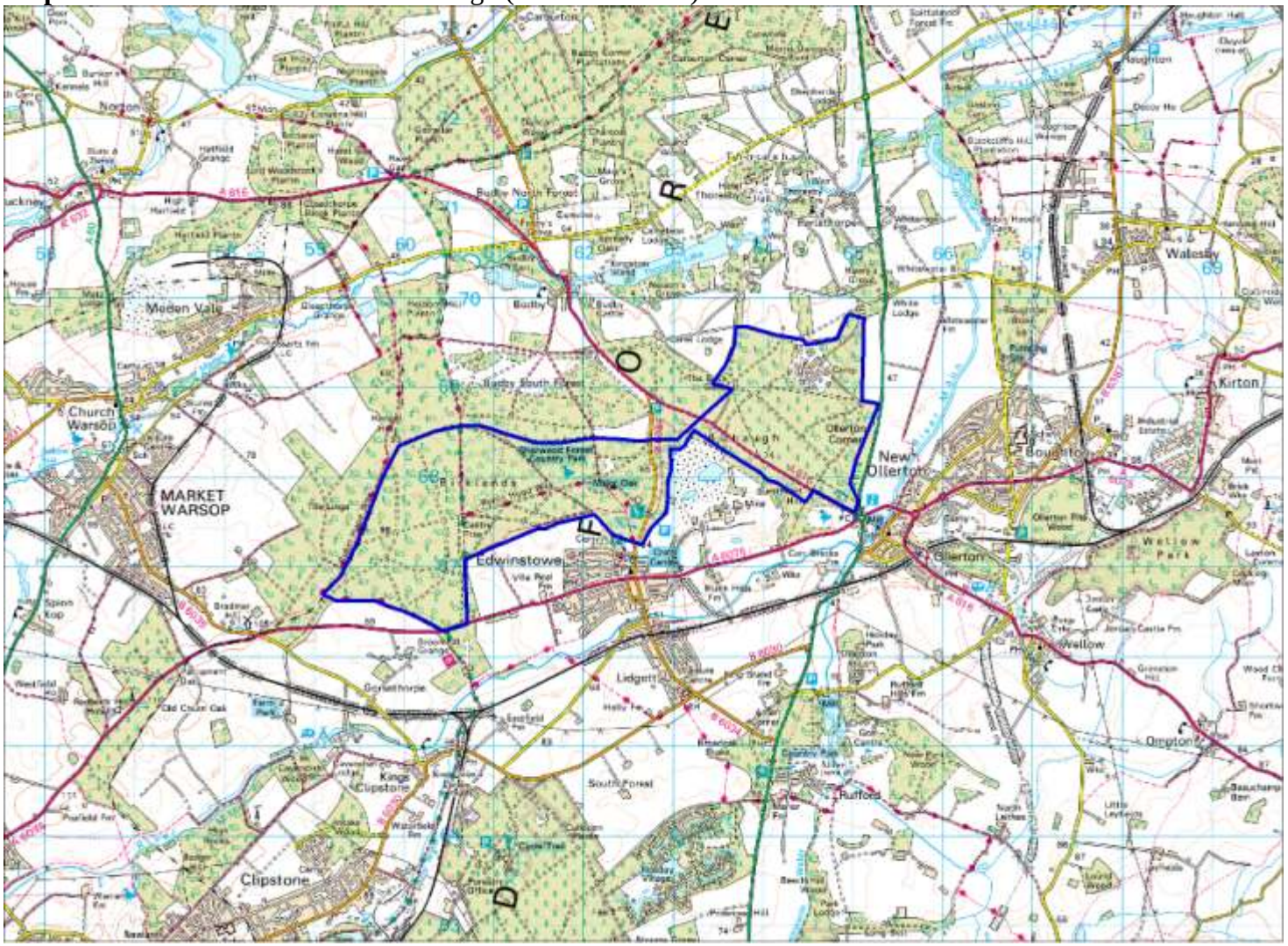
Map 1 Location of Birklands and Bilhaugh (outlined in blue)



SUMMARY

The ancient semi-natural woodlands of Birklands and Bilhaugh in Sherwood Forest are widely recognised as having national and European importance for the conservation of saproxylic invertebrates, especially beetles.

The main surviving areas of relatively unmodified former wood pasture habitat associated with the ancient forests of Birklands and Bilhaugh have been included within two adjoining Sites of Special Scientific Interest (SSSIs) - Birklands and Bilhaugh SSSI and Birklands West and Ollerton Corner SSSI. Nearly 272 hectares of the Birklands and Bilhaugh SSSI has been designated as a Special Area of Conservation (SAC) under the EU Habitats Directive, the tree aspect being covered under the Annex I habitat type of 'old acidophilous oak woods with *Quercus robur* on sandy plains', with 200 hectares of this included within the Sherwood Forest National Nature Reserve (NNR).

This document reports on a desk study to review and analyse all previous survey data for the Birklands and Bilhaugh SSSIs in order to assess the current condition and national importance of the saproxylic invertebrate assemblage of the two SSSIs and indicate whether current management practices appear sufficient to conserve the invertebrate fauna of the sites.

Assessment of site quality

Two systems have been devised for the relative assessment of site quality for nature conservation using saproxylic beetles: the Index of Ecological Continuity (IEC) and the Saproxylic Quality Index (SQI). The IEC focuses on relict old growth conditions while the SQI uses species rarity and while these two aspects clearly overlap to a considerable extent, they do result in subtle differences between the resulting assessments:

The IEC values for both the Victorian data and the records from the past 50 years (ie since SSSI designation) both exceed the suggested threshold for European significance, but the older data set is clearly the richer of the two in old growth species.

However, many of the missing species are difficult to find and may well still be present. Whether or not the decline in IEC value reflects a decline in site quality is unclear. Further specialist survey – especially survey targeted specifically at the apparently lost species – would be required in order to provide convincing evidence. The majority of these apparently lost species are specialists of decaying heartwood in veteran trees and so many may be expected to still be present since veteran oaks are still plentiful.

The one factor which may have caused losses is shading of the old trunks by secondary growth and plantations, as some species at least need sun-warmed trunks. Others breed in aerial dead branches of open-grown trees, and so similarly might have been lost through canopy competition with younger trees.

The equivalent SQI values both exceed the suggested threshold for national significance but only the Victorian data achieves European significance, but data quality issues make further conclusions invalid. The decline in SQI may just reflect increased documentation of common and widespread species which were ignored by the early collectors. The most valid conclusion appears to be that the SSSIs continue to be of high conservation value for rare saproxylic beetles.

Saproxylic assemblage types

The specialist beetle faunas of bracket fungi and heartwood decay are relatively species-rich in Sherwood Forest, in comparison to the bark and sapwood decay fauna; this is consistent with Sherwood being a national stronghold for old growth beetle species.

The majority of the 14 **red-rot[1] specialists** have been found within the past 50 years, and 10 within the past 25 years. Even the smallest and most difficult species of beetle have been found when specifically sought. This suggests that the fauna might be considered to be in good condition. However, the continued failure to find the nationally scarce *Anitys rubens* and *Mycetophagus piceus* appears unaccountable as these develop in relatively fresh red-rot, while the fungal agent of the decay is still active in the wood. The status of the nationally scarce *Ampedus elongatulus* is also odd, having been reported on just a single occasion. It is feasible that this situation is symptomatic of a lack of new generations of maturing oaks becoming available for colonisation by red-rot fungi, that the old hulks are now providing mainly late successional habitat.

Data on the 6 identified **white-rot specialists** – albeit statistically thin – suggests that there may have been major changes in the faunal composition due to changing land management, with a trend away from species of open forest conditions towards more shade-tolerant species.

The populations of the four **wood mould** darkling beetles (Tenebrionidae) appear to be in good condition, but the continued absence of records of the rove beetle *Quedius truncicola* (Staphylinidae) may be significant.

The Sherwood Forest saproxylic beetle fauna is also of special interest for its diversity of species which are primarily **subterranean** in habits, developing in the **decaying wood of roots and stumps**. Seven species have been reported, of which two are notable rarities. These two are not attracted to blossom as adults and so are extremely difficult to find without specialist trapping equipment. Such equipment has been developed in recent years but has not yet been tried within the two SSSIs. Until this is done, the lack of records of the two rarest species is not significant.

Site condition for the specialist fauna of **aerial dead branches** appears good; only one of the eleven species lacks modern records and others have clearly been long-overlooked.

[1] Red-rot is a term widely used by entomologists; arborists and some mycologists prefer to use brown-rot for the same type of decay

Populations of the **bracket fungus** beetle assemblage appear to be in good condition overall. The surprise is the lack of modern records for three normally widespread species *Dacne rufifrons*, *Mycetophagus quadripustulatus* and *Cis bidentatus*.

Current status of the key beetle species

Of the 7 Sherwood Forest species which have the most restricted ranges nationally, *Teredus cylindricus* (RDB Endangered), *Micridium halidaii* (RDB Endangered), *Ampedus cardinalis* (RDB Vulnerable), *Prionychus melanarius* (RDB Vulnerable), *Corticeus unicolor* (RDB Rare), and *Corticaria longicollis* (pRDB) have all been reported within the past 25 years. Only one of equivalent status, *Oxylaemus cylindricus* (RDB Extinct), has not been found since it was originally discovered here in the 19th century, but this requires specialist equipment (which has not be used here) in order to find it on demand – it has recently been rediscovered in SE England after a similar length of time. Although not clearly a true saproxylic, *Cryptocephalus querceti* (RDB Vulnerable), has also been found in recent years. Thus there is no evidence for a decline in these key species.

Total numbers of saproxylic species

The beetle list currently stands at 316 species, although this includes introduced conifer associates and other recent arrivals. This compares very well with the list for Windsor Forest and Great Park which is at least 365 species, and includes many southern and south-eastern species which could not be expected as far north as Sherwood. The Sherwood list also includes species with a northern and western distribution in Britain and other species which are not known from Windsor. Sherwood clearly remains an important northern equivalent of Windsor.

The other major saproxylic invertebrate group, the Diptera, have hardly been studied at Sherwood at all and are a major gap in knowledge. A preliminary investigation in 2010 found 44 saproxylic species, including 5 of Nationally Scarce status and one potentially of RDB status. Southern old forest species were represented. A record from 2009 of one additional RDB Endangered saproxylic species has also been more recently confirmed. Overall, there does appear to be a fairly complete representation of the various assemblages of wood-decay Diptera at Sherwood, with specialist species known from a wide range of different wood-decay situations, from sap-runs and bark beetles, to bracket fungi, white-rot and aerial rot-holes. The main question relates to how rich this fauna actually is and what level the conservation value. Further survey is desirable.

A good range of typical deadwood-nesting bees and wasps are known but the fauna is not known to be outstanding.

The false scorpions are a small group but well-represented in Sherwood – again a northern equivalent to Windsor Forest - with the especial interest of the RDB *Dendrochernes cyrneus.*

With modern records for two of the three RDB old tree spider species – *Midia midas* and *Mastigusa macrophthalma* - Sherwood Forest actually exceeds Windsor Forest in current site quality.

As with Windsor Forest, Sherwood appears to have thriving populations of the two old forest slugs *Limax cinereoniger* and *Malacolimax tenellus*.

Condition of the saproxylic fauna in relation to land management

While it is clear that the saproxylic beetle fauna of the two Birklands SSSIs remains in favourable condition following site designation, there are signs that damaging change has been occurring during the past 50 years. The key factors appear to be increasing shade and loss of open sunny areas with blossom. The abandonment of livestock grazing last century has led to the development of closed canopy conditions, and this has been exacerbated by plantation forestry in some areas. However, recent initiatives have opened up ancient oaks from competing plantations, and grazing has been restored to some sections. This work has the potential to be very beneficial to the saproxylic fauna.

Priorities for further survey

- One key saproxylic beetle assemblage – the subterranean fauna - has not been carefully investigated and a programme of subterranean trapping is recommended in order to clarify its condition, especially with regard to assessing the continued survival of the RDB beetle *Oxylaemus cylindricus*.
- Saproxylic Diptera are hardly known at all and need assessing;
- Continued monitoring of the condition of the saproxylic fauna in relation to current and future land management initiatives is essential in order to demonstrate conservation success.

ACKNOWLEDGEMENTS

The contract was funded by Natural England and managed by Steve Clifton and Nicola Orchard of Natural England. The website maintained by Trevor and Dilys Pendleton (www.eakringbirds.com) proved extremely useful in providing good access to species records. Sheila Wright (Nottingham Natural History Museum, Wollaton Hall) made her manuscript list of beetles available. A wide range of national invertebrate experts supported the study by providing additional data: Peter Chandler, Colin Johnson, Derek Lott, Howard Mendel (Elateroidea Recording Scheme), Adrian Norris (Non-marine Recorder for the Conchological Society), and Alan Stubbs. Michael Darby's bibliographical dictionary of coleopterists on www.coleopterist.org.uk provided useful background information on the Victorian beetle recorders who were active in Sherwood Forest.

CONTENTS

1 INTRODUCTION

1.1 Overview

The Sherwood Forest area of Nottinghamshire has long been recognised as one of the most special places in England for the beetles of decaying wood (saproxylic beetles). The richness of the beetle fauna has more recently been associated with site history as well as habitat quality (Harding & Rose, 1986). The Forest was unaccountably omitted by Speight (1989) in his listing of European forests of potential international importance by their fauna of saproxylic invertebrates[2]. Subsequently, two site quality assessment systems have been developed – one using species rarity, the other ecological continuity (see section 2.2) - and these have enabled a more scientific assessment of the beetle fauna. Both place Sherwood Forest amongst the very top sites in England, although it is only the continuity index which demonstrates European significance. While other invertebrate groups are also known to include deadwood specialities – notably Diptera - these have received much less attention in Sherwood Forest.

The core area of the remaining least-modified forest habitats is focused on the ancient woodlands of Birklands and Bilhaugh situated between the villages of Edwinstowe and Ollerton in north Nottinghamshire (see Map 1). This was designated as the Birklands & Bilhaugh Site of Special Scientific Interest (SSSI) in 1954, and adjoining areas as the Birklands West & Ollerton Corner SSSI in 2001, primarily for their ancient woodland vegetation communities dominated by pedunculate oak *Quercus robur*, sessile oak *Quercus petraea* and silver birch *Betula pendula* which form typically species-poor woodland stands (and which correspond to National Vegetation Classification types W10 and W16 woodland), areas of dry lowland heath, and their invertebrate faunas associated with decaying wood and open heathland habitats. An exceptional population of ancient and veteran oak trees occur at various densities within the woodland stands. Collectively the two SSSIs cover an area of 920.37 hectares largely comprising oak and birch-dominated wood-pasture (in various states of modification) and dry lowland heath.

About one half of the extent of the Birklands and Bilhaugh SSSI has also been designated as a Special Area of Conservation (SAC) under the EU Habitats Directive, partly as one of only four outstanding localities in the UK for the Annex I habitat type of 'old acidophilous oak woods with *Quercus robur* on sandy plains'. Some 200 hectares of the wood-pasture habitat found within the SAC are also included within the Sherwood Forest National Nature Reserve (NNR) declared by Natural England in 2002. Other – more outlying - remnants of the old Sherwood Forest have also been designated as SSSI: Clumber Park SSSI in 1981 and, further away towards the western edge of the old forest on the Peak District fringes, Calke Park SSSI in 1992 and Chatsworth Old Park in 1998.

Despite this recognition, no full and detailed compilation of the Sherwood Forest saproxylic invertebrate fauna had been attempted. At the start of the current project it was not possible to provide any figures on the following:

- the total numbers of saproxylic invertebrates which have been recorded;
- the proportion of these that may be long-established natives;
- the extent of colonisation by new arrivals;
- how many native species might still be present but overlooked;

[2] The UK is poorly represented in the Speight listing, with just five sites: Abernethy, Epping, Moccas Park, New Forest and Windsor Forest & Great Park.

- the proportion of the fauna that may have been lost through land-use changes since recording began, and especially since notification;
- the species currently under most threat locally.

Lott (1999 and 2007) has attempted some analysis of change in the saproxylic beetle fauna within the SSSIs in 1998 and 2006, but no work has been published covering the whole fauna back into the early days of species recording in the Forest in the middle of the 19th century.

1.2 Objectives of the 2010 project

Requirement:

- a desk study to review and analyse all previous survey data for Birklands and Bilhaugh to assess the current condition and national importance of the saproxylic invertebrate assemblage of the two SSSIs and whether current management practices appear sufficient to conserve the invertebrate fauna of the sites.

Methodology – aims:

- review and analyse changes to the wood-decay assemblage to add contextual information to validate the direct sampling approach of Common Standards Monitoring;

- provide a baseline against interest at notification and to evaluate future change.

This to include :

- a wholesale review of past survey data to examine any apparent decline or significant change to the species composition of the assemblage of special interest and the overall quality of the fauna since notification. The fauna should be broken down into the ISIS assemblage types, and these then subdivided further, to provide greater sophistication in terms of analysis against habitat requirements and hence conservation needs. Heartwood decay can be further subdivided into red-rot, white-rot and wood mould species, for instance, and these then relate to tree species, fungus species, and tree age. By doing this any changes in quality can be examined at both species and habitat requirement level;

- examination of any noticeable changes over time to the fauna from a bio-geographic perspective. This is particularly important at Birklands as the only English SAC where species associated with both northern and southern Britain form a key element of the assemblage, and the site is designated as SAC as the most northerly example of old oak woodland on sandy plains. This attribute is absent from the ISIS evaluation system but is an important element of the interest of the fauna at this particular site from a CSM perspective;

- examination of both the Site Quality Index (Fowles et al, 1999) and the Index of Ecological Continuity (Alexander, 2004) for the SSSI, as the SQI deals only with species rarity whereas the IEC deals with species richness of the special old growth community, and place in national context comparing against other sites;

- bring in the date-class of records to see if anything can be discerned over time and against known changes in habitat and/or management;

- consider species which might be expected to be present but which haven't so far been reported, and any implications of this;

- carry out a proxy condition assessment for this feature based on this desk study and review to emphasise any implications for future conservation management of the SSSIs/NNR.

1.3 Sources

The key starting point for the data review is the website http://www.eakringbirds.com established by local entomologists Trevor and Dilys Pendleton. This contains compilations of all the modern and historic Coleoptera, Arachnida and Lepidoptera records, and is kept as up-to-date as possible (data was extracted up to the end of 2009). This has been supplemented – where necessary - from a wide variety of other sources (details in References section).

The earliest Coleoptera records from the Forest date from the 1860s and the Forest was visited by most if not all of the eminent coleopterists of the latter half of the century. Their records were collated by Carr (1916). Recording seems to have been neglected for much of the 20th century, with a few published records from, for example, W.E. Ryles and E.C. Bedwell in the 1920s, and D. Tozer in 1930s and 1940s. It is very clear from the record that these early collectors only noted the rarer species, and that more widespread species were not recorded at all – the first record of the common woodworm beetle *Anobium punctatum* was only made in 2000. This makes assessment of change over time problematic, other than for particular rare species.

The early records are all documented as 'Sherwood Forest' but are assumed to mostly come from the Birklands and Bilhaugh area as this has been the core of surviving old wood pasture habitat throughout the historic biological recording period (see section 4.1).

Colin Johnson began visiting the Birklands and Bilhaugh area in the 1960s, often with Peter Skidmore and Eric Hunter. Since then, the area has been visited by many more recorders. It is only from this period onwards that, more or less, accurately located records have been forthcoming and these invariably originate from the areas covered by the two SSSIs.

2 SAPROXYLIC COLEOPTERA OF SHERWOOD FOREST

2.1 Summary of conservation significance

Sherwood Forest is a northern equivalent of Windsor Forest and Great Park for its rich variety of saproxylic beetles. It is:

- The richest site in the north of England for the Temperate broad-leaved forest fauna of the British Isles;
    - Its fauna has affinities with other northern sites such as Dunham, Duncombe and Calke Parks, as well as – to a lesser extent - Clumber, Hardwick and Kedleston Parks;
- One of the two key British sites (with Windsor) for *Teredus cylindricus* (Bothrideridae) and *Micridium halidaii* (Ptiliidae);
- One of the two key British sites (with Speyside) for *Corticaria longicollis* (Latridiidae);
- One of the three key British centres (with Windsor and the lower Severn Basin) for *Ampedus cardinalis* (Elateridae);

- A key British site for *Prionychus melanarius* and *Corticeus unicolor* (both Tenebrionidae), neither known from Windsor;
- At the northern edge of the British range for ten Red Data Book (RDB) beetles and eight Nationally Scarce (NS) species, and also close to the northern edge of the range of many more beetle species (full list in Appendix 1);
    - three RDB and two NS beetles have not been detected for over 100 years - *Stenichnus godarti* (Scydmaenidae), *Procraerus tibialis* (Elateridae) and *Oxylaemus cylindricus* (Bothrideridae) (all RDB) and *Abraeus granulum* (Histeridae) and *Stictoleptura scutellata* (Cerambycidae) (both NS), although these cannot be assumed to be extinct locally as the first four are difficult to find on demand. The last has only been reported on one occasion and may not have been resident at all – it is mainly known from a restricted area of SE England and other isolated records also exist elsewhere outside of its current range, perhaps suggesting chance introductions from commercial movement of timber around the country;
    - a significant majority of these range edge species have been detected in the past 25 years - 32 of the 49, ie 2/3 or 67%;
    - the apparent loss of flower-visiting beetles such as *Ischnomera sanguinicollis* (Oedemeridae) and *Mordellochroa abdominalis* (Mordellidae) may reflect the cessation of grazing and the closing over of the tree canopy which resulted;
    - the rest of the species with only older records are small and/or difficult to detect – Colin Johnson re-discovered many such species in the 1960s and 1970s using Berlese extractors, and Lott (1999) also found a number of such species by using other specialist methodologies such as grass traps and Tullgren funnels, eg *Microscydmus nanus* which had last been reported in 1913.
- At the south-eastern edge of the British range for 10 species with a northern and western distribution and which are therefore not present at Windsor (Appendix 1):
    - The key examples are *Ampedus pomorum* (Elateridae), *Saperda scalaris* (Cerambycidae), *Thymalus limbatus* (Trogositidae), *Trachodes hispidus* and *Trypodendron signatum* (Curculionidae), all with Nationally Scarce status.

2.2 Conservation assessment of the full saproxylic assemblage

2.2.1 Introduction

Two systems have been devised for the relative assessment of site quality for nature conservation using saproxylic beetles: the Index of Ecological Continuity (revised in Alexander, 2004) and the Saproxylic Quality Index (Fowles, Alexander & Key, 1999). The IEC focuses on relict old growth conditions while the SQI is about species rarity – while these two aspects clearly overlap to a considerable extent, they do result in subtle but important differences between the resulting assessments.

2.2.2 Index of Ecological Continuity

The Index of Ecological Continuity has been used to identify Britain's most important sites for the saproxylic invertebrates of ancient trees and wood-pasture type habitats, and a hierarchical site table has been presented. The Index calculation is based on the presence or absence of a select list of beetle species (revised by Alexander, 2004) – only Temperate forest species are included, not boreal forest species. The species are graded according to their degree of association with Britain's

remaining areas of old growth – mainly the old wood pastures and historic parklands - and these grades are used as the basis for a scoring system. The total of these scores provides the Index.

The species in the qualifying list include many which are difficult to find on demand and so the Index may be built up over a number of years. Records from earlier recording therefore contribute to the Index. A control on old records is however imposed, with only post-1950 records being used in the calculation. The Index for a particular site, at any one time, is a minimum figure as overlooked species may yet be discovered there.

Experience has suggested that sites of national importance have an IEC in the range of 25-80 while IEC values of 15-24 are of regional importance (Alexander, 2004). Sites in excess of 80 are considered to be of European significance.

In Table 1, the species data is grouped first by time period, to compare the Victorian data with records arising from the past 50 years. The second data grouping focuses on particular surveys which have been carried out in the last 10 years or so. The old data can justifiably be analysed using the IEC approach since IEC beetle species tend to be the more interesting to collectors and recorders, and therefore tend to be better represented in incomplete listings. However, such old data cannot be used in the actual current IEC calculation.

Data set	**Grade 1**	**Grade 2**	**Grade 3**	**IEC**
Data grouped by decades				
Victorian	18	18	38	128
Last 50 years	16	13	29	103
Individual data sets				
1998 Lott (1999)	6	6	13	43
2002 Entotax (2003)	4	3	18	36
2006 Lott (2006)	6	6	14	44
2009 Alexander CSM	3	3	8	23

Table 1 Index of Ecological Continuity calculated for various datasets

The IEC values for both the Victorian data and the records from the past 50 years (post SSSI designation) both exceed the suggested threshold for European significance, but the older data set is clearly the richer of the two in old growth species. However, many of the missing species (Table 2) are difficult to find and may well still be present. Whether or not the decline in IEC value reflects a decline in site quality is unclear. Further specialist survey – especially survey targeted specifically at the apparently lost species – would be required in order to provide convincing evidence.

Family & species	**IEC Grade**	**Dates & Recorders**	**Ecological requirements**
Histeridae			
Abraeus granulum	1	1889 Blatch	Heartwood decay
Ptiliidae			
Ptenidium gressneri	2	1907 & 1884 Blatch	Aerial rot-holes
Ptenidium turgidum	2	1889 Blatch	Heartwood decay
Ptinella limbata	2	1886 Blatch & Horner	Dead trees with bark attached
Scydmaenidae			

Eutheia linearis	3	1886 Fowler; 1883 Blatch	Heartwood decay
Stenichnus godarti	2	1886 Fowler	Heartwood decay
Staphylinidae			
Quedius truncicola	3	No date – Fowler	Heartwood decay, wood mould
Scirtidae			
Prionocyphon serricornis	3	1904 Taylor & Tomlin; 1870 Matthews	Ponded water on trunks
Elateridae			
Calambus bipustulatus	3	No date – Turner & Fowler	Aerial dead branches
Ampedus elongatulus	3	1865 Matthews	Heartwood decay, red-rot
Procraerus tibialis	1	No date Bedwell	Heartwood decay
Bostrichidae			
Lyctus brunneus	3	1913 Hardy	Dead sapwood
Ptinidae			
Ptinus subpilosus	2	1907 Donisthorpe	Heartwood decay
Anobiidae			
Anitys rubens	1	1906 Fowler, Taylor, Chaster, Matthews	Heartwood decay, red-rot
Dasytidae			
Aplocnemus impressus	2	1906 Taylor & Chaster	Aerial dead branches
Monotomidae			
Rhizophagus oblongicollis	1	1889 Blatch	Decaying roots underground
Latridiidae			
Enicmus brevicornis	3	No details (Carr 1916)	Mouldy bark
Mycetophagidae			
Mycetophagus piceus	2	1886 Blatch & Horner	Heartwood decay, red-rot
Mycetophagus populi	2	1904 Hardy	Aerial rot-holes
Tetratomidae			
Tetratoma desmaresti	3	1899; 1886 Blatch & Horner	Aerial dead branches
Oedemeridae			
Ischnomera sanguinicollis	1	No date Blatch & Fowler	Heartwood decay; white-rot
Cerambycidae			
*Stictoleptura scutellata**	1	1869 Taylor	Heartwood decay; white-rot; open sunny situations
Scolytinae			
Trypodendron signatum	3	1932 Ashe; Matthews, Blatch, Fowler; 1868 Taylor	Freshly dead trunks & large boughs

Table 2 IEC Beetle species present in Victorian period but not reported in past 50 years
*Species record based on single report, a large and conspicuous species

The majority of these apparently lost species are specialists of decaying heartwood in veteran trees and so many may be expected to still be present. The one factor which may have caused losses is

shading of the old trunks by secondary growth and plantations, as some at least need sun-warmed trunks. Others breed in aerial dead branches of open-grown trees, and so similarly might have been lost through canopy competition with younger trees.

Table 3 places the current IEC value for Sherwood Forest into context by comparing it with the most notable sites nationally (across Temperate Britain) and regionally (northern England).

Site name	**County**	**IEC**
European significance:		
Windsor Great Park & Forest	Berkshire	235
New Forest	Hampshire	171
Richmond Park	London	156
Moccas Park	Herefordshire	127
Bredon Hill	Worcestershire	120
Sherwood Forest	***Nottinghamshire***	***103***
Bushy Park	London	100
Epping Forest	Essex	97
Hatfield Forest	Essex	88
Langley Park	Buckinghamshire	87
Burnham Beeches	Buckinghamshire	83
Top northern sites:		
Calke Park	Derbyshire	75
Duncombe Park Estate	North Yorkshire	73
Dunham Park area	Cheshire	64
Clumber Park	Nottinghamshire	61
Kedleston Park	Derbyshire	61
Trentham Park & King's Wood	Staffordshire	48
Grimsthorpe Park	Lincolnshire	42

Table 3 Calculated values for the Index of Ecological Continuity for the richest sites in Britain and northern England

2.2.3 Saproxylic Quality Index

The Saproxylic Quality Index (Fowles et al, 1999) is a more recent development designed to take the whole saproxylic beetle fauna into account – including the boreal species of Caledonian forest - and to include some control of recording effort. The species are scored according to the level of their national status and on a geometric scale – from 1 point for common species through to 32 points for the rarest. The total of these scores is termed the Species Quality Score and the Species Quality Index is calculated by dividing this score by the number of qualifying saproxylic species recorded and then multiplying the result by one hundred.

The list of qualifying species is not however the full list of saproxylic beetles known from the site, as an attempt has been made to exclude naturalised introductions as well as species not fully saproxylic in habits. Subsequent developments in ecological knowledge has shown that some species which were omitted should in reality be included. No revision of the list has however been proposed.

The SQI calculation has certain provisos:

- a threshold of 40 qualifying species must have been recorded from the site;
- the list should be complete, ie include all qualifying species recorded during surveys;
- the same attention should have been applied to recording common species as rare ones.

Fowles et al (1999) suggest that an SQI of 500 is probably an appropriate threshold for assessing national importance, while 590 is suggested as defining European importance.

There appear to be few complete datasets available either for Sherwood Forest as a whole or for the areas covered by the present SSSIs - much of the past recording has been on an ad hoc basis. In the following table – Table 4 - SQI has been calculated for the accumulated whole data set and for records only from the last 50 years (ie since Colin Johnson renewed recording), as well as for a few individual data sets in the last 10 years which appear to have attempted to cover all saproxylic beetles – albeit varying in recording techniques employed. The 2009 data comes from the Common Standards Monitoring approach and is only partially complete.

Data source	**Number of qualifying species**	**Saproxylic Quality Score**	**Saproxylic Quality Index**
Full species list	256	1521	594.1
Last 50 years only	198	1068	539.4
1998 Lott (1999)	100	-	474
2002 Entotax (2003)	79	315	398.7
2006 Lott (2006)	68	348	511.8
2009 Alexander CSM	33	221	669.7

Table 4 Site Quality Index calculated for various datasets

Conclusions are difficult from this analysis. The accumulated data from the whole recording period and the last 50 years both indicate national importance, while the full dataset additionally suggests European importance. The decline in SQI may just reflect increased documentation of common and widespread species which were ignored by the early collectors. The most valid conclusion appears to be that the SSSIs continue to be of high conservation value for rare saproxylic beetles. The individual datasets demonstrate the instability of the SQI approach, fluctuating widely from well below national importance (398) up well into European importance (669). The incomplete 2009 data provides the highest SQI of all, but has yet to include the late spring peak in beetle activity, which may be expected to lower the index.

2.3 ISIS assemblage types

A new invertebrate habitat classification has recently been developed for use as the basis of a new computer application for Common Standards Monitoring of invertebrates – the Invertebrate Species and habitats Information System (ISIS). The aim is for the defined habitats (characterised by assemblages of associated invertebrates) to represent structural characteristics of the vegetation, land form and underlying soil types, and therefore relate directly to land management issues. Saproxylic invertebrates form a grouping of Specialist Assemblage Types (SATs) within the Broad Assemblage Type (BAT) of arboreal invertebrates. **A21 Wood decay assemblages** includes all invertebrates which are primarily associated with decaying wood. Where it is thought that sufficient

is known about their ecology they are further categorised into the following SATs: **A211 heartwood decay**, **A212 bark and sapwood decay**, and **A213 fungal fruiting bodies**. A211 and A213 are characteristic of large tree trunks and the larger boughs, and so are most species-rich in old growth conditions, such as ancient wood pastures and historic parklands with old trees – A213 is separated out as these species are more readily surveyed than heartwood species. A212 invertebrates are associated with decay types which can occur in a wide range of tree sizes and ages – from twigs and small branches through to dead bark, the cambial layer beneath and the superficial sapwood.

Not all of the 316 species known from Sherwood Forest are currently recognised by ISIS as belonging to wood decay assemblages. But the 294 which are categorised as wood decay species break down into the SATs as follows (Table 5):

ISIS assemblage type	Species representation	Percentage of national list
Generalist wood-decay fauna	57	
Heartwood decay	55	31.4
Bark and sapwood decay	128	25.4
Fungal fruit bodies	39	43.8
Conifer associates	15	

Table 5 Numbers of species included in each of the wood-decay species assemblage types of ISIS

This analysis suggests that the bracket fungi and heartwood decay fauna are relatively species-rich in Sherwood Forest, in comparison to bark and sapwood decay fauna. This is consistent with Sherwood being a national stronghold for old growth species.

The ecology of many of these species is poorly understood and so breaking the assemblages down further at assemblage scale is not feasible at present. However, the ecology of some is better known and a partial breakdown is possible.

2.3.1 A211 Heartwood decay

The 55 heartwood decay specialists can be further split into:

- red- or brown-rot specialists (14 species),
- white-rot specialists (6 species),
- wood mould specialists (5 species),
- generalist heart-rot species.

This level of distinction remains difficult at present and fewer than half are currently thought to be specialist of a particular stage or type of decay within the heartwood decay succession. It is possible, however, that some of the species currently regarded as specialists in the type of rot may be more general heart-rot species. Similarly species currently regarded as generalist heart-rot species may prove to favour red (brown) or white rot conditions. There is a considerable amount of work needed to improve our understanding of the ecology and habitat requirements of these species. Species which only occur within wood mould – the final stage of the decay succession are better understood.

2.3.1.1 Red-rot specialists

Fourteen species are currently thought to be exclusively associated with red or brown rot:

Oxypoda recondita (Staphylinidae) Nationally Scarce
- Not known to early recorders and first discovered by C. Johnson in 1969, noted again in 1985, and found in 1998 by Lott (1999);

Micridium halidaii (Ptiliidae) RDBK
- Discovered in the Forest in 1867 and re-discovered by C. Johnson in 1977, noted again in 1983-5;

Plectophloeus nitidus (Pselaphinae) RDB Vulnerable
- Discovered in the Forest in 1889 and re-discovered by C. Johnson in 1997, noted again in 1984, 1985 and 2006;

Quedius scitus (Staphylinidae) Nationally Scarce
- Discovered in the Forest in 1889, noted again in 1916, and rediscovered in 1998 by Lott (1999);

Ampedus balteatus (Elateridae)
- A well-known species in the Forest with many modern records;

Ampedus cardinalis (Elateridae) RDB Vulnerable
- Discovered in the Forest by the Victorians and rediscovered by C. Johnson in 1965, noted in 2006 and elytra almost certainly this species in 2009;

Ampedus elongatulus (Elateridae) Nationally Scarce
- Discovered in the Forest in 1865, but not reported since;

Dorcatoma chrysomelina (Anobiidae)
- First noted in the Forest in 1906, rediscovered by P. Skidmore and C. Johnson in 1965, and noted in 1998 by Lott (1999)

Dorcatoma flavicornis (Anobiidae) Nationally Scarce
- Well-known to the early recorders, rediscovered by P. Skidmore in 1961 and noted by F.A. Hunter in 1978;

Anitys rubens (Anobiidae) Nationally Scarce
- Well-known to the early recorders, but not noted since 1906;

Teredus cylindricus (Bothrideridae) RDB Endangered
- Discovered in the Forest in 1884, rediscovered by F.A. Hunter in 1962, noted 1964 and 2001, and found during CSM in 2009

Mycetophagus piceus (Mycetophagidae) Nationally Scarce
- Discovered in the Forest in 1886, but not noted since;

Cis fagi (Ciidae)
- Discovered in the Forest in 1886, rediscovered by C. Johnson in 1977, and noted again in 1984 and 2006;

Euglenes oculatus (Aderidae) Nationally Scarce
- Discovered in the Forest by the early recorders and with many modern records.

The majority of these have therefore been found within the past 50 years, and 10 within the past 25 years. Even the smallest and most difficult species have been found when specifically sought. This suggests that the fauna might be considered to be in good condition. However, the continued failure to find *Anitys rubens* and *Mycetophagus piceus* is unaccountable as these develop in relatively fresh red-rot, while the fungal agent of the decay is still active in the wood. The status of *Ampedus elongatulus* is also odd, having been reported on just a single occasion. It is feasible that this

situation is symptomatic of a lack of new generations of maturing oaks becoming available for colonisation by red-rot fungi, that the old hulks are providing mainly late successional habitat.

2.3.1.2 White-rot specialists

Just six of the 55 are currently thought to be white-rot specialists:

Dorcus parallelepipedus (Lucanidae)
- The Lesser Stag Beetle is well-known in the Forest, with modern records

Sinodendron cylindricum (Lucanidae)
- The Rhinoceros Beetle is well-known in the Forest, with modern records

Platycis minuta (Lycidae) Nationally Scarce
- First reported in the Forest by F.A. Hunter in 1978; noted again in 1989 and 2009;

Melandrya caraboides (Melandryidae) Nationally Scarce
- First reported in the Forest by T.A. and D.T. Pendleton in 2008 and 2009;

Ischnomera sanguinicollis (Oedemeridae) Nationally Scarce
- Known in the Forest to the early recorders but no modern records;

Stictoleptura scutellata (Cerambycidae) Nationally Scarce
- A single report from 1867.

These six species are a strange mixture. The *Platycis* and *Melandrya* are large and distinctive beetles, and might appear to be modern arrivals in the SSSIs, although it may just be that they were not considered worthy of noting by the early recorders. It does seem most likely that the *Melandrya* at least is a recent arrival in the SSSI. Both beetles are thought to be shade-tolerant species and neither has a requirement for nectar sources. The *Ischnomera* and *Stictoleptura* are both well-known to nectar at hawthorn and other blossom in open sunny situations, and their loss might be attributed to the closing in of the tree canopy which had followed abandonment of grazing and local emphasis on commercial forestry. *Stictoleptura scutellata* also develops in sun-exposed wood and would have been an early casualty to the changes in land management during the 20th century.

The white-rot fauna – albeit statistically thin – does suggest that there may have been major changes in the faunal composition due to changing land management, with a trend away from species of open forest conditions towards shade-tolerant species.

2.3.1.3 Wood mould specialists

Five beetle species are known to live specifically amongst the wood mould which accumulates in the base of cavities and hollow trunks as a result of fungal decay of the woody tissues.

Quedius truncicola (Staphylinidae) Nationally Scarce
- Discovered by one of the early recorders but not reported since;

Prionychus ater (Tenebrionidae) Nationally Scarce
- Originally noted by the early recorders but confusion with the following species meant that all early records were assumed to refer to *P. melanarius* (Carr, 1916); A.B. Drane appears to be the first person to report the true *P. ater* from the Birklands in 2000; subsequently noted by the Entotax survey in 2002;

Prionychus melanarius (Tenebrionidae) Nationally Scarce
- First recognised in the Forest, new to Britain, by Donisthorpe in 1908 – 'the Sherwood specimens appear to all be [this species]' (Fowler & Donisthorpe, 1913); regularly found in

the 1960s by P. Skidmore and C. Johnson, found during the Entotax survey in 2002, and noted by the Pendletons in 2008; elytra found during the 2009 CSM project;

Pseudocistela ceramboides (Tenebrionidae) Nationally Scarce

- Discovered in the Forest in 1869, rediscovered by C. Johnson and F.A. Hunter in 1963, and most recently reported by the Pendletons in 2009;

Mycetochara humeralis (Tenebrionidae) Nationally Scarce

- Reported on many occasions by the early recorders, rediscovered by C. Johnson and P. Skidmore in the 1960s, noted by A.P. Foster in 1987, Lott (1999) and the Pendletons in 2008 and 2009.

The populations of the four tenebrionids appear to be in good condition, but the continued absence of records of the *Quedius* may be significant.

2.3.2 A212 Bark and sapwood decay

The 128 reported bark and sapwood decay beetle fauna of Sherwood Forest is a large grouping of species and needs to be broken down into sub-SATs to consider its character and to draw out conclusions about change.

2.3.2.1 Subterranean root-decay specialists

The Sherwood Forest saproxylic beetle fauna is of special interest for its diversity of species which are primarily subterranean in habits, developing in the decaying wood of the roots and stumps. Seven species have been reported of which two are notable rarities.

Rhizophagus oblongicollis (Rhizophagidae) RDB Endangered

- Discovered in the Forest in 1889, but not reported since;

Rhizophagus cribratus (Rhizophagidae)

- A widespread species noted in 1886 and rediscovered by C. Johnson in 1963, and noted by F.A. Hunter in 1978;

Oxylaemus cylindricus (Bothrideridae) RDB ‘Extinct’ although rediscovered in Sussex during 2009

- Discovered in the Forest by Tomlin in the early recording period, but not reported since;

Stenocorus meridianus (Cerambycidae)

- A widespread species first reported from the Forest by the Pendletons in 2008;

Leptura quadrifasciata (Cerambycidae)

- Long known in the Forest, with many modern records.

Alosterna tabacicolor (Cerambycidae)

- A widespread species well-known in the Forest by the early recorders but not reported since;

Rutpela maculata (Cerambycidae)

- Long known in the Forest, with many modern records.

These species naturally divide into two groups. The first three are not attracted to blossom as adults and so are extremely difficult to find without specialists trapping equipment. Such equipment has been developed in recent years but has not yet been tried in the two SSSIs. Until this is done, the lack of records of the two rarest species is not significant.

The four long-horn beetles are all attracted to blossom in sheltered sunny situations for nectaring. The lack of modern records for the *Alosterna* may reflect the habitat changes already discussed, although the other three do seem to be OK.

2.3.2.2 Bark beetle assemblage

Sherwood Forest and the Birklands support a diverse assemblage of bark beetles (Scolytidae) – 11 species have been reported - and these in turn support a fauna of specialist predators:

Aplocnemus impressus (Dasytidae) Nationally Scarce

- Discovered in the Forest in 1906, but not since (it does occur close by at Hardwick Park, Derbyshire);

Aplocnemus nigricornis (Dasytidae) Nationally Scarce

- Discovered in the Forest by F.A. Hunter in 1978, but not reported since.

The two *Aplocnemus* are notoriously difficult to find and so little significance can be attached to the lack of records. The bark beetles themselves show little sign of change in species composition. The main species groups are associated with oak and conifers. One of the oak species, the nationally scarce *Trypodendron signatum* hasn't been reported from the Forest since 1932. Strangely the widespread ash bark beetle *Leperesinus varius* has not been reported from the Forest in over 100 years. Whether this reflects under-recording or a true decline is unclear.

2.3.2.3 Aerial dead branch assemblage

The specialist fauna of aerial dead branches, especially those in the lower canopy, is not widely appreciated. The following 11 species known from the Forest are amongst the best examples. The bark beetle predators are also well-known from this situation, as well as elsewhere.

Phloiophilus edwardsi (Phloiophilidae) Nationally Scarce

- Discovered by Matthews in the early recording period & rediscovered during the CSM project in 2009;

Orthocis alni (Ciidae)

- Discovered in the Forest in 1998 by Lott (1999) and either overlooked or ignored previously; subsequently noted by a number of recorders;

Cis pygmaeus (Ciidae)

- Discovered in the Forest in 1904 but not reported since;

Cis vestitus (Ciidae)

- First noted in the Forest by C. Johnson in 1965, and reported on a number of occasions subsequently;

Tetratoma desmaresti (Tetratomidae) Nationally Scarce

- Discovered in the Forest in 1886, reported again in 1899; rediscovered by the Entotax survey in 2002;

Orchesia minor (Melandryidae) Nationally Scarce

- Discovered near Ollerton Corner in 2009, presumably long overlooked, or perhaps a recent colonisation in response to increasing shade levels – a shade-tolerant species;

Orchesia undulata (Melandryidae)

- Discovered in the Forest in 1886, and reported on a number of occasions in recent years;

Abdera biflexuosa (Melandryidae) Nationally Scarce

- Discovered in the Forest only in 2006; this species appears to have been expanding its range somewhat and so may represent a recent arrival in the Forest;

Abdera quadrifaciata (Melandryidae) Nationally Scarce

- Discovered in the Birklands in 1998 by Lott (1999) and subsequently by A.B. Drane in 2000;

Conopalpus testaceus (Melandryidae) Nationally Scarce

- Well-known in the Forest to the early recorders, with plenty of modern records;

Leiopus nebulosus (Cerambycidae)

- Known to the early recorders, with plenty of modern records.

The main conclusion from this assemblage is that site condition appears good. Only one of the eleven species lacks modern records and others have clearly been long-overlooked.

2.3.3 A213 Fungal fruiting bodies

The specialist beetle fauna breeding in fruiting bodies of fungi naturally splits into three groups: i) those associated with small branches and which occur in the aerial dead branch assemblage as well as in fallen branches, ii) those which breed in medium-sized fungi on dead wood generally, such as *Trametes* species, and iii) those associated primarily with the larger bracket fungi. The last are the subject of this section. They are essentially part of the heartwood decay assemblage but are separated out as they are more readily recorded for the purposes of Common Standards Monitoring (CSM).

The 15 key species are:

Dacne bipustulata (Erotylidae)

- A widespread species first reported from the Forest by P. Skidmore in 1962 but almost certainly ignored by the early recorders; noted by various recorders subsequently;

Dacne rufifrons (Erotylidae)

- Only known from the early recorders;

Triplax russica (Erotylidae)

- Known to the early recorders and plenty of modern records;

Latridius consimilis (Latridiidae) Nationally Scarce

- Discovered in the Forest in 1929, rediscovered by C. Johnson in 1965, and subsequently by the Entotax survey in 2002;

Pseudotriphyllus suturalis (Mycetophagidae)

- Discovered in the Forest in 1868, rediscovered by A.B. Drane in 2000, and noted by the Entotax survey in 2002;

Triphyllus suturalis (Mycetophagidae)

- Discovered in the Forest in 1903; rediscovered by P. Skidmore in 1961, and many records subsequently;

Mycetophagus multipunctatus (Mycetophagidae)

- Discovered in the Forest by P. Kirby in 1987 and noted again by the Entotax survey in 2002;

Mycetophagus quadripustulatus (Mycetophagidae)

- A widespread species well-known to the early recorders but not reported for 100 years;

Cis bidentatus (Ciidae)

- A widespread species, known to the early recorders but only reported once since then, in 1962;

Cis castaneus = nitidus (Ciidae)

- A widespread species known to early and modern recorders;

Hallomenus binotatus (Tetratomidae) Nationally Scarce

- Discovered in the Forest in 1907, rediscovered by C. Johnson and F.A. Hunter in 1970; noted during the Entotax survey in 2002;

Tetratoma fungorum (Tetratomidae)

- A widespread species known to early and modern recorders;

Orchesia micans (Melandryidae) Nationally Scarce

- Discovered in the Forest by P. Skidmore in 1961, not reported since;

Eledona agricola (Tenebrionidae) Nationally Scarce

- Well-known to early and modern recorders;

Diaporis boleti (Tenebrionidae) RDB Vulnerable

- Discovered in the Forest in 1891 but not reported since; declined nationally in 20th century but a recovery is under way.

Populations of this assemblage in the Forest appear to be in good condition overall. The surprise is the lack of modern records for three widespread species *Dacne rufifrons*, *Mycetophagus quadripustulatus* and *Cis bidentatus*.

2.3.4 ISIS condition assessment

The ISIS software was used to calculate SQI values for the various more or less complete datasets available (Table 6). These are: the full species list for Sherwood Forest (including old unlocalised records), the list of all species reported since the SSSI was originally designated (mostly records from within the two current SSSIs), and the three specialist surveys carried out by Entotax in 2002 and Lott in 1998 and 2006.

Data source	**Number of qualifying species**	**Saproxylic Quality Score**	**Saproxylic Quality Index**	**Condition assessment**
Full site list	173	419	242	Favourable
Full list post designation	133	303	228	Favourable
1998 (Lott 1999)	52	115	221	Favourable
2002 Entotax	55	108	196	Favourable
2006 (Lott 2006)	45	93	207	Favourable

Table 6 Values for SQI of various datasets as calculated by ISIS

The saproxylic assemblage – as defined in ISIS – is assessed as being in favourable condition for each dataset. The actual calculated SQI values do however suggest a decline from the full list to the post-designation list, and each of the subsequent one year datasets is somewhat lower again. This result is difficult to interpret. The two Lott surveys were designed to be more or less identical in methodology although the habitat being surveyed would have been subtly different due to the time period – changing condition of individual trees, different availability of decaying wood, changing vegetation structure, and differences imposed by local weather patterns are amongst the main variables. These results will form an interesting baseline for the current Common Standards Monitoring work being undertaken in 2010/11 using the newly developed standard ISIS methodology.

2.4 Key species from a British perspective

It is frequently the more specialised characteristic species which are the first species to be lost from ecosystems subject to human impacts (Klein, 1989; Rukke, 2000). Total species richness or diversity indices may not represent such changes in composition or structure, often due to the replacement of characteristic by eurytopic species in the modified ecosystem. Hence the importance

of recognising characteristic species rather than just numbers of species or diversity indices in understanding biological deterioration of ecosystems (Good, 2009).

The SQI approach to site quality assessment does focus on characteristic species (at the coarse level of saproxylics) but relies solely on rarity for the assessment. The discovery of one or more poorly known species can have a dramatic impact on the SQI as a result. The IEC focuses on old growth specialists and scores individual species at a relatively low level; it is therefore more robust in its response to additional species being discovered on a site. Both indices are vulnerable to changing/developing knowledge about the species' ecology but the IEC is affected to a much lesser degree. It is important therefore not to use these indices as a 'quick-fix' approach to monitoring site quality; they should be used in parallel with a more species-focused approach.

An objective of areas reserved for natural or semi-natural biodiversity is the persistence of all their characteristic species (Margules and Pressey, 2000): "reserves, once established should promote the long-term survival of the species and other elements of biodiversity they contain by maintaining natural processes and viable populations and by excluding threats." Objectives such as this require species monitoring in some form (Good, 2009).

The following seven species are the key species which characterise the special interest of Sherwood Forest for saproxylic beetles at the species level. There are many other British Red Data Book species known but they are all also known from more than four major sites and generally are known from a selection of smaller sites in addition.

2.4.1 *Teredus cylindricus* (Bothrideridae)

British Red Data Book: Endangered (Welch 1987), confirmed by Hyman (1992).

Only known in Britain from 2 population centres (Welch, 1987):

- Sherwood Forest, where it was discovered as long ago as 1839 and reported on a number of occasions since then and most recently during the CSM work in 2009;
- Windsor Great Park & Forest, and adjoining areas such as Silwood Park and Langley Park; it was first discovered in Windsor Forest in 1925 and has been seen in the area much more regularly than at Sherwood – the population here appears to be expanding somewhat;

Most likely a predatory species, the adults probably feeding on the larvae of other saproxylics such as bark beetles (Scolytinae) and anobiid beetles,

- the adults are found on large old oak (and sweet chestnut) trees, beneath loose bark on decaying wood as well as within the red-rotted heartwood beneath; adults have also been found at fresh bracket fungi, where they may conceivably be feeding on fungal spores; they appear to be most active after nightfall;
- the larvae are unknown

Considered a high quality old growth species across its European range; Grade 1 old growth species in Harding & Rose (1986) and Alexander (2004); subfossil remains known from post-glacial Britain (Dinnin & Sadler; Whitehouse 2006).

2.4.2 *Micridium halidaii* (Ptiliidae)

British Red Data Book: Endangered (Welch 1987), but downgraded by Hyman (1994) to RDBK (Insufficiently Known)

Only known from four sites in two broad areas:

- Sherwood Forest area:
    - Sherwood, discovered here in 1867 and rediscovered at Birklands in 1977 and found there in 1983, 1984 and 1985;
    - Calke Park, discovered here in 1986
- Lower Thames Basin:
    - Windsor Forest, discovered here in 1980
    - Richmond Park, discovered here in 1984

The few specimens known have been found in red-rotten heartwood and beneath loose bark on ancient oak trees, and it has been suggested that it is associated with the mycelium of chicken-of-the-woods *Laetiporus sulphureus*.

Considered an old growth species across its European range; Grade 1 old growth species in Harding & Rose (1986) and Alexander (2004).

2.4.3 *Ampedus cardinalis* (Elateridae)

British Red Data Book: Vulnerable (Welch, 1987) confirmed by Hyman (1992).

Three main population centres plus three isolated small sites:

- Sherwood Forest – discovered here about the same time as at Windsor, ie late 19th century, and re-discovered in 1965, subsequently found in 2006;
- Lower Thames Basin - Windsor Forest & Great Park, Richmond Park, etc;
- Lower Severn Basin – Brockworth Park, Forthampton Oaks, Croome Park & Longdon Marsh;
- Parham Park;
- Moccas Park;
- Blenheim Park.

Develops in red-rotten heartwood of old oaks and sweet chestnuts, occurring within smaller boughs as well as trunks. Long larval period and adult dormancy; adults in pupal cells Sept-April, and under loose bark May-July.

Considered a high quality old growth species across its European range; Grade 1 old growth species in Harding & Rose (1986) and Alexander (2004).

2.4.4 *Prionychus melanarius* (Tenebrionidae)

British Red Data Book Vulnerable (Welch 1987), confirmed by Hyman (1992).

Four main centres in Britain:

- Sherwood Forest – known here since 1870;
- Lower Severn Basin – very widespread here, although first discovered in 1983;
- West Sussex – Arundel Park and area to west;
- Suffolk – Staverton & Ickworth Parks.

Its absence from Windsor Forest and Great Park appears inexplicable.

Larvae most often develop in black wood mould which accumulates in cavities in open-grown hollowing broad-leaved trees, often but not invariably beneath nests of birds such as jackdaw; also occasionally found in accumulations of frass beneath loose bark on trunks and large boughs. Adults nocturnal.

Not considered a high quality species elsewhere in Europe, but a Grade 1 old growth species in Britain (Harding & Rose 1986; Alexander 2004).

2.4.5 *Corticeus unicolor* (Tenebrionidae)

British Red Data Book Rare; confirmed by Hyman (1992).

Confined to the north Midlands, with two distinct areas:

- Sherwood Forest northwards to Thorne Moor, and known in area since mid 19th century;
- Cheshire, including Dunham Park, probably now extinct in the county.

Develops chiefly in freshly dead wood, mainly birch but also beech and oak, and is probably predatory on larvae of the beetle *Hylecoetus dermestoides* and other wood borers.

Not considered a high quality species elsewhere in Europe, but a Grade 2 in Harding & Rose (1986) and Alexander (2004), but questions remain about the origins of such isolated populations. This beetle is very widespread on the near continent of Europe and its presence in two pockets of country across the north Midlands may suggest introductions from imported timber – unlike the above four species, this is not a heartwood decay specialist, but lives in freshly dead wood with the bark still attached. There have been isolated reports from Plymouth and the New Forest in the past, and it has recently been found in Warwickshire – all suggestive of accidental importation.

2.4.6 *Corticaria longicollis* (Latridiiidae)

Overlooked for the British Red Data Book (Shirt 1987); RDB Insufficiently Known in Hyman (1994).

Only known in Britain from two areas:

- Sherwood Forest, where discovered in June 1889 (as C. serrata in Carr 1916). It was re-discovered near Edwinstowe in July 1965 (Johnson 1976) and has been found on a number of occasions since then, most recently in 1998 by Lott (1999).
- Speyside.

The species is best known throughout its European range from the nests of wood ants *Formica* spp, and this is the case in Speyside. The Sherwood Forest population uniquely inhabits wood mould in the ancient hollow oaks.

2.4.7 *Oxylaemus cylindricus* (Bothrideridae)

RDB Appendix – no post-1900 records (Shirt 1987); Extinct (Hyman 1992).

Until recently only known from 19th century records from two British sites:

- Sherwood Forest, discovered by Tomlin in 19th C but not reported since.
- 'New Forest, Lyndhurst, &c (E. Sheppard and others)' (Fowler 1889) but not reported since.

Re-discovered in SE England in 2009:

- Ebernoe Common, West Sussex, in numbers from roots of ancient oak trees, 2009, M. Telfer (pers. comm.).

This beetle is associated with the decaying roots of ancient trees and lives deep in the soil; it is best found by using specialist pitfall traps buried close to the host trees. Such traps were first tried in Britain in the late 1990s – they have not yet been tried at Birklands.

2.4.8 *Cryptocephalus querceti* (Chrysomelidae)

Although not an obvious saproxylic beetle this leaf beetle species needs to be discussed as it is associated with ancient oak trees and primarily known in Britain from New Forest, Sherwood and Windsor Forests, plus a handful of small isolated sites. It has RDB Vulnerable status in Britain. It favours old oaks in open parkland situations rather than more closed-canopy conditions. The adults feed on the foliage of ancient oaks, especially tender new leaves, while the larvae feed on fallen leaves. So ISIS categorises it as A1 arboreal canopy. However the larvae are thought to feed on leaf debris within cavities in the oak trunks (Cox 2007).

2.5 IUCN Red List of European Saproxylic Beetles

The International Union for Conservation of Nature **(**IUCN) was commissioned by the European Union to compile a Red List of European Saproxylic Beetles and the results were published in March 2010 (Nieto & Alexander, 2010). The Red List only covers 431 European saproxylic beetles at this stage, and focuses on a selection of key families, plus species already listed for special protection under the Habitats Directive. While most of the species known from Sherwood Forest (and covered by the selected families) have been assessed as having 'Least Concern' at a European level, three have been assessed as having 'Near Threatened' status and two as being 'Data Deficient'. None have been assessed as Threatened.

The 'Near Threatened' species are:

- *Ampedus cardinalis*
- *Ampedus elongatulus*
- *Pseudotriphyllus suturalis*

The 'Data Deficient' species are:

- *Pediacus dermestoides*
- *Dacne rufifrons*

With all five species, Britain appears to contain populations of European significance, the last three in particular are relatively widespread in Britain but very localised across the continental mainland. The European distribution of the two *Ampedus* is very fragmented, and the habitat (veteran trees) is threatened across the continent.

Three of these, at least, are considered to be in good condition in Sherwood Forest, with modern records and all found during the 2009 CSM project: *Ampedus cardinalis, Pseudotriphyllus suturalis* and *Pediacus dermestoides*. The other two have not been reported since being noted by the early recorders.

2.6 Changes in species composition

2.6.1 How many saproxylic beetle species are known from Sherwood Forest?

The current list of saproxylic Coleoptera known from Sherwood Forest appears to be 316 species - omitting some old records which cannot be substantiated (see Appendix 1). Dunham Park – the other northern site with a similar level of historic recording - has 228 species (Alexander 2008).

Directly comparable site lists are not readily available but Adrian Fowles' website http://thasos.users.btopenworld.co,/sqi.htm (consulted 11/3/2010) provides species counts for those qualifying for calculation of the SQI. The longest list is Windsor Forest and Great Park at 364 species – this excludes introductions and miscellaneous other species but may be compared with the equivalent Sherwood figure of 256 (using data from the present review).

Site name	**Total species count for SQI**
Windsor Forest & Great Park	364
New Forest	326
Bredon Hill	274
Sherwood Forest	***256***
Epping Forest	256
Richmond Park	254
Moccas Park	241
Esher Commons	236

Table 7 Total SQI qualifying species counts for the richest British sites

Sherwood Forest stands equal fifth in Britain (Table 7) on total species count of native saproxylic beetles with Epping Forest, behind Bredon Hill, the New Forest and Windsor . It is very clearly the richest site in the north of the England.

2.6.2 Problems with interpretation of historic data

Sherwood Forest was subject to considerable beetle recording from the mid 1800s through to the early 1900s; the people concerned were primarily old-fashioned collectors, targeting the rarities and not fully documenting all of their discoveries – the more common and widespread species were mostly documented much later. Recording levels fell off during the mid 20th century until Colin Johnson began studying the smaller species from the 1960s. The changing levels and subjects of recorder interest mean that there has been a lack of consistency in recording effort, making assessment of change very problematic. Many of the species reported are represented by single records only, and so do not demonstrate long-established populations.

The current list of 316 species includes a number of species believed not to be long-established natives to Britain but which have been introduced – and in some cases have become naturalised - following introduction, presumably mainly via the timber trade:

- *Cis bilamellatus* – an Australian species first noted in Britain in the 1870s
- *Corticeus lineatus* – probably only an adventives, once found in Sherwood (1904)
- *Dryophilus pusillus*

- *Euophryum confine* – a New Zealand species 2002 (Denton et al)
- *Hylastes ater*
- *Hylurgops palliates*
- *Plegaderus vulneratus*
- *Uleiota planata* – widespread on European mainland, first noted in Britain in early 20C, where associated with timber close to major ports; it has recently been expanding from the SE of England and was noted at Sherwood in 2008

Further species are conifer specialists and are therefore believed not to be native to the Sherwood Forest area but have become established locally through timber movements:

- *Arhopalus rusticus*
- *Asemum striatum*
- *Corticaria rubripes*
- *Cryptophagus parallelus*
- *Ernobius mollis*
- *Hylastes opacus*
- *Hylobius abietis*
- *Orthotomicus laricis*
- *Pityophagus ferrugineus*
- *Rhizophagus depressus*
- *Rhyncolus ater*
- *Sphaeriestes castaneus*

Thus 20 species appear to clearly not be long-established Sherwood natives, leaving a total of 296 species.

Irrespective of introductions caused by human activity, no fauna is static and species ranges have the potential to change naturally, although it is becoming increasingly difficult to distinguish between natural change and human-induced change. Two species were added to the Sherwood list from the 2009 CSM visits, one of which is almost certainly an overlooked species - *Orchesia minor* (Melandryidae) - while the other - *Agrilus sinuatus* (Buprestidae) - is claimed to be expanding its British range, although on rather thin evidence. It is credible that both have been overlooked at Sherwood. The recent discovery of Black-headed Cardinal Beetle *Pyrochroa coccinea* in the Forest is good example of a recent arrival as such a large and colourful insect could not have been overlooked. The 2006 discovery (Lott, 2006) of *Abdera flexuosa* and *Silvanus bidentatus* also suggest recent arrivals as the status of both is under active change nationally.

A full list of the 34 beetle species which were first reported in the Forest from 2000 is provided in Table 8. An attempt has been made to assess whether these represent overlooked species or recent arrivals. 15 are thought to be overlooked species but the rest appear to be recent arrivals. If the assessment as overlooked is correct then this provides evidence that many more species may remain to be discovered in the Forest.

Species	**First record**	**Larval habitat**	**Comments**
Plegaderus vulneratus (Histeridae)	2006	Conifers	New arrival
Nemadus colonoides (Leiodidae)	2006	Rot-holes	Overlooked
Bibloporus minutus (Pselaphinae)	2006	Under bark	Overlooked - confused within *bicolor* before 1963
Sepedophilus bipunctatus (Staphylinidae)	2008	Under bark	Overlooked?

Gyrophaena joyioides (Staphylinidae)	2002	Fungi	Overlooked?
Gyrophaena manca (Staphylinidae)	2003	Bracket fungi	Overlooked?
Quedius maurus (Staphylinidae)	2002	Under bark	Overlooked
Agrilus sinuatus (Buprestidae)	2009	Under bark	New arrival?
Ernobius mollis (Anobiidae)	2000	Conifers	New arrival
Anobium punctatum (Anobiidae)	2000	In sapwood	Overlooked
Lymexylon navale (Lymexylidae)	2008	Heartwood	Overlooked?
Uleiota planata (Silvanidae)	2008	Under bark	New arrival
Silvanus bidentatus (Silvanidae)	2006	Under bark	New arrival?
Endomychus coccineus (Endomychidae)	2002	Under bark	New arrival?
Orthoperus nigrescens (Corylophidae)	2000	Under bark	Overlooked?
Cis villosulus (Ciidae)	2006	Bracket fungi	Overlooked?
Orchesia minor (Melandryidae)	2009	Bracket fungi	Overlooked
Abdera biflexuosa (Melandryidae)	2006	Aerial dead branches	New arrival?
Melandrya caraboides (Melandryidae)	2008	Heartwood	New arrival?
Pyrochroa coccinea (Pyrochroidae)	1998	Under bark	New arrival
Rabocerus gabrieli (Salpingidae)	2008	In dead Wood	New arrival?
Anaspis costai (Scraptiidae)	2000	Under bark?	Overlooked?
Rhagium mordax (Cerambycidae)	2009	Under bark	New arrival?
Stenocorus meridianus (Cerambycidae)	2008	Stumps & roots	New arrival?
Arhopalus rusticus (Cerambycidae)	2008	Conifers	New arrival
Anaglyptus mysticus (Cerambycidae)	2002	Under bark	New arrival?
Tetrops praeustus (Cerambycidae)	2009	Under bark	New arrival?
Euophryum confine (Curculionidae)	2002	In decaying wood	New arrival
Acalles misellus (Curculionidae)	2002	Dead twigs	Overlooked
Acalles ptinoides (Curculionidae)	2000	Dead twigs	Overlooked
Kiklioacalles roboris (Curculionidae)	2002	Dead twigs	Overlooked
Hylobius abietis (Curculionidae)	2000	Conifers	New arrival
Hyurgops palliatus (Scolytinae)	2000	Conifers	New arrival

Table 8 Species recorded in the Birklands SSSIs for the first time in recent years (2000 was used as the cut off date, but *Pyrochroa coccinea* was also included as a good example of an obvious recent arrival)

2.6.3 Species at the edge of their British range in Sherwood Forest

2.6.3.1 Species at the northern edge of their British range

52 species have been identified as being close to the northern edge of their British range in Sherwood Forest (Table 9). 13 of these (25%) are only known from old records, pre SSSI designation. For species almost exactly on the northern edge, the equivalent figures are 21 in total of which 6 (35%) are only known from old records. This might suggest a significant recession of species ranges, but most of the species concerned are very small and difficult to find on demand, while others are favoured by open sunny situations with flowers for nectaring. The former group should be subjected to targeted surveys before reliable conclusions may be drawn. The second

group may have been lost through canopy closure following the unfavourable land management of much of the 20th century.

Species recorded in modern times	**GB Status**	**Date**	**Species only known from old records**	**GB Status**	**Date**
Histeridae			Histeridae		
**Plegaderus dissectus*	Nb	2006	**Abraeus granulum*	Na	1889
Ptiliidae			Scydmaenidae		
***Micridium halidaii*	RDBK	1985	**Stenichnus godarti*	RDB3	1886
Scydmaenidae			Elateridae		
**Microscydmus minimus*	RDB3	2006	**Procraerus tibialis*	RBB3	Old
Staphylinidae			Anobiidae		
Bibloporus minutus	Nb	2006	*Anitys rubens*	Na	1906
Euplectus nanus	RDB1	2006	Monotomidae		
Euplectus tholini	RDB3	2006	*Rhizophagus oblongicollis*	RDB1	1889
Plectophloeus nitidus	RDB2	2006	Erotylidae		
Sepedophilus bipunctatus	Nb	2008	*Dacne rufifrons*		Old
Elateridae			Bothrideridae		
***Ampedus cardinalis*	RDB2	2006	*Oxylaemus cylindricus*	'Extinct'	Old
**Ampedus quercicola*	Nb	2009	Ciidae		
Dermestidae			**Cis pygmaeus*		1904
Megatoma undata	Nb	1998	**Cis submicans*		Old
Anobiidae			Mordellidae		
Xestobium rufovillosum		2009	*Mordellochroa abdominalis*		1897
Anobium fulvicorne		2009	Oedemeridae		
Dorcatoma chrysomelina		1998	*Ischnomera sanguinicollis*	Nb	Old
Dorcatoma flavicornis	Nb	1978	Scraptiidae		
Lymexylidae			*Anaspis garneysi*		1908
**Lymexylon navale*	RDB2	2008	Cerambycidae		
Malachiidae			**Stictoleptura scutellata*	Na	1869
**Axinotarsus ruficollis*		1999			
Nitidulidae					
Cryptarcha strigata	Nb	2009			
Silvanidae					
Silvanus bidentatus	Nb	2006			
Cucujidae					
Pediacus dermestoides		2009			
Bothrideridae					
***Teredus cylindricus*	RDB1	2009			
Corylophidae					
**Orthoperus nigrescens*	Nb	2000			
Latridiidae					
Latridius consimilis	Nb	2002			
**Dienerella clathrata*		1989			
Ciidae					
Cis villosulus		2006			

Melandryidae					
Abdera biflexuosa	Nb	2006			
**Abdera quadrifasciata*	Na	2000			
Phloiotrya vaudoueri	Nb	2009			
Conopalpus testaceus	Nb	2008			
Tenebrionidae					
**Prionychus ater*	Nb	2002			
***Prionychus melanarius*	RDB2	2009			
Pseudocistela ceramboides	Nb	2009			
**Mycetochara humeralis*	Na	2009			
Aderidae					
Euglenus oculatus	Nb	2006			
Scraptiidae					
**Scraptia testacea*	RDB3	2006			
Anaspis costai		2000			
Cerambycidae					
Anaglyptus mysticus	Nb	2002			
Curculionidae					
Cossonus parallelepipedus	Nb	1963			
Phloeophagus lignarius		2000			

Table 9 Species with a southern and eastern lowland distribution in Britain, extending only as far north as Yorkshire

* species extending no further north than Sherwood

** species for which Sherwood is the key northern outpost

The date refers to the most recent record.

2.6.3.2 Species at the south-eastern edge of their British range

The Sherwood fauna includes many species with a northern and western distribution in Britain and which are therefore not known from Windsor Forest and Great Park. Eleven such species are listed in Table 10. Only one of these has not been recorded in recent years, since SSSI designation.

Species recorded in modern times	**GB Status**	**Date**	**Species only known from old records**	**GB Status**	**Date**
Scydmaenidae			Scolytinae		
Stenichnus bicolor		2002	*Trypodendron signatum*	Nb	1932
Staphylinidae					
Acrulia inflata		1964			
Elateridae					
Ampedus pomorum	Nb	2009			
Cantharidae					
Malthodes fuscus		1998			
Lymexylidae					
Hylecoetus dermestoides	Nb	2009			
Trogosittidae					
Thymalus limbatus	Nb	1978			
Latridiidae					

Enicmus fungicola	Nb	1970			
Tenebrionidae					
***Corticeus unicolor*	RDB3	2009			
Cerambycidae					
Saperda scalaris	Na	2007			
Curculionidae					
Trachodes hispidus	NB	2002			

Table 10 Species with a northern and western distribution in Britain, present in Sherwood Forest, but not known from Windsor Great Park & Forest
**speciality of Sherwood
The date refers to the most recent record

2.6.3.3 Significance of this mix of species at the edge of their British range

The position of Sherwood Forest in the north Midlands is the key to understanding this mixture of species. Sherwood is not unique in this and shares this species overlap with other key sites such as Dunham Park SSSI (Cheshire), Calke and Kedleston Park SSSIs (Derbyshire) and Duncombe Park and Castle Hill SSSIs (North Yorkshire). Sherwood however has by far the richest mix of these species, ie Sherwood is uniquely species-rich in its mix of southern species and those with a northern and western distribution in Britain. No other single British site contains populations of all of *Ampedus cardinalis*, *Corticeus unicolor*, *Micridium halidaii*, *Prionychus melanarius* and *Teredus cylindricus*. This richness arises primarily due to geography (position in the north Midlands), history (medieval forest) and size/tree population.

2.6.4 Species not yet recorded but which be expected to be overlooked long-established species

Examination of the current ranges and known ecologies of British saproxylic beetle species suggests that there are at least a further 40 long-established species possible for the Birklands and Bilhaugh area (Table 11) and these include a large number of RDB and NS species. It is suggested that the list of long-term natives is still under-recorded to a considerable extent. If these 40 potentials are added to the 296 then this would bring the Sherwood figure up to 336 which is closing the gap on Windsor's 365 SQI species considerably – however, Windsor also has its own share of potential species not yet detected.

Species	**Status**	**Comments on current distribution pattern & known local sites**	**Assemblage**
Histeridae			
Aeletes atomarius	RDB3	Duncombe & Dunham	Heartwood decay
Gnathoncus buyssoni		Leics, S Lincs & S Lancs	Nests, etc in cavities
Staphylinidae			
Dropephylla devillei		N & W distribution, close sites	Cambial layer
Dropephylla gracilicornis	N	Widespread in Britain	Cambial layer
Siagonium quadricorne		As far north as Co Durham	Cambial layer
Quedius microps	Nb	As far north as Co Durham	Heartwood decay & wood mould
Cantharidae			

Malthodes crassicornis	RDB3	Duncombe Park	Heartwood decay
Malthodes pumilus		Widespread in Britain	? heartwood decay
Dermestidae			
Trinodes hirtus	RDB3	Old records Dunham & Derbyshire	Loose bark on ancient tree trunks
Anobiidae			
Dorcatoma dresdensis	Na	Four Yorkshire records	Bracket fungi
Dorcatoma substriata	Na	Duncombe Park	Bracket fungi
Cleridae			
Tillus elongates	Nb	Hardwick Park & Yorkshire	Woodworm predator in heartwood & sapwood
Opilo mollis	Nb	Present in Notts & Yorkshire	Woodworm predator in heartwood & sapwood
Korynetes caeruleus		Wild sites in S Yorks & Notts	Woodworm predator in heartwood & sapwood
Nitidulidae			
Soronia punctatissima		Widespread in Britain	Freshly expsoed sap
Laemophloeidae			
Notolaemus unifasciatus	Na	As far north as Kedleston Park	Cambial layer
Cryptophagidae			
Cryptophagus micaceus	RDBK	In Derbyshire	Wasp & hornet nests in cavities
Erotylidae			
Triplax aenea		Widespread in Britain	Soft bracket fungi
Cerylonidae			
Cerylon fagi	Nb	Widespread in lowland GB	Cambial layer
Mycetophagidae			
Mycetophagus atomarius		Widespread in lowland GB	Hard black fungi (Ascomycetes)
Mycetophagus quadriguttatus	Na	Dunham Park, Kedleston	Mildewy cavities, mouldy bracket fungi
Tetratomidae			
Tetratoma ancora	Nb	Widespread in Britain	Aerial dead branches, especially hazel
Melandryidae			
Anisoxya fuscula	Nb	Duncombe Park & Kedleston	Aerial dead branches
Hypulus quercinus	RDB2	Duncombe & Grimsthorpe	Moist red-rotten heartwood
Tenebrionidae			
Corticeus bicolour		Widespread in lowland GB	Cambial layer with nark beetles
Scaphidema metallicum	Nb	Widespread in lowland GB	Moist decaying wood
Oedemeridae			
Ischnomera cinerascens	RDB2	Duncombe Park	Heartwood decay, white-rot
Ischnomera cyanea	Nb	Yorkshire sites	Heartwood decay – white-rot

Salpingidae			
Lissodema denticolle	Nb	Kedleston	Aerial dead branches
Aderidae			
Aderus populneus	Nb	S Yorkshire sites	Heartwood decay
Cerambycidae			
Grammoptera abdominalis	Na	Derbyshire, Notts & Lincs	Aerial dead branches; especially oak
Grammoptera ustulata	RDB3	Isolated record in Yorkshire	Aerial dead branches, especially old and mouldy ones
Anoplodera sexguttata	RDB3	Duncombe Park	Heartwood decay of fallen wood; moist shady red-rot
Pogonocherus hispidulus		Widespread in Britain	Cambial layer
Scolytinae			
Ernoporicus caucasicus	Na	Clumber & Yorkshire	Cambian layer, lime twigs
Ernoporus fagi	Na	Clumber Park	Cambial layer, beech
Ernoporus tiliae	RDB1	S Yorkshire & Lincs	Cambial layer, lime twigs
Xyleborinus saxeseni		As far north as Yorkshire	Cambial layer
Xyleborus dispar	Nb	As far north as Yorkshire	Cambial layer
Pteleobius vittatus		S Yorkshire & Cumbria	Cambial layer, especially elm, ash & lime

Table 11 Saproxylic beetle species whose natural ranges encompass Sherwood Forest but which have not yet been found there

All of these species could conceivably be present within the Forest and have been overlooked in the past. Like so many of the Forest's saproxylic beetles, a high proportion are small and difficult to find on demand. Targeted surveys would be needed to clarify their status here, but could not guarantee to find them even if present. Many are sun-loving species and may have been present in the Forest in the past but have been lost through the unfavourable land management of much of the 20th century, eg *Tillus elongatus* (Cleridae). Others have a requirement for flowering shrubs for nectaring and could have been lost for the same reasons, eg the two *Ischnomera* species and the longhorn *Anoplodera sexguttata*. The three ernoporine bark beetles require native beech and lime which may never have been present in the Birklands area – two of them are however known from Clumber Park.

2.6.5 Evidence for decline or significant change in species composition

This review has found it difficult to come to any firm conclusions about any significant change to the species composition of the assemblage of special interest and the overall quality of the fauna since notification. The data does suggest that a number of sun-loving species may have been lost, including species with a requirement for flowering shrubs, etc, for nectaring. This is consistent with the trend towards canopy closure following abandonment of livestock grazing and the establishment of conifer plantations.

The review of changes to species on the edge of their ranges at Sherwood may suggest that southern species have been declining and/or lost to a greater extent than northern species. This is the opposite trend to that which might be expected from the predicted impacts of climate change. However, there is a substantial list of species which have only recently been detected in the Forest, and these do include some southern species known to have been expanding northwards, notably *Agrilus sinuatus*, *Uleiota planata* (probably not native) and possibly *Abdera biflexuosa*.

As part of its Birklands Oakwood Project (Barwick, 1996), Forest Enterprise commissioned specialist survey work in 1998 (Lott, 1999) and again in 2006 (Lott, 2006). The 1998 fieldwork was targeted at comparing the saproxylic beetle fauna of stands of veteran oaks in a variety of situations and undergoing conservation management:

- Veterans engulfed in conifer plantation:
    - conifers thinned in 1997 resulting in dense bracken and bramble development;
    - conifers being thinned during 1998 survey work;
- Veterans engulfed in secondary woodland in the Country Park
    - relatively densely wooded section;
    - more open section but with high density of birches.

The main difference that could be identified from the results of standardised sampling was that species-richness was higher in the Country park than in the plantations. In particular there was a higher number of sub-cortical species – the bark and sapwood decay SAT (ISIS). This study was repeated in 2006 so that the two datasets could be compared and to explore changes over time. Species-richness was found to have increased in the old plantation areas.

The overwhelming impression gained from this review is that site condition is still very good and that recent management changes have considerable potential to benefit the saproxylic fauna, notably through removal of competing conifers and restoration of livestock grazing to substantial areas of both SSSIs. Large areas still combine ancient open-grown oaks with dense secondary woodland and plantation.

3 OTHER SAPROXYLIC INVERTEBRATES OF SHERWOOD FOREST

3.1 Diptera

3.1.1 Introduction

It is one of the more remarkable facts about Sherwood Forest that the saproxylic Diptera have been so poorly studied. To some extent this is understandable since saproxylic Diptera are most diverse in damper situations and Sherwood has a reputation for being a dry site. However, Windsor Forest and Great Park is well-known to be of major national importance for its saproxylic Diptera, and the affinities of the Sherwood Forest saproxylic beetle fauna are with Windsor. This may reflect Windsor having both ancient oak and beech, with the saproxylic Diptera most strongly associated with decaying beech. In contrast, Sherwood has an emphasis on ancient oak, with few other tree species well-represented. Windsor's ancient oaks do however support a saproxylic fly fauna of

significant interest, albeit perhaps not as rich as that of beech. There does seem to be considerable potential for the saproxylic Diptera fauna of Sherwood to be of significant conservation importance.

A brief examination of the recent National Reviews of scarce and threatened flies in Britain revealed just a single mention of Sherwood Forest. The flat-footed fly *Agathomyia woodella* is thought to develop in tough bracket fungi and related species are known to be fairly specific in their choice of hosts. The species is known from a thin scatter of sites across southern England, and has RDB Lower Risk (Nationally Scarce) status (Falk & Chandler, 2005). It was reported from Sherwood Forest in 1922 and is only known from one site further north, Pot Riding Wood, Yorkshire, where it was found in 1988. The fly was collected by F.W. Edwards in 1922 and is in the collections at the Natural History Museum (PJ Chandler, pers. comm.). Edwards also collected 7 species of fungus gnat on the same day but all common ones.

The lack of records does seem to reflect a lack of recorder activity rather than poor habitat quality *per se*. Part of the problem is that there are no active dipterists within close range and the Dipterists Forum has yet to hold a field meeting there (AE Stubbs, pers. comm.). There is a negative school of thought amongst dipterists that Sherwood is not of interest, and therefore not worth visiting.

A few saproxylic Diptera were noted during the CSM project in 2009/10:

- *Ctenophora pectinicornis* (Tipulidae) – a Nationally Scarce cranefly, developing in rot-holes in veteran trees;
- *Medetera dendrobaena* (Drosophilidae) – an uncommon fly with larvae feeding on bark beetle larvae in their galleries under bark on freshly dead branches;
- *Tachypeza nubila* (Hybotidae) – a very common species;
- *Xylophagus ater* (Xylophagidae) – widespread in ancient woodland and wood-pasture, developing beneath bark on dead branches in the early stages of decay;
- A stiletto-fly larva (Therevidae) – conceivably the RDB Endangered Forest Silver-stiletto *Pandivirilia melaleuca*, which is best known from Windsor Forest and Great Park, and which develops particularly in red-rot debris in ancient oaks (as here). The only other therevid which has been reared from wood mould in old trees is the more widespread *Thereva nobilitata*, although this may prefer the moister black wood mould in the base of the tree.

That these five species include one Nationallly Scarce species and potentially a RDB species strongly suggests that a detailed investigation of the fly fauna is strongly warranted.

The RDB species found was an *Odinia* sp of the *maculata* group, but apparently not clearly belonging to any of the described European species. The true *O. maculata* has RDB status in Britain and is known from a handful of sites across southern and Midland England, including the New Forest, Windsor Forest and the Forest of Dean (Ismay, in press). The larvae appear to develop in the sappy borings of insect larvae in freshly dead or dying tree trunks and laregr boughs. The Windsor record was in association with larvae of the oak jewel beetle *Agrilus biguttatus* – a species long known from the Sherwood Forest area. Clarification of which *Odinia* species is present here will require further work, but it does appear to be an important discovery.

A specialist survey was commissioned by Natural England during the late May to mid July period of 2010 (Godfrey, 2010). The total number of saproxylic species found (as listed in Alexander, 2002) was 44 – see Table 2 - including five with Nationally Scarce status and one almost certainly of British Red Data Book status.

The five Nationally Scarce species found by Godfrey (2010) are:

- *Ctenophora pectinicornis* (Tipulidae) – also found during CSM in 2010;
- *Ditomyia fasciata* (Ditomyiidae) – a fungus gnat developing in soft polypore bracket fungi on veteran trees;
- *Megamerina dolium* (Megamerinidae) – a small fly developing under bark on dead wood, and strongly associated with ancient woodlands and wood-pastures;
- *Lasiambia baliola* (Chloropidae) – a small fly developing beneath sappy bark on freshly dead timber;
- *Lasiambia brevibucca* (Chloropidae) – as above.

These records very clearly demonstrate that the SSSIs do support a significant saproxylic Diptera fauna despite the limited survey work. This has been further underlined by the recent confirmation of a first record from the SSSI of the saproxylic and RDB Endangered cranefly *Ctenophora ornata* (Tipulidae) (Pendleton & Pendleton, 2011), a nationally rare species strongly associated with decaying-wood habitats of ancient forest sites. Sherwood Forest represents its most northerly locality in the UK and there are just six post-1960 records largely from Windsor and the New Forest.

3.1.2 Hoverflies

There are 39 species of hoverfly associated with saproxylic habitat known from Britain and most have a degree of association with old growth and ancient woodlands. Five are conifer forest species and so that leaves 34 as broadleaf forest species. Six species of these were reported from Sherwood Forest in 2003 by Brian Wetton (data supplied by Steve Clifton, Natural England):

Brachyopa insensilis Nationally Scarce
Brachypalpoides lentus
Chalcosyrphus nemorum
Criorhina ranunculi Nationally Scarce
Myathropa florea
Xylota sylvarum
The most widespread species, *Myathropa florea*, has been reported on other occasions. A seventh species *Xylota segnis* was noted during the CSM project in 2009. These two species can also breed in non-saproxylic situations.

This is clearly an under-recorded group. Of the other 27 species, a further 21 do seem feasible on biogeographic and habitat grounds:

Brachyopa bicolor RDB3
Brachyopa pilosa Nationally Scarce
Brachyopa scutellaris
Brachypalpus laphriformis Nationally Scarce
Calliprobola speciosa RDB Endangered – unconfirmed record from Calke Park
Callicera aurata RDB3
Criorhina asilica Nationally Scarce
Criorhina berberina
Criorhina floccosa
Ferdinandea cuprea

Ferdinandea ruficornis Nationally Scarce
Mallota cimbiciformis Nationally Scarce
Pocota personata RDB Vulnerable – recently recorded from Calke Park & Duncombe Park
Psilota anthracina RDB Vulnerable – recently recorded from Calke Park
Sphegina clunipes
Sphegina elegans
Sphegina verecunda Nationally Scarce
Xylota abiens Nationally Scarce
Xylota florum Nationally Scarce
Xylota tarda Nationally Scarce
Xylota xanthocnema Nationally Scarce

With such sparse data, site quality cannot reliably be assessed for this group of Diptera.

3.1.3 Conservation significance

The biology - and especially the ecology – of most saproxylic Diptera is poorly understood and this makes analysis of the fauna in relation to the decaying wood habitats available problematic.

The species so far found to occur in Sherwood Forest do include a selection which is part of the southern old forest fauna, notably the craneflies *Ctenophora pectinicornis* and *C.ornata*, the fungus gnat *Ditomyia fasciata*, the hoverflies *Brachypalpus laphriformis*, *Mallota cimbiciformis* and *Xylota abiens*, and *Mycetobia pallipes*, *Agathomyia woodella*, *Lasiambia baliola*, and probably the *Odinia* sp. This situation is therefore very comparable with the saproxylic beetle fauna. However, the ranges of most of these extend farther northwards than Sherwood, and Sherwood is not therefore such an obvious key northern site.

The types of decay that are important for the fly fauna at Sherwood are also difficult to discern. Few of the species are obvious heartwood-decay species – unlike the beetles. But the smaller scale heartwood decay provided by rot-holes in the old tree trunks does appear to be important at Sherwood, supporting the cranefly *Ctenophora pectinicornis*, the hybotid *Euthyneura halidayi*, the hoverfly *Brachypalpus laphriformis* and the chyromyid *Chyromya britannica*. These small pockets of heartwood decay tend to be moister than the main columns of heartwood decay, with impeded drainage a key factor. While oaks tend to contain less of this habitat type, clearly there is sufficient at Sherwood to be supporting an interesting fauna. Further investigation of Sherwood's rot-hole Diptera could be very revealing.

Others amongst the flies known from Sherwood are specialists in the fruiting bodies of the wood-decay fungi, including the Nationally Scarce fungus gnat *Ditomyia fasciata* as well as *Acartophthalmus nigrinus*, *Leiomyza scatophagina*, *Tephrochamys flavipes*, and probably the Nationally Scarce *Agathomyia woodella*. Fungal associates are clearly another group which warrants further attention, especially fungus gnats.

Sap-run specialists also feature strongly, with the potentially RDB *Odinia* sp., and the two *Lasiambia* species being associated with fresh sap-runs and Mycetobia pallipes associated with decomposing accumulations of sap behind loose bark.

Dolichopodid flies include many with strong associations with freshly dead wood which has already been colonised by bark beetles. Larvae of the uncommon *Medetera dendrobaena* - found here in 2009 - are known to be a specialist predator on bark beetle larvae.

The rest of the fauna appears to be associated with decaying wood generally, with little known about any specialist requirements. It seems highly probable that white-rot is more important that red-rot, but nevertheless a good range of species have been found so far.

Overall, there does appear to be a fairly complete representation of the various assemblages of wood-decay Diptera at Sherwood, with specialist species known from a wide range of different wood-decay situations, from sap-runs and bark beetles, to bracket fungi, white-rot and aerial rot-holes. The main question relates to how rich this fauna actually is and what level the conservation value.

3.2 Aculeate Hymenoptera

Archer (1996) has reviewed the aculeate bee and wasp fauna of Sherwood Forest. Field visits between 1985 and 1992 were supplemented with examination of the collections in Nottingham Museum and literature records. Unfortunately he does not assess the fauna by their habitat requirements, making it difficult to draw out information on the deadwood-nesting part of the fauna. The species information contained in his paper was therefore correlated with the list of species with known or suspected saproxylic habitat associations maintained by the present author, developed from Alexander (2002).

A total of 30 species which are known to nest above ground level in decaying wood and/or trees have been found in the Forest, of which 18 were seen between 1985 and 1992 (see Table 12).

		Archer (1996)
Chrysididae ruby-tail wasps	*Chrysis angustula* *C ignita* *C impressa* *Trichrysis cyanea*	All 1985-92
Formicidae ants	*Lasius fuliginosus*	'reported'
Pompilidae spider-hunting wasps	*Dipogon subintermedius* *Dipogon variegatus*	Godfrey (2010) 1985-92
Eumenidae	*Ancistrocerus parietinus*	Literature record
	Ancistrocerus trifasciatus	1985-92
Vespidae social wasps	*Vespa crabro*	New immigrant, first colony 1986
Sphecidae digger wasps	*Trypoxylon clavicerum* *T figulus* *Crossocerus annulipes* *C cetratus* *C megacephalus* *Ectemnius cavifrons* *E ruficornis* *Passaloecus corniger*	All 1985-92
	Crossocerus dimidiatus *Rhopalum clavipes*	Museum specimen & literature record
	Pemphredon inornatus *P lethifer* *P lugubris*	Literature record

Colletidae	*Hylaeus brevicornis* *H communis*	1985-92
Megachilidae	*Megachile versicolor*	1985-92
	Chelostoma florisomne *Osmia rufa*	Museum specimen & literature record
	Megachile cetuncularis	Literature record
Anthophoridae	*Anthophora furcata*	Literature record

Table 12 List of deadwood-nesting aculeate bees and wasps known from Sherwood Forest

Only *Vespa crabro* was encountered during the CSM project in 2009. One additional species, the spider-hunting wasp *Dipogon subintermedius* was found by Godfrey (2010)

Only one of these has any national conservation status: *Ectemnius ruficornis*, nationally scarce. This digger wasp (Sphecidae) has a patchy distribution in Britain, mainly across the southern counties but with a concentration of records from Sherwood Forest northwards across Yorkshire. It appears to have increased its presence in northern England over recent decades (Falk, 1998).

Archer (1996) also picks out *Hylaeus brevicornis* as a regional rarity, as there are few records in the northern half of England. This tends to favour nesting in dead bramble stems rather than deadwood. This all suggests that the aculeate fauna of Sherwood Forest is not of great interest to nature conservation.

3.3 False Scorpions

Six species of false scorpion (see Table 13) have a strong association with ancient trees and deadwood in Britain (Alexander, 2002). Sherwood Forest is well-known to be a national stronghold for the British Red Data Book species (Bratton 1991) *Dendrochernes cyrneus*. This favours large old and open-grown trees in situations with concentrations of such trees and a long history of such concentrations. This effectively confines it to areas of medieval forest, historic deer parks, and river valleys with a tradition of willow pollarding. The false scorpion favours dead wood in warm and sunny situations, where it lives beneath loose bark and amongst dry dead sapwood. Its British distribution is central southern, occurring from Windsor Forest to Sherwood Forest, but is not known from the New Forest (Legg & Jones 1988).

	British conservation status	**Sherwood Forest**	**Windsor Forest & Great Park**
Lamprochernes chyzeri		-	Yes
Allochernes wideri		BAS Survey Team 1978	Yes
Chernes cimicoides		BAS Survey Team 1978	Yes
Dendrochernes cyrneus	RDB3	BAS Survey Team 1978 Foster AP 1987 Alexander KNA 2009	Yes
Withius piger		-	-
Larca lata	pRDB2	-	Yes

Table 13 Modern records for saproxylic false scorpions in Sherwood Forest, compared with Windsor Forest

This analysis suggests that the Sherwood Forest is a northern equivalent to Windsor Forest for saproxylic false scorpions. *L. chyzeri* is known from the Sherwood area but not yet reported from the Forest proper – the author has noted it in Clumber and Hardwick Parks. *Larca lata* is only known in Britain from Windsor and unlikely to be a overlooked species at Sherwood.

3.4 Spiders

The ancient oaks of Sherwood Forest also support the RDB (Bratton 1991) spiders *Midia midas* (formerly placed in the genus *Lepthyphantes*) (Linyphiidae) and *Mastigusa macrophthalma* (formerly in the genus *Tuberta*) (Agelenidae). There are few spiders strongly associated with saproxylic habitats and only three have conservation status – all listed in the British Red Data Book

Midia midas is the famous spider of Sherwood Forest, and has RDB Vulnerable status. It has also been found in Donington Park, Epping Forest, Hainault Forest and Windsor Forest. Elsewhere in Europe it has only been found in a handful of sites, making the British population of European significance. It appears to be confined to ancient trees – particularly ancient pollards - where it has been found in a range of microhabitats including accumulations of litter from the base of hollow oaks and beeches, and especially in the top of the bolling of pollards, as well as in bird nests and squirrel dreys. The most recent Sherwood Forest records are from 1979-80 – intensive surveys by groups of experienced workers have revealed only isolated individuals (Russell-Smith, 2002)

The *Mastigusa* is well-established and quite abundant in parts of Charnwood and Sherwood Forests, but has not been found recently in any of its old sites in southern Britain. It is strongly associated with ants, often but not exclusively in and around overmature trees and dead wood. Egg-sacs have been found in the carton nests of Jet Ant *Lasius fuliginosus*, but it has also been found in underground passages in the nests of soil-nesting species in the rocky terrain of Charnwood Forest (Merrett, in Bratton 1991). It has been found most recently by the Entotax survey in 2002.

The third RDB saproxylic spider is *Mastigusa arietina*, although this may be just a form of *M. macrophthalma*. It has not been recorded anywhere in Britain since 1926. Windsor Forest is one its former sites.

With modern records for two of the three species, Sherwood Forest actually exceeds Windsor Forest in current site quality.

3.5 Mollusca

Only two species of mollusc have a strong association with decaying wood – Ash-black Slug *Limax cinereoniger* and Slender Slug *Malacolimax tenellus*. Both also have strong associations with ancient wood pastures and ancient woodlands. This naturally makes them both of very localised distribution, but only Slender Slug has conservation status - nationally scarce; it is currently the subject of a species monitoring project by the Conchological Society. Both occur in Sherwood Forest and Windsor Forest – both have been seen in good numbers during the course of the CSM project in 2009.

Although known from Clumber Park since 1984, Slender Slug was first found in Birklands West during the CMS project in 2009 and the Sherwood Forest Country Park later the same year by members of the Conchological Society (records from Adrian Norris, Non-marine Recorder for the Conchological Society). It has also been reported from the Sherwood Pines Forest Park in 2008.

4 SITE MANAGEMENT ASPECTS

4.1 Land-use history

Historically the wider Sherwood Forest area contained a large expanse of uncultivated and unenclosed country which was reserved for hunting by the king, but also used by local people for rough grazing and as a source of various forest products – the area was very much multi-purpose within the local economy. The intensity of these land uses would have varied over time, in relation to local population size and economic factors, but the Forest was effectively a mosaic of heathy pastures and wood pastures for many centuries - certainly from the Norman period, when the Royal Forest was first mentioned in documents in 1154 (Page, 1906). The forest was characterised by a shifting mosaic of unenclosed woodland – oak and birch - and heathland subject to grazing, and enclosed arable land and woodland (Watkins, 1998). Most of the land was in private ownership, although large areas were subject to common grazing and other common rights until these rights were extinguished by enclosure. The parishioners of Edwinstowe claimed rights to graze pigs on the mast and to pasture their sheep in the woods, but not horses or horned cattle as the pasturage was not sufficient.

Throughout the medieval period the Birklands and Bilhaugh forest complex was technically one of a number of 'hays', or enclosed forests, scattered across the Royal Forest. These formed deer hunting enclaves for the King and his associates, and provided a private source of timber. Despite this status, a 1680 survey contains a rare reference to the cutting of oak branches at 'Bilhagh'. This suggests that, in this section of the Forest at least, pollarding or shredding was frequent, or had been so in the past. Various forest inhabitants claimed a right to cut timber in the 17th century although this seems not to have been the case in the 18th, as evidenced by a number of legal cases against labourers who had stolen firewood or damaged trees. Sales of 'dotard and decayed trees' in 1702 and of 'sear, dead, broken and decayed trees' in 1711 provide evidence of the existence of decayed trees at that time. Birkland and Bilhaugh held a great many red deer until about 1770 when they were killed off by the keepers of the dukes of Newcastle and Kingston. In 1791 the two main surviving areas of woodland at Birkland and Bilhaugh remained the sole property of the Crown and no timber or wood was cut there for the use of any private person - windfallen trees were sold.

The Birkland and Bilhaugh – the last remaining portion of the crown lands in Sherwood - were sold to the duke of Portland at Welbeck about 1800 who subsequently parted with much of them to Earl Manvers at neighbouring Thoresby. This area was described in 1794 as an open wood of large oak, but mostly decayed or stag-headed (Page, 1906). From the early 19th century, the ancient forest oaks had come under the protection of four main 'Dukery' estates: Clumber, Welbeck, Worksop Manor and Thoresby, and the owners valued the ancient trees for their aesthetics. The largest ancient oak of the woodlands – the Major Oak – increasingly became a visitor attraction in its own right from the early 1900s.

By the mid to late 20th century, grazing with livestock had ceased in Birkland and Bilhaugh, and the rabbit population had become seriously depleted. Plantation forestry was becoming the dominant land-use. Large areas had been leased by the landowning estates to the Forestry Commission and commercial conifer plantations became established since 1935 (Barwick, 1996). The landowning estates also embraced coniferous afforestation within the Birklands and Bilhaugh complex. A relatively small core area remain largely free of coniferous plantings and was leased to Nottinghamshire County Council in 1969 to be managed as the Sherwood Forest Country Park, visitor numbers here steadily rising to a peak in the 1990s of about 800,000 visitors. By the late 1980s. a substantial area of Bilhaugh had been destroyed by the expansion of the neighbouring

Thoresby Colliery. By this time, canopy closure became a feature throughout most of the remaining wood-pasture area.

4.2 Conservation management initiatives from the 1980s

New conservation management initiatives focussed on the SSSI areas began towards the end of the 20th century, largely as a result of initiatives funded by the Forestry Commission, English Nature and the HLF-funded Sherwood Initiative delivered by the Sherwood Forest Trust and the national drive to improve the ecological condition of SSSIs through positive management. This coincided with a programme of ancient tree survey across the SSSIs, which at the time established a minimum population of nearly 2400 ancient trees, 70% of which remained standing and 42% of these were alive (Clifton, 2000). More recent survey work using GPS has located a significant resource of tree stumps missed during these early surveys (Mosaic Mapping, 2009).

4.2.1 Forest Enterprise Plantations

The Birklands Oak Project was the earliest initiative and initially involved two approaches to oakwood restoration (Barwick 1996):

- Clear-felling of commercial pine stands containing veteran oaks, followed by planting of new oaks raised from a local seed source;
- Crown-thinning to remove competition and prevent canopy closure of pine over the oaks – the initial thinning was completed in the period 1987-89.

The first approach had led to dense bracken establishment as well as high density birch invasion and was thought to have run a significant risk of deadwood desiccation. The second approach was judged to be the most successful and plans made to extent it to other areas of the Forest. Thinning appeared to be a safer and more manageable approach, offering the opportunity of progressive manipulation of shade and shelter for the optimum management of ancient oaks and their successors. Forest Enterprise are continuing this process of restoring coniferous and mixed plantation stands to native oak-birch woodland with an open structure and a sustainable ancient tree population.

4.2.2 Thoresby Estate in-hand land

The Buck Gates area of Bilhaugh had remained unmodified by plantation forestry but without grazing until 1998, when a programme of intensive bracken management was initiated and the area enclosed and experimentally grazed by commercial sheep and cattle. A conservation grazing regime using hardier breeds of English longhorn cattle and Jacob sheep has been specially developed and now been operating since 2005 and has been extended into the SSSI east of the disused army camp following opening up of the ancient oaks there from plantations. The land immediately to the south, towards Ollerton Corner, remains in active forestry for much of its area, although a Higher Level Stewardship (HLS) Agreement with Natural England is now funding the progressive conversion of much of the coniferous plantation back to open oak-birch woodland-pasture.

4.2.3 Sherwood Forest Country Park

The Country Park established in 1969 was declared as Sherwood Forest National Nature Reserve in 2002. Much of the land with veteran trees remains engulfed in secondary woodland after over 50 years of little habitat management. Two large grazing enclosures were established in 2003 and were grazed in the first instance by rare breed sheep. English Longhorn cattle now annually graze both

enclosures to supplement active programmes of woodland thinning, felling around living ancient trees and bracken management being funded through a HLS Agreement with Natural England.

4.2.4 Key conservation management issues

The four key dimensions which determine the current representation of saproxylic invertebrates at any particular locality are as follows (Alexander, 2008):

- Total number of trees available
    - Sufficient to maintain viability of populations
- Density of those trees
    - open-grown trees are especially important for the Sherwood Forest fauna
    - more shady conditions support a different range of species;
- Age structure of those trees
    - Providing continuity of habitat in relation to the processes of tree aging, fungal colonisation and wood decay
- Management history
    - The less mobile species become increasingly confined to high quality refugia as a result of habitat fragmentation and isolation

At Sherwood, then, the priorities are to:

- Protect and sustain as many veteran trees as possible;
- Maintain open conditions around these;
- Bring on new generations of open-grown trees.

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APPENDIX 1: FULL LIST OF SAPROXYLIC COLEOPTERA WITH DATE CLASSES

*Nationally Scarce species ** RDB species (Hyman 1992)

Species	**1850-1949**	**1950-1999**	**2000 onwards**
Histeridae			
**Abraeus granulum* Erichson	1889 Blatch WG		
Abraeus perpusillus (Marsham)	1889 Blatch WG	1962 Skidmore	2006 Lott
**Plegaderus dissectus* Erichson	1870 Kidson Taylor J	1998 Lott; 1986 Wight; 1983 Johnson; 1978 Hunter; 1962 Johnson; 1960 Skidmore	2006 Lott; 2002 Denton ML et al; 2000 Drane
Plegaderus vulneratus (Panzer)			2006 Lott
Gnathoncus nannetensis (Marseul)	1905 Bedwell; 1903 Kidson Taylor	1998 Lott	
Gnathoncus rotundatus (Kugelann)		1998 Lott	2004 Dutton & Dutton
Dendrophilus punctatus (Herbst)	undated, Kidson Taylor & Tomlin		2006 Lott
Paromalus flavicornis (Herbst)		1998 Dutton & Dutton; 1978 Hunter FA; 1962 Skidmore P	2006 Lott
Margarinotus merdarius Hoffmann J	1886 Blatch WG		
Ptiliidae			
**Ptenidium gressneri* Erichson	1907 & 1884 Blatch WG		
***Ptenidium turgidum* Thomson, C.G.	1889 Blatch WG		
***Micridium halidaii* (Matthews, A.)	1867 Matthews A	1983-5 & 1977 Johnson C	
Ptinella aptera (Guérin-Méneville)	1886 Blatch & Horner; 1863 Fowler, Matthews & Rye	1998 Lott DA; 1970 Johnson C	
**Ptinella denticollis* (Fairmaire)	1886 Blatch & Horner		
Ptinella errabunda Johnson		1998 Lott DA; 1964-73 Johnson C	2006 Lott; 2000 Drane AB

Species	1850-1949	1950-1999	2000 onwards
***Ptinella limbata* (Heer)	1886 Blatch & Horner		
Pteryx suturalis (Heer)	1886 Blatch & Horner	1998 Lott DA; 1964 Johnson C	2006 Lott; 2000 Drane AB
Acrotrichus montandonii (Allibert)	Fowler		
Leiodidae			
Anisotoma humeralis (F.)	Bedwell, Chaster, Ryles, Kidson Taylor, Tomlin	1998 Lott; 1987 Bratton; 1986 Wright & Lott; 1978 Hunter; 1962 Johnson	2010 Alexander; 2008 Pendelton & Pendleton; 2006 Lott; 2000 Drane
Anisotoma orbicularis (Herbst)	Blatch 1906	1986 Wright & Lott	
Amphicyllis globus (F.)	1906 Taylor & Chaster; Fowler, Chaster & Tomlin		
***Agathidium confusum* Brisout			2010 Alexander
Agathidium nigrinum Sturm		1985 Johnson C	2002 Denton et al
Agathidium nigripenne (F.)	1886 Blatch & Horner	1978 Hunter FA	
Agathidium rotundatum Gyllenhal	Fowler & Chaster		
Agathidium seminulum (L.)		1978 Hunter, 1963 Johnson, 1960 Skidmore	2000 Drane AB
Agathidium varians Beck	1907 recorder not named		
Nemadus colonoides (Kraatz)			2006 Lott
Scydmaeidae			
***Eutheia linearis* Mulsant	1886 Fowler; 1883 Blatch		
***Microscydmus minimus* (Chaudoir)		1998 Lott; 1969-83 Johnson; Hammond PM	2006 Lott
**Microscydmus nanus* (Schaum)	1913 Bedwell; 1886	1998 Lott	2006 Lott
**Neuraphes plicicollis* Reitter	1884 1885 1889 Blatch	1998 Lott	2000 Drane
Stenichnus bicolor (Denny)	1886 Fowler	1978 Hunter; 1965 Johnson	2002 Denton et al; Drane 2000

Species	1850-1949	1950-1999	2000 onwards
****Stenichnus godarti** (Latreille)	1886 Fowler		
Staphylinidae: Omaliinae			
Coryphium angusticolle Stephens	1886 Blatch & Horner	1998 Lott; 1984 & 1973 Johnson C	2002 Denton et al
Acrulia inflata (Gyllenhal)		1964 Clarke RO; 1964 Johnson	
Phyllodrepa ioptera (Stephens)	1886 Blatch & Horner; Bedwell, Chaster, Kidson Taylor, Tomlin		2006 Lott; Denton et al 2002
Phyllodrepa koltzei Jászay & Hlavac	1905 Kidson Taylor		2002 Denton et al
Hapalaraea pygmaea (Paykull)	1904 Kidson Taylor	1998 Lott	
Phloeonomus punctipennis Thomson, C.G.	1886 Blatch & Horner	1998 Lott; 1964 Johnson	2006 Lott; 2002 Denton et al
Phloeonomus pusillus (Gravenhorst)	1886 Blatch & Horner		
Xylodromus concinnus (Marsham)	1886 Blatch & Horner		2000 Drane
Staphylinidae: Pselaphinae			
***Batrisodes venustus** (Reichenbach)	1924 Beare TH; 1913 Fowler	1998 Lott; 1984, 1977, 1969, 1965 Johnson; 1977 Hodge PJ	2006 Lott; 2000 Drane
Euplectus infirmus Raffray		1983 & 1984 Johnson C	2006 Lott
Euplectus karstenii (Reichenbach)	1886 Blatch & Horner	1977 Johnson C	
****Euplectus nanus** (Reichenbach)	1886 Blatch & Horner	1998 Lott; 1984, 1977, 1962 Johnson C; 1978 Hunter FA	2006 Lott
Euplectus piceus Motschulsky	1886 Blatch & Horner	1998 Lott; 1989, 1970, 1969, 1965 Johnson	2006 Lott; 2002 Denton et al; 2000 Drane
****Euplectus tholini** Guillebeau	1916 Matthews, Horner, Blatch, Fowler, Chaster, Tomlin	1998 Lott; 1978 Hunter; 1973 Johnson C	2006 Lott
****Plectophloeus nitidus** (Fairmaire)	1889 no details	1985, 1984, 1977 Johnson C;	2006 Lott

Species	1850-1949	1950-1999	2000 onwards
Bibloporus bicolor (Denny)	Chaster (may include *minutus)*	1977 & 1965 Johnson C	2000 Drane
**Bibloporus minutus* Raffray	old records for *bicolor* may include this species		2006 Lott
Staphylinidae: Phloeocharinae			
Phloeocharis subtilissima Mannerheim	1886 Blatch & Horner	1998 Lott; 1964 Johnson	2006 Lott
Staphylinidae: Tachyporinae			
**Sepedophilus bipunctatus* (Gravenhorst)			2008 Pendleton & Pendleton
Sepedophilus littoreus (L.)	Chaster & Taylor		2002 Denton et al
**Sepedophilus testaceus* (F.)	Taylor & Tomlin	1985 & 1983 Johnson	2006 Lott
Staphylinidae: Trichophyinae			
**Trichophya pilicornis* (Gyllenhal)	1886 Blatch & Horner		
Staphylinidae: Aleocharinae: Athetini			
Alaobia pallidicornis (Thomson)	1905, 1889 1886 Blatch	undated, Smith EJ	2002 Denton et al; 2000 Drane
Atheta liturata (Stephens)	1889 Blatch		
**Atheta pilicornis* (Thomson)	1905 1886 Blatch & Horner	1998 Lott	2002 Denton et al
Atheta vaga (Heer) syn *nigricornis* (Thomson)	1905 Taylor; 1886 Blatch & Horner		
Dadobia immersa (Erichson)	1886 Blatch & Horner	undated, Smith EJ	
Dinaraea aequata (Erichson)	1886 Blatch & Horner		2006 Lott; 2002 Denton et al
Dinaraea linearis (Gravenhorst)	2006 & 1998 Lott; 1887 Blatch & Horner		
**Traumoecia picipes* (Thomson)	Fowler		
Staphylinidae: Aleocharinae: Homalotini			
Bolitochara bella Maerkel		1985 Johnson C	2002 Denton et al
Bolitochara lucida (Gravenhorst)syn *reyi* Sharp (misident.)	1889 Blatch	1984 Johnson C	2002 Denton et al
Bolitochara obliqua Erichson	1907 Taylor & Tomlin	1985 Lott	2002 Denton et al

Species	1850-1949	1950-1999	2000 onwards
Leptusa fumida Kraatz	Taylor & Tomlin	1998 Lott	2010 2009 Alexander; 2006 Lott; 2002 Denton et al; 2000 Drane
Agaricochara latissima (Stephens)	1886 Blatch & Horner		2002 Denton et al
Gyrophaena affinis Mannerheim	1905 Taylor		2006 Lott; 2002 Denton et al; 2000 Drane
Gyrophaena fasciata (Marsham)	1905 Taylor		
Gyrophaena gentilis Erichson	1905 Taylor		
Gyrophaena joyioides Wüsthoff			2006 Lott; 2002 Denton et al
**Gyrophaena manca* syn. *angustata* (Stephens)			2003 Godfrey A
Gyrophaena minima Erichson	1905 Kidson Taylor		2006 Lott
Gyrophaena nana (Paykull)	1906 Kidson Taylor		
Anomognathus cuspidatus (Erichson)		1998 Lott; 1969 Johnson	2006 Lott
**Holobus (Oligota) apicatus* (Erichson)	1924 Beare TH; 1907 1886 Blatch & Horner	1989 1977 Johnson	2002 Denton et al; 2000 Drane
Staphylinidae: Aleocharinae: Oxypodini			
**Dexiogyia corticina* (Erichson)	1924 Beare; 1916 Fowler		2000 Drane
Haploglossa villosula (Stephens)	Fowler		
Ischnoglossa prolixa (Gravenhorst)	1905 Kidson Taylor		2006 Lott
Oxypoda recondita Kraatz		1998 Lott; 1985 1969 Johnson	
**Phloeopora corticalis* (Gravenhorst) nec *angustiformis* Baudi	1924 Beare; Fowler, Chaster, Kidson Taylor, Tomlin	1998 Lott	2006 Lott
Phloeopora testacea (Mannerheim)		1998 Lott; 1969 Johnson	2002 Denton et al
Staphylinidae: Aleocharinae: Placusini			
Placusa pumilio (Gravenhorst)	1886 Blatch & Horner	1998 Lott	2006 Lott
**Placusa tachyporoides* (Waltl)	1886 Blatch & Horner		

Species	1850-1949	1950-1999	2000 onwards
Staphylinidae: Scaphidiinae			
Scaphidium quadrimaculatum Olivier	Taylor & Tomlin	1999 Binding & Binding; 1995 Binding & Harris; 1987 Kirby P; 1986 Wright & Lott; 1984 Alexander; 1984 1983 Johnson	2010 Alexander; 2009 2008 Pendleton & Pendleton; 2006 Lott; 2002 Denton et al; 2000 Drane
Scaphisoma agaricinum (L.)	1886 Blatch & Horner	1998 Lott; 1996 Fowles AP; 1987 Key RS; 1962 Skidmore; Smith EJ	2010 Alexander; 2006 Lott; 2002 Denton et al; 2000 Drane
**Scaphisoma boleti* (Panzer)	1886 Blatch & Horner	1978 Hunter FA	
Staphylinidae: Staphylininae			
Atrecus affinis (Paykull)		1998 Lott	2008 Pendelton & Pendleton; 2006 Lott; 2002 Denton et al; 2000 Drane
Gabrius splendidulus (Gravenhorst)	1886 Blatch & Horner	1998 Lott; 1964 Johnson	2009 Alexander; 2006 Lott; 2002 Denton et al; 2000 Drane
**Quedius fulgidus* (Fabricius) syn. *assimilis*	1916 Fowler		
Quedius maurus (Sahlberg, C.R.)			2002 Denton et al
Quedius mesomelinus (Marsham)	Ryles WE		2009 Alexander
**Quedius scitus* (Gravenhorst)	1916; 1889 Kidson Taylor	1998 Lott	
**Quedius truncicola* Fairmaire & Laboulbène	Fowler		
**Quedius xanthopus* Erichson	Fowler, Blatch, Horner	1998 Lott; 1987 Key RS; 1983 1964 1963 Johnson; 1978 Hunter	2008 Pendleton & Pendleton; 2006 Lott; 2002 Denton et al; 2000 Drane
Lucanidae			

Species	1850-1949	1950-1999	2000 onwards
Dorcus parallelepipedus (L.)		1978 Hunter; 1963 Johnson; 1960 Skidmore	2009 2008 Pendeleton & Pendleton; 2008 Boroff A
Sinodendron cylindricum (L.)		1998 no details	2009 Pendeleton & Pendleton
Trogidae			
Trox scaber (Linnaeus)	1903 Kidson Taylor	1978 Hunter FA	
Scirtidae			
**Prionocyphon serricornis* (Müller)	1904 Taylor & Tomlin; 1870 Matthews A		
Buprestidae			
**Agrilus angustulus* (Illiger)	1916 1899 Tomlin		2010 Dutton
**Agrilus biguttatus* (Fab.)	1939 Tozer D; 1940 1913; 1908 Donisthorpe	1960-69 Hunter	2010 2009 Alexander; Pendleton & Pendleton
**Agrilus laticornis* (Illiger)	1903 Kidson Taylor	1998 Lott	2009 Pendleton & Pendleton; 2006 Lott; 2000 Drane
**Agrilus sinuatus* (Olivier)			2009 Alexander
Eucnemidae			
**Melasis buprestoides* (L.)	Bedwell & Tomlin	1999 Binding; 1978 Hunter; 1962 Johnson	
Elateridae			
**Calambus bipustulatus* (L.)	Turner & Fowler		
Denticollis linearis (L.)	Bedwell & Kidson Taylor	1998 Lott	2010 Alexander; 2009 Binding & Binding; 2009 2008 Pendleton & Pendleton; 2002 Denton et al; 2000 Drane
Stenagostus rhombeus (Olivier)	1868 Taylor	1998 Lott; 1986 Wright S; 1978 Hunter; 1962 Johnson	2010 2009 Alexander; 2009 2008 Pendleton & Pendleton; 2006 Lott

Species	1850-1949	1950-1999	2000 onwards
Ampedus balteatus (L.)	1905 Taylor	1998 Lott; 1991 1987 Key RS; 1986 Wright; 1981 1984; 1978 Hunter; 1962 Johnson	2010 2009 Alexander; 2006-9 Pendleton & Pendleton; 2006 Lott; 2002 Denton et al; 2000 Drane
***Ampedus cardinalis* (Schiodte)	Blatch	1965 Johnson	2009 Alexander; 2006 Dutton & Dutton
**Ampedus elongatulus* (F.)	1865 A Matthews (specimen in H. Willoughby Ellis Coll. (Yorkshire Museum) (H Mendel pc)		
**Ampedus pomorum* (Herbst)	1923 Ryle GB; Blatch Horner Fowler Chaster Taylor	1987 Foster AP; 1984 Drane; 1978 Hunter; 1962 1963 1965 1969 Johnson	2007 2008 2009 Pendleton & Pendleton
**Ampedus quercicola* du Buysson	1927 Bedwell; 1907;1905 Kidson taylor; 1874 Hardy JR	1978 Hunter; 1962 Skidmore & Johnson	2010 Alexander; 2009 Binding & Binding; 2009 2008 2007 Pendleton & Pendleton; 2003 Whiteley D; 2002 Denton et al; 2000 Drane
***Procraerus tibialis* (Boisduval & Lacordaire)	Bedwell		
Melanotus castanipes (Paykull)	1856 Janson; Blatch, Chaster, Fowler, Taylor	1998 Lott; 1962 Johnson	2010 2009 Alexander; 2009 2008 Pendleton & Pendleton; 2009 Binding & Binding; 2006 Lott; 2002 Denton et al; 2000 Drane
Lycidae			
**Pyropterus nigroruber* (Degeer)	1919; 1908; 1868 Taylor	1995 Binding; 1978 Hunter; 1965 1963 1962 Johnson	2006 2007 2008 Pendleton & Pendleton; 2000 Drane

Species	1850-1949	1950-1999	2000 onwards
**Platycis minutus* (F.)	2009 Pendleton & Pendleton; 1989 Johnson; 1978 Hunter	2009 Pendleton & Pendleton; 1989 Johnson; 1978 Hunter	2009 Pendleton & Pendleton; 1989 Johnson; 1978 Hunter
Cantharidae			
Malthinus punctatus (Geoffroy) syn *flaveolus* (Herbst)	2008 Pendleton & Pendleton; 2000 Drane; 1998 Lott; Kidson Taylor & Tomlin	2008 Pendleton & Pendleton; 2000 Drane; 1998 Lott; Kidson Taylor & Tomlin	2008 Pendleton & Pendleton; 2000 Drane; 1998 Lott; Kidson Taylor & Tomlin
**Malthinus frontalis* (Marsham)	2000 Drane; 1998 Lott; Kidson Taylor & Tomlin	2000 Drane; 1998 Lott; Kidson Taylor & Tomlin	2000 Drane; 1998 Lott; Kidson Taylor & Tomlin
Malthinus seriepunctatus Kiesenwetter	2006 & 1998 Lott; Ryles Kidson Taylor Tomlin	2006 & 1998 Lott; Ryles Kidson Taylor Tomlin	2006 & 1998 Lott; Ryles Kidson Taylor Tomlin
Malthodes fuscus (Waltl)		1998 Lott	
Malthodes marginatus (Latreille)	1907 Taylor		2010 Alexander; 2002 Denton et al
Malthodes minimus (L.)		1981 1953 no details	
Dermestidae			
**Megatoma undata* (L.)	1927; Fowler Ryles Kidson Taylor	1998 Lott; 1978 Hunter; 1962 Johnson	
Ctesias serra (F.)	1912; 1868 Hardy	1998 Lott; 1988 Fowles AP; 1987 Key RS; 1978 Hunter; 1965 Johnson	2010 2009 Alexander; 2009 2007 Pendleton & Pendleton; 2002 Denton et al; 2000 Drayne
Bostrichidae			
Lyctus brunneus (Stephens)	1913 Hardy JR (Carr, 1935)		
Anobiidae			
**Hedobia imperialis* (L.)	1916 Bedwell		2009 Pendleton & Pendleton
Ptinus fur (Linnaeus)		1998 Lott	2009 Alexander; 2002 Denton et al
**Ptinus subpilosus* Sturm	1907 Donisthorpe		
Grynobius planus (Fab.)	Bedwell & Taylor	1978 Hunter FA	2006 Lott

Species	**1850-1949**	**1950-1999**	**2000 onwards**
Dryophilus pusillus (Gyllenhal)	1899 Ryles	1978 Hunter; 1965 Johnson	
Ochina ptinoides (Marsham)			2010 Alexander
Xestobium rufovillosum (Degeer) Deathwatch Beetle		1987 Bratton	2010 2009 Alexander; 2007 Dutton & Dutton; 2000 Drane
Ernobius mollis (L.)			2000 Drane
Hemicoelus fulvicornis (Sturm)	1905 Taylor	1998 Lott	2009 2008 P&P; 2006 Lott; 2000 Drane
Anobium punctatum (Degeer)			2000 Drane
Ptilinus pectinicornis (L.)	1906 Kidson Taylor & Chaster		2000 Drane
Dorcatoma chrysomelina Sturm	1906 Kidson Taylor & Chaster	1998 Lott; 1965 Skidmore & Johnson	
**Dorcatoma flavicornis* (F.)	1916; Matthews & Kidson Taylor	1978 Hunter; 1961 Skidmore	
**Anitys rubens* (Hoffmann, J.J.)	1906 Fowler, Kidson Taylor, Matthews & Chaster		
Lymexylidae			
**Hylecoetus dermestoides* (L.)	1916; 1886 Fowler	1999 B&B; 1986 Wright; 1978 Hunter; 1962 Skidmore & Johnson	2009 B&B, P&P; 2002 Denton et al
***Lymexylon navale* (L.)			2008 Pendleton & Pendleton
Phloiophilidae			
**Phloiophilus edwardsii* Stephens	Matthews		2009 Alexander
Trogossitidae			
**Thymalus limbatus* (F.)	1868 Taylor	1978 Hunter; 1962 Johnson	
Cleridae			
Thanasimus formicarius (L.)	Bedwell & Tomlin	1999 Binding; 1998 Lott; 1978 Hunter	2010 Alexander; 2008 2008 P&P; 2000 Drane

Species	1850-1949	1950-1999	2000 onwards
Dasytidae			
**Aplocnemus impressus* (Marsham)	1906 Taylor & Chaster		
**Aplocnemus nigricornis* (F.)		1978 Hunter	
Dasytes aeratus Stephens		1988, 1965 no details	
**Dasytes plumbeus* (Müller, O.F.)	1870 Hardy & Ray		
Malachidae			
Axinotarsus ruficollis (Olivier)		1999 B&B	
Malachius bipustulatus (L.)		1999 B&B; 1985 Johnson	2009 B&B; 2009 2008 2007 2006 P&P; 2002 Denton et al;
Sphindidae			
**Sphindus dubius* (Gyllenhal)	1889 Blatch; 1870 KT		2002 Denton et al; 2000 Drane
Aspidiphorus orbiculatus (Gyllenhal)	1870 KT		2000 Drane
Nitidulidae			
Carpophilus sexpustulatus (F.)	1913 Morse	1981; 1978 Hunter; 1969 1963 1962 Johnson; 1962 Skidmore	
Epuraea aestiva (L.)	Taylor		2006 Lott; 2003 Marsh B; 2002 Denton et al; 2000 Drane
Epuraea biguttata (Thunberg)	Taylor	1983 Johnson	
**Epuraea longula* Erichson	Fowler		
Epuraea marseuli Reitter	1903 Taylor		2006 Lott; 2002 Denton et al
Epuraea pallescens (Stephens)	1906 Taylor		
Epuraea rufomarginata (Stephens)	1899; 1884 Fowler & Matthews	1963 Johnson	
Epuraea silacea (Herbst)	Taylor & Tomlin		
**Epuraea terminalis* Mannerheim		1966 Skidmore	
Soronia grisea (Linnaeus)	1906 Taylor	1998 Lott	
**Cryptarcha strigata* (F.)	Tomlin	1998 Lott	2009 Binding & Binding

Species	1850-1949	1950-1999	2000 onwards
Glischrochilus hortensis (Fourcroy)		1998 Lott	2009 Alexander; 2009 B&B, P&P; 2006 Lott; 2002 Denton et al; 2000 Drane
Glischrochilus quadriguttatus (Fabricius)	1886 Blatch & Horner	1978 Hunter	2009 B&B; 2006 Lott; 2002 Denton et al
Pityophagus ferrugineus (L.)	Tomlin	1978 Hunter	2009 Binding & Binding
Monotomidae			
Rhizophagus bipustulatus (Fabricius)	1886 Blatch & Horner	1998 Lott; 1962 Skidmore	2010 2009 Alexander; 2006 Lott; 2002 Denton et al
Rhizophagus dispar (Paykull)	1886 Blatch & Horner	1998 Lott	2010 2009 Alexander; 2008 P&P; 2002 Denton et al; 2000 Drane; 2006 Lott
Rhizophagus ferrugineus (Paykull)	1886 Blatch & Horner	1989 Johnson	2009 B&B; 2006 Lott
**Rhizophagus nitidulus* (Fabricius)	1906; 1886 Blatch & Horner	1983 Johnson	2009 P&P
***Rhizophagus oblongicollis* Blatch & Horner	1889 Blatch		
Rhizophagus parallelocollis Gyllenhal	Fowler		
Rhizophagus perforatus Erichson	1889 Blatch		2010 Alexander
**Rhizophagus picipes* (Olivier)	1885 Blatch		
Rhizophagus cribratus Gyllenhal	1886 Blatch & Horner	1978 Hunter; 1963 Johnson	
Rhizophagus depressus (Fabricius)	1886 Blatch & Horner		2008 P&P
Silvanidae			
Uleiota planata (Linnaeus)			2010 2009 Alexander; 2008 P&P
**Silvanus bidentatus* (Fabricius)			2006 Lott
Silvanus unidentatus (Olivier)		1963 Johnson; 1961-63 Skidmore	2009 Alexander; 2009 P&P; 2006 Lott
Cucujidae			
Pediacus dermestoides (Fabricius)	1916; 1909 Beare; Bedwell, Chaster, Fowler, Tomlin	1998 Lott; 1964 9162 Johnson; 1962 Skidmore	2010 2009 Alexander; 2009 P&P; 2002 Denton et al
Cryptophagidae			
Henoticus serratus (Gyllenhal)	1889; 1868 Taylor	1998 Lott	2002 Drane

Species	1850-1949	1950-1999	2000 onwards
Cryptophagus dentatus (Herbst)	1903 Taylor	1998 Lott	2009 Alexander; 2002 Denton et al; 2000 Drane
**Cryptophagus parallelus* Brisout de Barneville	1998 Lott	1998 Lott	
Cryptophagus pubescens Sturm	Fowler		
**Cryptophagus ruficornis* Stephens	1924 Beare; Chaster		
Cryptophagus scutellatus Newman		1998 Lott	2002 Denton et al
Atomaria pulchra Erichson			2002 Denton et al
***Atomaria morio* Kolenati		1998 Lott	
Erotylidae			
Dacne bipustulata (Thunberg)		1986 Lott; 1962 Skidmore	2002 Denton et al
Dacne rufifrons (Fabricius)	Chaster KT & Tomlin		
Triplax russica (Linnaeus)	Taylor	1999 B&B; 1995 Binding; 1994 Alexander; 1989 Johnson; 1987 Foster AP; 1961 Skidmore	2009 B&B; 2009 2008 P&P; 2006 Lott; 2003 Whiteley; 2002 Denton et al
**Tritoma bipustulata* Fabricius	1868 Taylor	1985 Johnson; Hunter; 1962 Skidmore	2002 Denton et al
Biphyllidae			
Biphyllus lunatus (Fabricius)		1963 Skidmore	
Bothrideridae			
***Teredus cylindricus* (Olivier)	1884 no details	1964 Clarke; 1962 Hunter	2009 Alexander; 2001 no details
***Oxylaemus cylindricus* (Panzer)	Tomlin		
Cerylonidae			
Cerylon ferrugineum Stephens	1886 Blatch & Horner	1998 1986 Lott; 1962 Skidmore & Johnson	2010 2009 Alexander; 2009 2008 P&P; 2002 Denton et al; 2006 Lott
Cerylon histeroides (Fabricius)	Taylor & Tomlin	1998 Lott; 1962 Johnson	2009 Alexander; 2006 Lott; 2002 Denton et al; 2000 Drane
Endomychidae			

Species	1850-1949	1950-1999	2000 onwards
Endomychus coccineus (Linnaeus)			2009 2008 P&P; 2007 Rogers R; 2002 Denton et al
Corylophidae			
Orthoperus atomus (Gyllenhal)	1907 no details		
Orthoperus nigrescens Stephens			2000 Drane
Latridiidae			
**Latridius consimilis* Mannerheim	1929 Nicholson & Bedwell	1985 Johnson	2002 Denton et al
**Enicmus brevicornis* (Mannerheim)	1916 no details		
**Enicmus fungicola* Thomson		1970 Johnson	
**Enicmus rugosus* (Herbst)	1922 Beare; Matthews & Fowler	1998 Lott; 1989 1977 1970 Johnson; 1984 Drane	
Enicmus testaceus (Stephens)	1905 Taylor & Chaster	1998 Lott; 1970 Johnson	
Dienerella clathrata (Mannerheim)		1989 1985 1983 Johnson	
Dienerella vincenti Johnson	Fowler	1998 Lott; 1989, 1985, 1983	2000 Drane
**Corticaria alleni* Johnson		1977 1970 Johnson	
***Corticaria longicollis* (Zetterstedt)	Tomlin	1998 Lott; 1989 1983 1977 1965 Johnson	
**Corticaria rubripes* Mannerheim syn *linearis* (Paykull)		1989 Johnson	
Mycetophagidae			
Pseudotriphyllus suturalis (Fabricius)	1868 KT		2009 Alexander; 2002 Denton et al; 2000 Drane
Triphyllus bicolor (Fabricius)	1903 no details	Hunter; 1984 1964 Johnson; 1961 Skidmore	2009 Alexander; 2008 P&P; 2006 Lott; 2002 Denton et al; 2000 Drane
Litargus balteatus Le Conte	1908 Tomlin		
Litargus connexus (Fourcroy)		1961 Skidmore	2010 Alexander; 2009 B&B
Mycetophagus multipunctatus Fabricius		1987 Kirby P	2002 Denton et al
**Mycetophagus piceus* (Fabricius)	1886 Blatch & Horner		

Species	1850-1949	1950-1999	2000 onwards
**Mycetophagus populi* Fabricius	1904 Hardy, coll Manc Mus det CJ		
Mycetophagus quadripustulatus (Linnaeus)	Fowler, KT, Tomlin		
Ciidae			
Octotemnus glabriculus (Gyllenhal)	Taylor & Tomlin	1983 Johnson	2010 2009 Alexander; 2006 Lott; 2002 Denton et al; 2000 Drane
Sulcacis nitidus (Fab., 1792) syn. *affinis* (Gyllenhal)		1964 Johnson	
Orthocis alni (Gyllenhal)		1998 Lott	2010 Alexander; 2009 P&P; 2006 Lott; 2002 Denton et al; 2000 Drane
Cis bidentatus (Olivier)	1886 Blatch & Horner	1962 Johnson	
Cis bilamellatus Wood		1998 Lott	2009 Alexander; 2009 B&B; 2006 Lott; 2002 Denton et al; 2000 Drane
Cis boleti (Scopoli)	Taylor & Tomlin		2010 2009 Alexander; 2009 B&B; 2006 Lott; 2002 Denton et al; 2000 Drane
Cis castaneus (Herbst 1793) syn *nitidus*	1886 Blatch & Horner	1998 Lott; 1987 Key	2009 Alexander; 2006 Lott; 2002 Denton et al; 2000 Drane
Cis fagi Waltl	1886 Blatch & Horner	1984 1977 Johnson	2006 Lott
**Cis festivus* (Panzer)	1905; 1886 Blatch & Horner	1998 Lott; 1965 Johnson	2006 Lott; 2002 Denton et al
Cis micans (Fab 1792) syn Cis hispidus (Paykull)	1969 Johnson; 1886 Blatch & Horner		
Cis pygmaeus (Marsham)	1904 KT		
Cis submicans Abeille de Perrin 1874 syn *micans* (previous GB usage)	Chaster Fowler Tomlin		
Cis vestitus Mellié		1998 Lott; 1965 Johnson	2009 Alexander; 2006 Lott; 2002 Denton et al; 2000 Drane
Cis villosulus (Marsham)			2006 Lott
Ennearthron cornutum (Gyllenhal)	1903 KT		

Species	1850-1949	1950-1999	2000 onwards
Tetratomidae			
**Hallomenus binotatus* (Quensel)	1907 Taylor	1970 Johnson	2009 Alexander; 2002 Denton et al; Hunter
**Tetratoma desmaresti* Latreille	1899; 1886 Blatch & Horner		2002 Denton et al
Tetratoma fungorum Fabricius	1886 Blatch & Horner	1962 Skidmore	2009 Alexander; 2009 2008 P&P; 2006 Lott; 2002 Denton et al
Melandryidae			
**Orchesia micans* (Panzer)		1961 Skidmore	
**Orchesia minor* Walker			2009 Alexander
Orchesia undulata Kraatz	1886 Blatch & Horner	1988 Fowles; 1986 Wright & Lott; 1984 Johnson	2008 P&P; 2006 Lott; 2002 Denton et al; 2000 Drane
**Abdera biflexuosa* (Curtis)			2006 Lott
**Abdera quadrifasciata* (Curtis)		1998 Lott	2000 Drane
**Phloiotrya vaudoueri* Mulsant	1916; 1868 Richard, Tyrer & Taylor	1988; 1960 Skidmore	2009 Alexander; 2009 2008 P&P
**Melandrya caraboides* (Linnaeus)			2009 2008 P&P
**Conopalpus testaceus* (Olivier)	1916; 1904 1869-70 Taylor; 1868 Tyrer; 1867 Turner	1998 Lott	2008 P&P; 2002 Denton et al; 2000 Drane
Mordellidae			
Mordellochroa abdominalis (Fabricius)	1897 Thornley		
Colydiidae			
**Synchita humeralis* (Fabricius)	1907 Donisthorpe & Taylor; 1904	1978 Hunter; 1965 Johnson	2006 Lott
Bitoma crenata (Fabricius)		1998 Lott; 1984 Alexander; 1964 Clarke; 1960 Skidmore	
Tenebrionidae			
**Eledona agricola* (Herbst)	1916; 1909 Beare; 1869 Taylor	1998 Lott; 1991 Key; Hunter	2009 Alexander; 2002 Denton et al; 2000 Drane

Species	1850-1949	1950-1999	2000 onwards
Nalassus laevioctostriatus (Goeze)	1893 Mosley	1999 B&B; 1998 Lott; 1995 Binding & Harris; 1989, 1987, 1986; 1963 Johnson	2010 2009 Alexander; 2009 2008 P&P; 2006 Lott & Godfrey a; 2003 Marsh B;2002 Denton et al; 200 Drane
Corticeus linearis (Fabricius)	1904 KT		
**Corticeus unicolor* Piller & Mitterpacher	Matthews Blatch Power	1998 Lott; 1991 Key; 1987 Foster AP; 1986 Wright; 1985 1984 1977 1970 1965 1962 Johnson; 1984 Alexander; 1960 1961 Skidmore	2010 2009 Alexander; 2009 B&B; 2009 2008 P&P; 2006 Lott; 2002 Denton et al; 2000 Drane
***Diaperis boleti* (Linnaeus)	1891 no details		
**Prionychus ater* (Fab.)			2002 Denton et al 2002; 2000 Drane
***Prionychus melanarius* (Germar)	1908 Donisthorpe	1987; 1965 1963 1962 Johnson	2010 2009 Alexander; 2008 P&P; 2002 Denton et al
**Pseudocistela ceramboides* (Linnaeus)	1908; 1869 Taylor	Hunter; 1963 Johnson	2010 2009 Alexander; 2009 P&P
**Mycetochara humeralis* (Fabricius)	1916 1907; 1905 1906 Taylor & Chaster	1998 Lott; 1987 Foster AP; 1970 1965 Johnson; 1961 Skidmore	2009 2008 P&P
Oedemeridae			
**Ischnomera sanguinicollis* (Fabricius)	Blatch & Fowler		
Pyrochroidae			
**Pyrochroa coccinea* (L.)		1998 Lott	2010 2009 Alexander; 2009 B&B; 2009 2008 P&P; 2006 Lott
Pyrochroa serraticornis (Scopoli)	Taylor		2002 Denton et al; 2000 Drane
Salpingidae			
**Rabocerus gabrieli* Gerhardt			2009 2008 P&P
Sphaeriestes (Salpingus) castaneus (Panzer)	Taylor	1998 Lott	2000 Drane
Vincenzellus ruficollis (Panzer)	Bedwell	1998 Lott	2006 Lott; 2000 Drane

Species	1850-1949	1950-1999	2000 onwards
Rhinosimus planirostris (Fabricius)	Bedwell & Taylor	1998 Lott	2010 2009 Alexander; 2009 P&P; 2006 Lott; 2002 Denton et al ; 2000 Drane
Rhinosimus ruficollis (Linnaeus)	1905 Taylor	1998 Lott	2009 P&P
Aderidae			
**Euglenus oculatus* (Paykull)	Taylor & Hardy	1998 Lott; Hunter; 1963 Johnson; 1961 1960 Skidmore	2009 Alexander; 2006 Lott; 2002 Denton et al; 2000 Drane
Scraptiidae			
***Scraptia testacea* Allen	1870 Taylor; 1899	1963-79 Johnson	2006 Lott; 2002 Denton et al
Anaspis costai Emery			2000 Drane
Anaspis fasciata (Forster)	Taylor	1998 Lott	2002 Denton et al; 2000 Drane
Anaspis frontalis (Linnaeus)	Thornley & Pegler	1998 Lott	2010 2009 Alexander; 2009 2008 P&P; 2002 Denton et al; 2000 Drane; 2006 Lott
Anaspis garneysi Fowler	1908 Donisthorpe		
Anaspis lurida Stephens	Taylor		
Anaspis maculata Geoffroy	Taylor	1999 Binding; 1998 Lott	2010 Alexander; 2009 P&P; 2002 Denton et al; 2000 Drane; 2006 Lott
Anaspis regimbarti Schilsky	Taylor	1998 Lott	2009 P&P; 2002 Denton et al; 2006 Lott
Anaspis rufilabris (Gyllenhal)		1999 Binding; 1998 Lott	2010 Alexander; 2009 B&B; 2002 Denton et al; 2006 Lott
**Anaspis thoracica* (Linnaeus)		1998 Lott	2010 Alexander
Cerambycidae			
Rhagium bifasciatum Fabricius	1886 Blatch & Horner	1998 Lott	2010 Alexander; 2009 B&B; 2009 2008 2006 P&P
Rhagium mordax Oak Longhorn Beetle			2009 B&B
Stenocorus meridianus (Linnaeus)			2008 P&P

Species	1850-1949	1950-1999	2000 onwards
Grammoptera ruficornis (Fabricius)	Bedwell, Carr & Taylor		2010 Alexander; 2009 P&P; 2002 Denton et al; 2000 Drane
Leptura (Strangalia) quadrifasciata (Linnaeus) Four-banded Longhorn	1916; 1912 Beare; 1868 KT	1995 Binding; 1962 Johnson	2009 2008 2006 P&P; 2006 Lott; 2002 Denton et al; 2000 Drane
**Stictoleptura scutellata* Fabricius	1869 KT		
Alosterna tabacicolor (Degeer)	Bedwell, Ryles & Taylor		
Rutpela maculata (Poda)	Carr	1998 Lott; 1962 Johnson	2009 B&B; 2009 2008 2007 2006 P&P; 2009 Pyke; 2002 Denton et al; 2000 Drane
Asemum striatum (Linnaeus) Opaque Sawer		1963 Hunter FA	2008 P&P
Arhopalus rusticus (Linnaeus) Dusky Longhorn			2009 2008 P&P
Phymatodes testaceus (Linnaeus) Tanbark Borer	1906 Taylor, Blatch & Chappell	1998 Lott	
Clytus arietis (Linnaeus) Wasp Beetle	Carr	1962 Johnson	2009 B&B; 2009 2008 2006 P&P; 2002 Denton et al
**Anaglyptus mysticus* (Linnaeus)			2002 Denton et al
Pogonocherus hispidus (Linnaeus)	1903 KT		
Leiopus nebulosus (Linnaeus)	Taylor	1998 Lott; 1960	2010 Alexander; 2008 P&P; 2002 Denton et al; 2000 Drane; 2006 Lott
**Saperda scalaris* (Linnaeus)	1912 & undated record	1998 Lott; 1986 Wright; 1982 Mendel; 1962 Johnson; 1960	2007 P&P; 2003 Whiteley
**Stenostola dubia* (Laicharting)	Wlloughby Ellis		
Tetrops praeusta (Linnaeus)			2009 P&P
Curculionidae: Cossoninae			
**Cossonus parallelepipedus* (Herbst)	1886 Blatch	1963 Johnson	
Euophryum confine (Broun)			2002 Denton et al

Species	1850-1949	1950-1999	2000 onwards
Rhyncolus chloropus (Linnaeus)	Fowler & Taylor		
Phloeophagus lignarius (Marsham)	Blatch, Taylor & Tomlin	1998 Lott	2000 Drane
Curculionidae: Cryptorhynchinae			
Acalles misellus Boheman			2002 Denton et al
**Acalles ptinoides* (Marsham)			2000 Drane
**Acalles roboris* Curtis			2002 Denton et al
Curculionidae: Mesoptiliinae			
Magdalis armigera (Fourcroy)	Chaster & Fowler		
**Magdalis carbonaria* (Linnaeus)	1905 KT		
**Magdalis cerasi* (Linnaeus)	Bedwell; 1905 KT; 1904 1903	1998 Lott; 1965; 1963 Johnson	
Magdalis ruficornis (Linnaeus)	KT		
Curculionidae: Molytinae			
Hylobius abietis (Linnaeus)			2008 2007 P&P; 2000 Drane
**Trachodes hispidus* (Linnaeus)	Tomlin		2006 Lott; 2002 Denton et al
Curculionidae: Scolytinae			
Scolytus intricatus (Ratzeburg)	1907 Donisthorpe; 1889 Blatch; 1868 Taylor	1998 Lott; 1964 Johnson	2010 2009 Alexander; 2006 Lott; 2002 Denton et al
Scolytus multistriatus (Marsham)	Chaster		
Dryocoetinus villosus (Fabricius)	1924 Beare; Bedwell Ryes & Taylor	1998 Lott; Johnson	2006 Lott; 2002 Denton et al
Orthotomicus laricis (Fabricius)	1885 Blatch		
Trypodendron domesticum (Linnaeus)	Taylor, Blatch & Horner	1998 Lott	2009 2008 P&P; 2006 Lott; 2002 Denton et al
**Trypodendron signatum* (Fabricius)	1932 Ashe; Matthews, Blatch, Fowler; 1868 KT		
Leperisinus varius (Fabricius)	KT		

Species	**1850-1949**	**1950-1999**	**2000 onwards**
Hylastes ater (Fabricius)	Chaster Taylor Tomlin		2009 Pendleton & Pendleton
Hylastes opacus Erichson	Fowler		
Hylurgops palliatus (Gyllenhal)			2000 Drane

APPENDIX 2: FULL LIST OF SAPROXYLIC DIPTERA WITH DATE CLASSES

*Nationally Scarce species ** RDB species (Hyman 1992)

Species	**1850-1949**	**1950-1999**	**2000 onwards**
Tipulidae			
**Ctenophora pectinicornis* (Linnaeus)			2010 Alexander KNA & Godfrey A
***Tanyptera nigricornis* (Meigen)		SK66 (Stubbs 1992)	
Tipula flavolineata Meigen			2010 Godfrey A
Tipula irrorata Macquart			2010 Godfrey A
Tipula scripta Meigen	SK66 (Stubbs 1992)		
Limoniidae			
Austrolimnophila ochracea (Meigen)			2010 Godfrey A
Epiphragma ocellare (Linnaeus)			2010 Godfrey A
Neolimonia dumetorum Meigen			2010 Godfrey A
Ditomyiidae			
**Ditomyia fasciata* (Meigen)			2010 Godfrey A
Keroplatidae			
Macrocera stigmoides Edwards			2010 Godfrey A
Mycetophilidae			
Apolephthisa subincana (Curtis)			2010 Godfrey A
Tetragoneura sylvatica (Curtis)			2010 Godfrey A
Mycomya wankowiczii (Dziedzicki)			2010 Godfrey A
Phthinia humilis Winnertz			2010 Godfrey A
Anisopodidae			
Sylvicola cinctus (F.)			2010 Godfrey A
Mycetobiidae			
Mycetobia pallipes Meigen			2010 Godfrey A
Scatopsidae			
Holoplagia richardsi (Edwards)			2010 Godfrey A
Xylophagidae			
Xylophagus ater Meigen			2010 Godfrey A 2009 Alexander KNA
Hybotidae			
Leptopeza flavipes (Meigen)			2010 Godfrey A
Euthyneura halidayi Collin			2010 Godfrey A

Species	**1850-1949**	**1950-1999**	**2000 onwards**
Euthyneura myrtilli Macquart			2010 Godfrey A
Oedalea flavipes Zetterstedt			2010 Godfrey A
Oedalea holmgreni Zetterstedt			2010 Godfrey A
Oedalea tibialis Macquart			2010 Godfrey A
Tachypeza nubila (Meigen)			2010 Godfrey A 2009 Alexander KNA
Dolichopodidae			
Medetera dendrobaena Kowarz			2009 Alexander KNA
Medetera truncorum Meigen			2010 Godfrey A 2009 Alexander KNA
Neurigona quadrifasciata (Fabricius)			2010 Godfrey A 2009 Alexander KNA
Sciapus platypterus (Fabricius)			2010 Godfrey A 2009 Alexander KNA
Opetiidae			
Opetia nigra Meigen			2010 Godfrey A 2009 Alexander KNA
Platypezidae			
Agathomyia woodella Chandler	1922 (Falk & Chandler 2005)		
Syrphidae			
**Brachypalpus laphriformis* (Fallén)	SK66 (Ball & Morris 2000)		
Chalcosyrphus nemorum (Fabricius)			2010 Godfrey A 2009 Alexander KNA
Criorhina berberina (Fabricius)	SK66 (Ball & Morris 2000)		2010 Godfrey A 2009 Alexander KNA
Criorhina floccosa (Meigen)	SK66 (Ball & Morris 2000)		
**Criorhina ranunculi* (Panzer)	SK66 (Ball & Morris 2000)		
Ferdinandea cuprea (Scopoli)		SK66 (Ball & Morris 2000)	
**Mallota cimbiciformis* (Fallén)	SK66 (Ball & Morris 2000)		
Myathropa florea (Linnaeus)		SK66 (Ball & Morris 2000)	2010 Godfrey A 2009 Alexander KNA
**Xylota abiens* Meigen	SK66 (Ball & Morris 2000)		
Xylota segnis (Linnaeus)			2009 Alexander KNA
Xylota sylvarum (Linnaeus)		SK66 (Ball & Morris 2000)	
Megamerinidae			
**Megamerina dolium* (Fabricius)			2010 Godfrey A 2009 Alexander KNA
Lonchaeidae			
Lonchaea scutellaris Rondani			2010 Godfrey A 2009 Alexander KNA
Clusiidae			
Clusia flava (Meigen)			2010 Godfrey A 2009 Alexander KNA
Clusiodes ruficollis (Meigen) syn. *fascialis* Collin			2010 Godfrey A 2009 Alexander KNA

Species	1850-1949	1950-1999	2000 onwards
Clusiodes gentilis (Collin)			2010 Godfrey A 2009 Alexander KNA
Acartophthalmidae			
Acartophthalmus nigrinus (Zetterstedt)			2010 Godfrey A 2009 Alexander KNA
Odiniidae			
***Odinia* sp ?*maculata* (Meigen)			2010 Godfrey A 2009 Alexander KNA
Asteiidae			
Leiomyza scatophagina (Fallén)			2010 Godfrey A 2009 Alexander KNA
Chloropidae			
**Lasiambia baliola* (Collin)			2010 Godfrey A 2009 Alexander KNA
**Lasiambia brevibucca* (Duda)			2010 Godfrey A 2009 Alexander KNA
Heleomyzidae			
Tephrochlamys flavipes (Zetterstedt)			2010 Godfrey A 2009 Alexander KNA
Suillia bicolor (Zetterstedt)			2010 Godfrey A 2009 Alexander KNA
Suillia variegata (Loew)			2010 Godfrey A 2009 Alexander KNA
Chyromyidae			
Chyromya britannica Gibbs			Centre Parcs 2007 Gibbs D
Drosophilidae			
Hirtodrosophila confusa			2009 Alexander KNA
Faniidae			
Fannia armata (Meigen)			2010 Godfrey A 2009 Alexander KNA