Natural England Research Report NERR025

Biodiversity studies of six traditional orchards in England

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Project details

This report results from research commissioned by English Nature and completed after the successor organisation, Natural England, was set up in October 2006. The work was undertaken under English Nature contract CPAU03/02/189 by the following team: Mike Lush, Eleanor Hewins and Jon Mellings of Just Ecology, Heather Robertson, of Natural England during the project, now retired, and individual consultants Keith Alexander, Vince Giavarini, Robin Stevenson and Malcolm Storey. Results from the report were used from 2005 to 2007 to support the proposal to list traditional orchards as a national priority habitat in the Biodiversity Action Plan. Since 2007, the report has been expanded to incorporate previous work by Paul Whitehead on one study site. The study site results are now being made more widely available, in the form of a permanent record, in this Natural England Research Report.

A summary of the findings covered by this report, as well as Natural England's views on this research, can be found within Natural England Research Information Note RIN025 – Biodiversity studies of six traditional orchards in England.

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We would like especially to remember the late Dr Oliver Gilbert, the renowned lichen expert, who had a long-term interest in orchard lichens. We feel privileged that he gave time to our project by joining Vince Giavarini for the survey of Rummers Lane Orchards.

Summary

Traditional orchards and their associated habitats, such as grasslands, walls, ponds and hedges, support a wide variety of wildlife. However, there have been relatively few systematic studies of the biodiversity value of traditional orchards. To help to fill this gap, English Nature (now Natural England) set up a project in 2004 to review the extent, distribution, biodiversity and management of traditional orchards in England. The study objectives included surveying a number of representative orchards to assess their biodiversity interest. This Natural England Research Report describes the results of field surveys carried out in 2004, together with some earlier species information which was available for one site. The information collected for the project was used to prepare the case for inclusion of traditional orchards in the national list of priority habitats in the UK Biodiversity Action Plan (BAP). This proposal was accepted by Government in August 2007. The orchard site survey results are now being made more widely and permanently available in this Natural England Research Report because of their value for informing orchard managers and advisers about orchard biodiversity, for the development of condition assessment methods and for the consideration of research priorities, particularly now that traditional orchards are a UK priority habitat in the Biodiversity Action Plan. An updated version of the overall case can be found in Robertson and Wedge (2008).

The aim of the site surveys was primarily to illustrate the kind of wildlife that orchards which are managed in a low intensity way can support, with particular reference to fungi, invertebrates and the lichens and bryophytes (mosses and liverworts) which grow on trees (That is, epiphytes). Habitat survey and collection of management information provided the context for the detailed survey of the chosen taxa. Resource constraints meant that only a small number of sites (six) could be surveyed. Thus the results should be seen as indicative case studies rather than exhaustive comparisons of different types of orchards or rigorous analysis of variation in response to geographical position, which would require more study sites to be surveyed.

The report is in two parts. The first part explains the selection of the survey sites and the survey methods. Also included is the description of the evaluation criteria employed to assess the species and habitat information, the summary of the results and analysis. Recommendations for further work and the key conclusions of the study follow this analysis. The second part of the report comprises the detailed results for each of the orchards that was surveyed.

The chosen sites were examples from counties in England which have the main concentrations of orchards and the sites covered as wide a geographic spread across the country as possible. The sites were: Slew Orchard, Devon (Ordnance Survey Grid Reference SX409741), a cherry orchard (1.3 ha); Luscombe Farm Orchards, Devon (Ordnance Survey Grid Reference SX748637), apple orchards (1.6 ha); Colston Farm Orchards, Devon (Ordnance Survey Grid Reference SX750648), apple orchards (1.9 ha); Broadway Farm Orchards, Gloucestershire (Ordnance Survey Grid Reference SO755148), mixed apple, pear and plum orchards (21 ha); Rummers Lane Orchards, Cambridgeshire (Ordnance Survey Grid Reference TF415075), mixed apple and plum orchards (8.3 ha); Park Farm Orchard, Kent (Ordnance Survey Grid Reference TQ944604), a cherry orchard (2.5 ha).

The habitat surveys of each orchard included recording a sample of orchard trees for girth size and veteran tree features, assessing the species composition of the orchard floor vegetation and the orchard boundaries and noting the presence of associated features such as ponds. Epiphytic lichen and bryophyte species and their abundances were recorded, and, for bryophytes only, all species found on every individual tree in a sample set. Fungus species were recorded in spring and autumn from orchard trees, fallen dead wood, the orchard floor and boundary features. Invertebrate species were recorded mainly from the canopies, epiphytes and wood-decay features of the trees, the ground and field layers of the orchard floor and orchard hedgerows. Five of the 6 orchards received 4 visits during 2004 for invertebrate recording. Broadway Farm Orchards were the exception in that the fruit tree census and an invertebrate survey were carried out in 2003, with slightly different methods. In addition, invertebrate records made by Paul Whitehead in 2001 and 2002 were incorporated into the Broadway Farm Orchards

results. Survey methods included manual searching, suction sampling, sweeping, beating, window flight interception traps and water traps. The main groups covered included Coleoptera, Heteroptera, Aculeate Hymenoptera, Psocoptera, Orthoptera and some Diptera. A few records of mammals and birds made by others are also listed in the results for the sites. Contextual information was gathered from a variety of different data sets including ancient woodland inventories, First Edition Ordnance Survey maps and recent aerial photographs. Historical and management information was supplied by orchard owners and managers.

The results were evaluated with reference to the assemblages and communities represented and the rarity and conservation status of habitats and species present, including BAP priority habitats and species and threatened species listed in Red Data Books. In addition, Indicators of Ecological Continuity were identified in the lichen and invertebrate data sets, using published lists of these indicators.

The overall numbers of species found in the species surveys were: 131 epiphytic lichens, 50 epiphytic bryophytes, 175 fungi and 522 invertebrate species. The sites varied in their diversity for different groups, for example Slew Orchard was the richest for lichens, and Rummers Lane Orchards had the most bryophytes. The sites also had a wide range of communities and associations, for example lichen communities ranged from a community (the Usneion) on very well-lit trees in humid conditions to a deeply-shaded bark community (the Pyrenulatum). Numbers of species represented in assemblages varied across sites, for example saproxylic (wood-decay) invertebrate faunas were particularly rich in Broadway Farm Orchards, while the highest number of field layer invertebrates was found in Slew Orchard. Fungi associated with dead wood were particularly varied at Broadway Farm Orchards, Rummers Lane Orchards and Park Farm Orchard. The character of the lichen and invertebrate species found in the orchards had particular similarities to wood pasture and parkland flora and fauna.

Priority BAP habitats, that is, Lowland Meadow and the pre-2007 priority habitat of Ancient and / or Species-rich Hedgerows, occurred singly or together at all sites except Rummers Lane Orchards. (The definition of priority hedgerows was widened in 2007 beyond ancient and species-rich hedgerows). An array of nationally rare and scarce species was found across all species groups surveyed with the exception of bryophytes. Locally rare bryophyte species were present in Rummers Lane Orchards. Priority BAP species occurred in Colston Farm Orchards (a waxcap grassland fungus, *Hygrocybe calyptriformis*), Park Farm Orchard (stag beetle, *Lucanus cervus*) and Broadway Farm Orchards (noble chafer beetle, *Gnorimus nobilis*).

Among the epiphytic lichens, 16 nationally rare or scarce species were found, including one species on Schedule 8 of the Wildlife and Countryside Act 1981. Thirteen provisional Red Data List or rare fungi species were found, every site having a species of interest. Waxcap grassland species, belonging to a threatened assemblage of fungi depending on unimproved grassland, were a particular feature at Colston Farm Orchards. A total of 45 nationally rare or scarce invertebrates were recorded. All sites had some nationally rare or scarce invertebrate species, primarily from the saproxylic (wood-decay) assemblage. Broadway Farm Orchards were particularly rich in these species. Apart from *Gnorimus nobilis*, other scarce beetles such as *Prionychus melanarius*, *Gracilia minuta* and *Anisoxya fuscula* were present. *Anthocoris visci*, a predatory bug, *Orthops visicola* a phytophagous bug, and the weevil *Ixapion variegatum*, all associated with mistletoe growing on apple trees, were found in Broadway Farm Orchards. Saproxylic invertebrates also featured strongly among locally rare invertebrate species present in the study sites.

The field and ground layers of the orchard floor also contained scarce invertebrate species and provided habitats for species which use a range of habitat resources, for example the nationally scarce saproxylic beetle *Anisoxya fuscula* was found on meadowsweet flowers in Broadway Farm Orchards. Colston Farm Orchards and Luscombe Farm Orchards contained areas of marshy grassland that featured the localised plant bug *Pachytomella parallela*, and the nationally scarce weevil *Rhinocyllus conicus* on marsh thistle (*Cirsium palustre*).

Hedgerows and non-fruit tree species on boundaries or in orchards contributed species of interest and provided shelter and food supplies, such as pollen and nectar, for invertebrate species. The rare fungus *Entoloma saepium*, an ectomycorrhizal fungus thought to be associated with plants in the family

Rosaceae, was found close to sloe (*Prunus spinosa*) and hawthorn (*Crateagus monogyna*) growing in the hedgerow around Slew Orchard. The provisional Red Data List fungus *Schizophyllum amplum* was found on a dead, fallen, poplar twig in the row of poplars along one of the boundaries of Rummers Lane Orchards. Saproxylic invertebrates in orchards may benefit from mature or veteran trees, other than apples, cherries, plums and pears, that may occur in boundary hedgerows and within orchards. An example at Slew Orchard was *Tanyptera nigricornis* (a Red Data Book cranefly), which was recorded on ash (*Fraxinus excelsior*) in the hedgerow boundary. Another example was the parasitic chalcid wasp *Haltichella rufipes*, which was found on ash at Broadway Farm Orchards.

As far as possible, given the small number of study sites, the patterns found in habitat features and species composition were analysed in relation to factors such as atmospheric deposition and rainfall, continuity of orchards and woodlands in space and time, fruit tree type, fruit tree size and stage and orchard floor habitat variation. Sites ranged in topographic position from steep valley sides to level river floodplains, and had a range of aspects, including north-east facing slopes, which might have been expected to be less suitable for orchard planting than warmer south-facing and west-facing slopes. Two orchards contained relatively young trees but three orchard sites had no saplings or very young trees, although these sites fortunately now have restoration plans. All sites had lichen and / or beetle Indicators of Ecological Continuity. Lichen Indicators and the richest lichen floras were in the Devon sites, which have not suffered from air pollution in the past. Beetle Indicators of Ecological Continuity and rich saproxylic faunas were found in sites with large trees and trees with relatively high amounts of veteran tree features, such as hollows and split bark. The two richest sites for the beetle indicators, Broadway Farm Orchards and Park Farm Orchard, had histories of extensive orchards in the surrounding landscape. Apple trees hosted the richest epiphytic bryophyte floras but richness was not related to tree age (as indicated by girth size) for this fruit tree type, although very young trees were observed to have little bryophyte cover. Waxcap grassland fungi were diverse in Colston Farm Orchards, where the orchard floor vegetation was species-rich and grazed short by sheep.

Recommendations for additional work to increase knowledge about orchard biodiversity and how it can be conserved include: further targeted surveys to explore the potential of orchard habitats for groups not covered in detail by the current project; investigation of the ecological impact of scrub growth around orchard trees; increase in knowledge of the demography of orchard fruit trees; research to investigate the landscape level role of orchards in conserving biodiversity; studies of the conservation biology of little known, yet apparently rich, orchard invertebrate communities; research into the factors influencing the species composition and abundance of epiphytic lichens and bryophytes; research into the interaction of factors which affect orchard biodiversity to develop predictive knowledge of which groups are likely to be particularly rich in certain orchards so that appropriate conservation action can be taken.

Consideration of the factors affecting the biodiversity of the orchard sites provides clues as to possible attributes that could be developed for use in condition assessment of orchards. Standard condition assessment methods have already been developed for two habitats of particular relevance to orchards, lowland grasslands and hedgerows. Both habitats are usually part of an orchard habitat mosaic. Orchard grasslands may not always conform to the grassland types covered by the grassland method, as in some cases they are less species-rich. This situation may not be due to input of agri-chemicals but be the result of shading, or leaf and fruit fall from orchard trees, or to heavy grazing. There may be particular species, such as waxcap fungi, that occur in such grasslands that still require particular grassland attributes, such as sward height, to be in a certain state. The fruit tree component of orchard habitat mosaics could provide several suitable attributes for condition assessment. Attributes with potential for development are age structure of the fruit trees, veteran tree features of living trees and fallen or standing dead wood, scrub and woodland cover and openness of canopy of fruit trees.

Key conclusions from the results of the orchard surveys are:

a) Orchards are hotspots for biodiversity in the countryside, capable of supporting a wide range of wildlife, including BAP priority habitats and species as well as an array of nationally rare and scarce species. The wildlife of orchard sites depends on the mosaic of habitats they encompass, including fruit trees, scrub, hedgerows, hedgerow trees, non-fruit trees within the

orchard, the orchard floor habitats, fallen dead wood and associated features such as ponds and streams.

b) Different orchards have particular biodiversity value for different groups, for example waxcap grassland may be a feature in one orchard, epiphytic lichens in another and saproxylic invertebrates in a third site. Therefore conservation of orchards as series of sites is required to conserve the full range of biodiversity they support.

c) Orchards, like wood pastures, are dynamic habitats and the habitat they provide for groups such as saproxylic invertebrates will change with the demography of orchard trees in a particular site. Continuity of habitat for long-term conservation requires trees at all stages of growth, either within one orchard or a series of orchards in a landscape.

d) Orchards appear to be a significant part of a spatial series or network of habitats at a landscape scale, which are able sustain scarce lichens and beetles, and perhaps other organisms, that require continuity of habitat through time. This habitat network is made up of orchards, hedgerow trees, wood pasture and ancient woodland.

e) The factors affecting the biodiversity of orchards operate at a range of scales, from the national scale, for example atmospheric dry deposition, through the landscape scale, for instance the location of an orchard within the matrix of surrounding habitats, to the site scale, such as the grazing management regime in the orchard. Some of these factors also appear to interact and as a result have particular biodiversity outcomes. Atmospheric pollution, continuity of orchards and woodland through time and availability of veteran fruit trees seem to interact to influence the occurrence of lichen and beetle Indicators of Ecological Continuity.

f) Existing condition assessment attributes for hedgerows and grasslands are relevant to orchard habitat mosaics. Several attributes of the fruit tree component such as age structure and scrub cover are also likely to be useful and should be further developed.

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1.1 Traditional orchards and their associated habitats, such as grasslands, walls, ponds and hedges, support a wide variety of wildlife. However, there have been relatively few systematic studies of the biodiversity value of traditional orchards. To help to fill this gap, English Nature (now Natural England) set up a project in 2004 to review the extent, distribution, biodiversity and management of traditional orchards in England. The objectives of the study were:

- To review existing information on the extent, distribution, biodiversity and management of traditional orchards in England, including their biodiversity value as related to individual orchards and to their role at the landscape scale.
- To review the current conservation status of orchards and the available mechanisms that could achieve their conservation, including an examination of the relationship between conservation of orchard biodiversity and other potential public benefits such as genetic conservation, resource protection and landscape character.
- To sample a number of representative orchards to assess their biodiversity interest, with particular reference to invertebrates, lower plants and fungi.
- From the information gained in the study produce recommendations for criteria that can be used to assess orchard quality and condition in relation to biodiversity and recommendations for management to conserve and enhance biodiversity, with, where appropriate, especial reference to modifications of current practices.

1.2 This Natural England Research Report describes the detailed results of field surveys carried out in 2004, plus some earlier survey records, which contribute to meeting these objectives, especially the third and fourth objectives. The review results were used to prepare the case in 2005-2006 for adding traditional orchards to the national list of priority habitats in the UK Biodiversity Action Plan. For an updated description of the overall case see Robertson and Wedge (2008). The proposal received widespread support and was accepted by Government in August 2007.

1.3 The primary aim of the site surveys was to illustrate the kind of wildlife that orchards which are managed in a low intensity way can support, with particular reference to lichens, fungi, bryophytes (mosses and liverworts) and invertebrates. Habitat survey and collection of management information supplied the context for the detailed survey of the chosen taxa. The surveys also provide practical examples of orchard evaluation and a discussion of factors which may affect orchard quality and condition.

1.4 Resource constraints meant that only a small number of sites (6) could be surveyed. Thus the results should be seen as indicative case studies rather than exhaustive comparisons of different types of orchards or rigorous analysis of variation in response to geographical position, which would both require more study sites to be surveyed.

1.5 For the purposes of the project, the definition of traditional orchards was taken broadly to be orchards that are currently managed at a low level of intensity, and orchards with a history of low-intensity management that are currently unmanaged. These orchards contrast with intensive orchards (also sometimes referred to as conventional orchards) which are orchards managed intensively for fruit production by the input of chemicals such as pesticides and inorganic fertilisers, frequent mowing of the orchard floor rather than grazing or cutting for hay, and planting of short-lived, high-density, dwarf or bush fruit trees.

1.6 The report is in two parts. The first part explains the selection of the survey sites and the survey methods. Also included is a description of the evaluation criteria employed to assess the species and habitat information, the summary of the results and their analysis. Recommendations for

further work and key conclusions follow this analysis. The second part of the report comprises the detailed results for each of the orchards that was surveyed.

2 Survey methods

Study site selection

2.1 In consultation with the project Steering Group, the case study sites were selected with several aims in mind. These were to:

- Illustrate the variety of orchard wildlife, in particular to gain an indication of the potential of orchard habitats for bryophytes, lichens, fungi and invertebrates.
- Obtain examples from areas of England which have the main concentrations of orchards in the country.
- Cover as wide a geographic spread across England as possible.

2.2 The names of the sites selected, their size, orchard tree types and Ordnance Survey grid references are shown in Table 1 and their location in England shown in Fig 1. The final choice was felt to satisfy the aims of selection as well as could be expected given resource constraints. The chosen sites were all managed in a low intensity way and thus had potential for biodiversity interest. They included orchards at different stages of maturity of the trees. Two sites had some existing biodiversity information available (Broadway Farm Orchards and Rummers Lane Orchards). Originally it was hoped that a site in Somerset could be included as this county has a significant concentration of orchards. However, it was not possible to obtain access to a suitable site by the time field work needed to begin, so a second Devon location, for which access had been obtained, was included instead.

2.3 A good east-west distribution of sites was achieved but an example of a northern orchard was not included. There are no equivalent large concentrations of orchards in northern England, and this fact, together with limited knowledge among the project steering group about northern orchards on which to base site selection, led to the omission of a northern representative site. Overall, it would be fair to say that the site surveys represent a reasonable first attempt at investigating the range in biodiversity of English orchards but that other areas of the country, such as the north and central parts of England, would need to be studied to gain a more complete picture.

2.4 Broadway Farm Orchards were treated in a slightly different way to the other sites. A survey of invertebrates had been carried out here by Paul Whitehead (J. & P. Whitehead Landscape Consultants) during 2001 (Whitehead & Whitehead 2001) and in 2002, as part of the People's Trust for Endangered Species / English Nature noble chafer studies. Dr Keith Alexander surveyed orchard trees and carried out further invertebrate survey with English Nature funding in 2003. These 2001-2003 survey findings have been incorporated into the current report and these elements of the 2004 survey method were not repeated at Broadway Farm Orchards in 2004.

2.5 One of the Devon locations, near Buckfastleigh, is made up of two orchard areas which lie close to each other. However, for reporting convenience, this Devon location has been split into two sites (Colston Farm Orchards and Luscombe Farm Orchards).

Table 1 Orchard sites selected for survey

Site name	Grid reference	County	Site size (ha)	Main orchard trees
Slew Orchard	SX409741	Devon	1.3	Cherry
Luscombe Farm Orchards	SX748637	Devon	1.6	Apple
Colston Farm Orchards	SX750648	Devon	1.9	Apple
Rummers Lane Orchards	TF415075	Cambridgeshire	8.3	Apple and plum
Park Farm Orchard	TQ944604	Kent	2.5	Cherry
Broadway Farm Orchards	SO755148	Gloucestershire	21	Apple, plum, pear

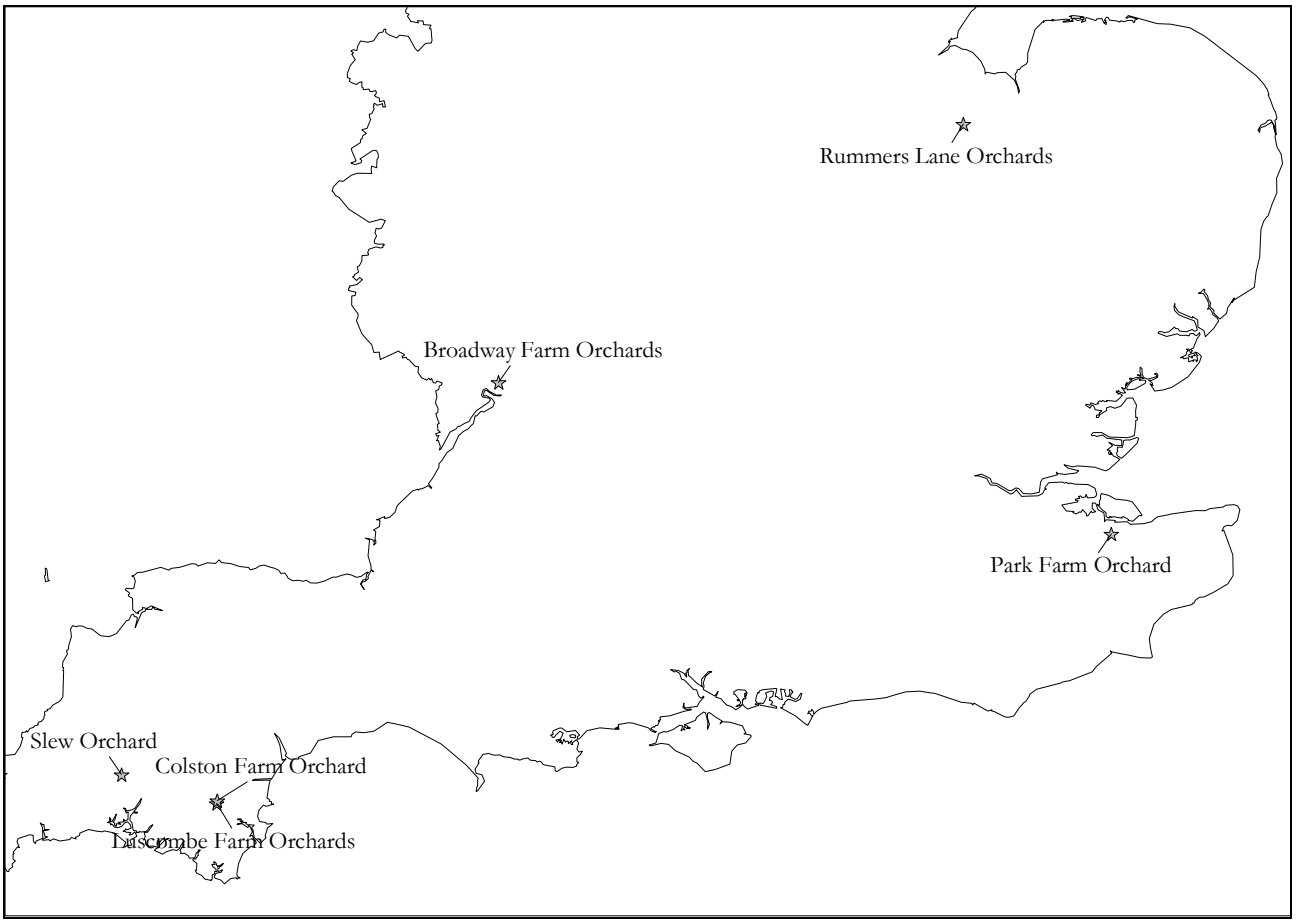

Figure 1 Outline map of southern England showing study site locations

Surveyors and survey dates

2.6 In 2004, habitat surveys were carried out by Dr Eleanor Hewins (EH) and Mike Lush (ML), with assistance from Dr Heather Robertson (HR) at Rummers Lane Orchards. As part of a team organised by Just Ecology, Robin Stevenson undertook the bryophyte surveys, Vince Giavarini surveyed the lichens, Dr Keith Alexander (KA) led the invertebrate work, assisted by Jon Mellings (JM) and Dr Malcolm Storey surveyed the fungi. Mike Lush and Dr Malcolm Storey also contributed invertebrate records made during the habitat and fungal surveys. Dr Oliver Gilbert joined Vince Giavarini for the lichen survey of Rummers Lane Orchards. The dates of the different surveys at each site, including earlier surveys of Broadway Farm Orchards by Paul Whitehead (PFW) and Dr Keith Alexander, are shown in Table 2.

Table 2 Site survey dates

Survey /Site	Slew	Luscombe	Colston	Rummers Lane	Park Farm	Broadway
Habitats	26/4/04: ML & EH	27/4/04: ML & EH	27/4/04: ML & EH	20/4/04 : ML, EH & HR 1/7/04: EH	21/4/04: ML & EH	22/4/04: ML & EH
Bryophytes	6/5/04	7/5/04	7/5/04	12/5/04, 19/5/04	17/5/04	3/5/04, 4/5/04
Lichens	2/8/04	1/8/04	1/8/04	13/8/04	24/8/04	3/8/04
Fungi	19/5/04, 30/9/04	20/5/04, 28/9/04	20/5/04, 28/9/04, 29/9/04	8/5/04, 24/8/04, 17/10/04	2/5/04, 10/10/04	12/5/04, 29/5/04, 22/9/04, 21/10/04
Invertebrates	26/4/04: JM 24/5/04: KA & JM 16/6/04, 17/6/04: KA 23/8/04: JM	27/4/04: JM 24/5/04, 25/5/04: KA & JM 16/6/04: KA 24/8/04: KA	27/4/04: JM 25/5/04, 27/5/04 KA & JM 16/6/04: KA 24/8/04: KA	20/4/04: JM 24/5/04, 27/5/04: KA & JM 15/6/04: KA 24/8/04: JM	21/4/04: JM 26/5/04, 1/6/04: KA & JM 14/6/04, 17/6/04: KA 23/8/04: JM	20/9/2001, 21/9/2001, 11/2/2002, 26/8/2002: PFW 24/5/03, 25/5/03, 26/6/03, 15/7/03: KA

Contextual information for sites, analyses and interpretation

2.7 Contextual information was provided by Dr Heather Robertson, who also undertook analyses and interpretation of the survey results. Available information on the landscape context of the sites, past and present, was obtained from various national data sets, including soil types, climatic and atmospheric deposition variables and topographic data. Slope angles were calculated from contours and distances across slopes. The landscape setting of the sites was assessed with the aid of recent UK Perspectives aerial photographs and digital Ordnance Survey Master Map information. Information from the habitat surveys was also incorporated into these descriptions. Historical information was derived from First Edition Ordnance Survey maps and ancient woodland inventories. Ancient woodlands are areas of woodland that, from evidence of old maps, have been known to be in existence since AD1600 (Marren 1992). Measures of distances between woodlands and orchards surrounding the study sites were made using MapInfo. Current areas of surrounding orchards which intersected with a 1 km-wide buffer around the edge of each study site were calculated by summing orchard polygons from Master Map, up-dated by examination of the aerial photographs. The distinction between traditional orchards and modern intensive orchards was made by interpretation of the aerial photographs. Illustrations of the differences between traditional and intensive orchards that are visible on aerial photographs can be found in Burrough and Robertson (2008).

Orchard management

2.8 The orchard owners or managers of the study sites were asked about the history of their orchards, if known, and about the management in place on the sites, including whether management was subject to agreements under agri-environment schemes such as the Countryside Stewardship Scheme. Owners and managers were also asked about any particular problems they had encountered in managing their orchards or opportunities they had provided, such as community access.

Habitat survey methods

Summary of coverage

2.9 The habitat survey was focussed on gaining a picture of the character of the fruit tree habitat, through sampling and recording details about individual trees, identifying the type of orchard floor habitat and recording the composition of site boundaries.

Fruit tree survey

2.10 In 2004, sample trees were selected by carrying out an approximate W-shaped walk through each orchard compartment and at regular intervals stopping and recording the closest tree. Numbers of stops and distances between stops were adapted to the size of each orchard compartment. The maximum number of trees recorded per compartment was 20. Features recorded are shown in Table 3.

2.11 General notes were made on the presence of vascular plant epiphytes on the trees, obvious woodpecker holes in the trunk or branches and suckers growing from the base of the tree. In practice, the % canopy alive feature was not easy to apply and was omitted in some cases, and these data have not been used in the analysis of results. The fruit tree survey at Broadway Farm Orchards in 2003 was carried out in a different way. The survey took the form of an almost complete census of all trees, but veteran tree feature recording was restricted to searching for evidence of heartwood decay, indicated by the presence of hollows in trunks and branches.

2.12 The general term of fruit tree ‘type’ was used to distinguish between apple, cherry, pear and plum. A fruit tree is often a combination of two genetic individual individuals, one a rootstock and the other a scion grafted on to the rootstock. Usually the taxonomic genus of the rootstock and scion is the same, but not always, for instance pear (*Pyrus*) is sometimes grafted onto a quince rootstock (*Cydonia*) (Webster & Wertheim 2003). No attempt was made to identify the varieties of each fruit type present (for example Bramley’s Seedling apple variety) in the orchard site survey.

2.13 Fruit tree form was noted in the general description of the fruit trees present in each orchard. The description of fruit tree form is not an exact science, different authors defining various forms such as ‘standard’ and ‘bush’ in different ways (Bunyard 1890, Sanders 1919, MAFF 1972, Morgan & Richards 1993). For the purposes of this report, a ‘standard’ tree has a trunk of about 2 metres or 6 feet between the ground and the first branches. A ‘half-standard’ tree has a trunk of around 1 metre or 4 feet, while ‘quarter-standards’ have shorter trunks and ‘coppice’ has no trunk at all.

Table 3 Features recorded in the fruit tree survey

Feature	Measurement unit / method	Comment
Fruit tree type	Presence	Identified as apple, cherry, pear or plum
Girth of trunk	cm / tape	Straight trunks, measured at 1.3 m from the ground. If forks or swellings present in the zone up to 1.3m, measurement made below fork or swelling
Tree height	m / estimate	
Distance to nearest neighbour	m / tape	Within and between row pattern sometimes not obvious, so nearest neighbour measure adopted
Veteran tree characters*		
Proportion of canopy alive	% / estimate	
Hollow trunk or large branches	Presence	
Cracks or splits in trunk or large branches	Presence	
Rot holes and sites	Presence	
Split or missing bark	Presence	
Sap runs	Presence	

Notes: *Veteran tree characters were adapted from the Veteran Tree Survey Method (Fay & de Berker 2003). m = metres, cm = centimetres.

Orchard floor habitat survey

2.14 The orchard floor vegetation was surveyed by walking over the site and recording plant species composition and sward structure. Abundances of plant species were recorded using the DAFOR scale (Dominant, Abundant, Frequent, Occasional, Rare). The affinity of the vegetation to National Vegetation Classification types (Rodwell, 1991, 1992, 2000) was identified as far as possible, in particular to ascertain whether priority Biodiversity Action Plan habitats were present (UK Steering Group 1995). Presence of associated habitats such as ponds was also noted. Nomenclature of vascular plants follows Stace (1997).

Orchard boundaries

2.15 The site surveys were carried out before the change in the definition of the priority Hedgerow habitat in the UK's Biodiversity Action Plan in 2007. The new definition is described at URL: **www.hedgelink.org.uk/index.php?id=29**. Criteria for defining the pre-2007 priority habitat, known as 'Ancient and / or Species-rich Hedgerows', included the presence of 5 or more native woody species in a 30 m length of hedgerow or a rich basal flora (UK Steering Group 1995). In the orchards site surveys, the types of boundaries were recorded and, where hedgerows occurred, sample 30 metre lengths were identified and the number of native woody species recorded. Ground flora at the base of the hedgerow was examined and, in particular, records made of the presence of any woodland herbs listed in the Hedgerow Regulations 1997 as species contributing to value of hedgerows. No formal criteria existed for defining a rich basal flora in the pre-2007 priority BAP hedgerow habitat action plan, so a somewhat arbitrary definition of presence of 7 or more woodland herbs in a 30 m section was employed for the site surveys.

Some additional plant species were recorded outside of the thirty-metre sections and in some cases a general list, rather than a 30 m section list was made. The condition of the hedgerow in terms of recent management was noted.

Lichen survey method

Sampling approach

2.16 About 5 to 7 hours were spent in each site with the exception of Colston Farm Orchards and Luscombe Farm Orchards which received visits of 3 to 4 hours apiece. A walkover survey was done first to familiarise the surveyor with the site. This was then followed by a more systematic survey of areas targeted during the walkover. Only epiphytic lichens of fruit trees were surveyed in the time available as they were regarded as the priority for survey and had been little-studied in the past. Notes were made on the position and abundance of individual lichen species on the trees, and the fruit tree types on which the lichen was growing. The presence of lichen community types (James and others 1977) was also recorded where possible and notes made about relation to fruit tree species where patterns seemed clear.

2.17 Over 95% of lichen taxa were identified in the field using a hand lens. Chemical spot tests were used for diagnostic purposes where necessary. Material requiring additional critical examination was collected for later determination using a microscope. Nomenclature follows Coppins (2002) and the British Lichen Society number is given for each species in the tables of results. This number is a unique species code number for use in the British Lichen Society Mapping or BioBase Recording Scheme. Future additions and changes to the species and names among the lichen flora of Britain can be followed by visiting the web site of the British Lichen Society URL: **www.thebls.org.uk**.

Assessment of lichen method in practice

2.18 The lichen survey methodology employed worked well and gave good results, although, faced with tall trees, sampling of the upper branches proved impossible. Given the range in site size, numbers of trees, their accessibility and judgements about worth for surveying, the degree to which the total lichen flora was examined varied somewhat between sites. In any future survey of sites involving tall trees, consideration would need to be given to attempting to sample the upper branch epifloras. This would have implications for both time (moving ladders about), and health and safety.

Bryophyte survey method

Sampling approach

2.19 Each site received about a day of survey effort, apart from Rummers Lane Orchards which were surveyed over two days. Attention was focussed on the epiphytic flora of the fruit trees, which represented the least-known habitat bryologically. Occasional records were made of species seen in passing in the orchard floor grasslands and it was noted that they seemed as species-poor as other neutral grasslands. Species lists were drawn up for each type of cultivated fruit tree (apple, plum, pear, cherry) growing in the orchard where more than a few individuals were present. Species lists were also made for the orchard as a whole and estimates of abundance for fruit tree type and for the orchard made, using the DAFOR scale.

2.20 A sample of individual trees in each orchard was examined in detail and the fruit tree type, the positions that bryophytes were found on the tree (lower trunk, upper trunk, branches and twigs), and their abundance (DAFOR) at each position were recorded. Trees were chosen more-or-less randomly, so as to give an idea of what an average tree was like. However, recordings were also made from some trees judged to be especially good. Girth of trees sampled was measured at 30 cm from the ground. The bryophyte species records from the individual sample trees are not

given in the report for reasons of space but can be made available to researchers. Tree girth sizes and numbers of bryophyte species are given in the relevant sections covering the survey sites.

2.21 Most of the species were identified in the field using a hand lens. Where necessary, material was collected for later identification and to serve as voucher specimens. Nomenclature follows Blockeel and Long (1998).

2.22 An attempt was made to measure the bark pH of the different fruit tree types as it was felt that it could be an important factor influencing bryophyte floras. An inexpensive, simple way of testing pH is by using test strips. This method was tried out using test strips manufactured by Machery-Nagel. These strips enable readings to be made between pH 4.5 and pH 10, at 0.5 intervals. Surfaces to be tested, which were either trunk or branch surfaces judged to be more-or-less lichen free, were sprayed with de-ionised water and the test strip was then applied. The back of the strip was gently rubbed to ensure a good contact, before the reading was taken.

Assessment of bryophyte method in practice

2.23 Where tall trees (branching at 2m or above) were involved then species determinations could only be made accurately from occasional fallen or drooping branches. Records from such trees are therefore only partial. Recording the position of growth was also affected by local management practices: in the western orchards the trees were generally taller, making a differentiation between lower and upper trunk species meaningful. In the Rummers Lane Orchards, many apple trees had unforked trunks of about a metre high (that is, half-standards as defined in this report). Some trees had the form of large ‘coppice’ individuals, where branches arise from the base of the tree, making such a differentiation into lower and upper trunk meaningless. Species growing on twigs appeared to be absent in the eastern orchards, but the category was present in the west; however, very few species occurred in this position, and they all occurred elsewhere on the tree, so it is probably a category of growth position not worth retaining.

2.24 The pH tests gave readings that ranged between 4.5 and 5.5. These readings were found among the same fruit tree types in an orchard and between fruit tree types and sites. No clear patterns emerged and the results are not given in the report. The effect of bark pH remains unclear and deserves further study.

Fungal survey method

Sampling approach

2.25 At least two full-day visits were made to each site, in May and October, as far as possible timed to correspond with the best weather conditions for fungal recording. The highest numbers of visits were made to the larger sites, Rummers Lane and Broadway Farm Orchards. Despite a very wet autumn, surveying in rain was largely avoided, as diagnostic smells are lost and wet specimens do not survive well; also it is not then possible to make sufficiently detailed notes to enable later identification. The survey was restricted to searching for fruiting bodies of macrofungi.

2.26 The sites were covered systematically at a slow walk, both the orchard floor and the trees being searched. At the larger sites, priority was given to the parts of the orchard floor likely to be more productive for fungi, that is, those without a tall and dense grass sward. For a few fruit trees of each type, and for some trees not cultivated for fruit, the accessible parts of the trunk were examined and, in the rare cases where sward was not thick, the ground under the canopy closely searched. Particular attention was given to trees in the family Rosaceae during the spring visits. Boundaries, unless inaccessible, were also walked. Other macrofungal microhabitats, such as wood piles, were sampled as found.

2.27 Where possible, fungi were identified in the field, but specimens that were hard to identify were taken for off-site examination, following the British Mycological Society's guidance for scientific collection. For specimens that could not be identified in the field, a short description and/or digital photography preserved information that would not be ascertainable later. Smell is often lost soon after collection, so this and taste (if appropriate) were recorded in the description. Digital photography was used to record colour and its location, which in some groups is rapidly lost as the fungus dries. The presence and distribution of loose scales, or a ring or other features that may be lost before examination were also recorded by notes or photography. Each collection was given a short voucher code (for example, letter of alphabet) to associate the line entry, specimen, description and photographs.

2.28 Care was taken to avoid fragile toadstools being shaken, crushed or damaged. In warm weather a chill box was used. Overnight stays were minimised because fresh material is easier to work with. When staying overnight, specimens were put out for spore prints on microscope slides while still fresh, and then the spore prints dried for a few minutes, labelled and wrapped in aluminium foil for the journey home. The specimens were dried overnight in a mushroom drier.

2.29 Off-site identification involved the use of keys, monographs and field guides, along with microscopy and chemical tests. Basidiomycete nomenclature follows Legon and Henrici (2005). For other taxa, nomenclature follows a variety of reference sources (see References and bibliography, Section 10) as standard checklists for these groups are not yet available. Some more critical species, where taxonomy is complex and uncertain, could not be identified in the time available.

Assessment of fungal survey method in practice

2.30 The findings of this survey report relate only to fungi that were seen to have fruiting bodies as it was not possible to resort to expensive DNA or serological identification techniques. Different fungus species vary in their requirements for fruiting, so surveying the same site in different years, or even a few weeks apart in the same year, will produce different lists of species. Surveying sites over several years, rather than just one year, is preferred to obtain a fuller picture of the fungi inhabiting a site. Although common species often have long fruiting seasons and come up reliably every season, the rarer the fungus, the more variable its appearance seems to be. In extreme cases a fungus may not be seen on a site for many years, until one year when it fruits abundantly all over the site, and other sites in the area too; in this case it is hard to know whether it is a long-term cryptic resident or occasional colonist.

Invertebrate survey method

Target groups, species and sub-habitats

2.31 Given the resource constraints of the project, and the size of the potential invertebrate fauna, survey effort needed to be prioritised. In addition, the expertise of the surveyors in particular invertebrate groups was a factor. The main insect orders identified in 2004 included: Coleoptera (beetles), Heteroptera (bugs), Aculeate Hymenoptera (bees, wasps and ants), Diptera (flies), Psocoptera (barkflies), Orthoptera (grasshoppers and crickets) and Odonata (dragonflies and damselflies) The main non-insect groups covered were Oniscoidea (woodlice), Diplopoda (millipedes) and Mollusca (slugs and snails). The report uses the term English name 'barkflies' for Psocoptera as it is the one used by the National Recording Scheme for Psocoptera (see URL: **www.brc.ac.uk/schemes/barkfly/homepage.htm**).

2.32 The survey in 2004 concentrated primarily on the following sub-habitats: tree canopy, including foliage and blossom (gall-producing species such as gall wasps and sawflies, plus leaf-mining species such as certain micromoths and Diptera, were recorded only incidentally); epiphytic cover of lichens and bryophytes on trees (supporting a specialist invertebrate fauna, especially Psocoptera, Lepidoptera and predatory Hemiptera); wood-decay (saproxylic) habitats of live and dead trees, fallen logs and fungi growing on decaying wood; orchard floor vegetation, bare

ground and mammal dung; orchard boundary habitats, in particular hedgerows. Some generalist species were recorded also, and the occasional record made from associated habitats such as freshwater.

2.33 The 2003 survey at Broadway Farm Orchards did not cover the orchard floor and tree canopy in detail but concentrated on the fauna of saproxylic and epiphytic habitats, especially Coleoptera and Pscoptera. However, the studies of Paul Whitehead in 2001 (Whitehead and Whitehead, 2001) and in 2002 at Broadway Farm Orchards provided further data on the terrestrial invertebrate fauna, and the species found are included in the results for this site (see Table 70).

Sampling approach

2.34 In 2004, each site was visited four times during the course of the summer (Table 2). To facilitate the recording of the chosen invertebrate groups, surveys were scheduled to correspond, where possible, with the flight periods of component species. Visits in April and May were timed to pick up fruit tree blossom-feeding and bud-feeding species and saproxylics. Visits in June were aimed at leaf-feeding species, saproxylic and other species utilising flowering umbellifers and other flowering hedgerow and grassland plants. The August visits were targeted at species associated with fruit, leaf-feeding species, species associated with fungi and late-maturing species, for example, Heteroptera.

2.35 Sampling was undertaken, wherever practical, in warm and sunny weather conditions and, for each discrete surveying period, in almost all cases the different site surveys were conducted within the space of a week. The surveyors walked the orchard sites in their entirety on the first day of the survey, during which important target areas for collections were identified.

2.36 The 2003 survey at Broadway Farm Orchards was carried out by visiting at 3 time periods during the year (Table 2). No equivalent April visit was made, compared to 2004, and the last visit was made in July rather than August. The May visit was somewhat hampered by poor weather. The dates of Paul Whitehead's visits to this site are given in Table 2. Three out of the four visits he made were outside the site survey periods for sites surveyed in 2003 or 2004.

Collection techniques

Direct capture techniques

2.37 In 2004, methods included the following:

- Sweeping: a sweep-net was primarily used for collecting grassland species, and for flying insects such as Hymenoptera and Diptera.
- Beating: beating-trays were used to collect invertebrates living on the trees themselves: Lepidopteran larvae, Coleoptera, Hemiptera, etc.
- Suction sampling: a standard domestic two-stroke leaf blower/suction machine, modified by introduction of a fixed net within the suction tube, was used to sample invertebrates of the ground layer (open grassland as well as at the tree bases) and, to a lesser extent, saproxylic and epiphyte habitats.
- Manual searching: Searching under bark, in fallen decaying wood, fungus fruiting bodies, fruit of orchard trees, and also dung where the site is grazed.

2.38 In the 2001, 2002 and 2003 surveys of Broadway Farm Orchards, sweeping, beating and manual searching were employed. The latter method included inspection of cut grass and hay and flood litter in 2001/2002, in addition to examination of the habitats listed above. No traps were set in 2001, 2002, and 2003, in contrast to sites surveyed in 2004 (see below).

Window flight interception traps

2.39 These traps capture flying insects by obstructing their flight paths. In 2004, traps were installed in all sites except Broadway Farm Orchards. The traps were suspended from the lateral branches of

fruit trees. Traps were constructed from four transparent, two litre plastic drinks bottles, placed upside down and with windows cut into them giving a capture potential of almost 360 degrees (so there was a reasonable chance of capturing insects travelling from almost any direction, on the horizontal plane). Insects flying into the clear plastic inside face of the traps were funnelled into the neck of the bottles where they were trapped in a 50/50 solution of water and ethylene glycol (antifreeze), with several drops of detergent (washing up liquid) to break the surface tension. Traps were secured by string from above and stabilized by guy ropes to prevent lateral movement. These were typically attached to other convenient branches or the trunk. The traps were also roofed to prevent desiccation and to stop them being overfilled by rainwater.

2.40 Before traps were installed, landowners and managers were approached for permission and consulted about any issues of health and safety concerning grazing livestock that could potentially have occurred. All landowners and managers agreed with the installation of flight interception traps, providing they were located at a reasonable height, out of reach of sheep.

2.41 Flight interception traps were initially set during the first batch of entomological site visits in late April 2004. The surveyors subsequently emptied these and reset them on the following visits. For the most part this meant that traps were left unattended for approximately one month between each sampling event, the exception being the two-month gap between the penultimate visit, in late June and final visit at the end of August. It is worth noting that David Green (pers comm) has achieved satisfactory results when traps of a similar design, containing comparable preservative, were left for up to three months without attention.

2.42 The number and distribution of flight interception traps at each site varied. Four traps were located in the Rummers Lane Orchards and Park Farm Orchard, two each at Luscombe and Slew orchards, and one at Colston Farm Orchards. The traps were located, wherever possible, in sunny yet sheltered situations and in such a way as to represent the habitat variation of each site as comprehensively as possible. In mixed orchards, for example, traps were located on as many of the different fruit tree types as possible. In some situations, trees appearing to be particularly favoured by invertebrates at the time of the initial survey were selected as trap locations.

Water traps

2.43 These traps are useful for collecting nectar-feeding species that typically fly low over the sward. Shallow, 9-inch diameter flowerpot bases were used; these were painted different colours in an attempt to mimic the colours of different plant species favoured by different species. The colours used included yellow, blue, pink/purple and white. No analysis of species according to colour choice was intended, the purpose being purely to provide a diversity of choice in an attempt to attract a diversity of insects. Each trap was filled with a premixed solution of ethanol (50%), water (50%) and a few drops of detergent (washing up liquid). Traps were filled to a depth of about 2cm and located in various sunny, yet sheltered positions, typically in open areas close to the boundaries of blocks of fruit trees, or in the more open strips within blocks of trees.

2.44 Unlike flight interception traps, water traps cannot reasonably be left for indefinite periods unattended as the liquid in the traps dries out. After permission from landowners and managers to set the traps was obtained, the surveyors were fortunate to gain the help of local volunteers, including landowners and managers to collect trapped specimens. Traps were set on the day of survey and volunteers, were asked to empty water traps into tubes after a two to three day period and keep the tubes for later collection.

Collection and storage of specimens

2.45 Specimens trapped using both water and flight interception traps were collected in specimen tubes and labelled with details of site, trap number, and set and empty dates. Initially specimens were stored dry. Excess liquid was strained from the specimens that were then transferred to tubes containing a wad of tissue paper or kitchen roll. Later, specimens were kept in solution, the solution being topped up with alcohol wherever appropriate to prevent undue putrification. Specimens collected by sweeping, beating and manual searching that required off-site

identification were mostly killed using a killing jar or by placing specimens directly into 70% alcohol, whichever was most appropriate for the taxa. These specimens were stored in specimen tubes labelled with details of date, site, habitat and grid reference.

Species identification and recording

2.46 Wherever possible, species were identified and recorded in the field, the details of sub-habitat being noted where appropriate. Trapped specimens and difficult taxa were collected for ex-situ laboratory identification. Vouchers were retained for all collected specimens where definite field identification could not be made. Specimens were identified to species level using appropriate specialist keys, for example the Royal Entomological Society's Handbooks for the Identification of British Insects and comparable works. Nomenclature followed recent updates as far as possible and the main works used are listed in the references and bibliography section. Critical species, where taxonomy is complex, were subject to verification by other experts where necessary. The tables of results generally give the family and order as well as species name for each species but occasionally higher level groups, such as class, are given instead of family and order.

Assessment of invertebrate survey method in practice

2.47 Water traps were set during the first part of the 2004 survey only (April and May). Since most of the orchards were being grazed with sheep, concerns emerged regarding the possibility of livestock drinking the solution in water traps. In addition, at some sites the traps captured large numbers of domestic honeybees (*Apis mellifera*) besides the targeted species of solitary Hymenoptera and Coleoptera. In view of these concerns, it was decided that the use of water traps should not be continued.

2.48 Certain taxa received more attention than others, due to resource limitations and expertise of the surveyors. More intensive and complete survey, for example, including use of Malaise traps would have yielded a wider range of fauna.

3 Summary of results, evaluation and conclusions

Introduction

3.1 This section provides a summary of the results of the site surveys, collated so that comparisons can be made across sites (Table 5 - 18, located at the end of the section). The findings are evaluated in terms of the biodiversity found in the sites and then analysed in relation to factors which may influence the variability encountered, including the effects of orchard management. Conclusions from the evaluation and analyses and recommendations for further work form the last part of Section 3. The details contributing to all these aspects of the case studies are available for study in the individual site accounts (Sections 4 to 9).

Evaluation and analysis methods

Site context, management and habitat features

3.2 The summary of the contextual information is presented in Table 5, including the calculations of orchard area in the landscape as described in paragraph 2.7. The summary of management was based on information provided by owners and managers and the observations of surveyors. It should be noted that the information on soil units, rainfall and atmospheric deposition comes from national data sets which show geographically extensive zones for these factors. There may well be local variation in say, soil type, which could affect case study sites. The zones can only give a broad indication of the conditions prevailing at particular locations.

Species assemblages, communities and associations

Rationale

3.3 The species composition data recorded for vascular plants, lichens, bryophytes, fungi and invertebrates in the study sites were analysed in terms of communities, assemblages and associations. These groupings provide a structure for assessing biodiversity value, for example in relation to priority BAP habitats. In addition, the search for pattern in the occurrence of species is critical if an understanding of how orchard habitats function is to be achieved, and the identification of important factors that influence species diversity and rarity is to be attempted. Given the limited number of study sites, inferences can only be tentative at this stage and require further study to confirm them.

Vascular plants

3.4 Species assemblages for vascular plants were, where possible, related to the National Vegetation Classification. This Classification is the standard way of assessing vegetation types in the UK and the ecology of the assemblages is discussed in detail in Rodwell (1991, 1992, 2000).

Epiphytic lichens

3.5 Epiphytic lichen communities were described largely using the preliminary conspectus of James and others (1977), with additional material from Wolsey and James (2004). The characteristics of the communities found in the study sites are summarised in Table 9, and typical species of these communities listed in Table 10. The summary in Table 9 attempts to highlight particularly important factors thought to influence the occurrence of particular communities.

Epiphytic bryophytes

3.6 Epiphytic bryophyte assemblages in the UK do not appear to have been studied in the same phytosociological way as vascular plants and lichens. In the current study, analysis of variation is attempted by examining species richness and the presence of obligate species, in particular in relation to fruit tree type (Table 11 - 13). Obligate bryophyte species are those that appear to require trees or shrubs as substrates across most of their range in the UK (Ron Porley, Natural England bryologist, pers comm), in contrast with facultative species that can grow on a wide range of substrates, including trees, shrubs, soil and rock. The bryophytes categorised as obligates are the same as those listed by Bates and others (1997), with the addition of *Pylaisia polyantha*, which was not classified by Bates and others. Comparisons are also made between the orchard bryophyte data and the findings of Bates and others (2004) from their extensive study of the distribution and environmental factors affecting epiphytic bryophytes across southern England.

Fungi

3.7 Fungi have not yet been formally assessed by means of species assemblages in the same way as vascular plants and lichens. One simple way of examining pattern, adopted in this report, is to record the habitat type where a particular fungus was found (Table 14). This is a somewhat looser categorisation than that for lichen communities and invertebrates. 'Grassland' fungi includes those found on dead grasses. 'Wood' refers to live and / or dead wood, and includes the very occasional records of fungi on orchard fruit. 'Grassland with trees / scrub' refers to species found on the orchard floor grassland but which seem to be associated with the presence of trees or scrub. It should be emphasized that the habitat category to which a species is assigned purely means where the fungus was found during the surveys, it does not imply that a species is confined to that habitat. For example, some of the species assigned to the grassland with trees / scrub category also occur on the ground of woodlands. The most obvious likely relationship for fungi in the grassland with trees / scrub category is where the fungus is behaving as an ectomycorrizal fungus, that is, it is symbiotically linked to the roots of vascular plants by means of sheaths growing around these roots. However, it should be noted that most fruit trees, and many of the hedgerow species along the boundaries, are in the family Rosaceae, which do not usually have ectomycorrhizal associates.

3.8 The species composition of one type of habitat has received more detailed attention in recent years, namely, the fungi found in 'waxcap' grasslands. Diversity of species from four taxon groups have been used to assess conservation value of site (Evans 2003). Species in the groups Clavariaceae, *Hygrocybe* (plus *Dermoloma*), *Entoloma*, Geoglossaceae are counted as qualifying species (Evans 2003). The total number of *Hygrocybe* species seen on a single visit can also be used to assess sites (Evans 2003). Total numbers of 'waxcap' species and *Hygrocybe* species found in the orchard sites are given in Table 16.

Invertebrates

3.9 The general assessment of invertebrate species composition in relation to habitat features is the subject of a separate Natural England project which is still in progress. In advance of the results of this project, a first attempt is made to assign orchard invertebrates to assemblages (Table 15). The saproxylic (wood-decay) assemblage is the exception, as it has already been the subject of detailed assessment and the categorisation of species published (Alexander 2002a). However, as with the assemblage assignments made for the survey project, this list is still regarded as provisional by Dr Keith Alexander. The assemblage types used to categorise the orchard fauna are briefly described below.

- **Canopy**: species which develop among the foliage of woody plants. The assemblage includes invertebrate herbivores associated with particular components (leaves, buds, fruit) and specialist predators and parasites. Species found on parasitic mistletoe (Canopy (P)), are included.
- **Carrion**: species living on dead animal matter.

- **Dung**: species typically associated with animal dung.
- **Epiphyte habitat**: Invertebrates that develop amongst, or feed predominantly upon, the lichens, bryophytes, algae and fungal spores encrusting the surfaces of woody plants. The assemblage includes a few predators that might more strictly be regarded as bark-living species rather than species restricted to living among epiphytes.
- **Field layer**: species which develop amongst herbaceous vegetation and live a more or less aerial existence there.
- **Generalist, Generalist (D)**: Species that are not easily categorised as they use such a wide variety of habitats. Generalist (D) species frequently occur in dead plant material in a variety of forms, including wood-decay debris.
- **Ground layer, Ground layer+**: species which are active mainly over the ground surface or amongst plant litter lying over it. Ground layer + species can occur in other situations, for example, on boulders and tree trunks.
- **Mosaic**: species that require a range of habitats, such as some bee species which use Canopy (C), Field (F) and Ground layer (G), the first two as foraging habitat and the third as nesting habitat.
- **Nest**: Species which develop in nests of other species, often in the nests of wasps (W), and bees or their hives (B).
- **Saproxylic**: species which depend on some part of the wood decay succession or products of it, or on associated fungi (Alexander 2002a). The assemblage also includes specialist predators and parasites.

Indicators of ecological continuity

3.10 Attempts to identify species which might indicate long continuity of tree cover in the landscape have been made for epiphytic lichen species (Rose 1976, Harding & Rose 1986, Rose 1992) and saproxylic beetle species (Alexander 2004). The numbers of Indicator species which occurred in the orchard study sites are summarised in Table 18.

3.11 Indicator species are particularly associated with ancient woodland or wood pasture. The woodlands tend to be high forest and not closed-canopy, ungrazed, coppice woodlands (Alexander 2004). For lichens, two indices have been developed based on selected species (Revised Index of Ecological Continuity RIEC, and the New Index of Ecological Continuity NIEC). Bonus lichen species (B) are significant local or rare species not included in the base scale but considered important as they add to the overall conservation interest (Coppins & Coppins, 2002). As yet, no such index has been developed for bryophytes as these appear more catholic in their habitat preferences and are less restricted to ancient, undisturbed habitat, as shown by Humphries and others (2002).

3.12 The saproxylic Indicator beetles are those associated with sites with documentary or archeological evidence of long continuity of tree cover and are species either of known or supposed low mobility (Alexander 2004). There is a continuum in the faithfulness of species to continuity of tree cover however, so the indicators are sub-divided into categories from 1 (species most closely associated with continuity) to category 3 (species less strongly associated with continuity).

Evaluation of species rarity and threat to habitats and species

Priority BAP habitats and species

3.13 Habitats and species regarded as particularly under threat are identified as priorities for conservation action in the Biodiversity Action Plan (UK Steering Group 1995). As explained in paragraph 2.15, definition of the priority hedgerow habitat has changed since the surveys were carried out. The pre-2007 priority habitats found in the site surveys are shown in Table 7 and the numbers of priority species shown in Tables 16 and 17.

Lichen and bryophyte species

3.14 Conservation evaluation and rarity are standardised against the IUCN Red Data Book categories (IUCN 2001, Church et al 2001, Woods & Coppins 2003). Some lichen species qualified as threatened or nationally rare or scarce. No bryophyte species fell into these categories. For the 3 categories of Critically Endangered, Endangered and Vulnerable, judgements are made on the basis of 5 criteria, measured in various ways: (A) rapid decline in population; (B) small range which is fragmented, declining or fluctuating; (C) small and declining population; (D) very small population / very small range; (E) probability of extinction. More stringent levels for these criteria are applied for the higher risk categories. For example, under criteria A, one measurement is % decline over the last 50-100 years where causes of decline are understood, have ceased and are clearly reversible. The Critically Endangered threshold is > 90% decline, Endangered is > 70% decline and Vulnerable is > 50% decline (Woods & Coppins 2003). The summary status definitions are as follows:

- **Critically Endangered (CR)**: Taxa facing an extremely high risk of extinction in the wild in the immediate future.
- **Endangered (EN)**: Taxa facing a very high risk of extinction in the wild in the near future.
- **Vulnerable (VU)**: Taxa facing a high risk of extinction in the wild in the medium term future.
- **Near Threatened (NT)**: Taxa considered to be at lower risk but are close to qualifying as Vulnerable.
- **Not evaluated (NE)**: Taxa not assessed against the criteria.
- **Lower risk (LR)**: Species which do not fall within the RDB categories as being particularly threatened, but are nevertheless rare are categorised as:
  - **Nationally rare (NR)**: Taxa recorded from 1-15 ten km squares.
  - **Nationally scarce (NS)**: Taxa recorded from 16-100 ten km squares.
- **Least concern (LC)**: Taxa which are not considered to be at risk. Widespread and abundant taxa are included in this category.
- **Schedule 8 (Sc 8)**: a specially protected species on Schedule 8 of the Wildlife and Countryside Act 1981.
- **International responsibility (IR)**: Britain has an international responsibility for the species (Woods and Coppins 2003).

Fungus species

3.15 Fungi have been provisionally assessed using the IUCN criteria (Ing 1992), though taxonomic difficulties and lack of information about current distributions are particularly problematic for this group. The Provisional Red Data list was very much a first attempt at creating such a list.

3.16 The rarity of fungus species in Britain can be assessed to some extent even if levels of risk are not clear. The British Mycological Society's Fungal Records Database (BMSFRD) gives the number of occurrences of individual species. The number given against ‘BMSFRD’ for species of special interest identified in the site survey sections represent the number of records in the UK and Ireland that have been submitted to the Society or entered from published sources, some going back a century or more. The counts refer to records, not sites. There is a strong bias towards larger and better-known species and probably also to interesting or rare ones. Most of the records were not collected as part of organised surveys, nor have they been vetted, so they are not comparable, for example, with Botanical Society of the British Isles' Flora 2000 records. Nevertheless the database contains over one million records and is probably the best guide available to the rarity of British macrofungi. In general a rare macrofungus will have less than about 100 records.

Invertebrate species

3.17 The status and conservation evaluation categories for invertebrates are slightly different compared to those for bryophytes and lichens, as for some invertebrate groups there is less

knowledge of distribution and abundance. A summary of the categories is given below, based on Ball (1986), Shirt (1987) and Bratton (1991), and the numbers of species found in these categories given in Table 17.

- **Red Data Book (RDB) 1 Endangered**: Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Criteria are:
  - Species known or believed to occur in only a single locality;
  - Species restricted to habitats which are especially vulnerable;
  - Species which have shown a rapid and continuous decline in the last twenty years and are now estimated to exist in five or fewer localities / 10 kilometre squares of the British National Grid; and
  - Species which are possibly extinct but have been recorded this century and which if rediscovered would need protection.
- **Red Data Book 2 Vulnerable**: Taxa believed likely to move into the Endangered category in the near future if the causal factors continue operating. Criteria are:
  - Species declining throughout their range;
  - Species in vulnerable habitats; and
  - Species whose populations are low.
- **Red Data Book 3 Rare**: Taxa with small populations that are not at present Endangered or Vulnerable, but are at risk. Criteria are:
  - Species which are estimated to exist in only fifteen or fewer localities / 10 km squares. This criterion may be relaxed where species are likely to exist in over fifteen 10 km squares but occupy small areas of especially vulnerable habitat.
- **Red Data Book K**: Taxa that are suspected, but not definitely known, to belong to any of the above categories, because of lack of information.
- **Nationally Scarce N**: Species estimated to occur in 16 to 100 ten kilometre squares since 1970. For some groups which are better known, the category is divided into:
  - Nationally Scarce category A (Na): species estimated to occur within a range of 16 to 30 ten kilometre squares ; and
  - Nationally Scarce category B (Nb): species estimated to occur within the range of 31-100 ten kilometre squares.
- **Local**: The term local is not rigidly defined, but loosely means species confined to a particular habitat type (usually associated with better quality examples of that habitat) or a particular geographic area, or species that are too widespread to warrant Nationally Scarce status but are nevertheless infrequently encountered.
- **Introduced species**: Species in square brackets, [ ], in the tables of results are species not native to Britain.

Biodiversity evaluation of orchard study sites

Diversity of species and assemblages

3.18 The overall numbers of species found in the lichen, bryophyte, fungus and invertebrate surveys is given in Table 8. In all, over 200 species were recorded per site, despite the surveys being only partial, as they concentrated on particular taxa and assemblages (see Section 2). The sites clearly varied in their diversity for different groups, for example Slew Orchard was the richest for lichens, Rummers Lane Orchards the richest for bryophytes. The sites also contained a wide range of communities, assemblages and associations (Table 9 - 15). For example, lichen communities ranged from a community (the *Usneion*) on very well-lit trees in humid conditions to a deeply shaded bark community (the *Pyrenulatum*). Numbers of species represented in assemblages varied across sites, for example, saproxylic invertebrate faunas were particularly rich in Broadway Farm Orchards, Slew Orchard and Park Farm Orchard, while the highest number of ground layer invertebrate species was found in Park Farm Orchard (Table 15). Fungi

associated with dead wood were particularly varied at Broadway Farm Orchards, Rummers Lane Orchards and Park Farm Orchards.

3.19 The character of the invertebrate and lichen groups had particular similarities to wood pastures and parklands flora and fauna, for example, as shown by presence of lichen species such as *Ochrolechia inversa* and *Pertusaria multipuncta* and saproxylic beetles such as *Prionchys melanarius* and *Mycetochara humeralis*. Orchard floor vegetation supported a variety of invertebrate species. Among the sites surveyed, Slew Orchard had the highest number of field layer invertebrates. Of particular importance in Slew Orchard were the steep, south-facing grassy banks, which supported a typical invertebrate fauna of unimproved grasslands on warm, freely-draining, soils. Hedgerows provided additional invertebrate habitat in most of the sites, through their value for shelter and food supplies such as pollen and nectar.

3.20 Comparisons of diversity in orchards with information on similar habitats such as wood pastures are difficult because of lack of uniformity in sample methods and sampling intensity. Scale differences are also a major issue. Wood pastures and parklands are structurally and compositionally similar to orchards yet are usually much larger than orchards. For example, Boconnoc Park in Cornwall has 190 epiphytic lichens in an area of 100 ha (Harding and Rose 1986), while Slew Orchard, in the same unpolluted part of England, has 80 species packed into an area one hundreth the size (1.3 ha). Diversity of epiphytic bryophytes per unit area also appears to be relatively high in orchards. A survey of epiphytic bryophytes, carried our between 1992 and 1995, across 107 2 x 2 km (42,800 ha) squares on a transect from South Wales to East Anglia (Bates and others 2004) gathered data on all the epiphytes that could be found in the sample squares (132 species). The 6 orchard sites, in a combined area of less than 40 ha, contained 36% of the total number of species found in the 1992-1995 survey, plus an additional species (*Sanionia uncinata*). The average number of species on apple trees in the orchards (6.43) was only exceeded by the number of bryophytes on ash and elder in the averages expressed by tetrad in the transect study (Bates and others 1997).

Priority BAP habitats

3.21 Priority BAP habitats, that is, Lowland Meadow and the pre-2007 habitat of Ancient and / or Species-rich Hedgerows, occurred singly or together at all sites except Rummers Lane Orchards (Table 7). The grasslands are an integral part of the orchard habitat mosaic and have associated fungi and invertebrate fauna, discussed below. The hedgerows provided shelter for invertebrates, additional canopy habitat and nectar and pollen resources and additional niches for other groups such as fungi, as shown at Park Farm Orchard and Slew Orchard.

Rare, scarce and threatened species

3.22 An array of nationally rare and scarce species was found in the orchards, across all groups, with the exception of bryophytes (Tables 16 - 17). Locally rare bryophyte species were present in Rummers Lane Orchards. Priority BAP species occurred in Colston Farm Orchards (a waxcap grassland fungus, *Hygrocybe calyptriformis*), Park Farm Orchard (stag beetle, *Lucanus cervus*) and Broadway Farm Orchards (noble chafer beetle, *Gnorimus nobilis*).

3.23 Among the epiphytic lichens, 16 nationally rare and scarce species were found, including one species on Schedule 8 of the Wildlife and Countryside Act 1981 (*Parmelinopsis minarum*). Species for which Britain has an international responsibility also occurred, for example *Usnea articulata* at Luscombe Farm Orchards. Thirteen rare or provisional Red Data List fungus species were found, every site having a representative. Waxcap grassland species, belonging to a threatened assemblage of fungi depending on unimproved grassland, were a particular feature at Colston Farm Orchards.

3.24 A total of 45 nationally rare or scarce invertebrates were recorded, every site contained some examples. The saproxylic assemblage dominated the rare, scarce and local fauna (Table 17). Broadway Farm Orchards were particularly rich in these species. Apart from *Gnorimus nobilis*, other scarce wood-decay beetles such as *Prionychus melanarius*, *Gracilia minuta* and *Anisoxya*

fuscula were present. Several species found in orchard sites are associated with the plant family Rosaceae, to which fruit trees belong, for example the nationally scarce beetles *Scolytus mali* and *Magdalis cerasi*. Other invertebrates apart from beetles were also represented, for example there was a population of the local bristly millipede (*Polyxenus lagurus*) at Colston Farm Orchards and the nationally scarce brown or tree ant (*Lasius brunneus*) was found at Rummers Lane Orchards. This latter species is an example of species found beyond its known range by the orchard surveys.

3.25 A good variety of epiphytic barkflies (Psocoptera) were found among epiphytes in the western orchards, and it should be noted that this group of invertebrates has not yet been assessed for RDB or nationally scarce status. A population of the nationally scarce lace bug (*Physatocheila smreczynskii*) was found in the epiphyte habitat in Slew Orchard. This invertebrate is characteristic of old apple trees and is particularly scarce in south-west England. In 2007 it was recognised as a priority BAP species. A nationally scarce hoverfly (*Eupeodes nitens*), found at Colston Farm Orchards, is a canopy species that is usually associated with ancient woodland (Falk 1991b). *Anthocoris visci*, a nationally scarce predatory bug associated with mistletoe on apple trees, was found in Broadway Farm Orchards.

3.26 The field and ground layers of the orchard floor also contained scarce species and provided habitats for species which use a range of habitat resources, for example the nationally scarce saproxylic beetle *Anisoxya fuscula* was found on meadowsweet flowers in Broadway Farm Orchards. Colston Farm Orchards and Luscombe Farm Orchards contained areas of marshy grassland that featured the localised plant bug *Pachytomella parallela*, and the nationally scarce weevil *Rhinocyllus conicus* on marsh thistle (*Cirsium palustre*). The dung beetle fauna was overall relatively species-rich. A total of 12 species were noted across the study sites. A solitary wasp, the nationally scarce *Tiphia minuta*, which parasitises dung beetle larvae, was found at Colston Farm Orchards.

3.27 Hedgerows and trees other than those cultivated for their fruit, where they occurred on boundaries or within the orchards, also contributed species of interest. The rare fungus *Entoloma saepium*, an ectomycorrhizal fungus thought to be associated with Rosaceae, was found close to sloe (*Prunus spinosa*) and hawthorn (*Crateagus monogyna*) growing in the hedgerow around Slew Orchard. The provisional Red Data List fungus *Schizophyllum amplum* was found on a dead fallen poplar twig in the row of poplars along one of the boundaries of Rummers Lane Orchards. Saproxylic invertebrates can benefit from non-fruit veteran trees of hedgerows and orchards. *Cossonus parallelepipedus* (Nationally Scarce weevil, Indicator of Ecological Continuity) was found by Paul Whitehead in 2001 in decaying heartwood in a large white willow (*Salix alba*) at Broadway Farm Orchards. *Tanyptera nigricornis* (RDB3 cranefly) was recorded on ash (*Fraxinus excelsior*) in the hedgerow boundary at Slew Orchard.

Site series and relative value

3.28 The study sites demonstrated the richness and variety of biodiversity that orchards can harbour, with individual sites each having particular highlights in terms of diversity or rarity of species present. This finding points to the need to conserve series of orchards in order to ensure that the fullest possible range of species is safeguarded. A process of picking on certain groups to evaluate orchards (generally those groups where evaluation criteria have been developed to assess conservation value), runs the risk of underplaying the contribution of wider orchard biodiversity. This diversity has been shown by the orchard surveys to be considerable, especially when set against to the low levels of biodiversity in agriculturally intensive landscapes which make up the bulk of the English countryside (Vickery and others 2001, Robinson and Sutherland 2002).

3.29 However, application of existing evaluation criteria for particular groups would give minimum assessments of relative orchard value. A suggested evaluation would be as follows. Broadway Farm Orchards would be of regional value according to its score for saproxylic beetles that are Indicators of Ecological Continuity (Alexander 2004). The number of *Hygocybe* fungus species

found at Colston Farm Orchards would indicate regional importance (Evans 2003). Using less formal criteria, Park Farm Orchard would probably be regarded as of county importance for its saproxylic invertebrates, including the priority BAP stag beetle, while Slew Orchard would possibly be regarded as of county to regional importance for its lichens. Luscombe Farm Orchards and Rummers Lane Orchards might be assessed as of local to county importance, the former for its lichens and invertebrates and the latter for its bryophytes.

Factors influencing patterns in species composition

National scale: atmospheric deposition and rainfall

3.30 These factors operate at a national scale, although sites within national zones of rainfall and deposition may vary due to more local factors such as topography and sources of emissions. In respect of lichens, the study sites do vary in line with the national zones however, with sites in Devon (Slew Orchard, Luscombe Farm Orchards, Colston Farm Orchards) having the richest lichen floras, suited to areas which have not suffered from high levels of pollution in the past (Hawksworth and Rose 1970). The Devon sites are still in zones with low levels of dry deposition but because of high rainfall in these areas, are likely to receive more wet deposition of sulphur and nitrogen than the other sites.

3.31 The impact of nitrogen is less well known than sulphur and the fertilising or acidifying effects of nitrogen compounds is only beginning to be understood (Mitchell and others 2005). Nitrogen levels may be implicated in the spread of particular lichen species in historically low sulphur dioxide zones (NEGTAP 2001). *Xanthoria polycarpa* and *Physica aipolia* (both of which occur in the Devon orchards) show a post-1970 increase in Devon, a low sulphur dioxide zone, and perhaps this increase reflects increased nitrogen deposition in the county.

3.32 Unpolluted air and high rainfall (and its consequence, high humidity,) favour the development of the *Usneion* lichen community in the Devon sites. This community is best developed in Luscombe Farm Orchards, the study site at the highest altitude.

3.33 Bryophyte diversity in the study orchards does not show the same pattern in relation to atmospheric deposition as epiphytic lichens, although nitrogen enrichment from atmospheric sources might be deleteriously affecting the bryophytes of Park Farm Orchard in Kent. In contrast to the lichens, the richest bryophyte site is in the east of England (Rummers Lane Orchards). However, Bates and others (2004) suggest that some bryophytes might be able to take advantage of habitats where epiphytes have been reduced by historical sulphur dioxide pollution, and, now that levels of this pollutant have fallen, be able to invade habitats free from competition. *Ulota phyllantha* is suggested as a possible species responding in this way. This species was found at Broadway Farm Orchards, Rummers Lane and Park Farm, all orchards in areas that have suffered from air pollution in the past (Hawksworth & Rose 1970).

3.34 A climatic pattern among epiphytic bryophytes was identified by Bates and others (2004). *Frullania tamarisci*, *Neckera pumila*, *Metgeria temperata* and *Microlejunea ulicina* are only found in the Devon orchards (high rainfall zones) and are species that Bates and others suggest are linked to a south-western distribution because of their more demanding requirements for climatic moisture.

Landscape scale: topographic position and soil type

3.35 The study orchards occurred in a wide variety of topographic positions in the landscape, with almost every site aspect represented and slopes varying from flat to steep (30 degrees) (see Table 5). Slope aspects included north-east facing slopes, which might have been expected to be less suitable for orchard planting than warmer south-facing and west-facing slopes. Given this variation, there seem to be few obvious relationships to species composition. One possible effect

of the southerly aspect and consequently warmer and drier microclimate of Slew Orchard may perhaps be seen in the rather limited list of fungi on wood. The number is low despite a relatively high amount of available dead wood or veteran tree features (Table 6), compared to fungus diversity in other similarly well-endowed sites (for example, Rummers Lane Orchards). Elsewhere, greater dead wood fungus diversity has been found where dead wood in moist conditions is available for fungus colonisation (Ranius & Jansson 2000).

3.36 Steepness of slope of some sites (Colston Farm Orchards especially) is likely to have precluded ploughing. Lack of disturbance and continuity of grassland cover can be significant in allowing rich waxcap fungi grasslands to develop (Evans 2003), as at Colston Farm Orchards. Slope angle is likely to interact with climate and soil parent material to influence soil nutrient status of soils, which in turn affects grassland flora and pH of tree bark, the latter even within a single tree species (Mitchell and others 2005). The Devon sites appear to be on relatively infertile soils which are subject to leaching by high amounts of rainfall, while the floodplain soils of Broadway Farm Orchards and Rummers Lane Orchards may be more fertile. This possibility is supported by the finding that the Devon sites are the only ones with bracken (*Pteridium aquilinum*). Any possible soil type effect on tree bark pH in the orchard sites is obscure. Apple trees in Broadway Farm Orchards are more similar to those in the Devon sites than those at Rummers Lane Orchards in terms of bryophyte diversity (Table 11, Table 13), despite likely differences in soil type between Devon sites and Broadway Farm Orchards.

Landscape scale: continuity of orchards and woodlands in space and time

3.37 A notable finding of the site surveys was the presence of Indicators of Ecological Continuity in all of the study orchards, even in those orchards not present a century ago (Table 5, Table 18). As mentioned above, the closest habitat analogue to orchards seems to be wood pasture. Apart from beetle and lichen Indicators of Ecological Continuity, the flora and fauna of orchards share species with ancient woodland and wood pasture, including other saproxylic invertebrates and faunas associated with epiphytes (Alexander 2002a, Alexander pers obs). With regard to epiphytic bryophytes, Bates and others (2004) detected an association between particular bryophytes and ancient woodland, including old pollarded trees, in their multivariate analysis, while at the other extreme of this ordination of data different bryophyte species were associated with open landscapes with rivers and streams. Comparison with those bryophyte species recorded in orchards shows a slight trend among the latter to be located towards the ancient woodland extreme of the ordination produced by Bates and others (2004).

3.38 Available evidence on orchard landscapes that might help to explain the presence of indicators of ancient woodland or wood pasture comprised the following: the occurrence of woodlands on ancient woodland inventories; woodlands and orchards mapped on First Edition Ordnance Survey maps; the amount of woodland and orchard present in the landscape now; connectivity of the study sites to these surrounding habitats, including through the hedgerow network.

3.39 Ancient woodlands, past and present, occurred relatively close (within 1 km) to most sites, the exception being Rummers Lane Orchards where the nearest ancient woodland site was 22 km away (Table 5). Slew Orchard is on the site of an ancient woodland (Slew Wood) identified in the Devon ancient woodland inventory (Lister and Pinches 1986). Relatively large ancient woodlands (more than 20 ha in size) occurred in the vicinities of Slew Orchard, Luscombe Farm Orchards and Park Farm Orchards.

3.40 Three sites had orchards present over a century ago (Luscombe Farm Orchards, Colston Farm Orchards and Broadway Farm Orchards), while there were orchards across the lane from the Park Farm Orchard site, in addition to well-dispersed orchards in the surrounding landscape. Several of these orchards were still present on recent aerial photographs. Despite relatively little ancient woodland in the vicinity, the orchards around Broadway Farm Orchards were historically very extensive and the area still has the greatest area of traditional orchard among the study sites, interconnected by hedgerows containing hedgerow trees (Table 5). Clements and Alexander (in press) have shown that long-established hedgerows can provide suitable habitat for

saproxylic indicator beetles. Whitehead (1996) provided a comprehensive analysis of arboreal beetles from farm orchards, open-grown specimen trees and hedges, on the Kemerton Estate in Worcestershire. This research showed that scarce saproxylic beetles occurred in all these habitats. Trees in the most ancient hedges had more rare species but rare species were not confined to these trees.

3.41 In the current study, the numbers of indicator beetles per site were highest where orchards were most extensive in the landscape in the past and where low intensity, traditional, orchards are most extensive at present, that is, Broadway Farm Orchards and Park Farm Orchard (Table 5, Table 18). Around Rummers Lane Orchards there were few orchards present in the landscape historically, apart from some tiny examples. Woodlands were also absent in the surrounding area. Although the presence of only one Indicator beetle in Rummers Lane Orchards is not of much significance in assessing continuity, the First Edition 1:2500 map of the area dated 1886-1888, which mapped individual trees, shows that these trees were quite plentiful along roadsides and ditches and even in 'parkland' arrangements, for example around the nearby Inham Hall. It is likely that the Fens always had some wet woodland and floodplain trees and the latter habitat has been shown to be a refuge for saproxylic indicator beetles (Alexander & Foster 1999).

3.42 Epiphytic lichen indicators were present in the Devon sites, all of which have some continuity of orchard or woodland, but were probably excluded from more easterly sites by the history of air pollution. Humphries and others (2004) found total bryophyte numbers in UK conifer stands were positively correlated with amount of semi-natural woodland within 1 km of the stand. Rummers Lane is perhaps surprising in this context, in that it is the least wooded of the study site landscapes yet has the richest epiphytic bryophyte flora. However, remnant fen scrub and woodland may have been rich sources of bryophyte colonizers for fenland orchards.

3.43 Overall, the results for the study sites suggest that orchards are a significant part of a spatial series or network of habitats at a landscape scale, which are able to sustain scarce lichens and beetles, and perhaps other taxa, that require continuity of habitat through time. This habitat network is made up of orchards, hedgerow trees, wood pasture and ancient woodland.

Landscape scale and mosaics of habitats

3.44 The occurrence of ponds in three of the orchard sites illustrates the potential such sites have for wide-ranging species which depend on a mosaic of habitats at a landscape scale. Ponds in orchards were probably created to supply water for livestock. In the case of great crested newts, these amphibians need a network of ponds, in association with rough grassland for foraging, and fallen logs and hedgerows for shelter (Langton and others 2001). All these habitat occurred in the orchard sites. Broadway Farm Orchards in particular contain a dense pattern of ponds, with 8 in one square kilometre, contrasting with the national average of 1.4 ponds per square kilometre (Oldham and Swan 1997). The study sites appeared to be within the home range of several bird species, such as green woodpecker, and within the foraging range of greater horseshoe bats (English Nature 2000, Billington 2004).

Site factors: orchard trees

Fruit tree type

3.45 The main findings about effects of differences in fruit tree type came from the study of epiphytic lichens and bryophytes, although a few species-specific invertebrates were noted, such as the uncommon apple blossom weevil *Anthonomus pomorum* and the plant bug *Atractotomus mali* in the apple orchards at Luscombe Farm.

3.46 The presence of the *pre-Lobarion* lichen community in the Devon sites seemed confined to pear trunks. In most ancient woods and forests in southern England this community would be recognised as a shade-tolerant, pioneer community. Pear seemed to provide suitable moist, spongy, bark crevices and surfaces that the species comprising the community require.

3.47 The species richness of bryophytes did seem to be related to fruit tree type. Overall, more species were recorded from apple (49), compared to cherry (22), pear (14) and plum (12). However, apple was the predominant type in the study sites, and pear was only examined at one site (Broadway Farm Orchards) so it could be argued that sample size affected the results. Comparison of individual tree samples refutes this view. Average number of species per tree was greatest for apple, followed by cherry (in Slew Orchard), then plum and pear (Broadway Farm Orchards). This was true when compared across sites where apple trees were sampled or, more convincingly, within the same sites where bryophytes on other fruit tree types were also recorded (Table 12, Table 13). It should be remembered that these samples were not chosen in a strictly random way, but they were selected without conscious bias towards a particular fruit tree type in relation to species number or girth size. Thus the samples are helpful for exploratory analysis, which can be followed up by more rigorous study in future.

3.48 Comparison with the results of Bates and others (2004) suggests that the orchard bryophytes seem to be grouped largely at the end of the species ordination produced by these authors that is related to some tree species with higher pH bark. The group includes apple (*Malus*), although no pH records are referred to for this species. The reasons for differences in epiphytic floras according to fruit tree type may involve tree form, bark texture and bark chemistry. Bryophytes in orchards were observed to be more abundant where the trees had more level branch surfaces (often seen in apple trees) rather than steeply sloping branch surfaces (a common feature of plum trees). Cherry and plum bark tend to be smoother than apple bark (which flakes as the tree ages), while pear bark is furrowed. Smooth or furrowed bark may be more difficult to colonise than flaky bark, in the case of bryophytes at least. Lichens were richest in the cherry orchard and pear had a particular lichen community (see above) so bark texture may not be an important issue for lichen diversity.

3.49 Bark chemistry may influence species composition but it is a complex factor, subject to interactions with chemistry of rainfall and soil types (Mitchell and others 2005). Bark pH can be quite variable within species, as shown by Bates and others (1993). In their study, bark of oak trees at Slapton Ley National Nature Reserve varied between pH 4.1 and pH 5.1 while bark of ash varied between pH 4.9 and pH 5.7. These differences are actually quite large given that the pH scale is expressed on a logarithmic scale. Lichen species composition in the orchards hinted that cherry trees might have an acid bark, and pear trees, at the other extreme, basic bark, while bryophyte composition suggested that plum bark was relatively acid and apple bark was basic. More data are required, including measurements of bark chemistry, to elucidate the relationships between this factor and the species composition of epiphytes.

Fruit tree density and scrub

3.50 Canopy cover may be a factor influencing differences in plant distributions on the orchard floor and among epiphytic species. Table 6 gives subjective estimates of degree of canopy closure in the study sites. In Slew Orchard, plants with affinities to woodland, such as *Hyacinthoides non-scripta* (bluebell), *Anenome nemorosa* (wood anemone) and *Luzula pilosa* (hairy woodrush) seemed to occur more commonly, or were restricted to, areas under the tree canopy.

3.51 The closed canopy created by closely-spaced trees can produce a habitat for lichens that differs from the microclimate of open canopy conditions. The moisture retained beneath closed canopies provides an ideal habitat for lichens that thrive under low light conditions and especially those species with *Trentepohlia* as algal partner, for example, *Anisomeridium polypori, Dimerella pineti, Opegrapha atra, Opegrapha varia, Opegrapha vermicellifera, Opegrapha vulgata* and *Porina aenea*. Broadway Farm Orchards and Rummers Lane Orchards are examples of sites where some of these species occur. Conversely, open canopy conditions benefit lichen communities that are optimally developed in well-lit situations such as the *Parmelion* and *Usneion*, as in the open canopy situations in the Devon orchards. Even in areas of previously high air pollution, which are now under lower, more stable pollution burdens, open canopy conditions can help to accelerate the colonisation of re-invading *Parmelion* species. In one area within Rummers Lane Orchards, a group of low-branching, hollow-pyramid-shaped, apple trees supported a thriving

community that includes *Evernia prunastri*, *Hypogymnia tubulosa, Platismatia glauca, Ramalina farinacea* and *Usnea subfloridana*.

3.52 The effect of canopy cover on bryophytes was unclear. There was often great variation in bryophyte cover within orchards for no obvious reason. Species behaved unpredictably, being unaccountably absent from adjacent, seemingly identical, trees. Even on the same tree, individual branches sometimes had hugely different amounts of bryophyte cover. However, Rummers Lane Orchards had the richest bryophyte flora and had the most extensive closed canopy, which would have been even denser during the ten years or so when scrub swamped the fruit trees before it was cleared as part of the orchard restoration plan.

3.53 Shade and shelter may be factors affecting the balance between lichen and bryophyte abundances. Harding and Rose (1986) noted that in an analogous habitat to orchards, namely wood pasture, the more heavily shaded situations were dominated by bryophytes but lichens were less prominent. The study of Atlantic oak woods by Mitchell and other (2005), suggested that the more exposed site had less bryophytes and a more lichen-dominated community. Similarly, Humphries and others (2002) noted that old-growth pine stands are not noted for their bryophyte flora because of their open structure and dry microclimate.

3.54 The Devon orchards and Broadway Farm Orchards had notable invertebrate faunas associated with the lichens, bryophytes and algae growing on the trees. Cover of lichens and bryophytes was high in the Devon sites but less so at Broadway (Table 6). The richness of the fauna did not seem related to be in a simple way to the amount of this cover. Gilbert (1971) found increased abundance and diversity of species of barkflies (Psocoptera) on trees with abundant lichen and algal cover compared to trees without such high cover. The latter trees were in the polluted centre of Newcastle-upon-Tyne. Gilbert also noted that psocids feed preferentially on algae and fungal spores rather than lichens. Wetter climates, as in the Devon sites and Broadway Farm Orchards, may enhance availability of algae and fungal spores compared to orchards in the drier east of England.

3.55 The amount of scrub within the orchards was mostly very low (Table 7), except in Broadway Farm Orchards, where a substantial proportion of the trees were being overgrown by scrub. The impact of scrub and young woodland re-growth on ancient trees in wood pastures has been raised as a concern (Key and Ball 1993), for instance, through shortening the life of the older, out-competed trees. The effect on saproxylic invertebrates requiring well-lit, warm micro-habitats is also a concern but quantitative studies have been lacking. However, Ranius and Jansson (2000), in a quantitative project, showed that the frequency of saproxylic beetles in oak in Sweden was higher in plots that were originally open and were still grazed compared to plots that were ungrazed and where the canopy had been closed in the past. The group of beetles associated with fungi on trees were the only group to show an opposite trend, possibly because the closed canopy was more favourable for these fungi. Rose (1992) contended that most closed, shady, high forests and neglected coppice woodlands are too dense and dark to support rich lichen and bryophyte epiphyte communities. These habitats may be more analogous to dense scrub in orchards than the open arrangement of orchard trees, and shade from scrub may have the same impact on orchard trees. Overgrown hedgerows at Broadway Farm Orchards, again similar to dense scrub, were found to be too dark and dry for macrofungi.

Fruit tree size, stage and age

3.56 Tree size, as measured by girth at 1.3 m above the ground, is one measure of the stage that individual trees and populations have reached. Girth broadly corresponds to age, though this is clearest at the extremes of difference between young, small-girth trees and mature, large-girth specimens. In between these ages, girth sizes among similar-aged trees may be influenced by local soil conditions or climatic conditions varying across the country. With this caveat in mind, girth size is used here as a stage measure that approximates to age of orchard trees, aided by information from site owners and managers about planting dates for trees in the study sites.

3.57 The study orchards included trees of varying ages, with Broadway Farm Orchards having some of the largest, and probably oldest, apple and plum trees (Table 6). Large cherries occurred at Slew Orchard and Park Farm Orchard. The sample of trees at Slew Orchard (Table 19) shows a bimodal distribution of small, young trees which had been recently planted and large, old trees dating from the early years of the twentieth century. Luscombe Farm Orchards and Colston Farm Orchards represent relatively young age groups.

3.58 Among the sites in low pollution areas, Slew Orchard had the greatest number of lichen species (Table 8), although Luscombe Farm Orchards and Colston Farm Orchards, despite their generally younger age, had quite substantial floras, including Indicators of Ecological Continuity (Table 18). Humphries and others (2002) found that lichen species richness was positively correlated with stand age in semi-natural oak and planted conifer stands in the UK. Dettki and Esseen (1998) found species richness of macrolichens in boreal forest in Sweden increased with stand age, up to about 200 years, after which there was a slight decrease. A similar pattern of increasing species richness with age may be present, to some degree, in the Devon orchard sites. An example of a lichen community found at the extreme age range of trees is contained in Broadway Farm Orchards. Here, the *Calicion* community was found. It is a lichen community associated with old, dry, exposed bark, or trunks with missing bark, often in sites affected by industrial pollution (Wolsey and James 2004).

3.59 The overall bryophyte flora of the study sites showed no particularly obvious patterns of age or stage of trees and bryophyte species richness. No relation between bryophyte species richness and stand age of trees was found by Humphries and others (2002). The individual tree sample data allowed bryophyte species-richness to be explored further for the orchard sites. The girth size measurements for apple ($n = 72$) and cherry ($n = 17$) were not correlated with number of bryophyte species per tree, either using actual values or ranked values, suggesting age of trees was not a major influence. However, very young trees were observed to have little bryophyte cover. There were insufficient samples of pear to test. However, plum girth ($n = 17$) was significantly negatively correlated with number of species (r -0.61 for ranked values, $p < 0.01$). The reasons are unclear, possibly the difference in micro-climate from the sample areas may have had an influence rather than stand age (see paragraphs 9.33 - 9.35, Broadway Farm Orchards).

3.60 Obligate epiphytic bryophytes may be among the first bryophyte colonisers of trees, being displaced later by more competitive facultative species (Ron Porley, Natural England bryologist, pers comm, Bates and others 1997). If this was the case in orchards then a negative correlation of number of obligate bryophytes with girth size might be expected. Only apple had sufficient occurrences of obligate species to make a test reasonable. The number of obligate species was positively correlated with average overall number of bryophyte species on apple (r 0.71 for ranked values, $p < 0.01$). Number of obligate species was negatively correlated with girth size (r -0.4 for ranked values, $p < 0.01$), lending support to the hypothesis that obligate species are early colonisers. Orchard trees may sometimes represent relatively ‘recent’ substrates for bryophyte colonization, compared to mature woodlands or hedgerow trees in the landscape. This possibility is perhaps indicated by the finding that the trees in the study sites supported 67% of the obligate species defined by Bates and others (1997) in their transect study, but a rather lower proportion (55%) of the facultative species recorded in their study.

3.61 Saproxylic invertebrates and fungi associated with wood substrates might be expected to be found more frequently in stands of large girth (that is, older trees) than in small girth individuals of the same tree type (that is, younger trees). Ranius and Jansson (2000) found that numbers of beetle species were positively related to increasing trunk girth in oaks, particularly beetles associated with fruiting bodies of fungi growing on trees. Grove (2002) found that the basal diameter of large trees was a robust indicator of abundance and richness of saproxylic invertebrates in lowland tropical forest in Australia.

3.62 In the orchard study sites, fungus species associated with wood were certainly more in evidence in orchards with larger trees, with the exception of Slew Orchard (see paragraph 3.35), although

fungi were recorded on fallen dead wood as well as on standing living trees. Fallen dead wood was somewhat more abundant in orchards with larger trees (Table 6), confounding any direct relationship to tree girth. Overall, although many of the fruit trees were old, the dead wood in the orchard sites was mostly very dry, which probably reduced the range of fungus species found. Even the insides of many of the hollow trees were dry. The greatest variety of saproxylic invertebrates occurred in orchard sites with the largest trees (Table 6, Table 15).

3.63 Records of veteran tree features, such as hollow trunks and missing bark, are collated for the study sites in Table 6. Two sets of data are presented, one which includes young (small girth) and old trees and one which only includes old trees (over 25 cm girth), to assess the effect of age class on average amounts of veteran tree features. The orchard with the most marked age difference between trees, Slew Orchard, shows the most effect, the relative amount of veteran tree features being 22% for the whole sample and 38% for large trees. Grove (2002) found larger trees were better predictors of saproxylic invertebrate richness. Interestingly, the ranking of number of saproxylic invertebrates exactly matched the ranking of relative amounts of veteran tree features among trees over 25cm girth in those orchard sites with comparable data, that is, excluding Broadway Farm Orchards (Table 6, 15). The site with the lowest amount of veteran tree features, Luscombe Farm Orchards (15%), had the fewest saproxylics, and Slew Orchard, with the highest relative amount (38%) had the highest ranking for number of saproxylics. In Broadway Farm Orchards veteran features were recorded differently. Nevertheless, the high number of saproxylics at Broadway Farm Orchards is matched by a high incidence of hollows in trees (47%). Økland and others (1996) found increased diversity of dead tree parts (based on size, state of degradation and position) was related to increased saproxylic invertebrate species-richness in mixed forest habitat in Norway. There do not appear to have been comparable quantitative studies in wood pasture habitats so the orchard project results may be the first to indicate this relationship in this type of habitat.

3.64 The wood-decay habitats in the orchard sites certainly supported saproxylic invertebrate species characteristic of the wide range of niches available in such habitats, including species which rely on rotten heartwood (such as noble chafer, *Gnorimus nobilis*), species living on fungi of dead wood (for example, the hairy fungus beetle, *Mycetophagus quadripustulatus*), predators such as the solitary wasp, *Stigmus solskyi*, which feeds on aphids, and nest-building species such as the brown or tree ant (*Lasius brunneus*).

3.65 While the surveys of the study sites illustrate the current biodiversity of these sites, the dynamic element that controls species occurrences should not be forgotten. There were no young trees in three of the orchard sites, though fortunately restoration plans are in now in place that should remedy this problem over future years. Age structure of the fruit tree population clearly influences the development of veteran tree features. Luscombe Farm Orchards are a good example, in that veteran tree features have not yet developed to any great degree there, but the long term continuity of the population of orchards depends on having orchards or parts of orchards with trees of this range in ages and sufficient trees of all age groups, from saplings to young trees, mature and veteran trees. The age / size structure of trees in Broadway Farm Orchards (Figures 12 - 14) show the effect of lack of replacement planting, during a past period of little management, on the structure of an orchard tree population. No trees here were measured in size classes smaller than 59 cm girth. This situation appears be replicated across other sites belonging to the population of low-intensity, traditional, orchards, (Robertson pers obs) and action to restore the balance to the age structure of orchard trees is a high priority.

Site factors: orchard floor habitat variation

3.66 The orchards contained a wide range of sward structures (Table 7) from heavily grazed, very short swards (Park Farm Orchard) to tall, tussocky swards (Broadway Farm Orchards). This range was undoubtedly related to variation in the intensity of grazing and cutting management. Species-richness also varied from species-poor (for example, Rummers Lane Orchards) to more diverse swards, which resembled the priority Lowland Meadow BAP type (for example, Colston Farm Orchards). Past management history probably played a major role. Rummers Lane had

been unmanaged for ten years, with fruit fall and scrub development contributing to nutrient enrichment of the orchard floor and resultant low species diversity. In addition, the orchards here may once have been cultivated for soft fruit or vegetables when they were planted as part of small-holdings at Wisbech St Mary. Lack of recent grazing and cutting at Broadway Farm Orchards had resulted in species-poor grassland replacing the richer grassland recorded 18 years ago. Heavy grazing can also reduce species diversity in neutral grassland (Gibson 1997), as may be the case at Park Farm Orchard. Nutrient inputs via supplementary feeding of sheep in Park Farm Orchard have probably also contributed towards causing the species-poor character of the sward at this site.

3.67 Sward structure and sward diversity appear to have had ecological effects on other taxa in the orchards, especially on fungi and invertebrates. The greatest diversity of waxcap fungi seem to be associated with agriculturally unimproved grasslands (Evans 2003), especially MG5 *Cynosurus cristatus-Centaurea nigra* grassland (Rodwell 1992). This association may be because unimproved grasslands tend to have low soil nutrient status, which seems important for survival of waxcap fungi. Colston Farm Orchards had MG5 grassland and had the best developed waxcap fungi grassland. The other necessary factor is a short sward (Evans 2003). At Colston Farm the sward was relatively short but the species-rich grassland areas of Slew Orchard and Luscombe Farm had taller swards, which were unsuitable for waxcaps. Rummers Lane Orchards, perhaps surprisingly, had a narrow strip of waxcap grassland between the roadside ditch and the edge of the trees. Two *Hygrocybe* species that appear to be relatively tolerant of high fertility, *H. virginea* and *H. conica* (Evans 2003) were recorded here. The strip may possibly have escaped past disturbance and nutrient enrichment, unlike the vegetation beneath the orchard trees.

3.68 Park Farm Orchard had a fungus species list with some unusual species, which probably benefited from the short sward. More species were found fruiting in spring than autumn, possibly reflecting the heavy spring grazing, which is relaxed over summer until September. The intensity of grazing and nutrient enrichment through dung and feed may have indirectly affected the lichen flora at Park Farm, through enrichment of tree bark. Several nitrophyte lichens, suited by high nitrogen levels, were recorded here, including *Bacidia neosquamulosa* and *Lecanora barkmaniana.*

3.69 For sites with comparable data, invertebrates in the field layer assemblage were more diverse in the sites with species-rich swards (Tables 7, 15). The field layer assemblage at Broadway Farm Orchards was not sampled as intensively but the role of the orchard floor at this site in providing nectar and pollen for saproxylic invertebrates was illustrated by the record of *Anisoxya fuscula* (a nationally scarce beetle) on flowers of meadowsweet (*Filipendula ulmaria*). Paul Whitehead (pers obs) has found that meadowsweet flowers are also visited by noble chafer beetles (*Gnorimus nobilis*). This species also occurred at Broadway Farm Orchards. The very short sward at Park Farm Orchard restricted the variety of field layer invertebrates but this site had more ground layer species than the other sites with comparable data (Table 15). This latter result was probably because of the presence on the orchard floor of a number of logs, which provided daytime cover for nocturnally active species, making them easy to find. Paul Whitehead's survey of Broadway Farm Orchards yielded almost as many ground layer species as Park Farm Orchard. Broadway Farm Orchards were located beside the River Severn, and habitats containing ground layer species included flood litter as well as cut grass and hay.

3.70 Variation in soil moisture had effects on vascular plants and other taxa. Damp ground at Luscombe Farm Orchards was the location of the fungus *Inocybe sindonia*. Marshy grassland areas added to the diversity of invertebrates, for example, marshy grassland at Luscombe Farm Orchards harboured four Nationally Scarce species (see paragraphs 5.34 to 5.37).

Site factors: orchard boundary character

3.71 The boundaries of most of the sites were predominantly composed of hedgerows, some with hedgerow trees. The hedgerows provided shelter, additional canopy habitat and nectar and

pollen resources for invertebrates and additional niches for other groups. The condition of hedgerows and hedgerow trees can affect associated species. Frequent trimming of hedgerows can greatly reduce fruit and flower crops (Croxton & Sparks 2002). However, none of the hedgerows in the orchard sites were heavily managed. Very overgrown hedgerows may shade out basal flora and affect other taxa, as was found for fungus species at Broadway Farm Orchards (see paragraph 9.36).

Interactions between factors

3.72 The results from the study sites provided preliminary information about the effects of interactions between factors. One important set of interactions that the sites seemed to illustrate was between pollution, tree cover continuity and veteran tree features. These factors operate at national, landscape and site scale respectively. The response of lichen and invertebrate (beetle) Indicators of Ecological Continuity (Table 18) can be modelled simply as follows, although further work would be needed to see if these relationships hold more widely.

Table 4 Interaction between pollution, tree cover continuity and veteran tree features

Past / present air pollution low	Ancient woodland/orchard continuity high	Veteran tree features abundant	IEC response	Site example
✓	✓	✓	Lichens ✓✓ Beetles ✓✓	Slew Orchard
×	✓	✓	Lichens × Beetles ✓✓	Broadway Orchards Park Farm Orchard
×	×	✓	Lichens × Beetles ✓	Rummers Lane Orchards
✓	✓	×	Lichens ✓✓ Beetles ×	Colston Orchards Luscombe Orchards
×	×	×	Lichens × Beetles ×	None

Note that '✓ ' shows that a factor operates or is present, while '×' is the opposite. For Indicator species, '✓✓ ' shows more Indicators are present than a single '✓' and '×' shows that no species are present.

Condition assessment attributes

3.73 Consideration of the factors affecting the biodiversity of the orchard sites provides clues as to possible attributes that could be developed for use in condition assessment of orchards. Broadly, condition assessment aims to find out if a habitat can continue to support an abundance of wildlife, and particular species characteristic of that habitat, through time. This health check uses attributes, such as the amount of broadleaved herbs in grassland, to see if the habitat is in 'favourable' (healthy) condition, in this example if it is capable of supporting a rich flora. Standard condition assessment methods have already been developed for a wide range of habitats, including two of particular relevance to orchards. These two methods are lowland grassland condition assessment (Robertson and Jefferson 2000) and hedgerow condition assessment (Defra 2007). Both habitats are usually part of an orchard habitat mosaic.

3.74 The hedgerow condition assessment method, which involves recording attributes such as height and width of the hedgerow and gappiness, should be directly usable in condition assessment of

orchards. The grassland method is aimed at semi-natural grassland types such as lowland meadows and acid grassland, usually defined by their National Vegetation Classification type (Rodwell 1992). While these may often be directly relevant to assessing orchard floor condition, in some cases orchard grasslands may not conform to these grassland types, being less species-rich, for example as at Rummers Lane Orchards and Park Farm Orchard. This situation may not be due to input of agri-chemicals but be the result of shading, or leaf and fruit fall from orchard trees, or to heavy grazing. There may be particular species that occur in such grasslands that still require particular attributes to be in a certain state. For example, a very short sward would be an attribute in a state indicating favourable condition for fungi species which need this grassland structure, such as waxcap fungi. Condition assessment in these cases needs to be species- or group-specific. Attributes such as amount of broadleaved herbs and sward height are also of great significance for invertebrates, including some of those depending on wood-decay habitats in the orchard trees. Again, attributes specifically for species or groups of species may be needed. For example, an abundance of tall herbs such as meadowsweet (*Filipendula ulmaria*) and large umbellifers could be an attribute in a state indicating favourable condition for some invertebrates which depend on the habitat mosaic in an orchard. For instance, these plants can be nectar sources for adults of some saproxylic beetles, including noble chafer (*Gnorimus nobilis*) (Section 3 this report and UK Steering Group 1995).

3.75 The fruit tree component of orchard habitat mosaics can provide several suitable attributes for condition assessment. These are similar to the ones being developed for wood pasture habitats (Dr Keith Kirby, Natural England principal woodland specialist pers comm). For orchards the following attributes are likely to be worth developing:

- **Age structure of the fruit trees**. To support a wide range of wildlife and ensure habitat continuity through time, a balanced age structure which includes old veteran trees and young replacement trees is required. These requirements may not necessarily need to be met within one orchard but may be represented in a group or 'population' of orchards, provided the orchard wildlife of concern is able to move between these orchards. Favourable condition would be defined by the attribute of age structure being a mix of ages from young to old, rather than being made up only of trees of a relatively narrow age range. More information is needed on the life spans and survival rates of fruit trees and the relationships between age and girth size to develop the attribute. Life span and survival rates will affect calculations about how many trees are needed, and of what ages, to maintain a population of trees in favourable condition with regard to age structure in an orchard or group of orchards. Girth size is worth developing as a quick and approximate way of ascertaining age structure where planting dates are unknown.
- **Fallen or standing dead wood and veteran tree features of living trees**. These features are of great importance as habitats for wildlife. While ensuring that the age structure of an orchard includes old trees is important in providing such habitat, management policy can also affect veteran tree features and dead wood. A very 'tidy' management regime can limit availability of these features even in an orchard of old trees. Development of an attribute linked to the abundance of these features is likely to be useful in condition assessment.
- **Scrub and woodland cover**. Scrub and young trees which invade unmanaged orchards can significantly change the habitat, from open, sunny and warm to shady, dark and cool, with consequent effects on wildlife. While scrub and woodland have their own value for wildlife, where the species of concern are those depending on open-grown trees, increases of scrub and young trees such that they swamp the cultivated fruit trees would be seen as an unfavourable state of a scrub / woodland cover attribute. Some scrub is useful in an orchard for shelter and forage, a role often played by hedgerows around the orchard, so a total lack of scrub would be unlikely to be regarded as favourable, at least for some species groups.
- **Openess of canopy of fruit trees**. The fruit trees themselves can provide a varied habitat depending on the degree of openness of the orchard canopy. This may be completely closed as at Rummers Lane Orchards, or open as at Slew Orchard, or a mixture, as at Park Farm Orchard. These differences may affect which species are present among a group such as

lichens (Table 9). Knowledge of the species on concern in particular orchards will help define appropriate states for this attribute.

Recommendations for further work

3.76 Proposed areas of work arising from questions raised by the site surveys are summarised below. The primary aims of such work would be to increase knowledge about orchard biodiversity and how it can be conserved.

- Further targeted surveys to explore the potential of orchard habitats for groups not covered comprehensively by the current project. Among the invertebrates, high priorities would be Lepidoptera (moths and butterflies), Diptera (flies) and Araneae (spiders). The Myxomycetes, which belong to the Protozoa kingdom but are regarded as 'honorary fungi' (Ing 2001), would be worth investigating. Apple trees are said to support the best communities of Myxomycetes of bark (Professor Bruce Ing pers. comm.). Study of more wide-ranging species not covered by the specialist surveys, but for which the surveys have indicated that orchards have some potential, would also be helpful, particularly studies of birds, bats and amphibians.
- Research to investigate the landscape level role of orchards in conserving biodiversity that utilises a range of habitats with similar features, such as hedgerow trees, wood pasture and ancient woodland in addition to orchards, in particular saproxylic invertebrates and lichens requiring continuity of habitat in space and time.
- Studies of the conservation biology of little known, yet apparently rich, orchard invertebrate communities, especially epiphytic invertebrates including barkflies (psocids) and solitary wasps (sphecids).
- Investigation of the impact of scrub growth around orchard trees, especially in relation to tree survival, the qualities of the veteran tree features, and the species composition and abundance of epiphytic lichens and bryophytes, saproxylic invertebrates and fungi.
- Increased knowledge of the demography of orchard fruit trees, especially in relation to the replacement rates required, and the rate of development of particular features that support important biodiversity, such as saproxylic invertebrates.
- Research into the factors influencing the species composition and abundance of epiphytic lichens and bryophytes, including bark chemistry, bark texture and tree form, and, for bryophytes particularly, micro-climate, light levels and successional patterns in relation to tree age and canopy cover.
- Research into the interaction of factors which affect orchard biodiversity, in order to develop predictive knowledge of which groups are likely to be particularly rich in certain orchards, thus enabling appropriate conservation action to be taken. In particular, further testing the applicability of the suggested range of interactions between pollution load, orchard and woodland landscape continuity and veteran tree features is needed.

Key conclusions from the orchard surveys

3.77 Orchards are hotspots for biodiversity in the countryside, capable of supporting a wide range of wildlife, including BAP priority habitats and species as well as an array of nationally rare and scarce species. The wildlife of orchard sites depends on the mosaic of habitats they encompass, including fruit trees, scrub, hedgerows, hedgerow trees, non-fruit trees within the orchard, the orchard floor habitats, fallen dead wood and associated features such as ponds and streams.

3.78 Different orchards have particular biodiversity value for different groups, for example waxcap grassland may be a feature in one orchard, epiphytic lichens in another and saproxylic invertebrates in a third site. Therefore conservation of orchards as series of sites is required to conserve the full range of biodiversity they support.

3.79 Orchards, like wood pastures, are dynamic habitats and the habitat they provide for groups such as saproxylic invertebrates will change with the demography of orchard trees in a particular site. Continuity of habitat requires trees at all stages of growth, either within one orchard or a series of orchards in a landscape.

3.80 Orchards appear to be a significant part of a spatial series or network of habitats at a landscape scale, which are able sustain scarce lichens and beetles, and perhaps other organisms, that require continuity of habitat through time. This habitat network is made up of orchards, hedgerow trees, wood pasture and ancient woodland.

3.81 The factors affecting the biodiversity of orchards operate at a range of scales, from the national scale, for example atmospheric dry deposition, through the landscape scale, for instance the location of an orchard within the matrix of surrounding habitats, to the site scale, such as the grazing management regime in the orchard. Some of these factors also appear to interact and as a result have particular biodiversity outcomes. Atmospheric pollution, continuity of orchards and woodland through time and availability of veteran fruit trees seem to interact to influence the occurrence of lichen and beetle Indicators of Ecological Continuity.

3.82 Existing condition assessment attributes for hedgerows and grasslands are relevant to orchard habitat mosaics. Several attributes of the fruit tree component such as age structure and scrub cover are also likely to be useful and should be further developed.

Table 5 Contextural information for orchard sites

Factor / site	Slew Orchard	Luscombe Farm Orchards	Colston Farm Orchards	Rummers Lane Orchards	Park Farm Orchard	Broadway Farm Orchards
Character Area / Natural Area	South Devon	South Devon	South Devon	The Fens	North Downs	Severn & Avon Vales
Soil unit zone	Unit 13 + 12: Freely draining acid loamy soils over rock, low fertility + Freely draining, loamy floodplain soils, moderate to high fertility	Unit 6: Freely draining slightly acid loams, low fertility	Unit 6: Freely draining slightly acid loams, low fertility	Unit 21: Loamy and clayey soils with naturally high groundwater, lime-rich to moderate fertility	Unit 5: Freely draining loamy soils, lime-rich	Unit 21 + Unit 8: Loamy and clayey soils with naturally high groundwater, lime-rich to moderate fertility + Slightly acid loamy and clayey soils with slightly impeded drainage, moderate to high fertility
Surface soil texture in sites	Loam	Sandy loam	Sandy loam	Silty clay	Loam on sandy clay	Silty clay
Altitude (metres)	20-45	80-110	30-40	< 2	40-50	0-10
Slope %	20	Front Orchard: 20 Bunkhouse & Garden Orchards: 10	Front Orchard: 20 Main Orchard (valley): 5-30	0	0-5	0-5
Aspect	South	Front Orchard: North-east Bunkhouse & Garden Orchards: East-south-east	Front Orchard: East Main Orchard (valley): North-east to North / South-south-west to South	Flat	Flat-East	Flat-East

Table continued...

Factor / site	Slew Orchard	Luscombe Farm Orchards	Colston Farm Orchards	Rummers Lane Orchards	Park Farm Orchard	Broadway Farm Orchards
Rainfall zone (mm)	1061-1290	1291-1690	1291-1690	466-640	466-640	641-740
Atmospheric dry SO2 deposition zones: ranking among sites (1 = least)	1	2	2	5	6	4
Atmospheric dry NO2 deposition zones: ranking among sites (1 = least)	1	1	1	4	6	5
Atmospheric wet SO4 deposition zones: ranking among sites (1 = least)	4	5	5	2	1	3
Atmospheric wet NO3 deposition zones: ranking among sites (1 = least)	4	5	5	2	1	2
Area of orchard patches (ha) intersecting with or within 1 km zone around site: % traditional	0.7: 100%	4.8: 77%	7.8: 86%	69.7: 12%	120.4: 25%	53.7: 100%

Table continued...

Factor / site	Slew Orchard	Luscombe Farm Orchards	Colston Farm Orchards	Rummers Lane Orchards	Park Farm Orchard	Broadway Farm Orchards
Distance to nearest traditional orchard (km)	0.25	Adjacent	Adjacent	Adjacent	0.3	Adjacent
Distance to nearest existing ancient woodland / distance to nearest replanted ancient woodland site if closer	0.2	0.4 / 0.08	0.8	22	0.14	0.67
Orchard present on First Edition Ordnance Survey map: date	No: 1889	Yes: 1889-90	Yes: 1889-90	No: 1886-1888	No: 1872	Yes: 1888-1889
Summary of current orchard management	Lightly grazed by livestock	Organic fruit production, lightly grazed by livestock	Organic fruit production, moderately grazed by livestock	Organic fruit production, moderately grazed by livestock	Heavily grazed by livestock plus supplementary feeding of livestock	Mostly ungrazed

Notes: Atmospheric dry SO_2 deposition: range 3 to > 14 kg/ha/year; Atmospheric dry NO_2 deposition: range 2.1 to 6.7 kg/ha/year, Atmospheric wet SO_4 deposition: range < 3.7 to 9.4 kg/ha/year, Atmospheric wet NO_3 deposition: range < 2.7 to >6.2 kg/ha/year. Deposition figures from NEGTAP (2001). Rainfall data from Meteorological Office data for 1971-2000, URL: **www.metoffice.com/climate/uk**. Soil data from the National Soil Map. Unspecified data from Natural England sources, Ordnance Survey map information or field survey information.

Table 6 Habitat features of orchard sites: fruit tree information

Factor / site	Slew Orchard	Luscombe Farm Orchards	Colston Farm Orchards	Rummers Lane Orchards	Park Farm Orchard	Broadway Farm Orchards
Average distance between trees (m)	8.7	6.7	5.6	Range in Area averages 3.9-8.6 Apple: 5.5 Plum: 4	7.1	Remnant areas: c25-40 Stocked areas: 5-10
Density: number/ ha	(129)	(223-230)	(319)	(120-417)	(198)	6-c.82
Canopy cover estimate	Open	Open	Open	Closed	Patchily closed	Patchily closed
Average tree girth all trees (cm) by type	Cherry: 112 Plum (1): 106 Apple (1): 12	Apple: 46 Bunkhouse: 56 Front: 36	Apple: 51	Apple: 112 Range in Area averages for apple: 57-193 Plum: 55	Cherry: 128	Apple:116 Pear: 136 Plum: 88
Average tree girth excluding young trees < 25 cms girth	Cherry: 179 Plum: as above	Apple: 53 Bunkhouse: 59 Front: 45	Apple: 67	As above	As above	As above
Standing dead trees; estimate of abundance	Occasional	Very rare	Very rare	Occasional	Occasional to locally frequent	Rare (7% of total)
Fallen dead wood: estimate of abundance	Occasional	Very rare	Very rare	Occasional (locally large wood piles on border of site)	Occasional	Occasional
Trees with veteran features (%)*	53	44	40	83	90	[47% +]
Relative amount of veteran tree features (%)*	22	13	14	24	33	[47]

Table continued...

Factor / site	Slew Orchard	Luscombe Farm Orchards	Colston Farm Orchards	Rummers Lane Orchards	Park Farm Orchard	Broadway Farm Orchards
Trees > 25 cm girth with veteran features (%)*	91	52	57	83	90	(47% +)
Relative amount of veteran tree features for trees > 25 cm girth (%)*	38	15	19	24	33	[47]
Epiphytic cover estimate (lichens and bryophytes)	High	High	High	Low- moderate	Low	Low-moderate

Notes:

( ) Derived data, for comparative purposes between sites. Densities for all sites except Broadway calculated from average distances for the sample of trees measured, taking into account row widths if known. However, if local clearings occur within stands elsewhere in the orchard site these figures may be over-estimates. Actual numbers of trees were censused per area for Broadway, average distances derived from density, but note that trees are not uniformly distributed.

* Veteran tree features: seven types recorded for all sites except Broadway, where only hollows were recorded. Relative proportion of veteran tree features (excluding canopy % alive) calculated as total number of features across all trees in sample / maximum possible number (7 x number of trees is sample).

[ ] For Broadway, simple % of trees with hollows is given. The % of trees with veteran tree features would be the minimum estimate as other features would very likely be present on other trees without hollows.

Subjective estimates of dead wood abundance and epiphyte cover were made from a compilation of comments across surveyors.

Table 7 Habitat features of orchard sites: orchard floor, scrub and boundaries

Factor / site	Slew Orchard	Luscombe Farm Orchards	Colston Farm Orchards*	Rummers Lane Orchards	Park Farm Orchard	Broadway Farm Orchards
Grassland sward height (cm)	4-15	2-45	5-10	5-30	2	2-40
Herb cover (%)	20	3-15	60	<1 - 30 (excluding Urtica, 1% or less)	10	1-30
Priority BAP grassland type	Lowland meadow	Lowland meadow	Lowland meadow	None	None	Lowland meadow (local patches)
Scrub cover (%)	< 1	< 1 - 3	< 1	< 1	< 1	22% of trees in scrub, including dense bramble
Priority BAP hedgerow	Present	Present	Present	None	Present	Present

Notes: * Colston Farm Orchards data from Main Orchard only.

Table 8 Total number of lichen, bryophyte, fungus and invertebrate species found in orchard sites

Species group / site	Slew Orchard	Luscombe Farm Orchards	Colston Farm Orchards	Rummers Lane Orchards	Park Farm Orchard	Broadway Farm Orchards*	Total across all sites
Lichens (epiphytes)	80	65	59	44	52	56	131
Bryophytes (epiphytes)	21	19	23	42	12	24	50
Fungi	18	18	31	54	55	61	175
Invertebrates	167	117	139	120	134	201	522
Total	286	219	252	260	253	342	878

Notes: * Invertebrate survey less intensive at Broadway Farm Orchards

Table 9 Epiphytic lichen communities on orchard trees

Community name & appearance	Tree characters / Atmospheric environment of community	Slew Orchard	Luscombe Farm Orchards	Colston Farm Orchards	Rummers Lane Orchards	Park Farm Orchard	Broadway Farm Orchards
Calicion Crust	Old, exposed, dry bark or missing bark / Industrial pollution						Occasional
Parmelion Leafy	Well-lit branches, upper trunks / Unpolluted	Best developed (equal)	Best developed (equal)	Present	Best developed (equal) - one area only	Some species present, probably re-developing	Present
Lecanorion Crust	Well-lit small branches / Low intensity agriculture (species-rich) or industrial pollution (species-poor)	Best developed		Present	Very poorly developed	Species-poor type	
Pertusarion Crust	Branches in some shade / Unpolluted	Present	Present	Present			Present
Graphidion: general Crust	Young, smooth bark and twigs in moderate shade / Unpolluted		Best developed (equal)	Best developed (equal)	Very poorly developed		Almost absent
Graphidion: Pyrenuletum Crust	Deeply shaded bark / Unpolluted						Rare
Pre-Lobarion Micro-crust	Shaded, spongy, sheltered bark / Unpolluted	Present	Present	Present			
Usneion Bushy	Very well-lit trees in humid places, often acid bark / Unpolluted	Present	Best developed	Present			
Xanthorion Leafy	Nutrient rich or hyper-eutrophicated bark / Low intensity agriculture (species-rich) or intensive agriculture, moderate industrial pollution (species-poor)	Occasional	Rare	Occasional	Frequent	Occasional	Frequent

Table 10 Characteristic epiphytic lichen species in communities found on orchard trees

Community	Characteristic lichen species
Calicion	*Calicium glaucellum, Calicium salicinum, Chaenotheca ferruginea, Cliostomum griffithii, Diploicia canescens, Hypocenomyce scalaris*.
Parmelion	Most typical were species such as *Evernia prunastri, Flavoparmelia caperata, Hypogymnia physodes, Hypogymnia tubulosa, Hypotrachyna revoluta, Melanelia fuliginosa ssp. glabratula, Melanelia subaurifera, Parmelia saxatilis, Parmelia sulcata, Parmotrema chinense, Pertusaria albescens, Pertusaria amara, Punctelia subaurifera, Punctelia ulophylla and Ramalina farinacea.* Southern or western elements were *Flavoparmelia soredians, Parmelina pastillifera, Parmelinopsis horrescens and Parmelinopsis minarum.* A mainly eastern species was *Parmelina tiliacea*
Lecanorion	*Buellia griseovirens, Candelariella reflexa, Fuscidea lightfootii, Gyalideopsis anastomosans, Lecanora jamesii, Micarea coppinsii, Mycoblastus fucatus, Ochrolechia inversa, Phlyctis argena, Placynthiella icmalea*. Species-poor variant had *Lecanora conizaeoides* and *Scoliciosporum* spp. intermixed with *Melanelia subaurifera*.
Pertusarion	Occasional *Arthonia spadicea, Buellia disciformis, Opegrapha vulgata, Pertusaria hymenea, Pertusaria leioplaca, Pertusaria multipuncta, Pertusaria pertusa.*
Graphidion: general	Species characteristic of twigs included *Arthonia punctiformis*, *Arthonia didyma*, *Arthonia radiata*, *Arthopyrenia punctiformis* and *Opegrapha atra*. Small branches had *Lecania naegelii*, *Lecanora albella*, *Lecanora carpinea*, *Lecanora chlarotera*, *Lecanora confusa*, *Lecidella elaeochroma*, *Mycoporum antecellens* and *Rinodina sophodes*. Where bark was moderately shaded *Graphis elegans*, *Graphis scripta* and *Phaeographis dendritica* became conspicuous.
Graphidion: Pyrenuletum	*Trentepohlia* occurs as algal partner of *Anisomeridium polypori, Dimerella pineti, Opegrapha atra, Opegrapha sorediifera, Opegrapha varia, Opegrapha vermicellifera, Opegrapha vulgata* and *Porina aenea.*
Pre-Lobarion	*Anisomeridium polypori, Normandina pulchella* and *Opegrapha vermicellifera, Lepraria lobificans.* Less common associates included *Agonimia tristicula, Bacidia arceutina, Bacidia rubella, Caloplaca obscurella, Dimerella pineti* and *Gyalecta truncigena.* Rarer lichens were *Bacidia phacodes, Caloplaca phlogina, Lauderlindsaya acroglypta, Leptogium teretiusculum* and *Ramonia chrysophaea*.
Usneion	Generally high cover of *Ramalina* spp. and *Evernia prunastri*. Species of exposed twigs and branches were *Usnea articulata, Usnea cornuta, Usnea flammea* and *Usnea subfloridana*, *Usnea esperantiana* and *Usnea rubiginosa.*
Xanthorion	Frequent *Phaeophyscia orbicularis*, *Physcia adscendens*, *Physcia tenella*, *Physconia grisea*, *Xanthoria candelaria*, *Xanthoria parietina* and *Xanthoria polytropa* joined by *Hyperphyscia adglutinata* and *Candelaria concolor*. Nitrophyte species new to the British lichen flora such as *Bacidia neosquamulosa* and *Lecanora barkmaniana* may or may not belong here.

Table 11 Number of bryophyte species found in each site on different fruit tree species

Fruit tree type / site	Slew	Luscombe	Colston	Rummers Lane	Park Farm	Broadway	No of obligates	Total species all sites
Apple	12	19	23	42	0	23	12	48
Cherry	18	0	0	0	12	0	3	22
Pear	0	0	0	0	0	14	1	14
Plum	0	0	0	10	0	12	2	12
Total species	21	19	23	42	12	24		50
Obligates among total	4	8	11	14	3	9	17	

Table 12 Number of bryophyte species on different fruit trees from individual tree sample data

Fruit tree type	Number in sample (Number with bryophytes)	Average girth of trees (cm)	Average number of species / tree	Percent of species which are obligates / tree*
Apple	73 (72)	109	6.43	25.5
Cherry (Slew)	18 (17)	183	3.33	5.0
Pear (Broadway)	6 (5)	167	1.5	6.7
Plum (Broadway)	18 (17)	75	1.94	10.8

Notes: No details of species on individual trees were recorded at Park Farm Orchard.

Table 13 Number of bryophyte species from individual apple tree sample data for different sites

Site	Number in sample (Number with bryophytes)	Average girth of trees (cm)	Average number of species / tree	Percent of species which are obligates / tree*
Slew	7	104	5.57	23.6
Luscombe	15	62	5.53	42.6
Colston	14 (13)	81	7.79	28.3
Rummers	21	146	8.1	21.6
Broadway	16	132	4.25	13.0

Notes: * Trees without bryophytes were excluded from the percent of species which were obligates / tree. No details of species on individual trees were recorded at Park Farm Orchard.

Table 14 Number of fungus species associated with habitats in orchard sites

Associated habitat	Slew	Luscombe	Colston	Rummers Lane	Park Farm	Broadway	Total all sites
Grassland	3	2	18	14	15	16	52
Grassland with trees or scrub	4	3	6	3	2	11	26
Soil + dung + fire site habitats	0	0	0	0	7	1	8
Wood and fruit	11	13	6	36	31	33	87
Other	0	0	1	0	0	0	1

Table 15 Number of invertebrate species in habitat assemblages in orchard sites

Assemblage	Slew	Luscombe	Colston	Rummers Lane	Park Farm	Broadway *	Total all sites
Canopy inc mistletoe	21	22	24	25	19	14	70
Carrion	0	0	0	1	1	0	2
Dung	2	1	8	3	3	3	12
Epiphyte	16	13	13	6	4	19	31
Field layer	55	44	46	28	20	27	141
Freshwater	2	0	1	2	2	0	4
Generalist & Generalist (D)	6	3	3	4	6	21	33
Ground total & Ground layer +	19	14	14	12	35	30	78
(Under) ground	0	0	0	0	0	1	1
Mosaic (C, F) & (C, F, G)	4	2	2	2	3	5	9
Nests inc (B & W)	0	0	1	2	0	1	4
Saproxylic	42	19	26	35	41	79	135
Unknown	0	0	1	0	0	0	1
Wetland	0	0	0	0	0	1	1
Total	**167**	**117**	**139**	**120**	**134**	**201**	**522**

Notes: * Invertebrate survey less intensive at Broadway Farm Orchards. For assemblage abbreviations see paragraph 3.9.

Table 16 Rarity and conservation status of lichens, bryophytes and fungi in orchard sites

Rarity / conservation category	Slew	Luscombe	Colston	Rummers Lane	Park Farm	Broadway Farm	Total species
Lichens							
International Responsibility	3	1	1				5
Schedule 8 Wildlife & Countryside Act	1						1
Red Data Book: Vulnerable	1						1
Red Data Book: Near Threatened	2	1	1				4
Nationally rare				1	2		3
Nationally scarce	4		1		5	1	8
Total Red Data and nationally rare/scarce	7	1	2	1	7	1	16
Bryophytes							
New Vice-County Records (Local rarity)				2			2
Fungi							
Priority BAP species			1				1
Provisional Red Data List			2	1			
Rare (<100 records) in British Mycological Society Database	1	1	1	1	3	3	
Total Red Data and Rare	1	1	3	2	3	3	13
Waxcap grassland species: Hygrocybe spp			6	3	2	1	
Total waxcap grassland species	2		11	5	4	1	19

Notes: Total species in above table and following two tables equals the number of species from combined data. Some species occur on more than one site so the overall total may differ from a sum of site figures.

Table 17 Rarity and conservation status of invertebrates found in orchard sites

Rarity / conservation category	Slew	Luscombe	Colston	Rummers Lane	Park Farm	Broadway Farm *	Total species
Priority BAP species					1	1	2
Red Data Book 2 (Vulnerable)						3	3
Red Data Book 3 (Rare)	1						1
Red Data Book K (Insufficiently known)					1		1
Nationally Scarce (16-100 ten km sqs, A or B not distinguished)	1	1	2			3	5
Nationally Scarce A (16-30 ten km sqs)				1	3	5	7
Nationally Scarce B (31-100 ten km sqs)	3	4	5	2	5	16	28
Total Red Data & nationally scarce	5	5	7	3	9	27	45
Local	26	15	18	12	14	55	97
Rare and scarce species by assemblage							
Canopy			1			1	2
Epiphyte	1						1
Field layer	1	4	2				4
Ground layer			1			2	3
Saproxylic	3	1	3	3	9	24	35
Local species by assemblage							
Canopy		2	1		1	2	4
Dung			2		1	1	2
Epiphyte	4	6	5	1		7	13
Field layer	6	4	4	2		5	17
Freshwater	1		1				1
Generalist						4	4
Ground layer	2				2	6	9
Nests				1		1	2
Saproxylic	13	3	5	8	10	28	44
Wetland						1	1

Notes: * Less intensive sampling at Broadway Farm Orchards compared to other sites.

Table 18 Number of lichen and beetle species identified as Indices of Ecological Continuity in orchard sites

Group	Slew	Luscombe	Colston	Rummers Lane	Park Farm	Broadway Farm *	Total species
LICHENS (number)	8	5	4				12
BEETLES (number: weighted score)	2: 2			1: 1	6: 7	13: 20	21: 29

Invertebrate IEC are scored as IEC 1, IEC 2, IEC 3: IEC 1 is most faithful to ancient sites (Alexander 2004).

4 Slew Orchard

Landscape setting

4.1 Slew Orchard is a small orchard situated about 0.5 km north of Latchley, near Tavistock, on the northern side of the River Tamar (Figure 2). The orchard is within the Tamar Valley Area of Outstanding Natural Beauty. The orchard is on a south-facing slope, which varies in angle from gentle to fairly steep (Table 5). The surrounding landscape is largely made up of grassland fields enclosed by hedgerows but is also quite heavily wooded. Slew Orchard is connected to the hedgerow network on its north-western boundary and to woodland 0.2 km to the west of the orchard by a belt of trees and scrub running from the south-western edge of the orchard. Pasture surrounds three sides of the orchard and a mown grassland lies along the southern side. Other orchards are scarce within 1 km of the site, and amount to less than 1 ha in area. The closest orchard is 0.25 km away and is traditionally managed. At a national scale, the area is in a relatively high rainfall zone (Table 5), with low levels of atmospheric dry deposition of sulphur and nitrogen but relatively high levels of wet deposition of these two elements (Table 5).

History and management

4.2 Slew Orchard is composed mainly of standard cherries, but also has some scattered apples, two pears and one plum. The Tamar Valley was once an important area for cherry growing (Common Ground 2000). The first cherry orchards were planted around the end of the 18th century and the market boomed in the following century, particularly due to an escalating demand from the increasing mining population nearby. The Ordnance Survey First Edition 1:10560 map of 1889 shows abundant evidence of mining activity, with the nearest mine being 0.35 km to the east of the site and 0.2 km, across the river, to the south. The urban market of Plymouth was only 20 km away and improved rail links opened up an even wider market in the early years of the 20th century.

4.3 The 1889 map shows that Slew Orchard was not present at that time, its site being occupied by Slew Wood. This 17 ha woodland has since been largely cleared except for two remnants of 1.1 ha and 2.2 ha. Slew Wood is identified as ancient woodland on the provisional ancient woodland inventory for Devon (Lister & Pinches 1986). Slew Orchard is at the eastern end of the former Slew Wood, and is still connected by a belt of trees to the remaining patches, as described in paragraph 4.1 above. Interestingly, the extent of other orchards within 1 km was still relatively low (16 ha in total) on the First Edition maps of the area dated 1889 - 1891. These maps show that another ancient woodland lay only 0.5 km to the east of the site. This woodland of over 200 ha still exists but has largely been replanted with conifers. Slew Orchard was planted sometime in the early years of the 20th century.

4.4 After World War Two the demand for cherries declined and many orchards were grubbed out. Slew Orchard survived probably because it was amongst the last to be planted so the trees were younger and still quite productive. Around 1980 the tops of the old cherry trees in Slew Orchard were lopped off in an unsuccessful attempt to prolong their lives.

4.5 The orchard was put into a Countryside Stewardship Scheme (CSS) agreement in 1998. Under this agreement, active management is now underway to conserve the orchard. Restorative pruning is being carried out to prolong the life of the old trees as long as possible, including removing parts affected by *Taphrina wiesneri*, a parasitic fungus that stops the trees from fruiting. Young cherries and apples have been planted into gaps in the orchard (Figure 2), using old varieties, including those found in Slew Orchard. Most dead trees have been left either standing or where they fell, to provide dead wood habitat for wildlife.

4.6 Under the CSS agreement, the grassland is lightly sheep grazed, although there has been occasional grazing by cattle in the past. The animals have no supplementary feeding. The *Urtica dioica* (common nettle) patches are topped. The agreement also includes hedgerow planting and management. Provision of educational access is an additional part of the agreement.

4.7 A major concern of the manager of the orchard was the age structure of the trees, given the gap in ages between newly planted trees and the old trees. When the old trees die, there will be no replacement by trees in a mature stage of life in the short term. There were also concerns about sheep causing patches of bare ground by congregating beneath trees, and encouraging growth of nettles through eutrophication by accumulation of dung. The lack of pollinating insects, thought to be due to the decline of wild bee colonies, was another concern.

Fruit tree survey

4.8 The sample of trees measured in the orchard showed that trees were on average 8.7m apart (Table 19). The canopy was classed as open, with gaps between canopies of adjacent trees. The measurements indicate the strongly 'bimodal' distribution of sizes, with the larger cherry trees greater that 25 cm girth having an average girth of 179 cm (Table 19), the smaller trees averaging 15 cm girth. A very high proportion of the large trees showed veteran tree features and the relative amount of veteran tree features in this part of the sample was only exceeded by Broadway Farm Orchards (Table 6). Standing dead trees and fallen dead wood were present occasionally across the site. Climbers present were ivy (*Hedera helix*) and honeysuckle (*Lonicera periclymenum*), while bramble (*Rubus fruticosus agg*) and elder (*Sambucus nigra*) also occurred around the base of some trees. Scrub cover overall in the orchard was less than 1%.

Orchard floor habitats

4.9 The orchard floor vegetation was grassland, which was fairly rich in vascular plants, especially on the lowest and steepest parts of the bank (Figure 3). Here, the grassland comprised a mix of fine grasses, such as *Anthoxanthum odoratum* (sweet vernal-grass) and *Festuca rubra* (red fescue), as well as occasional *Lotus corniculatus* (common bird's-foot-trefoil), *Lathyrus pratensis* (meadow vetchling) and other herbs. The grassland appeared to be MG5a *Cynosurus cristatus-Centaurea nigra* grassland *Lathyrus pratensis* sub-community, according to the National Vegetation Classification (Rodwell 1992). Elsewhere, the grassland was less species-rich and perhaps transitional to an MG6 *Lolium perenne-Cynosurus cristatus* grassland. The grassland was ranker, with much greater abundance of coarse grasses, such as *Dactylis glomerata* (cock's-foot), as well as *Urtica dioica* patches, which accounted for 3% of the area.

4.10 Beneath many of the older trees the grassland had affinities with woodland ground flora, as species such as *Arum maculatum* (wild arum), *Viola riviniana* (common dog-violet), *Hyacinthoides non-scripta* (bluebell) and *Brachypodium sylvaticum* (wood false-brome) became more common. Other woodland plants, namely *Luzula pilosa* (hairy woodrush), *Anemone nemorosa* (wood anemone), *Digitalis purpurea* (foxglove) and *Veronica montana* (wood speedwell), only occurred directly under the trees. The woodland character of the flora may be a result of the past history of ancient woodland on the site. The vascular plant species list for the grassland is given in Table 20.

4.11 Overall, broad-leaved herbs comprised about 20% of the sward cover. Stands of creeping thistle (*Cirsium arvense*) and nettle (*Urtica dioica*) were present locally, typically beneath the trees. Sward height varied from 4 to 15cm, with the patches of *Urtica dioica* standing taller than the main sward. Litter cover and bare ground were both very sparse, each accounting for less than 1% of the total area, although there were localised patches of bare ground around the bases of many of the bigger trees. The grassland was ungrazed at the time of the visit.

Orchard boundaries

4.12 The orchard was enclosed by hedgerows on banks, with sheep fencing on both sides (Figure 2). There were a number of mature *Fraxinus excelsior* (ash) trees present in the hedgerows. The hedgerows were continuous around the orchard but for descriptive purposes have been split up as shown below in the following paragraph and in Table 21 which gives their vascular plant species composition. The hedgerows sections were all regarded as species-rich under the pre-2007 priority Habitat Action Plan definitions. Two sections had 5 or more native woody species per 30 m, thus qualifying under this criterion and all had a rich herbaceous flora, including seven or more woodland species as defined by the list in the Hedgerow Regulations 1997. Hedgerows with rich basal flora qualified as priority habitat in the pre-2007 HAP definition, although there was no formal definition of this criterion (UK Steering Group 1995). The somewhat arbitrary definition of presence of 7 or more woodland herbs in a 30 m section was employed for the current study. The richness of the hedgerows seemed to reflect the past woodland history of the site.

4.13 The northern boundary was somewhat overgrown (that is, it had not been trimmed recently), with gaps accounting for about 2% of its length. The eastern boundary hedgerow was thinner (leggier) at its base than the northern boundary, and overgrown, with gaps accounting for 5% of its length. The southern boundary was similar in structure to the eastern boundary, being overgrown and leggy, and gaps accounted for less than 1% of its length. The western boundary was the most recently trimmed of the four boundaries, with only one hedgerow tree (*Fraxinus excelsior*, ash). This hedgerow had some large gaps, accounting for 3% of its length.

Epiphytic lichens

Community characteristics

4.14 All trees at this site were examined. The lichen cover was high, reaching 100% on twigs and branches and sometimes above 75% on tree trunks. In total 80 taxa were recorded from this orchard. Of these, 29 were noted only once or twice giving a core population of over 50 lichen taxa. In species diversity terms, the site was the richest for epiphytic lichens and was about 20% richer than Luscombe or Colston Farm orchards. Species recorded are listed in Table 22. Historically, levels of sulphur dioxide have been low in the area. Hawksworth and Rose reported in 1970 that there were less than 30 micrograms per cubic metre of sulphur dioxide in the air. The low levels of atmospheric dry deposition of sulphur and the presence of humid conditions have allowed cherry trees in Slew Orchard to support a rich flora, in contrast to cherry trees at Park Farm Orchard.

4.15 Lichen communities included the *Usneion, Lecanorion, Parmelion, Pertusarion*, pre-*Lobarion* and *Xanthorion*. Dominant or abundant species within these communities included *Hypotrachyna revoluta* (Parmelion), *Physcia tenella (Xanthorion)* and *Ramalina farinacea (Usneion)*. The *Xanthorion*, which indicates nutrient-enriched bark, was only occasionally present. Moist bark of pear trunks had pre-*Lobarion* species, including *Bacidia arceutina, Bacidia phacodes, Bacidia rubella, Caloplaca obscurella, Gyalecta truncigena, Leptogium teretiusculum, Normandina pulchella* and *Opegrapha vermicellifera*.

4.16 The presence of 8 Indicators of Ecological Continuity of ancient woodland and wood pasture (Table 22) in the orchard may be the result of the long history of such woodland in the vicinity of Slew Orchard, which could have enabled colonization of Slew Orchard by these species.

Lichen species of special interest

4.17 ***Parmelinopsis minarum*** the New Forest Parmelia (RDB Vulnerable, Schedule 8): This species was found in several small patches on the south side of a cherry trunk up to a height of 170 cm from the ground. The habitat was open and well lit. The species was first recorded in Britain from crevices of a wall at Bolt Head, Devon (Church and others 1996). Since then, the New Forest and

west Cornwall appear to have become its main strongholds. It has also been found growing on gorse at several Cornish mine sites (Giavarini, 2000) where it occurred alongside *Parmelinopsis horrescens* and *Hypotrachyna revoluta*. This raises doubts over its true rarity as the species is suspected to have been widely overlooked in hyperoceanic areas especially among scrubby vegetation. A re-evaluation of the conservation status of the species is considered to be a priority.

4.18 ***Usnea esperantiana*** (Near Threatened, International Responsibility): This species was occasional on cherry, pear and apple, on trunks and canopy twigs. The distribution of the species is mainly centred in south west England on deciduous trees and scrub.

4.19 ***Parmelinopsis horrescens*** (Near Threatened, International Responsibility): A few scattered patches were found on the south side of a cherry trunk. This location was at the opposite end of the site to *Parmelinopsis minarum*, with which it often grows in south west England.

4.20 ***Arthonia anombrophila*** (Nationally Scarce, possibly Endemic, International Responsibility): A single patch was recorded on a small area of smooth bark on the north side of a pear approximately 2 m up from the ground.

4.21 ***Micarea coppinsii*** (Nationally Scarce): The species is a relatively recently described crustose lichen of twigs and branches of deciduous trees and shrubs, especially those in humid sites. It is probably more common than the current status suggests. It was collected from the canopy twigs of cherry at Slew Orchard.

4.22 ***Lecanora compallens*** (Nationally Scarce): This lichen is a recently described species that may be increasing and might therefore be commoner than current records suggest.

Bryophytes

4.23 Because of the small size of this orchard virtually every tree was examined in detail for epiphytic bryophytes. Overall abundance data for the cherries and apples are provided in Table 23. The vast majority of bryophytes on cherries were present on the exposed roots and base of the trees, or on trunk bosses. Very few mosses were actually present on the branches of cherries, whereas this is where the majority of bryophytes occurred on apple and pear trees. The new saplings had no bryophytes. The samples of bryophytes on 18 individual trees (Table 24) showed that there was considerable variation in numbers of species on the large cherry trees, (from zero to 7 species). Apple (7 trees in the sample) had more species per tree than cherry (Table 24). As was the case for lichens, the cherries in Slew Orchard had more bryophyte species than those at Park Farm Orchard. Ground bryophytes recorded from the orchard floor included *Atrichum undulatum* and *Brachythecium rutabulum*.

Fungi

Habitat associations and characteristics

4.24 Generally, the grassland sward at Slew Orchard was too long for most grassland fungi. The main exception was in the shade of the southern hedge where many of the fungi were found (Table 25). The main group of species recorded in the orchard were associated with wood habitats (Table 25) but no unusual species were encountered. *Laetiporus sulphureus* (chicken of the woods) was present on some of the trees. *Boletus chrysenteron agg*, an ectomycorrhizal species, was found associated with trees on the orchard boundary. *Byssostilbe stilbigera*, a parasite of myxomycetes of dead wood was found in the orchard.

Fungus species of special interest

4.25 ***Entoloma saepium*** (BMSFRD: 4): This species is apparently genuinely rare in Britain. It is thought to be an ectomycorrhizal fungus. This type of fungus forms sheaths around the roots of

vascular plants. *Entoloma* species may form such a symbiotic relationship with the roots of Rosaceae, but this is not yet certain (Noordeloos 1992). *Entoloma saepium* was found close to sloe (*Prunus spinosa*) and hawthorn (*Crateagus monogyna*) growing in the hedgerow around Slew Orchard.

Invertebrates

General overview of assemblages and characteristics

4.26 The main contributions to the invertebrate fauna recorded come from the field layer and the dead and decaying wood (saproxylic) assemblages (56 species and 42 species respectively). The vascular plant species-richness may have influenced the field layer fauna, and the greater proportion of field layer species compared to ground layer species found may reflect the sward structure resulting from the light grazing of the sward. Park Farm Orchard in contrast had a heavily grazed, very short, sward and greater proportion of ground dwelling species were recorded there.

4.27 The relatively high amount of veteran tree features recorded for the larger trees at Slew Orchard (Table 19) probably positively affected the richness of the saproxylic fauna. Slew Orchard had the richest fauna (16 species) living among the epiphytic lichens and bryophytes on the trees (Table 15). The hedgerows provided shelter for invertebrates and mature hedgerow trees provided additional wood decay habitats. Flowering hedgerow shrubs contributed a source of pollen and nectar for flying insects once the fruit trees had finished flowering. Overall, several nationally rare and scarce species were recorded in the orchard (Table 26). Two of the species found were Indicators of Ecological Continuity (Alexander 2004). Their presence was perhaps because of the history of ancient woodland in the area.

Canopy and mosaic fauna

4.28 The canopy foliage fauna in Slew Orchard included the plant bug *Atractotomus mali* and the jumping plant louse *Psylla mali* on apple. Interestingly, the plant bug *Orthotylus ochrotrichus* was present here and is known to feed partly on red spider mites and aphids in certain old traditional orchards (Southwood & Leston, 1959).

4.29 Three species of solitary bee of the genus *Andrena* (*A. haemorrhoa, A. fulva* and *A. dorsata*) were recorded. Whilst not being exclusively associated with fruit-trees such as cherry, these spring bees were recorded nectaring on blossom. These bees require a mosaic of habitats including canopy blossom. They nest on the ground and also forage in the field layer. *Andrena haemorrhoa* was particularly abundant, a welcome finding given the concerns of the site manager about lack of pollinating insects.

Epiphyte fauna

4.30 Slew Orchard supported an interesting species-rich fauna associated with the luxuriant lichen and moss cover of the trunks and boughs of the fruit trees. There was a notable variety of barkflies (Psocoptera), with 12 species noted in 2004, the richest of the orchards visited, along with Broadway Farm Orchards. The fauna included large populations of the uncommon picture-winged barkfly *Loensia fasciata* and *L. variegata*, as well as the uncommon *Enderleinella obsoleta*. Predatory bugs also featured strongly and included *Temnostethus pusillus* and *Loricula elegantula*. Collectively this fauna was more characteristic of ancient wood pasture habitat than any other habitat type.

Species of special interest in epiphyte habitats

4.31 ***Physatocheila smreczynskii*** (Nationally Scarce, Category B): A large population of this lace bug was found. It is a characteristic species of old apple trees and is rare in the south west; only

one site is known in Cornwall. In the 2007 BAP review, this species was recognised as a priority for conservation action.

Saproxylic fauna

Wood-decay species

4.32 A good variety of invertebrates which rely directly on wood-decay habitats were present due to the high proportion of older cherry trees and occasional standing dead trunks and fallen major boughs. The fauna included a speciality of Rosaceous trees, the bark beetle *Scolytus rugulosus*.

Wood-decay species of special interest

4.33 ***Conopalpus testaceus*** (Nationally Scarce, Category B, Indicator of Ecological Continuity Category 3): This was the most significant find. The beetle was taken by beating cherry boughs as well as by the flight interception traps. It develops in the decaying crown wood of a variety of trees, including oak in particular, hornbeam, hazel, plum trees in a number of Gloucestershire orchards (Paul Whitehead pers obs), as well as in ancient blackthorn hedges (Paul Whitehead pers obs). It occurs in old wood pasture and is particularly rare in the south west. The Slew Orchard record appears to be only the second record for Devon, the other being at the ancient wood pasture of Whiddon Park. There is one known site in Cornwall, also an ancient wood pasture. Slew Orchard appears therefore to be a regionally important site for this species.

4.34 ***Scolytus mali*** (Nationally Scarce, Category B): This wood-decay beetle is a speciality of trees in the family Rosaceae and is frequently encountered in traditional orchards.

4.35 ***Orchesia undulata*** (Indicator of Ecological Continuity Category 3): An old wood pasture wood decay beetle, which was found in the traps. *O. undulata* also occurs in wood pasture, at exposed woodland margins, and has been found in old cherry orchards in the Wyre Forest (Smart & Winnall 2006).

4.36 ***Tetrops praeustus***: Although characteristic of traditional orchards in lowland England, and often widespread, this longhorn beetle was of interest at this site as it appears to have not previously been found this far into the south west peninsula of England. Twinn & Harding (1999) show no records for Devon or Cornwall.

4.37 ***Tanyptera nigricornis*** (RDB3): This cranefly was recorded by Dr Malcolm Storey on *Fraxinus excelsior* (Ash) in the hedgerow boundary. The larvae are known occasionally to develop in *F. excelsior* but are more commonly associated with decaying *Quercus* (Oak) and *Betula* (Birch). Whether or not this species utilises fruit trees is unknown.

Fungus associates

4.38 Fruit bodies of the fungus chicken-of-the-woods *Laetiporus sulphureus* located on two of the old cherry trees supported a good range of the more widespread associates. Species present included the shining fungus beetle *Dacne bipustulata* and the hairy fungus beetle *Mycetophagus quadripustulatus*, as well as the uncommon rove beetle *Quedius mesomelinus*. This was the only orchard visited found to support Platypezid flies, which develop in the fruiting bodies of fungi. *Protoclythia modesta*, a saproxylic species associated with *Armillaria mellea* (Alexander 2002a) was taken in flight interception traps on apple and cherry.

Nesting species, predators and parasites

4.39 Some interesting solitary wasps were recorded which have affinities to saproxylic habitats, though are not strictly confined to these habitats. These species included *Rhopalum coarctatum*, an uncommon Sphecid that nests in hollow stems and dead wood. *R. coarctatum* mainly feeds on flies (Diptera) but also takes species from other groups including barkflies (Psocoptera), aphids (Aphidoidea) and beetles in the Staphylinidae family. The rather local solitary wasp *Stigmus solskyi* (Sphecidae) was found at this site. *S. solskyi* utilizes the emergence holes of wood-boring

beetles for nesting. Another Aculeate worthy of mention in this context is *Pemphredon lethifer* (Sphecidae), which nests in broken stems (Richards 1980).

Field and ground layer fauna

4.40 The steep, south-facing grassy banks on the lower slopes were unimproved and herb-rich, and supported an invertebrate fauna typical of unimproved grasslands on warm freely draining soils. Amongst the less widespread species noted were the grass ant *Myrmecina graminicola*, the malachite beetle *Malachius viridis*, and the whorl snail *Vertigo pygmaea*. More widespread species present included the common blue butterfly *Polyommatus icarus*, the sorrel flea beetle *Chaetocnema hortensis*, and the weevils *Strophosoma nebulosum, Miccotrogus picirostris* and *Mecinus pyraster*. Several species of nomad bee were recorded. These bees are called “cuckoo” bees because they lay their eggs in cells provisioned with food for larvae of *Andrena* species, another group of bees. The nomad bees included *Nomada ruficornis* (associated with *A. haemorrhoa*), *N. goodeniana* (associated with *A. nigroaenea*) and *N. flavoguttata* (associated with smaller *Andrena* species such as *A. saundersella* and *A. minutula*).

4.41 The soil fauna included the local ant-guest woodlouse *Platyarthrus hoffmannseggi*, noted here in the nests of *Myrmica ruginodis* ants. The widespread robber fly *Machimus atricapillus* was a feature of Slew Orchard but was not found in any of the other orchards surveyed. It is a general predator found in sheltered sunny situations and the larvae were presumably soil-dwellers in the banks with unimproved grassland. The striking red and black Rhopalid bug *Corizus hyoscyami*, a polyphagous species occurring mainly in southern, coastal regions (Southwood and Leston, 1959) was also found here but at none of the other orchards surveyed.

Field layer species of special interest

4.42 ***Beris fuscipes*** (Nationally Scarce): This soldier fly was taken in the flight interception traps. It is a species most frequent in Britain in the south west, and develops in fens and marshes where sheltered by bushes and woodland edge. It may have been using hedge-bottoms in Slew Orchard.

Table 19 Fruit trees surveyed in Slew Orchard

Obs no	Fruit tree type	Girth cms	Height	Distance to nearest neighbour	Canopy live %	Hollow trunk / branch	Cracks / splits	Rot holes	Rot sites	Bark missing	Bark split	Sap runs
1	Cherry	225	9		60		1	1	1	1		
2	Cherry	79	8		98							
3	Cherry	5	2									
4	Cherry	13	3.5									
5	Cherry	16	4.5									
6	Cherry	16	4									
7	Cherry	23	5	7								
8	Cherry	21	5	7								
9	Cherry	17	4	9								
10	Cherry	174	9	10	20		1	1	1	1		
11	Cherry	171	11	12	90		1	1	1	1		
12	Cherry	189	12	6	95			1			1	
13	Cherry	167	8	8	0			1	1		1	
14	Cherry	197	6	5	95				1			
15	Cherry	207	9	11	98		1		1			1
16	Cherry	207	9	12	99		1		1	1		
17	Cherry	170	10	11	100				1		1	

Table continued...

Obs no	Fruit tree type	Girth cms	Height	Distance to nearest neighbour	Canopy live %	Hollow trunk / branch	Cracks / splits	Rot holes	Rot sites	Bark missing	Bark split	Sap runs
18	Apple	12	2	6								
19	Plum	106	5		100		1	1	1	1		
Average all types		**106**	**7**	**9**	**78**							
Percent all types						**0**	**32**	**32**	**47**	**26**	**16**	**0**

Average girth cherry only - 112

Average girth cherry trees > 25 cm girth - 179

Percent of all trees with a vet character - 53

Percent of trees > 25 cm girth with a vet character - 91

All trees % of possible number of vet charac occurrences - 22

Trees > 25 cm girth % of possible number of vet charac occurrences - 38

Notes: Includes several newly planted trees (8). 19 trees recorded, one (no 11) recently fallen. Only 12 nearest neighbour distances measured. 1 = veteran tree character present.

Table 20 Grassland vascular plant species list for Slew Orchard

Species	Common name	Abundance
Agrostis stolonifera	creeping bent	F
Anemone nemorosa	wood anemone	R
Anthoxanthum odoratum	sweet vernal-grass	A LD
Arum maculatum	lords-and-ladies	R
Bellis perennis	daisy	R
Brachypodium sylvaticum	wood false-brome	R
Cardamine flexuosa	wavy bitter-cress	R
Cardamine pratensis	cuckooflower	O
Cerastium fontanum	common mouse-ear	O
Cirsium arvense	creeping thistle	F
Cirsium palustre	marsh thistle	R
Cirsium vulgare	spear thistle	R
Conopodium majus	pignut	R
Dactylis glomerata	cock's-foot	A
Digitalis purpurea	foxglove	R
Festuca rubra	red fescue	O
Filipendula ulmaria	meadowsweet	R
Fraxinus excelsior	ash	R
Galium mollugo	hedge bedstraw	R
Hedera helix	ivy	R
Holcus lanatus	yorkshire-fog	F
Hyacinthoides non-scripta	bluebell	R
Lathyrus pratensis	meadow vetchling	R
Leontodon hispidus	rough hawkbit	R
Lonicera periclymenum	honeysuckle	R
Lotus corniculatus	common bird's-foot-trefoil	O
Lotus pedunculatus	greater bird's-foot-trefoil	R
Luzula campestris	field wood-rush	O
Luzula pilosa	hairy wood-rush	R
Plantago lanceolata	ribwort plantain	O
Poa annua	annual meadow-grass	R

Table continued…

Species	Common name	Abundance
Poa pratensis	smooth meadow-grass	O
Potentilla anserina	silverweed	R
Pteridium aquilinum	bracken	R
Ranunculus acris	meadow buttercup	R
Ranunculus bulbosus	bulbous buttercup	R
Ranunculus ficaria	lesser celandine	A
Ranunculus repens	creeping buttercup	F
Rubus fruticosus agg.	bramble	R
Rumex acetosa	common sorrel	R
Rumex obtusifolius	broad-leaved dock	F
Stellaria graminea	lesser stitchwort	O
Taraxacum officinale agg.	dandelion	A
Trifolium repens	white clover	A
Urtica dioica	common nettle	O LD
Veronica chamaedrys	germander speedwell	O
Veronica montana	wood speedwell	R
Veronica persica	common field-speedwell	R
Viola riviniana	common dog-violet	R

Notes: D = Dominant, A = Abundant, F = Frequent, O = Occasional, R = Rare, L = Locally (used to modify other categories)

Table 21 Vascular plant species in 30 metre hedgerow sections at Slew Orchard

Species	Common name	North	East	South	West
Acer pseudoplatanus	sycamore		x	x	
Agrostis capillaris	common bent		x		
Allium ursinum	ramsons		x		x
Anemone nemorosa	wood anemone	x	x	x	x
Anthriscus sylvestris	cow parsley				x
Arctium minus	lesser burdock				x
Arum maculatum	lords-and-ladies	x	x	x	x
Asplenium adiantum-nigrum	black spleenwort		x		
Athyrium filix-femina	lady-fern	x			x
Blechnum spicant	hard-fern	x	x		x
Brachypodium sylvaticum	false-brome	x	x		x
Cardamine flexuosa	wavy bitter-cress	x			
Cirsium palustre	marsh thistle				x
Claytonia sibirica	pink purslane			x	
Corylus avellana	hazel	x	x	x	x
Crataegus monogyna	hawthorn	x		x	x
Dactylis glomerata	cock's-foot				x
Digitalis purpurea	foxglove	x	x		x
Epilobium montanum	broad-leaved willowherb				x
Euonymus europaeus	spindle	x			
Euphorbia amygdaloides	wood spurge			x	
Filipendula ulmaria	meadowsweet			x	
Fraxinus excelsior	ash	x		x	
Galium aparine	cleavers	x		x	
Galium mollugo	hedge bedstraw	x	x	x	x
Geranium robertianum	herb-robert	x		x	x
Geum urbanum	wood avens				x
Hedera helix	ivy	x	x	x	x
Holcus lanatus	Yorkshire-fog				x
Hyacinthoides non-scripta	bluebell	x		x	x
Ilex aquifolium	holly	x			

Table continued…

Species	Common name	North	East	South	West
Juncus inflexus	hard rush			x	
Lamiastrum galeobdolon	yellow archangel			x	
Lapsana communis	nipplewort	x			
Lonicera periclymenum	honeysuckle	x			x
Lysimachia nemorum	yellow pimpernel	x			x
Mercurialis perennis	dog's mercury		x	x	
Narcissus sp.	a daffodil			x	
Phleum pratense	Timothy	x			
Phyllitis scolopendrium	hart's-tongue		x		
Poa sp.	a meadow-grass				x
Potentilla anserina	silverweed				x
Potentilla sterilis	barren strawberry	x	x		x
Prunus spinosa	blackthorn		x		x
Pteridium aquilinum	bracken		x		x
Quercus robur	pedunculate oak		x		
Ranunculus bulbosus	bulbous buttercup	x	x		
Ranunculus ficaria	lesser celandine			x	x
Rhododendron ponticum	rhododendron			x	
Rosa arvensis	field-rose			x	x
Rosa canina	dog-rose				x
Rubus fruticosus agg.	bramble	x	x	x	x
Rumex obtusifolius	broad-leaved dock	x	x	x	x
Sambucus nigra	elder	x	x		x
Scrophularia nodosa	common figwort		x		
Silene dioica	red campion	x		x	x
Silene latifolia	white campion		x	x	x
Solanum dulcamara	bittersweet				x
Stachys sylvatica	hedge woundwort				x
Stellaria holostea	greater stitchwort	x	x	x	x
Stellaria media	common chickweed		x		
Tamus communis	black bryony				x
Teucrium scorodonia	wood sage	x			x

Table continued...

Species	Common name	North	East	South	West
Urtica dioica	common nettle	x	x	x	x
Viola riviniana	common dog-violet	x			x
	Outside of 30m sections				
Fraxinus excelsior	ash				x
Ulex europaeus	gorse				x

Notes: x = present. Species underlined = native woody species. Species in bold type = woodland species listed in the Hedgerow Regulations 1997.

Table 22 Lichen species recorded in Slew Orchard

BLS No	Lichen taxa	Abundance	Evaluation & Rarity	Woodland Status
34	*Acrocordia gemmata*	O	LC	-
212	*Amandinea punctata*	O	LC	-
48	*Anisomeridium biforme*	O	LC	-
1588	*Arthonia anombrophila*	R	NS, IR	NIEC(B)
68	*Arthonia punctiformis*	O	LC	-
69	*Arthonia radiata*	O	LC	-
1540	*Arthopyrenia analepta*	R	LC	-
131	*Bacidia arceutina*	R	LC	-
144	*Bacidia delicata*	R	LC	-
161	*Bacidia phacodes*	R	LC	-
164	*Bacidia rubella*	O	LC	-
204	*Buellia disciformis*	R	LC	-
207	*Buellia griseovirens*	O	LC	-
271	*Caloplaca obscurella*	R	LC	-
2317	*Caloplaca phlogina*	R	NS	-
297	*Candelariella reflexa*	R	LC	-
375	*Cladonia coniocraea*	O	LC	-
384	*Cladonia fimbriata*	R	LC	-
429	*Cliostomum griffithii*	R	LC	-
489	*Dimerella pineti*	R	LC	-
491	*Diploicia canescens*	R	LC	-
511	*Evernia prunastri*	F	LC	-
987	*Flavoparmelia caperata*	F	LC	-

Table continued...

BLS No	Lichen taxa	Abundance	Evaluation & Rarity	Woodland Status
521	*Fuscidea lightfootii*	O	LC	-
532	*Graphis elegans*	O	LC	-
533	*Graphis scripta*	O	LC	-
541	*Gyalecta truncigena*	O	LC	-
1125	*Hyperphyscia adglutinata*	R	LC	-
582	*Hypogymnia physodes*	F	LC	-
583	*Hypogymnia tubulosa*	O	LC	-
1013	*Hypotrachyna revoluta*	D	LC	-
636	*Lecanora carpinea*	R	LC	-
639	*Lecanora chlarotera*	F	LC	-
1996	*Lecanora compallens*	R	NS	-
641	*Lecanora confusa*	F	LC	-
797	*Lecidella elaeochroma e.*	F	LC	-
2330	*Lepraria incana s. lat.*	O	LC	-
1629	*Lepraria lobificans*	O	LC	-
848	*Leptogium teretiusculum*	O	LC	NIEC
997	*Melanelia fuliginosa subsp. g*	O	LC	-
1020	*Melanelia subaurifera*	F	LC	-
877	*Micarea denigrata*	R	LC	-
1720	*Micarea coppinsii*	O	NS	-
885	*Micarea nitschkeana*		LC	-
908	*Mycoblastus fucatus*	O	LC	-
75	*Mycoporum antecellens*	R	LC	NIEC
920	*Normandina pulchella*	O	LC	-
924	*Ochrolechia inversa*	O	LC	NIEC
938	*Opegrapha atra*	F	LC	-
964	*Opegrapha varia*	R	LC	-
965	*Opegrapha vermicellifera*	O	LC	-
1015	*Parmelia saxatilis*	O	LC	-
1022	*Parmelia sulcata*	O	LC	-
1008	*Parmotrema chinense*	O	LC	-
999	*Parmelinopsis horrescens*	R	NT, IR	NIEC(B)

Table continued...

BLS No	Lichen taxa	Abundance	Evaluation & Rarity	Woodland Status
1004	*Parmelinopsis minarum*	R	VU (B), Sc8	NIEC (B)
1056	*Pertusaria albescens alb.*	R	LC	-
1058	*Pertusaria amara amara*	F	LC	-
1076	*Pertusaria hymenea*	R	LC	-
1079	*Pertusaria leioplaca*	R	LC	-
1083	*Pertusaria multipuncta*	O	LC	NIEC
1087	*Pertusaria pertusa*	R	LC	-
1100	*Phaeographis dendritica*	O	LC	NIEC
1107	*Phaeophyscia orbicularis*	R	LC	-
1109	*Phlyctis argena*	O	LC	-
1113	*Physcia aipolia*	O	LC	-
1112	*Physcia tenella ten*	A	LC	-
732	*Placynthiella icmalea*	O	LC	-
985	*Punctelia borreri*	O	LC	-
2070	*Punctelia subrudecta s. str*	F	LC	-
1989	*Punctelia ulophylla*	O	LC	-
1228	*Pyrrhospora quernea*	O	LC	-
1234	*Ramalina farinacea*	D	LC	-
1235	*Ramalina fastigiata*	D	LC	-
1469	*Usnea cornuta*	F	LC	-
1516	*Usnea esperantiana*	O	NT, IR	-
1461	*Usnea flammea*	R	LC	-
1470	*Usnea rubiginosa*	R	LC	-
1471	*Usnea subfloridana*	R	LC	-
1530	*Xanthoria parietina*	O	LC	-
1531	*Xanthoria polycarpa*	O	LC	

Notes: D = Dominant, A = Abundant, F = Frequent, O = Occasional, R = Rare. For explanation of BLS number see paragraph 2.17, for Evaluation & Rarity see paragraph 3.14 and for Woodland Status see paragraph 3.11.

Table 23 Bryophytes recorded in Slew Orchard

Bryophyte taxa	Cherry DAFOR	Apple DAFOR*	Obligate epiphytes
Amblystegium serpens	R		
Brachythecium rutabulum	O	R	
Bryum capillare	O		
Dicranum scoparium	O		
Eurynchium praelongum	R		
Frullania dilatata	F	A	1
Frullania tamarisci		O	
Homalia trichomanoides	R	O	
Homalothecium sericeum	R	A	
Hypnum cupressiforme	A	A	
Hypnum resupinatum	A	A	
Isothecium myosuroides	R		
Metzgeria furcata	O	A	
Microlejeunea ulicina	R		1
Mnium hornum	R		
Neckera pumila		R	
Orthotrichum affine	R	R	1
Polytrichum formosum	R		
Rhynchostegium confertum	R	A	
Ulota bruchii	R		1
Zygodon viridissimus		A	
Total	**18**	**12**	**4**
Total species in site = 21			

*Notes: D = Dominant, A = Abundant, F = Frequent, O = Occasional, R = Rare.

Table 24 Number of bryophytes on individual trees in Slew Orchard

Tree type	Girth cm	Number of species	Number of obligate epiphytes	Percent of species / tree obligate epiphytes
Cherry	192	0	0	
Cherry	164	1	0	0
Cherry	189	1	0	0
Cherry	192	1	0	0
Cherry	155	2	0	0
Cherry	180	2	0	0
Cherry	208	2	0	0
Cherry	227	2	0	0
Cherry	176	3	0	0
Cherry	185	3	1	33.3
Cherry	115	4	0	0
Cherry	205	4	0	0
Cherry	137	5	1	20
Cherry	205	5	0	0
Cherry	210	5	0	0
Cherry	182	6	1	16.7
Cherry	179	7	1	14.3
Cherry	201	7	0	0
Average	**183.4**	**3.3**	**0.2**	**5.0**
Apple	116	5	0	0
Apple	103	6	1	16.7
Apple	81	6	2	33.3
Apple	82	5	2	40
Apple	82	8	2	25
Apple	103	4	2	50
Apple	160	5	0	0
Average	**103.9**	**5.6**	**1.3**	**23.6**

Table 25 Fungus species recorded in Slew Orchard

Latin name	Family	Associated habitat	Notes
Armillaria mellea s.l.	Tricholomataceae	Wood	Rhizomorphs on dead cherry trunk
Boletus chrysenteron agg	Boletaceae	Grassland + trees / scrub	Single fruitbody under oak, hazel, birch
Byssostilbe stilbigera		Wood	Synnemata on myxomycete, *Trichia persimilis*
Collybia erythropus	Tricholomataceae	Wood	Single fruitbodies on/by dead wood
Entoloma clypeatum	Entolomataceae	Grassland + trees / scrub	4 fruitbodies under sloe
Entoloma saepium	Entolomataceae	Grassland + trees / scrub	4 fruitbodies under live sloe and hawthorn (and dead sheep!)
Handkea utriformis	Lycoperdaceae	Grassland	1 old fruitbody in grass
Hypoxylon fuscum	Sphaeriaceae	Wood	On dead hazel twig
Laccaria laccata	Tricholomataceae	Grassland + trees / scrub	Fifteen fruitbodies under hazel, bracken
Laetiporus sulphureus	Coriolaceae	Wood	Colony on one dying *Prunus* trunk
Marasmius oreades	Tricholomataceae	Grassland	5 fruitbodies in grass
Mycena galericulata	Tricholomataceae	Wood	Nine toadstools on fallen, dead, decorticate *Prunus* trunk
Mycena stylobates	Tricholomataceae	Wood	Single fruitbody
Phellinus ferruginosus	Phellinaceae	Wood	Dead fruitbody on fallen cherry pole
Phellinus pomaceus	Phellinaceae	Wood	2 fruitbodies on dead plum twig
Psathyrella candolleana	Coprinaceae	Wood	1metre up inside hollow apple trunk
Uromyces muscari	Pucciniaceae	Grassland	On leaves of bluebell
Xylaria hypoxylon	Sphaeriaceae	Wood	Old fruitbody on knot-hole on live apple

Table 26 Invertebrate species recorded in Slew Orchard

Species	Family/Order	Assemblage	UK status	Notes
Drapetisca socialis	Araneida	Epiphyte	Widespread	Under bark on cherry trunk
Nuctenea umbratica	Araneida	Saproxylic	Widespread	Under bark on cherry trunk
Anobium punctatum	Col: Anobiidae	Saproxylic	Widespread	In dead cherry twigs
Grynobius planus	Col: Anobiidae	Saproxylic	Widespread	Swept from grassland
Protapion filirostre	Col: Apionidae	Field layer	Widespread	
Protapion fulvipes	Col: Apionidae	Field layer	Widespread	Swept
Cantharis cryptica	Col: Cantharidae	Mosaic (C, F)	Widespread	Beaten from cherry foliage
Malthodes marginatus	Col: Cantharidae	Saproxylic	Widespread	Beaten from cherry foliage
Rhagonycha lignosa	Col: Cantharidae	Canopy	Widespread	Beaten from hawthorn hedge
Bembidion lampros	Col: Carabidae	Ground layer+	Widespread	Suction sampler at base of plum tree
Dromius quadrimaculatus	Col: Carabidae	Saproxylic	Widespread	Swept from grassland
Dromius quadrinotatus	Col: Carabidae	Saproxylic	Widespread	Beaten from apple branches
Pterostichus madidus	Col: Carabidae	Ground layer	Widespread	From beneath decaying log
Grammoptera ruficornis	Col: Cerambycidae	Saproxylic	Widespread	Larvae develop in dry twigs of various deciduous trees
Rhagium bifasciatum	Col: Cerambycidae	Saproxylic	Widespread	
Tetrops praeustus	Col: Cerambycidae	Saproxylic	Local	Beaten from plum foliage
Chaetocnema hortensis	Col: Chrysomelidae	Field layer	Widespread	Suction sampler from grass bank
Crepidodera ferruginea	Col: Chrysomelidae	Field layer	Widespread	Swept from grass bank on lower slope
Gastrophysa viridula	Col: Chrysomelidae	Field layer	Widespread	Flight interception trap, cherry, shaded, one
Oulema obscura	Col: Chrysomelidae	Field layer	Widespread	Swept
Oulema melanopa sensu lato	Col: Chrysomelidae	Field layer	Widespread	Swept from grassland near hedgerow
Cis boleti	Col: Ciidae	Saproxylic	Widespread	In fungus on dead cherry trunk
Adalia 10-punctata	Col: Coccinellidae	Canopy	Widespread	Beaten from plum foliage

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Coccinella septempunctata	Col: Coccinellidae	Canopy	Widespread	Beaten from apple foliage
Halyzia 16-guttata	Col: Coccinellidae	Canopy	Widespread	Swept beneath apple canopy
[Euophryum confine]	Col: Curculionidae	Saproxylic	Widespread	In red rotten heartwood of old cherry
Barypeithes pellucidus	Col: Curculionidae	Ground layer+	Widespread	Swept beneath apple canopy
Ceutorhynchus floralis	Col: Curculionidae	Field layer	Widespread	
Mecinus pyraster	Col: Curculionidae	Field layer	Local	Suction sampler from grass bank
Miccotrogus picirostris	Col: Curculionidae	Field layer	Widespread	Suction sampler from grass bank
Otiorhynchus singularis	Col: Curculionidae	Canopy	Widespread	Beaten from hawthorn hedge
Phyllobius oblongus	Col: Curculionidae	Canopy	Widespread	Beaten from hawthorn branches
Strophosoma nebulosum	Col: Curculionidae	Field layer	Local	Suction sampler from grass bank
Agriotes sputator	Col: Elateridae	Field layer	Widespread	In water trap
Athous bicolor	Col: Elateridae	Field layer	Widespread	Swept
Athous haemorrhoidalis	Col: Elateridae	Ground layer	Widespread	Flight interception trap, cherry, shaded, one
Melanotus villosus sensu lato	Col: Elateridae	Saproxylic	Widespread	In white rotten heartwood of dead cherry
Dacne bipustulata	Col: Erotylidae	Saproxylic	Local	In *Laetiporus sulphureus* bracket fungus on old cherry tree
Aridius nodifer	Col: Latridiidae	Generalist (D)	Widespread	In *Laetiporus sulphureus* bracket fungus on old cherry tree
Sinodendron cylindricum	Col: Lucanidae	Saproxylic	Local	Under bark on dead cherry wood
Conopalpus testaceus	Col: Melandryidae	Saproxylic	Nb	Two beaten from cherry foliage
Orchesia undulata	Col: Melandryidae	Saproxylic	Local	Flight interception trap, cherry, well-lit, two females
Malachius bipustulatus	Col: Malachiidae	Saproxylic	Widespread	Swept from grass bank on lower slope

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Malachius viridis	Col: Malachiidae	Field layer	Local	Flight interception trap, cherry, well-lit, one
Mycetophagus quadripustulatus	Col: Mycetophagidae	Saproxylic	Local	In *Laetiporus sulphureus* bracket fungus on old cherry tree
Oedemera nobilis	Col: Oedemeridae	Field layer	Widespread	Beaten from hawthorn in hedge
Pyrochroa serraticornis	Col: Pyrochroidae	Saproxylic	Widespread	
Scaphosoma agaricinum	Col: Staphylinidae	Saproxylic	Local	Suction sampler at base of cherry trunk
Aphodius depressus	Col: Aphodiidae	Dung	Widespread	Flight interception trap, cherry, well-lit, one
Phyllopertha horticola	Col: Scarabaeidae	Field layer	Widespread	Beaten from hawthorn in hedge
Leperesinus varius	Col: Curculionidae	Saproxylic	Widespread	Fallen ash bough in hedge; larval tunnels under bark of dead ash branch
Scolytus mali	Col: Curculionidae	Saproxylic	Nb	Galleries under bark of dead cherry trunk
Scolytus rugulosus	Col: Curculionidae	Saproxylic	Local	In dead branches of cherry
Anaspis frontalis	Col: Scraptiidae	Saproxylic	Widespread	
Anaspis garneysi	Col: Scraptiidae	Saproxylic	Widespread	Flight interception trap, cherry, shaded, one
Anaspis humeralis	Col: Scraptiidae	Saproxylic	Widespread	Beaten from cherry foliage
Anaspis maculata	Col: Scraptiidae	Saproxylic	Widespread	Beaten from apple branches
Anaspis regimbarti	Col: Scraptiidae	Saproxylic	Widespread	Flight interception trap, cherry, shaded, one
Quedius mesomelinus	Col: Staphylinidae	Ground layer +	Widespread	In *Laetiporus sulphureus* bracket fungus on old cherry tree
Cylindrinotus laevioctostriatus	Col: Tenebrionidae	Saproxylic	Local	Under bark on dead trunk of cherry
Lagria hirta	Col: Tenebrionidae	Field layer	Widespread	Swept
Machimus atricapillus	Dip: Asilidae	Field layer	Local	On cherry trunk
Peplomyza litura	Dip: Lauxaniidae	Saproxylic	Widespread	Flight interception trap, cherry, well-lit, one

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Protoclythia modesta	Dip: Playpezidae	Saproxylic	Local	Flight interception trap, apple, one
Mesembrina meridiana	Dip: Muscidae	Generalist	Widespread	Sunbathing on lichen (*Parmelia*) on cherry trunk
Rhagio scolopaceus	Dip: Rhagionidae	Field layer	Widespread	On tree trunk
Beris fuscipes	Dip: Stratiomyiidae	Field layer	N	Flight interception trap, cherry, shaded, two males
Beris vallata	Dip: Stratiomyiidae	Field layer	Widespread	Flight interception trap, cherry, well-lit, one
Chloromyia formosa	Dip: Stratiomyiidae	Field layer	Widespread	Beaten from apple foliage
Chorisops tibialis	Dip: Stratiomyiidae	Saproxylic	Widespread	Flight interception trap, apple, three
Pachygaster atra	Dip: Stratiomyiidae	Saproxylic	Widespread	Beaten from cherry foliage
Helophilus pendulus	Dip: Syrphidae	Field layer	Widespread	At grassland flowers
Rhingia campestris	Dip: Syrphidae	Dung	Widespread	Grassland and scrub
Syritta pipiens	Dip: Syrphidae	Field layer	Widespread	At grassland flowers
Haematopa pluvialis	Dip: Tabanidae	Field layer	Widespread	Flight interception trap, cherry, well-lit, two females
Tanyptera nigricornis	Dip: Tipulidae	Saproxylic	RDB3	On ash branch
Cylindroiulus punctatus	Diplopoda	Saproxylic	Widespread	Under bark on dead trunk of cherry
Nemasoma varicorne	Diplopoda	Saproxylic	Local	Under bark on cherry trunk
Ephemera danica	Ephemeridae	Freshwater	Widespread	On Bramble leaf in hedge
Arion subfuscus	Gastropoda	Ground layer+	Widespread	On cherry trunk
Cochlicopa lubrica	Gastropoda	Ground layer+	Widespread	Suction sampler at base of plum tree
Deroceras reticulatus	Gastropoda	Ground layer+	Widespread	Under log
Helix aspersa	Gastropoda	Ground layer+	Widespread	Suction sampler at base of cherry trunk
Lehmannia marginata	Gastropoda	Epiphyte	Widespread	
Oxychilus alliarius	Gastropoda	Ground layer+	Widespread	Suction sampler at base of cherry trunk
Succinea putris	Gastropoda	Ground layer+	Widespread	Swept from grassland
Vertigo pygmaea	Gastropoda	Ground layer+	Local	Suction sampler from grass bank

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Anthocoris nemorum	Hem: Anthocoridae	Canopy	Widespread	Flight interception trap, cherry, shaded, one
Cardiastethus fasciiventris	Hem: Anthocoridae	Saproxylic	Local	Beaten from dead cherry branch
Temnostethus pusillus	Hem: Anthocoridae	Epiphyte	Local	Beaten from cherry branch
Xylocoris cursitans	Hem: Anthocoridae	Saproxylic	Local	Under bark on dead trunk of cherry
Aphrophora alni	Hem: Cercopidae	Canopy	Widespread	Beaten from apple branches
Heterogaster urticae	Hem: Lygaeidae	Field layer	Widespread	Flight interception trap, cherry, shaded, one
Loricula elegantula	Hem: Microphysidae	Saproxylic*	Widespread	Beaten from dead cherry bough
Acetropis gimmerthali	Hem: Miridae	Field layer	Widespread	Swept
Atractotomus mali	Hem: Miridae	Canopy	Widespread	Beaten from apple foliage
Campyloneura virgula	Hem: Miridae	Canopy	Widespread	Flight interception trap, apple, one
Capsus ater	Hem: Miridae	Field layer	Widespread	Swept from grass bank on lower slope
Leptopterna ferrugata	Hem: Miridae	Field layer	Widespread	Swept
Liocoris tripustulatus	Hem: Miridae	Field layer	Widespread	Flight interception trap, cherry, shaded, one
Lygocoris contaminatus	Hem: Miridae	Canopy	Widespread	Flight interception trap, cherry, shaded, three
Lygocoris pabulinus	Hem: Miridae	Canopy	Widespread	Flight interception trap, cherry, shaded, three
Orthotylus ochrotrichis	Hem: Miridae	Canopy	Widespread	Flight interception trap, cherry, shaded, seven including male (dissected)
Phytocoris populi	Hem: Miridae	Canopy	Widespread	Flight interception trap, apple, one
Pithanus maerkeli	Hem: Miridae	Field layer	Widespread	Swept
Stenotus binotatus	Hem: Miridae	Field layer	Widespread	Swept
Palomena prasina	Hem: Pentatomidae	Canopy	Widespread	
Psylla mali	Hem: Psyllidae	Canopy	Widespread	On apple foliage
Corizus hyoscyami	Hem: Rhopalidae	Field layer	Local	Grassland

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Physatocheila smreczynskii	Hem: Tingidae	Epiphyte	Nb	Beaten from apple branches
Andrena dorsata	Hym: Andrenidae	Mosaic (G, F, C)	Widespread	Flight interception trap
Andrena fulva	Hym: Andrenidae	Mosaic (G, F, C)	Widespread	Water trap
Andrena haemorrhoa	Hym: Andrenidae	Mosaic (G, F, C)	Widespread	Water trap
Nomada fabriciana	Hym: Anthophoridae	Field layer	Widespread	Water trap
Nomada flavoguttata	Hym: Anthophoridae	Field layer	Widespread	Swept from grassland near hedgerow
Nomada goodeniana	Hym: Anthophoridae	Field layer	Widespread	Swept from grassland by hedge
Nomada ruficornis	Hym: Anthophoridae	Field layer	Local	Water trap
Apis mellifera	Hym: Apidae	Saproxylic	Widespread	
Bombus lapidarius	Hym: Bombidae	Field layer	Widespread	
Bombus lucorum	Hym: Bombidae	Field layer	Widespread	Swarming
Bombus pascuorum	Hym: Bombidae	Field layer	Widespread	
Lasius niger	Hym: Formicidae	Ground layer	Widespread	Swept from grassland
Myrmecina graminicola	Hym: Formicidae	Ground layer	Local	Two
Myrmica ruginodis	Hym: Formicidae	Ground layer	Widespread	Under logs
Myrmica scabrinodis	Hym: Formicidae	Ground layer	Widespread	Beaten from mature apple
Pemphredon (Cemonus) lethifer	Hym: Sphecidae	Generalist (D)	Widespread	Flight interception trap
Rhopalum (Corynopus) coarctatum	Hym: Sphecidae	Generalist (D)	Uncommon	Flight interception trap
Stigmus solskyi	Hym: Sphecidae	Saproxylic	Widespread	Flight interception trap
Vespa crabro	Hym: Vespidae	Saproxylic	Local	At apple foliage
Vespula rufa	Hym: Vespidae	Generalist	Widespread	Flight interception trap, cherry, shaded, one
Opisthograptis luteolata	Lep: Geometridae	Canopy	Widespread	Beaten from cherry
Celestrina argiolus	Lep: Lycaenidae	Canopy	Widespread	

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Lycaena phlaeas	Lep: Lycaenidae	Field layer	Widespread	
Polyommatus icarus	Lep: Lycaenidae	Field layer	Widespread	In flight
Aglais urticae	Lep: Nymphalidae	Field layer	Widespread	Larvae on nettle (Urtica dioica)
Polygonia c-album	Lep: Nymphalidae	Field layer	Widespread	
Anthocharis cardamines	Lep: Pieridae	Field layer	Widespread	
Artogeia rapae	Lep: Pieridae	Field layer	Widespread	
Gonepteryx rhamni	Lep: Pieridae	Canopy	Widespread	
Pieris brassicae	Lep: Pieridae	Field layer	Widespread	
Maniola jurtina	Lep: Satyridae	Field layer	Widespread	Swept
Parage aegeria	Lep: Satyridae	Field layer	Widespread	
Panorpa germanica	Mecoptera	Field layer	Widespread	Flight interception trap, cherry, shaded, one
Hemerobius micans	Neuroptera	Canopy	Widespread	Flight interception trap, cherry, well-lit, one
Calopteryx virgo	Odonata	Freshwater	Local	
Oniscus asellus	Oniscoidea	Ground layer+	Widespread	Under log
Philoscia muscorum	Oniscoidea	Ground layer+	Widespread	Under log
Platyarthrus hoffmannseggi	Oniscoidea	Ground layer+	Widespread	Under log with Myrmica ruginodis
Porcellio scaber	Oniscoidea	Generalist	Widespread	Under bark on cherry trunk
Dicranopalpus ramosus	Opiliones	Canopy	Widespread	On cherry trunk
Mitostoma chrysomelina	Opiliones	Field layer	Widespread	Suction sampler at base of cherry trunk
Phalangium opilio	Opiliones	Field layer	Widespread	Flight interception trap, apple, one
Chorthippus parallelus	Orthoptera	Field layer	Widespread	Swept
Tetrix subulata	Orthoptera	Field layer	Widespread	Swept
Tetrix undulata	Orthoptera	Field layer	Widespread	At base of cherry trunk
Caecilius flavidus	Psocoptera	Epiphyte	Widespread	Beaten from apple foliage
Ectopsocus briggsi	Psocoptera	Epiphyte	Widespread	Beaten from plum branches
Ectopsocus petersi	Psocoptera	Epiphyte	Widespread	Beaten from cherry branches

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Elipsocus hyalinus	Psocoptera	Epiphyte	Widespread	On dead cherry trunk
Enderleinella obsoleta	Psocoptera	Epiphyte	Local	Beaten from apple foliage
Graphopsocus cruciatus	Psocoptera	Epiphyte	Widespread	Off ivy on cherry trunk
Loensia fasciata	Psocoptera	Epiphyte	Local	Flight interception trap, cherry, shaded, one
Loensia variegata	Psocoptera	Epiphyte	Local	Flight interception trap, cherry, well-lit, three
Mesopsocus unipunctatus	Psocoptera	Epiphyte	Widespread	Beaten from plum foliage
Philotarsus parviceps	Psocoptera	Epiphyte	Widespread	Flight interception trap, cherry, well-lit, one
Stenopsocus immaculatus	Psocoptera	Epiphyte	Widespread	Flight interception trap, apple, one
Stenopsocus stigmaticus	Psocoptera	Epiphyte	Widespread	Flight interception trap, apple, one

Notes: see paragraphs 3.9 and 3.17 for explanations of assemblages and status categories.

* *Loricula elegantula*: difficult to assign to one assemblage. Classified as saproxylic by Alexander 2002a, but sometimes regarded as part of the epiphyte assemblage. It tended to occur among epiphytes in the current survey.

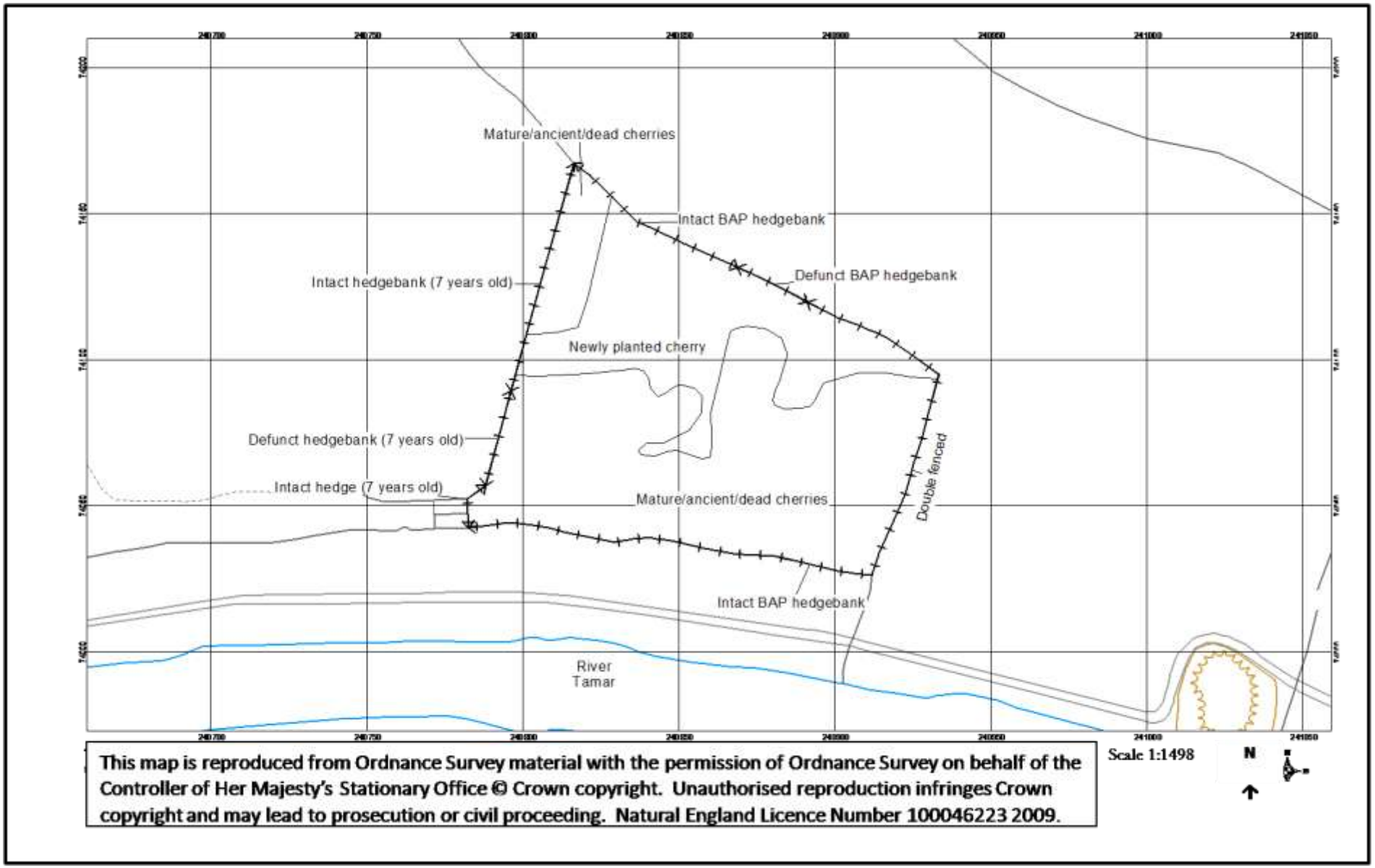

Figure 2 Map of Slew Orchard (SX409741). Orchard type and boundaries map

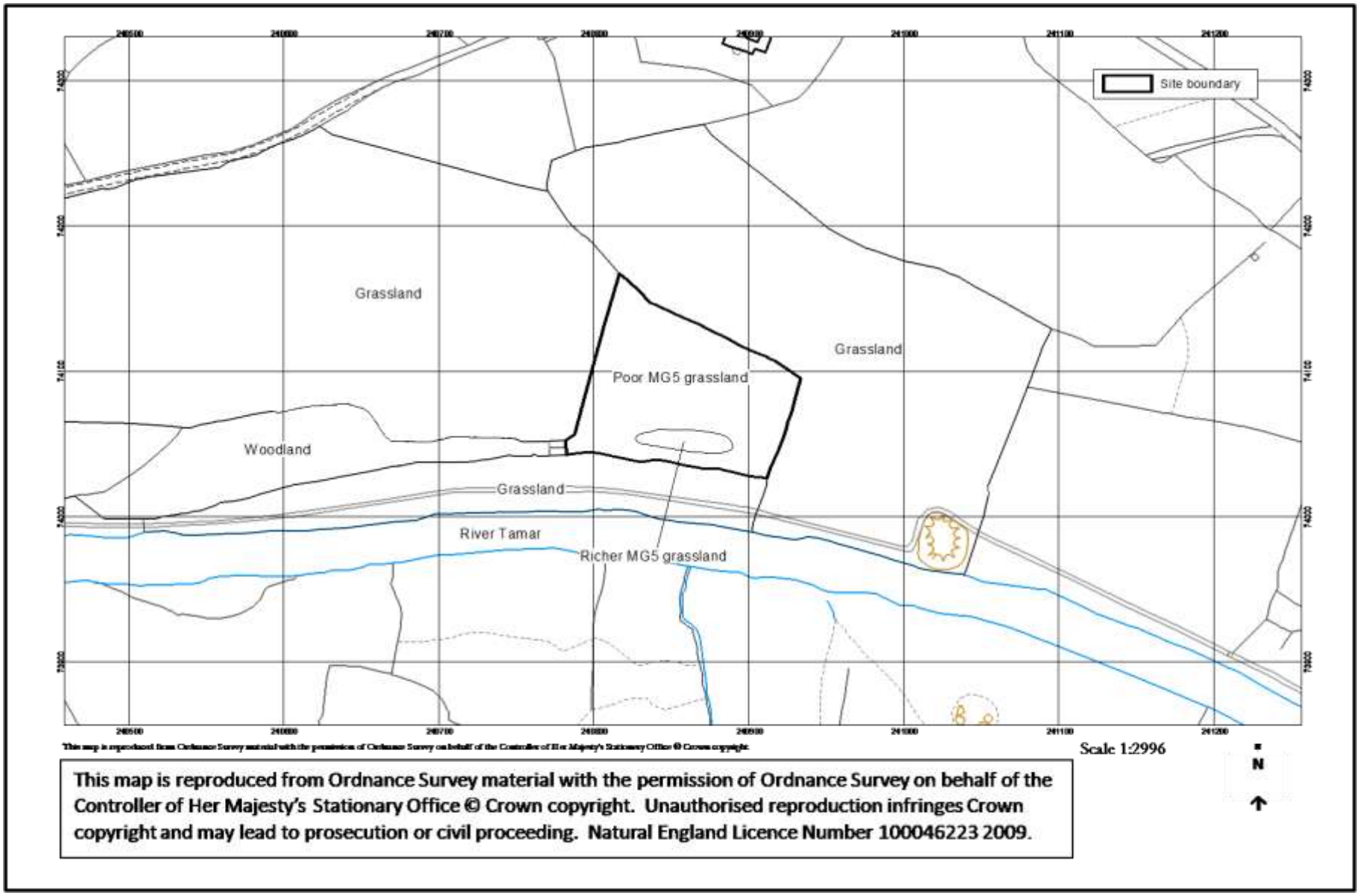

Figure 3 Map of Slew Orchard (SX409741).Orchard floor, surrounding land use and compartments map

5 Luscombe Farm Orchards

Landscape setting

5.1 Luscombe Farm Orchards are a set of three small orchards which lie in a sheltered valley made by a western tributary stream of the River Dart (Figure 4). The stream valley slopes gently down to the main river valley. One of the orchards, Front Orchard, is on the moderately steep north-east facing slopes of the stream, while the other two orchards, Bunkhouse and Garden Orchards, occupy gentle east-south-east facing slopes on the other side of the valley. The site is about 2.5 km south-east of Buckfastleigh in Devon and lies within a wider landscape dominated by grassland, divided into small hedged fields. This pastoral landscape is interspersed with blocks of broad-leaved and conifer woodland and some rough grazing land. Luscombe Farm Orchards are connected by the hedgerow network to surrounding woodland and are adjacent to a newly re-planted orchard. The immediate surroundings of the orchard include grassland and recently planted woodland on a previous orchard site (Figure 5). The nearest established traditional orchard is 0.15 km away, but a more intensively managed orchard is only 0.03 km from the site. The area of orchards within 1 km is less than 5 ha and includes another study site, Colston Farm Orchards (see Section 6). Luscombe Farm Orchards are at a higher altitude (80-110 m) than Colston Farm Orchards, indeed the site is at the highest altitude of all the study sites. On a national scale, the site is in a high rainfall zone, where atmospheric dry deposition of sulphur and nitrogen are relatively low, although wet deposition rates are high (Table 5).

History and management

5.2 Luscombe Farm Orchards are predominantly apple, with a few plums and pears. The orchards are in the South Hams district where orchards and cider production were well-established by the end of the 17th century (Morgan & Richards 1993). Orchards were present in the same compartments on the 1889-1890 First Edition Ordnance Survey 1:10560 map, though most trees now present are considerably younger than this date. Bunkhouse Orchard contains several old trees, probably planted at least 80 years ago. However, most trees in this orchard were standards planted 18 years ago, in 1986. Front Orchard has an individual apple approaching the size of the old trees in Bunkhouse Orchard but the majority are young standard apple, some dating from 22 years ago (1982), others from12-15 years ago (1989-1992) and the most recent from 6 years ago (1999). Garden Orchard is composed of dwarf trees, with trunks of about 1 m in height before branching begins (quarter to half standard). The trees date from 20 years ago (1984).

5.3 The 1889-90 maps show orchards present in the area around Luscombe Farm, though they total less than 20 ha. The nearest ancient woodland (22 ha) is only 0.08 km away but has been re-planted (Lister & Pinches 1986). Hedgerow trees still connect it to Luscombe, across a narrow lane. The closest existing ancient woodland (2 ha) is 1.5 km distant.

5.4 Luscombe Farm Orchards are organically managed (with certification from the Soil Association) and the fruit is hand-picked to produce cider and juice. No sprays have been used. Grease collars to prevent pest attack have not usually been used, though were noticeable on some of the trees. The orchards contain a number of apple varieties, including Beauty of Bath and Bramley. The orchards were once more densely planted than at present, as indicated by 3-4 m distances between some trees compared to the average distance (6.7 m) recorded by the fruit tree survey (see below).

5.5 Most of the pruning of the trees has taken place within the previous three to four years. Deadwood and prunings are removed and used for firewood, hence there was little fallen or standing deadwood left within any of the orchards. The grassland in Front Orchard is managed

by sheep grazing, while Bunkhouse Orchard is strimmed and grazed with two or three ponies plus occasional sheep grazing. Garden Orchard is occasionally grazed by ponies. Domestic fowl are able to wander freely throughout the orchards. The hedges around the orchards are occasionally laid, when required.

Fruit tree survey

Bunkhouse Orchard and Garden Orchard

5.6 Table 27 summarises the information on the trees sampled in Bunkhouse Orchard. Veteran tree features were relatively low in abundance (16%), as would be expected given the age of the trees. The canopy of both orchards was judged to be open with gaps between adjacent trees. The trees in Garden Orchard were not sampled but were all of an even age structure, about 4m tall and spaced about 4m apart. The girth of the trunks in Garden Orchard varied from 30 to 47cm. Most were completely intact, with no rot sites and intact healthy canopies. Ivy was present on some trees in Bunkhouse Orchard and polypody ferns (*Polypodium* species) grew epiphytically on some trees. A few non-fruit trees were present within Bunkhouse Orchard and included *Quercus robur* (pedunculate oak) and *Acer pseudoplatanus* (sycamore). Scrub cover in both orchards amounted to less than 1%.

Front Orchard

5.7 The 19 trees sampled in Front Orchard are described in Table 19. Like the other orchards the canopy was open. Average girth size was smaller than Bunkhouse Orchard (36 cm compared to 56 cm) but average spacing was the same. Again, veteran tree features were relatively low in abundance (9%), in line with the youth of the trees. Ivy was present on some trees and polypody ferns (*Polypodium* species) grew epiphytically on a few trees. Bramble scrub was present but at low cover (3%).

Orchard floor habitats

Grasslands in Bunkhouse Orchard and Garden Orchard

5.8 The main orchard floor habitat was grassland. Bunkhouse Orchard had a type of neutral grassland with a strong woodland component and some ruderal species (Table 28). The grassland appeared to be quite close to a MG5a *Cynosurus cristatus-Centaurea nigra* grassland *Lathyrus pratensis* sub-community (Rodwell 1992), but low grazing and shading from the fruit trees may have led to a community with more affinities to woodland. Coarse grasses (*Dactylis glomerata* and *Holcus lanatus*) were abundant or frequent. There were low abundances of characteristic MG5 species: *Festuca rubra* (red fescue), *Lotus corniculatus* (common bird's-foot-trefoil), *Agrostis* species (bent species) and *Trifolium pratense* (red clover). There was a complete lack of other MG5 species: *Cynosurus cristatus* (crested dog's-tail), *Centaurea nigra* (black knapweed), *Lathyrus pratensis* (meadow vetchling) and *Lolium perenne* (perennial rye-grass). The vegetation also had affinities to W24 *Rubus fruticosus-Holcus lanatus* underscrub community (Rodwell 1991), especially the W24b *Arrhenatherum elatius-Heracleum sphondylium* sub-community. However, it was almost completely lacking in *Rubus fruticosus* agg (bramble). Also lacking from the stand was *Arrhenatherum elatius* (false oat-grass), though this was likely to have been missed so early in the year, and *Taraxacum officinale agg* (dandelion). Whilst the central part of the grassland in Bunkhouse Orchard was undisturbed, the edge, especially in the north, was fairly disturbed and included *Alliaria petiolata* (garlic mustard). Overall, the herb cover was approximately 15%. The grassland structure in Bunkhouse Orchard comprised an average sward height of 5-15 cm, with less than 1% litter and bare ground.

5.9 The grassland in Garden Orchard was much the same in composition to that of Bunkhouse Orchard, with a few additional species: *Cirium palustre* (marsh thistle), *Pentaglottis sempervirens* (green alkanet) and *Hyacinthoides non-scripta* (bluebell). Planted daffodil (*Narcissus* species),

was also present. The herb cover was very low at approximately 3%. At the time of survey the average sward height was approximately 30-45 cm , with less than 1% litter and bare ground.

Grassland species of special interest

5.10 A number of *Cardamine pratensis* (cuckooflower) individuals with double flowers occurred in both orchards, most abundantly in Garden Orchard. The plants appeared to have around sixteen petals instead of four and a further flower with an equivalent number of petals in place of the ovaries. Whether or not these were a planted cultivar of the flower (sold as *Cardamine pratensis flore pleno*) or a natural variation was not clear. However, if these were natural variations then it is likely that they may have a certain genetic value.

Grassland in Front Orchard

5.11 The grassland was similar to Bunkhouse Orchard but with less shading and with finer grasses (*Festuca rubra* and *Anthoxanthum odoratum*) more abundant (Table 29). It appeared to be mainly rather species-poor MG5a *Cynosurus cristatus-Centaurea nigra* grassland *Lathyrus pratensis* sub-community with some elements of W24b *Rubus fruticosus-Holcus lanatus* underscrub *Arrhenatherum elatius-Heracleum sphondylium* sub-community. However, it was still lacking characteristic MG5 species: *Cynosurus cristatus,Trifolium repens, Centaurea nigra* and *Lolium perenne*. Woodland species present included *Mercurialis perennis* (dog's mercury), *Primula vulgaris* (primrose) and *Hyacinthoides non-scripta* (bluebell). Marshy grassland was present at the base of the slope at the northern side of the orchard and had species such as *Cirsium palustre* (marsh thistle). A small stream flowed along the hedgerow at this northern edge of the orchard. Overall, herb cover was approximately 10%. The grassland grazed by sheep at the time of the survey and hence had a fairly short sward of 2-10cm. Less than 1% of the area was bare ground or litter.

Pond and ditch in Bunkhouse Orchard

5.12 Along the southern boundary of the site was a fairly large pond, which had been formed by damming the stream. Several plant species not seen elsewhere in the orchard occurred on the margins or in the pond: *Chrysosplenium oppositifolium* (opposite-leaved golden-saxifrage), *Claytonia sibirica* (pink purslane), *Geranium robertianum* (herb-robert), *Heracleum mantegazzianum* (giant hogweed), *Impatiens glandulifera* (Indian balsam), *Iris pseudacorus* (yellow iris), *Juncus effusus* (soft-rush), *Lamiastrum galeobdolon* (yellow archangel), *Ranunculus repens* (creeping buttercup), *Scrophularia auriculata* (water figwort), *Solanum dulcamara* (bittersweet), *Taraxacum officinale agg* (dandelion), and *Veronica montana* (wood speedwell). Of particular concern was the presence of *Heracleum mantegazzianum* (giant hogweed) that, along with *Impatiens glandulifera*, is an invasive introduction that could form dense stands to the detriment of other vegetation.

5.13 Running west to east through the southern part of the site was a shallow ditch. The edges of the ditch were grassland similar to elsewhere, but the ditch bottom contained a number of wetland species seen around the pond and, in addition, *Scrophularia nodosa* (common figwort).

Orchard boundaries

Bunkhouse Orchard and Garden Orchard

5.14 The boundary types around Luscombe Farm Orchards are summarised in Figure 4. Note that the BAP hedgerows identified on this map are classified according to pre-2007 HAP criteria. A fence divides Garden Orchard from Bunkhouse Orchard. The boundaries around these two orchards included fences, hedgerows and a well-vegetated wall. The northern boundary of Bunkhouse Orchard consisted of a hedgerow with trees and had been fenced on the orchard side. On the other side of the hedgerow was a track. The hedgerow was less than 30m in length, so the whole was treated as a 30m sample. It had four native woody species and seven woodland species listed in the Hedgerow Regulations 1997 in the ground flora. Hedgerows with rich basal flora

qualified as priority habitat in the pre-2007 HAP definition although there was no formal definition of this criterion (UK Steering Group 1995). The somewhat arbitrary definition of presence of 7 or more woodland herbs in a 30 m section was employed for the current study. Species recorded from the northern boundary and from the wall are listed in Table 30. Due to time restrictions the other hedgerows were not surveyed.

Front Orchard

5.15 The boundaries of Front Orchard are shown on Figure 4. Most of the boundaries to this orchard consisted of hedgerows, plus hedgerow trees together with sheep fencing, though in places only fences was present. The hedgerows had gaps in places. Part of the western hedge and the south-eastern corner had been recently laid. The hedgerows were identified as species-rich, containing seven native woody species and seven woodland herbs as defined by the Hedgerow Regulations 1997. The northern and western sections were particularly rich. However, no separate species list was produced for each section of hedgerow. An aggregated list is given in Table 31.

Epiphytic lichens

Community characteristics

5.16 Bunkhouse Orchard and a few trees in Front Orchard were chosen for detailed study. These trees were selected subjectively so that a range of trees and situations could be surveyed in the time available. Most of the trees studied were different varieties of apple, but pear was also examined. In total, 65 lichen taxa were recorded, approximately one-third of which were noted on only one or two occasions. Consequently, the site supports a core lichen flora of approximately 43 taxa. Historically, levels of sulphur dioxide have been low in the area. Hawksworth and Rose reported in 1970 that there were less than 30 micrograms per cubic metre of sulphur dioxide in the air. The low levels of atmospheric dry deposition of sulphur and the presence of humid conditions have allowed a rich lichen flora to survive.

5.17 The lichen communities appeared to be representative of at least five different community types (James and others 1977), the *Parmelion, Xanthorion, Graphidion,* pre-*Lobarion* and *Usneion*. The pre-*Lobarion* community is made up of species with a particular preference for moist, spongy, bark crevices and surfaces, yet not persistently damp enough to have attracted large quantities of bryophytes. The presence of bryophytes, however, appears to favour certain lichen taxa that require moderately damp conditions and additional anchorage, and abhor drying out, for example, *Agonimia tristicula, Lepraria lobificans* and *Normandina pulchella*. *Leptogium teretiusculum* was another key component of this community at Luscombe Orchards, as was *Caloplaca obscurella*. The community is best developed on tree trunks that have a well-developed radial canopy providing sufficient shade and shelter to be capable of protecting the bark from drying out during periods of very warm weather. Dominant or abundant species in other communities were *Arthonia punctiformis* (*Graphidion*), *Hypotrachyna revoluta* (*Parmelion*), *Physcia tenella* var. *tenella* (*Xanthorion*), *Punctelia subrudecta* (*Parmelion*) and *Ramalina farinacea* (*Usneion*). The *Xanthorion*, which is indicative of nutrient-enriched bark was generally rare.

5.18 The presence of 5 Indicators of Ecological Continuity of ancient woodland and wood pasture (Table 32) in the orchards may be the result of the long history of woodland in the vicinity, and perhaps also the long-term presence of orchards on the site and nearby, which has enabled these Indicator species to survive in Luscombe Farm Orchards. Another factor may be a history of low levels of air pollution.

Lichen species of special interest

5.19 *Usnea articulata* (Near Threatened, International Responsibility): This lichen, sometimes called the ‘string of sausages’ lichen, is known to be locally abundant in parts of south west England. In

Luscombe Farm Orchards it occurred mostly on twigs in the canopy of apple trees in humid yet well-lit, well-ventilated, situations. It was seen on about 10 trees.

Bryophytes

5.20 Each orchard was recorded separately, and species found are shown in Table 33. Individual sample trees were only recorded from Garden and Front Orchards (Table 34). The largest number of species was found in Bunkhouse Orchard (18). Front Orchard had 13 species. Garden Orchard was interesting in that, although very small, it provided an opportunity to examine bryophytes on dwarf apples. While fewer species were found (10), there was much higher cover of *Frullania dilatata* on the dwarf stock compared to other trees in Luscombe Orchards. Another feature of these orchards was the considerable variation in abundance (and presence) of bryophyte species over short distances. Generally young trees had very little moss cover. The individual sample trees (all apple) showed that the number of species per tree was considerably less than the average for apple in Colston Farm Orchards but similar to the average in Slew Orchard (Table 13). No ground-dwelling bryophytes were recorded.

Fungi

Habitat associations and characteristics

5.21 Luscombe Farm Orchards yielded relatively few fungi (Table 35). Fungi associated with wood formed the largest group. Only a few grassland fungi were recorded. Most of the fungi in Bunkhouse Orchard were associated with a woodpile and damp areas around a pond and its outflow stream. The common fungus *Inocybe sindonia* occurred on damp ground in this area. Damp logs around an old bonfire site near the pond were quite productive for dead wood fungi in the spring, but had been cleared up by the autumn. Garden Orchard was generally unproductive, as was Front Orchard, which, at the time of the fungus surveys, had very long grass and thus was unsuitable for many grassland fungus species. It also had several bonfire sites that were too dry to be productive. The hedgerows were generally overgrown, though had recently been cut back in places. They were unproductive for fungi.

Fungus species of special interest

5.22 *Simocybe haustellaris* (BMSFRD: 91): This species was found on logs around an old bonfire site in Bunkhouse Orchard.

Invertebrates

General overview of assemblages and characteristics

5.23 Bunkhouse Orchard was the main focus of the survey work, although Front Orchard was also visited. The field layer made the largest contribution to the fauna recorded in Luscombe Farm Orchards (Table 15), probably reflecting the structure of the lightly grazed grassland sward and the range of plant species it contained. The marshy grassland in Front Orchard was a particularly notable habitat for several nationally scarce species.

5.24 The site overall had the fewest number of saproxylic invertebrates (Table 15) among the sites surveyed. The lack of fallen dead wood and relatively young age of the trees, which have not developed veteran tree features yet, are likely to be the reasons for the limited saproxylic fauna. No Indicators of Ecological Continuity were found amongst the saproxylics, again probably because of the lack of suitable habitat. The continuity of orchards and ancient woodland in the area may mean that such species might have been present if suitable habitat had been available within the orchards. It would be interesting to record the orchards over future years to study the colonization patterns among saproxylic invertebrates to see if Indicators and other species arrive

from local source pools for these species. The high cover of lichens and bryophytes supported a rich fauna associated with epiphytes, the number of species recorded (14) in this assemblage was only surpassed by Slew Orchard (Table 15).

5.25 Beehives were present at the northern edge of Garden Orchard and domestic bees, rather than feral or wild bees, were probably the source of the honey bee (*Apis mellifera*) records for the site.

Canopy and mosaic fauna

5.26 The foliage fauna at Luscombe Farm Orchards included such characteristic apple species as the local apple blossom weevil *Anthonomus pomorum* and the more widespread plant bug *Atractotomus mali* and the jumping plant louse *Psylla mali*, as well as woolly aphid *Eriosoma lanigerum*, and the leafhopper *Edwardsiana rosae*. The last species is associated with many plants in the family Rosaceae. Interestingly, the plant bug *Orthotylus ochrotrichus* was present here and is known to feed partly on red spider mites and aphids in certain old traditional orchards (Southwood & Leston 1959).

5.27 Due to the presence of bee hives within this orchard, domestic honeybee *Apis mellifera* was an abundant and important pollinator of fruit trees on this site. Two species of mining bee *Andrena ovatula* (a mosaic assemblage species) and *A. saundersella* (allocated to the field layer assemblage) were also recorded and may visit fruit tree blossom. *A. haemorrhoa*, which was recorded from all the other sites, including nearby Colston Farm Orchards, was not recorded at Luscombe Farm Orchards. However the “cuckoo” nomad bee, *Nomada ruficornis*, which parasitises the nests of this *Andrena* species, was present, suggesting that *A. haemorrhoa* may have been overlooked.

Epiphyte fauna

5.28 An interesting species-rich fauna was associated with the luxuriant lichen and moss cover of the trunks and boughs of the fruit trees. Species present included a large population of the local tree snail *Balea perversa* (probably the recent segregate *B. heydeni*), although bristly millipede *Polyxenus lagurus*, which was plentiful at the nearby Colston Farm Orchards, appeared to be absent. A good variety of barkflies (Psocoptera) were present with ten species noted, including large populations of the local picture-winged barkfly *Loensia fasciata* and *L. variegata*, as well as the local *Reuterella helvimacula* and *Trichadenotecnum sexpunctatum*. The predatory bugs *Temnostethus gracilis* and *Loricula elegantula* were typically associated, as well as the local harvestman *Oligolophus hanseni*. Collectively this fauna was more characteristic of ancient wood pasture habitat than any other habitat type.

Saproxylic fauna

5.29 The orchard supported a limited variety of saproxylics due to the relatively young age of trees. Fewer solitary wasp species were recorded at Luscombe Farm Orchards than at other sites. However, *Stigmus solskyi* (Sphecidae), which nests in the emergence holes of wood-boring beetles, was recorded here. Another commoner eumenid wasp, *Symmorphus mutinensis*, which nests in cut or broken plant stems (Richards 1980) was also found.

Saproxylic species of special interest

5.30 ***Malthinus balteatus*** (Nationally Scarce Category B): This soldier beetle was present as an adult and will have been developing in dead branchwood on site, but probably in a damp shady situation such as alongside the small stream rather than in the fruit tree wood. It is a characteristic species of wooded Dartmoor river valleys.

5.31 ***Tetrops praeustus***: Although characteristic of traditional orchards in lowland England, this local longhorn beetle was of interest at this site as it appears to have not previously been found this far into the south west peninsula of England. Twinn & Harding (1999) show no records for Devon or Cornwall.

Field layer and ground layer fauna

5.32 Bunkhouse Orchard supported a species-poor grassland fauna typical of nutrient-enriched pastures. Front Orchard, which had areas of rather more herb-rich grassland, had characteristic species such as the local plant bug *Pachytomella parallel*a, as well as the more widespread plantain weevil *Trichosirocalus troglodytes*. The presence of marshy grassland in Front Orchard added significantly to the invertebrate conservation interest of this orchard and harboured four Nationally Scarce species (see below).

5.33 A nomad bee, *Nomada flavoguttata*, a field layer species which is associated with some of the smaller *Andrena* species, including *A. saundersella*, was recorded in the orchards. The ant, *Lasius platythorax*, was also found. The extent of the distribution of this species in the UK is unknown at present, though it was also found in Park Farm Orchard.

Field and ground layer species of special interest

5.34 ***Rhinocyllus conicus* (Nationally Scarce, Category B)**: This weevil is well known from Dartmoor but has been recorded from parts of England (Paul Whitehead pers obs). It occurred on marsh thistle (*Cirsium palustre*).

5.35 ***Beris fuscipes* (Nationally Scarce)**: This soldier fly is a species most frequent in Britain in the south west, and develops in fens and marshes where sheltered by bushes and woodland edge.

5.36 ***Meloe violaceus* (Nationally Scarce, Category B)**: Also known as the violet oil-beetle, it is sometimes associated with buttercups (*Ranunculus* species) as an adult, but its larvae are parasitic in the nests of bees (Apoidea), probably solitary species such as *Anthophora* and *Osmia* (Hyman and Parsons 1992).

5.37 ***Callimorpha dominula* (Nationally Scarce, Category B)**: Also known as the scarlet tiger moth, this species is fairly common in its limited south western range in Britain. Larvae were found in the wetter grassland areas of the orchards. The larvae feed on *Symphytum officinale* (comfrey) and a variety of other herbs, often in wetland habitats.

Other fauna

5.38 Greater horseshoe bats are known to have roost sites in the Buckfastleigh area. Luscombe Orchards lie within the favoured 4 km foraging zone around these roosts (English Nature 2000) and may be used for foraging area. However, radio tracking has not, as yet, pin-pointed the orchards as a specific foraging area (Billington 2004).

Table 27 Fruit tree survey at Luscombe Farm Orchards

Orchard	Obs no	Fruit tree type	Girth cms	Height m	Distance to nearest neighbour m	Canopy live %	Hollow trunk / branch	Cracks / splits	Rot holes	Rot sites	Bark missing	Bark split	Sap runs
Bunkhouse	1	Apple	60	5	9.5								
Bunkhouse	2	Apple	38	4.5	9.5								
Bunkhouse	3	Apple	76	4	5	99	1			1		1	
Bunkhouse	4	Apple	93	4.5	8	100			1	1			
Bunkhouse	5	Apple	48	6	8	100				1		1	
Bunkhouse	6	Apple	93	7	6	100			1	1	1		
Bunkhouse	7	Apple	9	2.5	6	100							
Bunkhouse	8	Apple	34	6	9	100				1			
Bunkhouse	9	Apple	61	5	10	100					1	1	
Bunkhouse	10	Apple	42	4.5	5								
Bunkhouse	11	Apple	60	4.5	3		1		1	1	1		
Bunkhouse	12	Apple	46	4	6								
Bunkhouse	13	Apple	38	3	4		1		1	1			
Bunkhouse	14	Apple	32	4.5	5								
Bunkhouse	15	Apple	60	4.5	7								
Bunkhouse	16	Apple	66	5.5	7								
Bunkhouse	17	Apple	60	5	4								
Bunkhouse	18	Apple	53	7	6								

Table continued...

Orchard	Obs no	Fruit tree type	Girth cms	Height m	Distance to nearest neighbour m	Canopy live %	Hollow trunk / branch	Cracks / splits	Rot holes	Rot sites	Bark missing	Bark split	Sap runs
Bunkhouse	19	Apple	106	6	7.5				1				
Bunkhouse	20	Apple	47	6	7.5					1			
Front	21	Apple	6	2	6	100							
Front	22	Apple	27	4	6	100							
Front	23	Apple	71	6	7	100					1		
Front	24	Apple	34	4	3	100				1			
Front	25	Apple	17	3	8	100							
Front	26	Apple	50	4	4	100			1	1			
Front	27	Apple	26	4	4	100							
Front	28	Apple	90	5	8	100			1				
Front	29	Apple	56	5	7	30				1		1	
Front	30	Apple	35	4	6	100							
Front	31	Apple	75	6	12	99	1		1	1			
Front	32	Apple	14	3	10	100							
Front	33	Apple	9	2	11	100							
Front	34	Apple	39	3.5	6								
Front	35	Apple	25	4	6	100							
Front	36	Apple	5	2	4	100							
Front	37	Apple	49	5	6	100				1		1	

Table continued...

Orchard	Obs no	Fruit tree type	Girth cms	Height m	Distance to nearest neighbour m	Canopy live %	Hollow trunk / branch	Cracks / splits	Rot holes	Rot sites	Bark missing	Bark split	Sap runs
Front	38	Apple	27	4	5	100							
Front	39	Apple	31	3.5	7	100							
Average			**46**	**4**	**7**	**97**							
Percent							**10**	**0**	**21**	**33**	**10**	**13**	**0**

Percent of all trees with a veteran character - 44

All trees % of possible number of veteran character occurrences - 13

Percent of trees > 25 cm girth with a veteran character - 52

Trees > 25 cm girth % of possible number of veteran character occurrences - 15

Notes: Only seven trees with canopy state recorded in Bunkhouse Orchard. Of the 20 trees in Front Orchard one was a dead sapling. Data for remaining 19 given above. One of these has no canopy measure. 1= veteran tree characters present.

Table 28 Grassland vascular plant species list for Bunkhouse Orchard

Species	Common name	Abundance
Acer pseudoplatanus	sycamore	O
Achillea millefolium	yarrow	O
Agrostis stolonifera	creeping bent	O
Angelica sylvestris	wild angelica	R
Arum maculatum	lords-and-ladies	R
Bellis perennis	daisy	O
Cardamine flexuosa	wavy bitter-cress	R
Cardamine pratensis	cuckooflower	O
Cardamine pratensis flore pleno	cuckooflower (double-flowered)	R
Cerastium fontanum	common mouse-ear	O
Cirsium vulgare	spear thistle	O
Cruciata laevipes	crosswort	R (LA)
Dactylis glomerata	cock’s-foot	A
Digitalis purpurea	foxglove	R
Dryopteris filix-mas	male-fern	R
Festuca rubra	red fescue	O
Galium aparine	cleavers	R
Geranium molle	dove’s-foot crane’s-bill	R
Geum urbanum	wood avens	R
Glechoma hederacea	ground-ivy	O
Heracleum sphondylium	hogweed	F
Holcus lanatus	Yorkshire-fog	F
Hyacinthoides hispanica	Spanish bluebell	O
Hypochaeris radicata	cat’s-ear	R
Lotus pedunculatus	greater bird's-foot-trefoil	R
Plantago lanceolata	ribwort plantain	F
Potentilla anserina	silverweed	R
Primula vulgaris	primrose	R
Pteridium aquilinum	bracken	R
Ranunculus ficaria	lesser celandine	F
Rubus fruticosus agg.	bramble	R

Table continued…

Species	Common name	Abundance
Rumex obtusifolius	broad-leaved dock	F
Senecio jacobaea	common ragwort	R
Silene dioica	red campion	R
Stachys sylvatica	hedge woundwort	R
Leontodon saxatile	lesser hawkbit	F
Trifolium pratense	red clover	R
Trifolium repens	white clover	A
Urtica dioica	common nettle	O
Veronica chamaedrys	germander speedwell	F

Notes: D = Dominant, A = Abundant, F = Frequent, O = Occasional, R = Rare, L = Locally (used to modify other categories)

Table 29 Grassland vascular plant species list for Front Orchard

Species	Common name	Abundance
Achillea millefolium	yarrow	O
Agrostis capillaris	common bent	O
Ajuga reptans	bugle	R
Angelica sylvestris	wild angelica	O
Anthoxanthum odoratum	sweet vernal-grass	A
Bellis perennis	daisy	O
Cardamine flexuosa	wavy bitter-cress	R
Cardamine pratensis	cuckooflower	O
Cerastium fontanum	common mouse-ear	R
Cirsium palustre	marsh thistle	R
Conopodium majus	pignut	R
Dactylis glomerata	cock’s-foot	F
Euphrasia sp.	eyebright	R
Festuca rubra	red fescue	A
Filipendula ulmaria	meadowsweet	R
Genista tinctoria	dyer’s greenweed	R
Holcus lanatus	Yorkshire-fog	F
Hyacinthoides non-scripta	bluebell	O
Hypochaeris radicata	cat’s-ear	R
Lotus pedunculatus	greater bird's-foot-trefoil	O

Table continued…

Species	Common name	Abundance
Luzula campestris	field wood-rush	O
Lysimachia nemorum	yellow pimpernel	R
Mentha sp.	a mint	F
Mercurialis perennis	dog's mercury	R
Narcissus sp.	daffodil	R
Plantago lanceolata	ribwort plantain	A
Potentilla reptans	creeping cinquefoil	O
Potentilla sterilis	barren strawberry	O
Primula vulgaris	primrose	O
Pteridium aquilinum	bracken	O
Ranunculus acris	meadow buttercup	O
Ranunculus ficaria	lesser celandine	R
Ranunculus repens	creeping buttercup	A
Rubus fruticosus agg.	bramble	F
Rumex acetosa	common sorrel	F
Sambucus nigra	elder	R
Senecio jacobaea	common ragwort	R
Taraxacum officinale agg.	dandelion	F
Trifolium pratense	red clover	F
Urtica dioica	common nettle	R
Veronica chamaedrys	germander speedwell	O
Veronica serpyllifolia	thyme-leaved speedwell	R
Viola sp.	a violet	R

Notes: D = Dominant, A = Abundant, F = Frequent, O = Occasional, R = Rare, L = Locally (used to modify other categories)

Table 30 Vascular plant species lists for the northern boundary hedge and western boundary wall of Bunkhouse Orchard

Species	Common name	North	West
Acer pseudoplatanus	sycamore	x	
Anemone nemorosa	wood anemone	x	x
Asplenium trichomanes	maidenhair spleenwort		x
Corylus avellana	hazel	x	
Cymbalaria muralis	ivy-leaved toadflax		x
Dryopteris filix-mas	male-fern	x	
Festuca rubra	red fescue		x
Fraxinus excelsior	ash	x	
Galium aparine	cleavers		x
Geranium robertianum	herb-Robert		x
Glechoma hederacea	ground ivy	x	
Hedera helix	ivy	x	x
Heracleum sphondylium	hogweed		x
Lamiastrum galeobdolon	yellow archangel	x	
Mercurialis perennis	dog's mercury	x	
Phyllitis scolopendrium	hart's-tongue	x	
Polypodium sp.	polypody	x	
Primula vulgaris	primrose	x	
Pteridium aquilinum	bracken	x	
Rubus fruticosus agg.	bramble	x	x
Sambucus nigra	elder	x	
Silene dioica	red campion		x
Ulmus sp.	elm	x	
Umbilicus rupestris	navelwort	x	
Urtica dioica	common nettle	x	x
Veronica hederifolia	ivy-leaved speedwell	x	
Viola riviniana	common dog-violet		x

Notes: x = present. Species underlined = native woody plants. Species in bold type = woodland species listed in the Hedgerow Regulations 1997.

Table 31 Vascular plant species in the boundary hedgerows of Front Orchard

Species	Common name
Acer pseudoplatanus	sycamore
Corylus avellana	hazel
Crataegus monogyna	hawthorn
Digitalis purpurea	foxglove
Epilobium montanum	broad-leaved willowherb
Fraxinus excelsior	ash
Galium aparine	cleavers
Hedera helix	ivy
Hyacinthoides non-scripta	bluebell
Ilex aquifolium	holly
Lamiastrum galeobdolon	yellow archangel
Lonicera periclymenum	honeysuckle
Mercurialis perennis	dog's mercury
Phyllitis scolopendrium	hart's-tongue
Polypodium sp.	polypody
Primula vulgaris	primrose
Prunus spinosa	blackthorn
Pteridium aquilinum	bracken
Ribes uva-crispa	gooseberry
Rubus fruticosus agg.	bramble
Sambucus nigra	elder
Scrophularia nodosa	common figwort
Senecio jacobaea	common ragwort
Silene dioica	red campion
Silene latifolia	white campion
Sorbus aucuparia	rowan
Teucrium scorodonia	wood sage
Umbilicus rupestris	navelwort
Urtica dioica	common nettle

Notes: Species underlined = native woody species. Species in bold type = woodland species listed in the Hedgerow Regulations 1997

Table 32 Lichen species at Luscombe Farm Orchards

BLS No	Lichen taxa	Abundance	Evaluation & Rarity	Woodland Status
38	*Agonimia tristicula*	O	LC	-
212	*Amandinea punctata*	O	LC	-
48	*Anisomeridium biforme*	O	LC	-
49	*Anisomeridium polypori*	R	LC	-
56	*Arthonia didyma*	R	LC	-
68	*Arthonia punctiformis*	A	LC	-
69	*Arthonia radiata*	F	LC	-
70	*Arthonia spadicea*	R	LC	-
1540	*Arthopyrenia analepta*	R	LC	-
1542	*Arthopyrenia punctiformis*	R	LC	-
271	*Caloplaca obscurella*	R	LC	-
289	*Candelaria concolor*	O	LC	-
297	*Candelariella reflexa*	O	LC	-
375	*Cladonia coniocraea*	R	LC	-
384	*Cladonia fimbriata*	R	LC	-
410	*Cladonia pyxidata*	R	LC	-
511	*Evernia prunastri*	F	LC	-
987	*Flavoparmelia caperata*	F	LC	-
521	*Fuscidea lightfootii*	F	LC	-
532	*Graphis elegans*	O	LC	-
533	*Graphis scripta*	O	LC	-
547	*Gyalideopsis anastomosans*	R	LC	-
582	*Hypogymnia physodes*	O-F	LC	-
583	*Hypogymnia tubulosa*	O	LC	-
1013	*Hypotrachyna revoluta*	A	LC	-
159	*Lecania naegelii*	R	LC	-
639	*Lecanora chlarotera*	F	LC	-
641	*Lecanora confusa*	O	LC	-
658	*Lecanora jamesii*	O	LC	NIEC
797	*Lecidella elaeochroma e.*	F-A	LC	-

Table continued...

BLS No	Lichen taxa	Abundance	Evaluation & Rarity	Woodland Status
1629	*Lepraria lobificans*	O	LC	-
848	*Leptogium teretiusculum*	R	LC	NIEC
997	*Melanelia fuliginosa subsp. g*	O	LC	-
1020	*Melanelia subaurifera*	F	LC	-
75	*Mycoporum antecellens*	O	LC	NIEC
920	*Normandina pulchella*	F	LC	-
927	*Ochrolechia subviridis*	O	LC	-
938	*Opegrapha atra*	O	LC	-
943	*Opegrapha vulgata*	R	LC	-
1015	*Parmelia saxatilis*	R	LC	-
1022	*Parmelia sulcata*	R	LC	-
1007	*Parmelina pastillifera*	R	LC	-
1008	*Parmotrema chinense*	O	LC	-
1058	*Pertusaria amara amara*	O	LC	-
1076	*Pertusaria hymenea*	R	LC	-
1079	*Pertusaria leioplaca*	O	LC	-
1087	*Pertusaria pertusa*	R	LC	-
1100	*Phaeographis dendritica*	R	LC	NIEC
1109	*Phlyctis argena*	O	LC	-
1113	*Physcia aipolia*	F	LC	-
1112	*Physcia tenella ten*	A	LC	-
1168	*Porina aenea*	O	LC	-
2070	*Punctelia subrudecta s. str*	A	LC	-
1989	*Punctelia ulophylla*	F	LC	-
1234	*Ramalina farinacea*	A	LC	-
1235	*Ramalina fastigiata*	F	LC	-
1233	*Ramalina lacera*	R	LC	-
1298	*Rinodina sophodes*	R	LC	-
1322	*Scoliciosporum umbrinum*	R	LC	-
1456	*Usnea articulata*	O	**NT, IR**	NIEC(B)
1469	*Usnea cornuta*	O	LC	-

Table continued...

BLS No	Lichen taxa	Abundance	Evaluation & Rarity	Woodland Status
1461	*Usnea flammea*	O	LC	-
1471	*Usnea subfloridana*	F	LC	-
1530	*Xanthoria parietina*	O	LC	-
1531	*Xanthoria polycarpa*	O	LC	

Notes: D = Dominant, A = Abundant, F = Frequent, O = Occasional, R = Rare. For explanation of BLS number see paragraph 2.17, for Evaluation & Rarity see paragraph 3.14 and for Woodland Status see paragraph 3.11.

Table 33 Bryophytes recorded in Luscombe Farm Orchards

Bryophyte taxa	Bunkhouse: apple DAFOR	Garden: apple DAFOR	Front: apple DAFOR	Obligate epiphytes
Brachythecium rutabulum	O	O	R	
Bryum capillare	R		R	
Cryphaea heteromalla	R			1
Eurhynchium praelongum	R	F	R	
Frullania dilatata	F	F	O	1
Homalothecium sericeum	O		O	
Hypnum cupressiforme	F	O		
Hypnum resupinatum	F	O	F	
Isothecium myosuroides	R		R	
Leucodon sciuroides	R		R	1
Metzgeria furcata		R	F	
Metzgeria temperata	R	R		1
Microlejeunea ulicina	R	O		1
Neckera complanata	R			
Orthotrichum affine	R	R		1
Orthotrichum lyellii	R		R	1
Rhynchostegium confertum	R		R	
Ulota bruchii	R	R	R	1
Zygodon viridissimus	O		R	
Total	**18**	**10**	**13**	**8**

Total species in site = 19

Note: D = Dominant, A = Abundant, F = Frequent, O = Occasional, R = Rare

Table 34 Number of bryophytes on individual trees in Luscombe Farm

Tree type	Girth cm	Number of species	Number of obligate epiphytes	Percent of species / tree obligate epiphytes
Apple	45	7	3	42.9
Apple	36	6	4	66.7
Apple	45	3	1	33.3
Apple	48	6	3	50
Apple	49	5	3	60
Apple	39	2	1	50
Apple	46	4	2	50
Apple	44	7	4	57.1
Apple	50	5	2	40
Apple	42	6	3	50
Apple	116	5	0	0
Apple	96	7	1	14.3
Apple	126	8	2	25
Apple	96	8	2	25
Apple	54	4	3	75
Average	**62.1**	**5.5**	**2.3**	**42.6**

Table 35 Fungus species recorded in Luscombe Farm Orchards

Latin name	Family	Associated habitat	Notes
Auricularia auricula-judae	Auriculariaceae	Wood	On live? elder branches and trunk
Byssomerulius corium	Meruliaceae	Wood	On stick under sycamore
Chondrostereum purpureum	Meruliaceae	Wood	On logs in wood pile
Coprinus domesticus	Coprinaceae	Wood	Single button with ozonium stage on dead branch
Inocybe sindonia	Cortinariaceae	Grassland + trees / scrub	4 old fruitbodies under hazel, elder, sycamore, poplar, above pond
Laccaria laccata	Tricholomataceae	Grassland + trees / scrub	6 fruitbodies under oak
Lycoperdon pyriforme	Lycoperdaceae	Wood	Numerous fruitbodies on two old moss-covered fallen branches, under sycamore
Nectria cinnabarina	Nectriaceae	Wood	Perfect and imperfect stages on fallen twig
Rosellinia mammiformis	Xylariaceae	Wood	Frequent, on dead branches
Scleroderma areolatum	Sclerodermataceae	Grassland + trees / scrub	Group of earthballs
Scleroderma bovista	Sclerodermataceae	Grassland + trees / scrub	4 fruitbodies under oak
Scutellinia scutellata	Humariaceae	Wood	Fruitbodies on burnt logs
Simocybe haustellaris	Cortinariaceae	Wood	1 fruitbody on wet rotten wood
Trametes versicolor	Coriolaceae	Wood	On cut logs in woodpile
Vascellum pratense	Lycoperdaceae	Grassland	15 old fruitbodies on and around old compost heap
Xylaria hypoxylon	Sphaeriaceae	Wood	Fruitbodies on burnt pole
Xylaria longipes	Sphaeriaceae	Wood	On floating dead sycamore log in waterfall
Xylaria polymorpha	Sphaeriaceae	Wood	On dead stump

Table 36 Invertebrate species recorded in Luscombe Farm Orchards

Species	Family/Order	Assemblage	UK status	Notes
Gibbaranea gibbosa	Araneae	Canopy	Widespread	
Pisaura mirabilis	Araneae	Field layer	Widespread	
Anobium punctatum	Col: Anobiidae	Saproxylic	Widespread	Flight interception trap, apple, one
Protapion fulvipes	Col: Apionidae	Field layer	Widespread	Suction sampler at tree base
Protapion filirostre	Col: Apionidae	Field layer	Widespread	Swept
Apion frumentarium	Col: Apionidae	Field layer	Widespread	
Ischnopterapion loti	Col: Apionidae	Field layer	Widespread	
Neocoenorrhinus aequatus	Col: Attelabidae	Canopy	Widespread	Beaten from hawthorn
Cantharis cryptica	Col: Cantharidae	Mosaic (C, F)	Widespread	Flight interception traps, one
Malthinus balteatus	Col: Cantharidae	Saproxylic	Nb	Beaten from apple branches
Malthinus seriepunctatus	Col: Cantharidae	Saproxylic	Local	Flight interception traps, one
Rhagonycha fulva	Col: Cantharidae	Field layer	Widespread	Flight interception trap, apple, one
Dromius quadrinotatus	Col: Carabidae	Saproxylic	Widespread	Beaten from apple branches
Grammoptera ruficornis	Col: Cerambycidae	Saproxylic	Widespread	Beaten from apple branches
Tetrops praeustus	Col: Cerambycidae	Saproxylic	Local	Flight interception traps, one
Chrysolina banksi	Col: Chrysomelidae	Field layer	Local	Under fallen branch
Gastrophysa viridula	Col: Chrysomelidae	Field layer	Widespread	Swept from nettles
Longitarsus luridus	Col: Chrysomelidae	Field layer	Widespread	
Phaedon tumidulus	Col: Chrysomelidae	Field layer	Widespread	Swept
Phratora vulgatissima	Col: Chrysomelidae	Canopy	Widespread	
Adalia 10-punctata	Col: Coccinellidae	Canopy	Widespread	Beaten from apple branches
Adalia bipunctata	Col: Coccinellidae	Canopy	Widespread	
Propylea 14-punctata	Col: Coccinellidae	Canopy	Widespread	
Rhyzobius litura	Col: Coccinellidae	Field layer	Widespread	Suction sampler at tree base
Anthonomus pomorum	Col: Curculionidae	Canopy	Local	Beaten from apple branch
Barypeithes pellucidus	Col: Curculionidae	Ground layer +	Widespread	Suction sampler at tree base

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Rhinocyllus conicus	Col: Curculionidae	Field layer	Nb	Swept from marsh thistle
Rhinoncus pericarpius	Col: Curculionidae	Field layer	Widespread	
Sitona puncticollis	Col: Curculionidae	Field layer	Local	
Trichosirocalus troglodytes	Col: Curculionidae	Field layer	Widespread	Beaten from apple branches
Agriotes pallidulus	Col: Elateridae	Field layer	Widespread	Swept
Athous haemorrhoidalis	Col: Elateridae	Ground layer	Widespread	Beaten from hawthorn
Meloe violaceus	Col: Meloidae	Field layer	Nb	
Pyrochroa serraticornis	Col: Pyrochroidae	Saproxylic	Widespread	On foliage
Phyllopertha horticola	Col: Scarabaeidae	Field layer	Widespread	Beaten from apple branch
Anaspis garneysi	Col: Scraptiidae	Saproxylic	Widespread	
Anaspis maculata	Col: Scraptiidae	Saproxylic	Widespread	Beaten from elder blossom
Paederus litoralis	Col: Staphylinidae	Ground layer +	Widespread	Swept
Forficula auricularia	Dermaptera	Generalist	Widespread	Beaten from apple branches
Chrysopilus asiliformis	Dip: Rhagionidae	Field layer	Widespread	Flight interception trap, apple tree, five
Rhagio scolopaceus	Dip: Rhagionidae	Field layer	Widespread	At rest on tree trunk
Chloromyia formosa	Dip: Stratiomyidae	Field layer	Widespread	
Beris fuscipes	Dip: Stratiomyiidae	Field layer	N	Flight interception traps, eight
Chorisops tibialis	Dip: Stratiomyiidae	Saproxylic	Widespread	Flight interception trap, apple, two
Pachygaster atra	Dip: Stratiomyiidae	Saproxylic	Widespread	Flight interception traps, one
Pachygaster leechi	Dip: Stratiomyiidae	Saproxylic	Widespread	Flight interception traps, one
Rhingia campestris	Dip: Syrphidae	Dung	Widespread	
Cylindroiulus punctatus	Diplopoda	Saproxylic	Widespread	White rotten apple wood
Proteroiulus fuscus	Diplopoda	Saproxylic	Widespread	White rotten apple wood
Aegopinella nitidula	Gastropoda	Ground layer +	Widespread	
Arion subfuscus	Gastropoda	Ground layer +	Widespread	Under fallen branch
Balea perversa/heydeni	Gastropoda	Epiphyte	Local	Large numbers beaten from apple branches

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Cepaea hortensis	Gastropoda	Ground layer +	Widespread	Beaten from apple branches
Deroceras reticulatus	Gastropoda	Ground layer +	Widespread	Under fallen branch
Trichia striolata	Gastropoda	Ground layer +	Widespread	Swept from nettles
Anthocoris nemorum	Hem: Anthocoridae	Canopy	Widespread	Beaten from apple branches
Cardiastethus fasciiventris	Hem: Anthocoridae	Saproxylic	Local	Beaten from walnut branch
Temnostethus gracilis	Hem: Anthocoridae	Epiphyte	Local	Beaten from apple branches
Eriosoma lanigerum	Hem: Aphididae	Canopy	Widespread	Beaten from apple branches
Edwardsiana rosae	Hem: Cicadellidae	Canopy	Widespread	Beaten from apple branches
Cixius nervosus	Hem: Cixiidae	Canopy	Widespread	
Tachycixius pilosus	Hem: Cixiidae	Canopy	Widespread	
Scolopostethus affinis	Hem: Lygaeidae	Field layer	Widespread	Suction sampler at tree base
Loricula elegantula	Hem: Microphysidae	Saproxylic*	Widespread	Beaten from apple branches
Atractotomus mali	Hem: Miridae	Canopy	Widespread	Beaten from apple branches
Capsus ater	Hem: Miridae	Field layer	Widespread	Swept
Leptopterna ferrugata	Hem: Miridae	Field layer	Widespread	Swept
Liocoris tripustulatus	Hem: Miridae	Field layer	Widespread	Swept from nettles
Notostira elongata	Hem: Miridae	Field layer	Widespread	Swept
Orthotylus ochrotrichis	Hem: Miridae	Canopy	Widespread	
Pachytomella parallela	Hem: Miridae	Field layer	Local	Swept
Phytocoris tiliae	Hem: Miridae	Canopy	Widespread	Beaten from apple branches
Psallus ambiguus	Hem: Miridae	Canopy	Widespread	
Stenodema laevigatum	Hem: Miridae	Field layer	Widespread	Swept
Stenotus binotatus	Hem: Miridae	Field layer	Widespread	Swept
Nabis rugosus	Hem: Nabidae	Field layer	Widespread	
Psylla mali	Hem: Psyllidae	Canopy	Widespread	Beaten from apple branches
Andrena ovatula	Hym: Andrenidae	Mosaic (G, F, C)	Widespread	Water trap
Andrena saundersella	Hym: Andrenidae	Field layer	Widespread	Water trap

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Nomada flavoguttata	Hym: Anthophoridae	Field layer	Widespread	Water trap
Nomada ruficornis	Hym: Anthophoridae	Field layer	Local	Water trap
Apis mellifera	Hym: Apidae	Saproxylic	Widespread	Water trap
Bombus lapidarius	Hym: Bombidae	Field layer	Widespread	
Bombus pascuorum	Hym: Bombidae	Field layer	Widespread	
Bombus terrestris	Hym: Bombidae	Field layer	Widespread	
Symmorphus mutinensis	Hym: Eumenidae	Field layer	Widespread	Flight interception trap
Lasius niger sens. str.	Hym: Formicidae	Ground layer	Widespread	
Lasius platythorax	Hym: Formicidae	Ground layer+	Unknown	
Myrmica rubra	Hym: Formicidae	Ground layer	Widespread	
Myrmica ruginodis	Hym: Formicidae	Ground layer	Widespread	Swept
Myrmica scabrinodis	Hym: Formicidae	Ground layer	Widespread	Swept
Stigmus solskyi	Hym: Sphecidae	Saproxylic	Widespread	Flight interception trap
Vespula vulgaris	Hym: Vespidae	Generalist	Widespread	Flight interception trap, apple tree, eight workers
Callimorpha dominula	Lep: Arctiidae	Field layer	Nb	
Opisthograptis luteolata	Lep: Geometridae	Canopy	Widespread	Beaten from apple
Celastrina argiolus	Lep: Lycaenidae	Canopy	Widespread	General hedgerow
Micropterix calthella	Lep: Micropterigidae	Field layer	Widespread	Several moths in each of several creeping buttercup flowers
Inachis io	Lep: Nymphalidae	Field layer	Widespread	
Panorpa germanica	Mecoptera	Field layer	Widespread	Flight interception trap, apple tree, six
Hemerobius lutescens	Neuroptera	Canopy	Widespread	Flight interception traps, one
Philoscia muscorum	Oniscoidea	Ground layer +	Widespread	Suction sampler at tree base
Porcellio scaber	Oniscoidea	Generalist	Widespread	White rotten apple wood
Oligolophus hanseni	Opiliones: Phalangiidae	Canopy	Local	Beaten from apple branches
Paroligolophus agrestis	Opiliones	Epiphyte	Widespread	Beaten from apple branches

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Leptophyes punctatissima	Orthoptera	Field layer	Widespread	Beaten from hedgerow
Meconema thalassinum	Orthoptera	Canopy	Widespread	Beaten from apple branches
Tetrix subulata	Orthoptera	Field layer	Widespread	
Caecilius flavidus	Psocoptera	Epiphyte	Widespread	Beaten from apple branches
Ectopsocus briggsi	Psocoptera	Epiphyte	Widespread	Flight interception trap, apple tree, one
Elipsocus hyalinus	Psocoptera	Epiphyte	Widespread	Beaten from apple branch
Loensia fasciata	Psocoptera	Epiphyte	Local	Flight interception traps, three
Loensia variegata	Psocoptera	Epiphyte	Local	Beaten from apple branches
Mesopsocus unipunctatus	Psocoptera	Epiphyte	Widespread	Beaten from apple branch
Philotarsus parviceps	Psocoptera	Epiphyte	Widespread	Beaten from apple branches
Reuterella helvimacula	Psocoptera	Epiphyte	Local	Beaten from apple branches
Stenopsocus immaculatus	Psocoptera	Epiphyte	Widespread	Beaten from apple branches
Trichadenotecnum sexpunctatum	Psocoptera	Epiphyte	Local	Flight interception trap, apple tree, one

Notes: see paragraphs 3.9 and 3.17 for explanations of assemblages and status categories.

* *Loricula elegantula*: difficult to assign to one assemblage. Classified as saproxylic by Alexander 2002a, but sometimes regarded as part of the epiphyte assemblage. It tended to occur among epiphytes in the current survey.

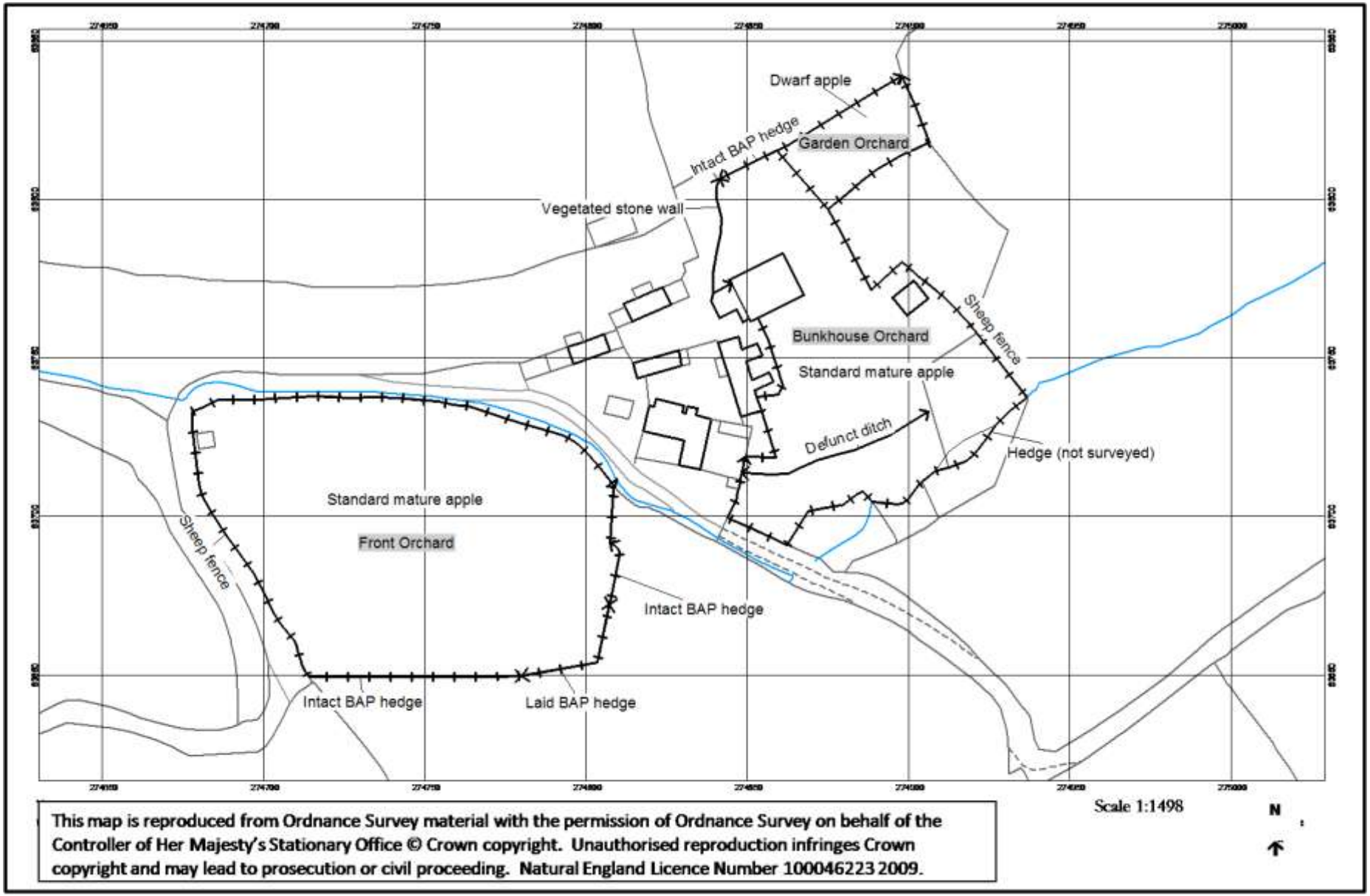

Figure 4 Map of Luscombe Farm Orchards (SX748637). Orchard type and boundaries map

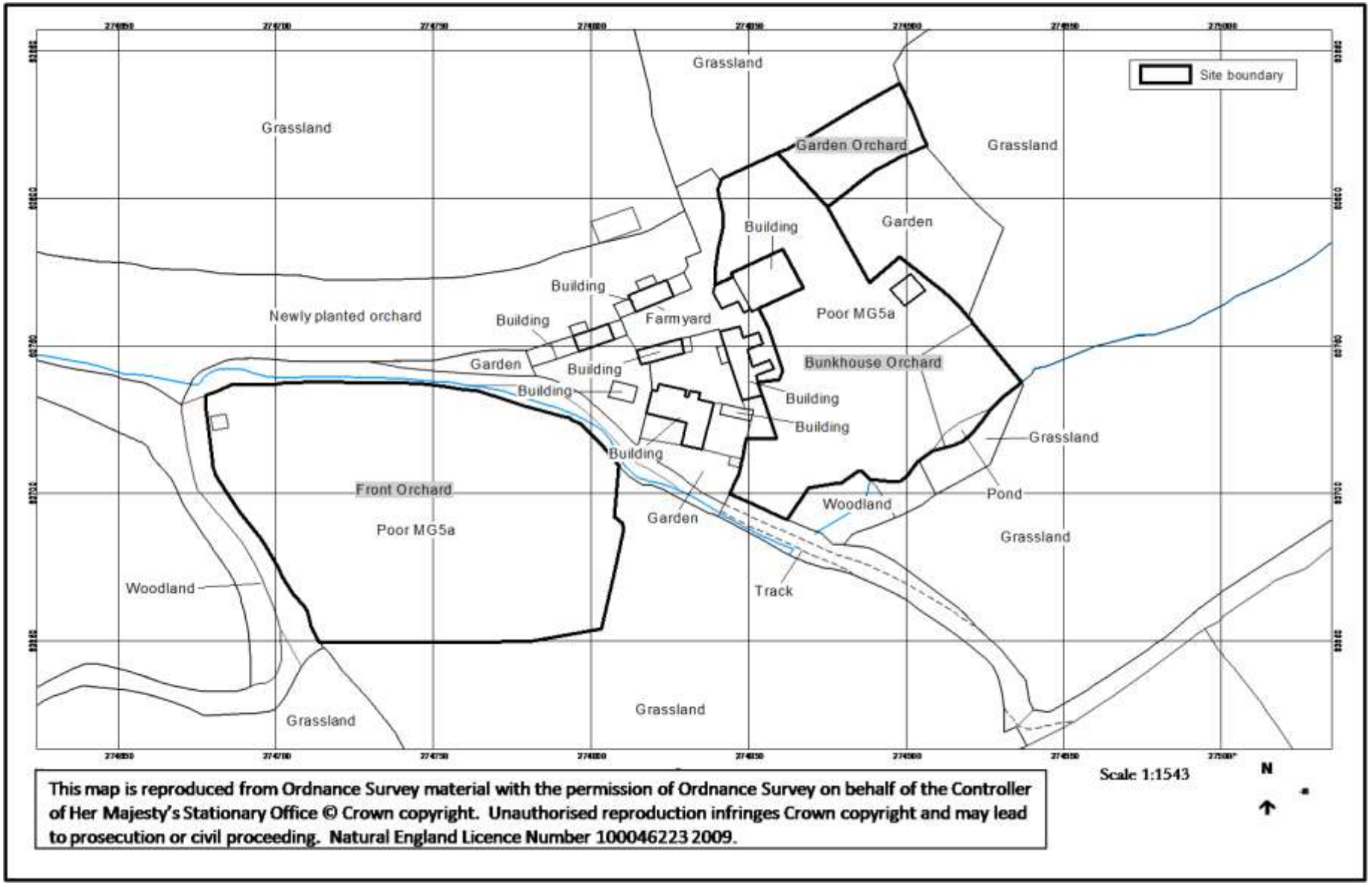

Figure 5 Map of Luscombe Farm Orchards (SX748637). Orchard floor, surrounding land use and compartments map

6 Colston Farm Orchards

Landscape setting

6.1 Colston Farm Orchards comprise two small orchards located in the valley of a small tributary stream which joins the River Dart from the west (Figure 6). The orchards are about 1.7 km south-east of Buckfastleigh in Devon. The orchards are in a similar topographic position as Luscombe Farm Orchards (section 5) but are at a lower altitude (30-40 m) and are on somewhat steeper slopes in places (Table 5). The site is set in a mixed grassland and arable landscape, which is divided up by hedgerows, and interspersed with blocks of woodland and scrub and small orchards. Grassland predominates around Colston Farm Orchards, except where a belt of scrubby woodland lies along the northern boundary (Figure 7). The site is connected by this woodland and by hedgerows to the hedgerow network and surrounding woodland. Colston Farm Orchards are only 0.85 km from Luscombe Farm Orchards and like this site, there is only a small area of orchards within 1 km of the site, including the orchards at Luscombe (Table 5). The nearest traditional orchard is across the lane to the south. At a national scale the site lies in zones of high rainfall and high wet atmospheric deposition of sulphur and nitrogen, but in a low dry deposition zone for these elements (Table 5).

History and management

6.2 The two orchards that make up Colston Farm Orchards are Main Orchard and Front Orchard (Figure 6). Both were planted primarily with standard apples but there are a few pears and plums. The orchards are close to the border of the South Hams district where orchards and cider production were well-established by the end of the 17th century (Morgan & Richards 1993). Orchards were present in the same compartments on the 1889-1890 First Edition Ordnance Survey 1:10560 map, though most trees now present are considerably younger than this date. A small stream runs through the site and separates the north to north-east facing Main Orchard from the south-facing side of the valley which is now predominantly scrubby grassland rather than orchard (Figure 7). This area was orchard both in 1889-1890 and in more recent Master Map polygon data and was included in the survey.

6.3 The 1889-90 map shows that there were less than 20 ha of orchards present in the surrounding 1 km zone at this time, as was the case for Luscombe Farm Orchards. The closest existing woodland (3.3 ha) defined as ancient in the provisional ancient woodland inventory for Devon (Lister & Pinches 1986) is at a distance of 0.8 km to the north.

6.4 The orchards are now managed organically and the fruit is used for cider and juice. The orchards form part of an organic cider group, along with some surrounding orchards, including Luscombe Farm Orchards. The orchards are periodically grazed by sheep.

Fruit tree survey

6.5 The measurements of a sample of trees from Main Orchard are given in Table 37. No measurements were made in Front Orchard but it was similar in structure to Main Orchard. The canopy of Main Orchard was open with gaps between the canopies of adjacent trees. Girth sizes in Main Orchard were similar to those at Luscombe Orchards, indicating that some large individual trees were probably 80 years or more in age, other trees were likely to have been around 20 to 30 years old, and some were newly planted saplings. Veteran tree features were relatively limited in occurrence (Table 37), even among trees of greater than 25 cm girth.

Standing and fallen dead wood were both very rare. Scrub cover was present in the form of occasional bramble patches and covered less than 1% of the site.

Orchard floor habitats

Grasslands on valley slopes

6.6 The grassland beneath the fruit trees in Main Orchard was surveyed in detail (Table 38). Front Orchard was not surveyed apart from noting that it was unimproved neutral grassland, lying partly on a moderate east facing slope and partly on a plateau. Main Orchard had unimproved neutral grassland, situated on a steep north-east facing slope. The grassland type was closest to MG5a *Cynosurus cristatus-Centaurea nigra* grassland *Lathyrus pratensis* sub-community (Rodwell 1992). Species more typical of woodland were also present, for example *Arum maculatum* (lords and ladies) and *Primula vulgaris* (primrose). The grassland was fairly species rich, with a mix of fine grasses such as *Anthoxanthum odoratum* (sweet vernal-grass) and coarser grasses such as *Dactylis glomerata* (cock's-foot), along with species such as *Luzula campestris* (field woodrush) and *Ranunculus bulbosus* (meadow buttercup). There was about 60% herb cover and the grassland was rather patchily grazed to sward heights of 5 to 10 cm. Some bare ground and litter were also present, but each accounted for less than 1% of the orchard floor.

6.7 The grassland on the opposite side of the stream to Main Orchard was rather different. It was on steep south-facing slopes and appeared to have had a much lower grazing pressure, as scrub, including bramble, covered 30% of the area. This had led to a very patchy grassland flora, listed in Table 39. The grassland was probably closest to MG5 *Cynosurus cristatus-Centaurea nigra* grassland (Rodwell 1992).

Grassland species of special interest

6.8 A number of *Cardamine pratensis* (cuckooflower) individuals with double flowers were seen by Robin Stevenson. Whether or not these were a planted cultivar of the flower (sold as *Cardamine pratensis flore pleno*) or a natural variation was not clear. However, if these were natural variations then it is likely that they may have a certain genetic value.

Streamside grassland

6.9 A small stream ran northwest to southeast through the site, dividing Main Orchard from the south facing slope (Figure 6). On either side of the stream was a narrow strip of low-lying, marshy grassland. This was particularly rich in wetland plants. Whilst no attempt was made to record all of the plants within this habitat, characteristic species are listed in Table 40. In places, livestock had created trampled, bare, ground.

Orchard boundaries

6.10 The type of boundaries around Main Orchard are summarised in Figure 6. The boundaries, including interior divisions, consisted of predominantly of stone walls, with two ancient hedge banks and one hedge without a bank. Standard trees were present within these hedgerows, including one ancient oak pollard by the lane at the southern end of the site. Table 41 shows the species recorded within each boundary. The boundaries around Front Orchard were not surveyed but this orchard appeared to be mainly surrounded by hedgerows with hedgerow trees.

6.11 The central stone wall in Main Orchard was heavily vegetated, with tree species growing from it and from nearby, which resulted in a moderately high level of shading. This favoured a woodland ground-flora (Table 41). The section of the central wall to the north of the fruit tree area (Figure 6) could not really be classed as either a wall or a hedge, as the wall was completely defunct, having fallen in places, and was surrounded by *Prunus spinosa* (blackthorn) and *Corylus avellana* (hazel) scrub. An intact fence ran parallel to the wall.

6.12 The eastern boundary wall, to the north of the farmhouse, separated the orchard site from a garden. The wall was so heavily festooned with woodland plants and climbers as to appear as a hedge from a distance. The south-eastern boundary wall of Main Orchard (Figure 6) was only moderately vegetated and occasional trees were present along it.

6.13 The northern boundary of the site, above the south facing valley slopes, comprised a newly-laid hedge on a sandy bank. A 30m section of this hedge contained five native woody species (thus meeting the pre-2007 BAP criterion) and had ten woodland herbs listed in the Hedgerow Regulations 1997 in the ground flora. Hedgerows with rich basal flora qualified as priority habitat in the pre-2007 HAP definition, although there was no formal definition of this criterion (UK Steering Group 1995). The somewhat arbitrary definition of presence of 7 or more woodland herbs in a 30 m section was employed for the current study. The hedgerow was therefore identified as a species-rich hedgerow (Table 41). The south-western boundary of Main Orchard was formed by a hedge on a stone-lined bank. This had been fenced off from livestock and had become overgrown with many small trees. As a result the ground flora was fairly shaded. The flora was relatively species-poor and the hedgerow was not classed as species-rich according to the pre-2007 BAP criteria. The western boundary consisted of a newly coppiced hazel (*Corylus avellana*) hedge with abundant *Allium ursinum* (ramsons) and *Pteridium aquilinum* (bracken). Due to time restrictions this was not fully surveyed, but was poor in species so would not have been classed as a species-rich hedgerow according to the pre-2007 BAP criteria.

Epiphytic lichens

Community characteristics

6.14 The majority of trees examined in Colston Farm Orchards were apple varieties plus a few pears and plums. Front Orchard was chosen for detailed survey, with less than an hour spent in Main Orchard. The decision to focus much of the survey effort on Front Orchard was made because it was considered important to conduct a thorough survey of at least one area and Front Orchard was chosen as it was better-lit than Main Orchard.

6.15 Colston Farm Orchards appeared to be less humid than Luscombe Farm Orchard because *Usnea articulata*, which requires high humidity, was not present, although the site lies in a relatively sheltered situation. The 60 lichen taxa recorded are listed in Table 42. Of these, 24 taxa were seen only once or twice, so approximately 34 taxa make up the core lichen epiphyte population. Historically, levels of sulphur dioxide have been low in the area. Hawksworth and Rose reported in 1970 that there were less than 30 micrograms per cubic metre of sulphur dioxide in the air. The low levels of atmospheric dry deposition of sulphur and the presence of relatively humid conditions have allowed a rich lichen flora to survive.

6.16 Seven lichen communities were found: *Graphidion, Lecanorion, Parmelion, Pertusarion*, pre-*Lobarion, Usneion* and *Xanthorion* (James and others 1977). The pre-Lobarion was found on spongy bark of pear and includes *Anisomeridium polypori, Agonimia tristicula, Gyalecta truncigena, Leptogium teretiusculum* and *Normandina pulchella*. *Bacidia rubella* was also found on one tree, though it can be easily overlooked in the sterile state. *Ramonia chrysophaea* also appeared to belong to this community. Dominant or abundant species included *Arthonia punctiformis* (Graphidion), *Lecidella elaeochroma* (*Graphidion*), *Physcia tenella* var. *tenella* (*Xanthorion*), *Punctelia subrudecta* (*Parmelion*) and *Ramalina farinacea* (*Usneion*). *Xanthorion* elements, which indicate nutrient-enriched bark, were only occasionally present.

6.17 Four Indicators of Ecological Continuity were present (Table 42) and may reflect the historical continuity of orchards and woodland in the area and history of low levels of pollution.

Lichen species of special interest

6.18 ***Lecanora compallens*** (Nationally Scarce): This is a recently described species that may be increasing and might therefore be commoner than current records suggest.

6.19 ***Ramonia chrysophaea*** (Near Threatened, International Responsibility): This lichen has a preference for permanently moist areas of fruit tree trunks and thus requires shade and shelter, as well as un-enriched, low pH, bark surface.

Bryophytes

6.20 Bryophyte species recorded are shown in Table 43. A total of 23 species were found on the apples in Colston Farm Orchards. Many of the young trees had no moss cover. Fourteen of the fruit trees were sampled in detail (Table 44). Most of these were 'ordinary' trees in terms of bryophyte cover, but a few 'good' trees were also included. The average number of species per tree was the second highest after Rummers Lane Orchards (Table 13) and contained the highest average percentage of obligate species (Table 13). Ground bryophytes in this site included the following species: *Atrichum undulatum, Cratoneuron filicinum, Diplophyllum albicans, Eurhynchium praelongum, Fissidens bryoides, Pellia epiphylla, Plagiomnium undulatum, Pogonatum aloides, Rhytidiadelphus squarrosus, Scleropodium purum* and *Thuidium tamariscinum.*

Fungi

Habitat associations and characteristics

6.21 Grassland fungi made the most important contribution (18 species) to the total list recorded, while there were only 6 species associated with wood (Table 45). Colston Farm Orchards were the best orchards for grassland fungi among the study sites surveyed. Waxcaps were the main feature. A good total was recorded (11 species), considering only one autumn visit was made to the site. Good quantities of *Entoloma porphyrophaeum* were recorded in Front Orchard. The southern section of Main Orchard produced more *Entoloma porphyrophaeum* and several waxcaps, including about 50 fruitbodies of *Hygrocybe calyptriformis*. The northern section of Main Orchard was very similar to southern part, but with a larger number of fruitbodies of *Hygrocybe calyptriformis* (about 80). The south-facing scrubby grassland on the other side of the valley to Main Orchard was less productive, although in places the turf looked botanically more diverse.

6.22 The relatively steep slopes of Main Orchard probably precluded ploughing in the past. Orchards were present here in 1889-1890 and ground disturbance is likely to have been limited, at least since then, to re-planting of trees. The turf in Main Orchard could therefore be over 100 years old, which, combined with relatively low nutrient status of the soil, indicated by the grassland plant community, may explain the richness of the grassland fungi, as is suggested for sites elsewhere (Evans 2003). The height of the sward during the present survey (5-10 cm) is probably around the maximum height that waxcaps will tolerate.

6.23 Front Orchard contained woodpiles that produced several fungi species in the spring, but which had been burnt by autumn. The hedgebanks around Main Orchard appeared suitable for many fungal species, though no particularly significant species were found. A few large oaks along the north east boundary of Front Orchard and the southern boundary of Main Orchard supported a few mycorrhizal species including Boletus species, which often occurred surprisingly far beyond the tree canopy (Table 45).

Fungus species of special interest

6.24 ***Agaricus moelleri*** (BMSFRD: 64): This species was found in Front Orchard under an apple tree.

6.25 ***Hygrocybe calyptriformis*** (Provisional Red Data List, Priority BAP species, BMSFRD: 791): This species fruited in very good numbers. Apparently it fruited well at many sites in 2004.

6.26 ***Geoglossum glutinosum*** (BMSFRD: 289): A small cluster of fruitbodies of this species were found deep in the grass.

6.27 ***Camarophyllopsis schulzeri*** (Provisional Red Data List, BMSFRD: 37): A small group of this rare grassland fungus was found in the grassland.

Invertebrates

General overview of assemblages and characteristics

6.28 The field layer contributed most (47 species) to the overall fauna recorded, probably reflecting the plant species diversity and the moderate levels of grazing. The saproxylic fauna was relatively limited (26 species) because of the lack of suitable habitat, given the predominance of young trees (Table 6, Table 15). However, three members of the fauna were Nationally Scarce beetles, although no Indicators of Ecological Continuity were recorded. The fauna found among the abundant moss and lichen cover on the trees was diverse. The hedgerows provided valuable shelter and alternative sources of nectar and pollen.

Canopy and mosaic fauna

6.29 The foliage fauna of the fruit trees included characteristic apple species such as the uncommon weevil *Anthonomus pomorum* and the more widespread plant bug *Atractotomus mali* and the jumping plant louse *Psylla mali*, as well as a large population of the woolly aphid *Eriosoma lanigerum*. The ground nesting bee, *Andrena haemorrhoa*, (mosaic assemblage) was abundant feeding on apple blossom. This species, like others of its genus, is an important pollinator of fruit trees.

Canopy species of special interest

6.30 ***Eupeodes nitens*** (Nationally Scarce): A specimen of this hoverfly (old name *Metasyrphus* in Falk 1991b) was taken in a flight interception trap hung from one of the apple trees. This is an arboreal species, with the adults known to take nectar from flowers in sheltered sunny areas close by. Records have been nearly always from ancient deciduous forest (Stubbs and Falk 1983, Falk 1991b).

Epiphyte fauna

6.31 An interesting species-rich fauna was associated with the luxuriant lichen and moss cover of the trunks and boughs of the fruit trees. One feature of particular note was the large population of the local bristly millipede *Polyxenus lagurus*. The tree snail *Balea perversa* (probably the recent segregate *B. heydoni*) was also numerous here, and there was a good variety of barkflies (Psocoptera). Ten species were noted, including large populations of the local picture-winged *Loensia fasciata* and *L. variegata*, as well as the local *Reuterella helvimacula*. The predatory bugs *Temnostethus gracilis* and *Loricula elegantula* were typically associated with this habitat. Larvae of the Brussels lace moth *Cleorodes lichenaria* (Geometridae) were frequently beaten from *Malus* during the late April visit. This lichen-feeding species is locally common in south-west England. Collectively this fauna was more characteristic of ancient wood pasture habitat than any other habitat type.

Saproxylic fauna

6.32 These orchards supported a limited variety of wood-decay invertebrates but three Nationally Scarce beetle species were detected during the study and are described below. A few other wood decay species present are also worthy of mention. The local longhorn beetle *Pogonocherus hispidus* is known to develop in the dead branchwood of fruit trees. Paul Whitehead has also noted it developing in mistletoe (pers obs). The originally Australian wood-decay beetle *Pycnomerus fuliginosus* is now a well-known feature of the south Dartmoor area. The fungus gnat *Leia fascipennis* was taken in the flight interception trap. It is thought to develop in bird nests in trees (P.J. Chandler, pers comm). Only one deadwood-nesting solitary wasp species was recorded from Colston Farm Orchards, although it should be noted that only one flight

interception trap was set in the orchards and no water traps were used. Most records for solitary bees and wasps made during the site surveys came from the trap samples. The solitary wasp, *Crossocerus megacephalus*, was found in Colston Farm Orchards. It nests in rotting wood, commonly utilizing the redundant holes of wood boring beetles (Richards 1980).

Saproxylic species of special interest

6.33 ***Orchesia micans*** (Nationally Scarce, Category B): This beetle develops mainly in the fruiting brackets of the fungus *Inonotus hispidus*, which is one of the main heartwood-decay fungi in apple. One was taken in a flight interception trap within the orchard although the fungal host was not apparent.

6.34 ***Malthinus balteatus*** (Nationally Scarce, Category B): This soldier beetle was present as an adult and will have been developing in dead branchwood on site, probably in a damp shady situation. This is a characteristic species of wooded Dartmoor river valleys.

6.35 ***Scolytus mali*** (Nationally Scarce, Category B): This bark beetle is a specialist of trees in the family Rosaceae and occurs widely in traditional orchards.

Field layer and ground layer fauna

6.36 The steep, south-facing grassy banks across the stream from Main Orchard were herb-rich and supported a typical invertebrate fauna for unimproved grasslands on warm freely-draining soils, including species such as the local plant bug *Pachytomella parallela*, as well as more widespread species, such as common blue butterfly *Polyommatus icarus* and the sorrel flea beetle *Chaetocnema hortensis*. Old anthills of yellow meadow ant, *Lasius flavus*, were a valuable feature, as these are increasingly scarce in the modern farmed landscape. The bee-fly *Bombylius major*, was seen visiting flowers in the grassland; bee-flies are associated with ground nesting solitary bee species, such as the *Andrena* species recorded from the site (Stubbs & Drake, 2001). The exposed earth bank at the top boundary of this grassland provided bare ground likely to be beneficial to ground nesting aculeate Hymenoptera. Field layer species of “cuckoo” bees were recorded including *Nomada goodeniana*, which parasitizes the common *Andrena nigroaena*, and *N. ruficornis*, the somewhat local “cuckoo” of *A. haemorrhoa*. One local species associated with herb-rich grassland slopes, *Andrena cineraria*, was occasionally seen emerging from burrows on the south-facing slope. The marshy grassland of the streamside supported two Nationally Scarce insects and there were also a good variety of more widespread wetland invertebrates.

Field layer species of special interest

6.37 ***Rhinocyllus conicus*** (Nationally Scarce, Category B): This weevil is well known from Dartmoor but has been recorded from parts of England (Paul Whitehead pers obs). It occurred on marsh thistle (*Cirsium palustre*).

6.38 ***Beris fuscipes*** (Nationally Scarce): This soldier fly is a species most frequent in Britain in the south west, and develops in fens and marshes where sheltered by bushes and woodland edge.

Dung fauna

6.39 Six species of dung beetle (Aphodiidae and Scarabaeidae) were noted. One of these was the somewhat localised *Onthophagus coenobita*, which utilises most types of animal dung besides carrion and decaying fungi. The other five were all *Aphodius* species: *A. depressus, A. sticticus, A. fimetarius/A. pedellus, A. pusillus* and *A. sphacelatus*.

Dung species of special interest

6.40 ***Tiphia minuta*** (Nationally Scarce, Category B): The larvae of this species are thought to parasitise the larvae of dung beetles (Richards, 1980, Falk, 1991a).

Other fauna

6.41 Viviparous Lizard (*Lacerta vivipara*) was seen sunning itself upon the eastern boundary wall. Greater horseshoe bats are known to have roost sites in the Buckfastleigh area. Colston Orchards lie within the favoured 4 km foraging zone around these roosts (English Nature 2000) and may be used for foraging area. However, radio tracking has not, as yet, pin-pointed the orchards as a specific foraging area (Billington 2004).

Table 37 Fruit tree survey at Colston Farm Orchards

Obs no	Fruit tree type	Girth cms	Height	Distance to nearest neighbour	Canopy live %	Hollow trunk / branch	Cracks / splits	Rot holes	Rot sites	Bark missing	Bark split	Sap runs
1	Apple	44	8	4	100							
2	Apple	34	8	6	100							
3	Apple	33	7	6	100							
4	Apple		6	6	100							
5	Apple	65	7	6	95		1	1	1	1		
6	Apple	102	8	6	98							
7	Apple	64	6	5	98				1		1	
8	Apple	83	4	5	99							
9	Apple	78	7	6	100			1	1			
10	Apple / Pear?	80	8	5	99				1		1	
11	Apple	60	3	6	99	1		1	1	1	1	
12	Apple	7	1.5	5	100							
13	Apple	66	5	5	80				1	1		
14	Apple	6	2	6	100							
15	Apple	8	2	6								
16	Apple	71	5	6	100				1			
17	Apple	99	7	5	98						1	
18	Apple	10	2	8	100							

Table continued...

Obs no	Fruit tree type	Girth cms	Height	Distance to nearest neighbour	Canopy live %	Hollow trunk / branch	Cracks / splits	Rot holes	Rot sites	Bark missing	Bark split	Sap runs
19	Apple	7	1.5	6	100							
20	Apple	58	8	4	100							
Average		**51**	**5**	**6**	**98**							
Percent						**5**	**5**	**15**	**35**	**15**	**20**	**0**

Percent of all trees with a veteran character - 40

All trees % of possible number of veteran character occurrences - 14

Percent of trees > 25 cm girth with a veteran character - 57

Trees > 25 cm girth % of possible number of veteran character occurrences - 19

Notes: One tree had fallen but was alive (no 4), no girth measure. One had no canopy measure. One was possibly a pear. 1 = veteran tree character present.

Table 38 Grassland vascular plant species list for Main Orchard, Colston Farm Orchards

Species	Common name	Abundance
Agrostis stolonifera	creeping bent	O
Anthoxanthum odoratum	sweet vernal-grass	A
Arum maculatum	lords-and-ladies	R
Cardamine pratensis	cuckooflower	R
Cerastium fontanum	common mouse-ear	O
Cerastium glomeratum	sticky mouse-ear	R
Cirsium arvense	creeping thistle	R
Cirsium palustre	marsh thistle	R
Conopodium majus	pignut	R
Cynosurus cristatus	crested dog’s-tail	O
Dactylis glomerata	cock’s-foot	F
Festuca rubra	red fescue	O
Holcus lanatus	Yorkshire-fog	A
Hypochaeris radicata	cat's-ear	R
Lolium perenne	perennial rye-grass	F
Lotus pedunculatus	greater bird’s-foot-trefoil	R
Luzula campestris	field wood-rush	F
Luzula pilosa	hairy wood-rush	R
Plantago lanceolata	ribwort plantain	F
Poa pratensis	smooth meadow-grass	R
Potentilla sterilis	barren strawberry	O
Primula vulgaris	primrose	O
Pteridium aquilinum	bracken	R
Ranunculus acris	meadow buttercup	O
Ranunculus bulbosus	bulbous buttercup	O
Ranunculus ficaria	lesser celandine	A
Rubus fruticosus agg.	bramble	R
Rumex acetosa	common sorrel	O
Rumex obtusifolius	broad-leaved dock	R
Senecio jacobaea	common ragwort	R
Stellaria graminea	lesser stitchwort	R

Table continued…

Species	Common name	Abundance
Stellaria holostea	greater stitchwort	R
Taraxacum officinale agg.	dandelion	O
Trifolium repens	white clover	A
Urtica dioica	common nettle	R
Veronica chamaedrys	germander speedwell	O
Veronica serpyllifolia	thyme-leaved speedwell	R
Viola riviniana	common dog-violet	R

Notes: D = Dominant, A = Abundant, F = Frequent, O = Occasional, R = Rare

Table 39 Grassland vascular plant species on the south facing slopes at Colston Farm Orchards

Species	Common name
Achillea millefolium	yarrow
Anthoxanthum odoratum	sweet vernal-grass
Arum maculatum	lords-and-ladies
Bellis perennis	daisy
Cardamine pratensis	cuckooflower
Carex panicea	carnation sedge
Cerastium glomeratum	sticky mouse-ear
Cirsium arvense	creeping thistle
Cirsium palustre	marsh thistle
Dactylis glomerata	cock's-foot
Festuca rubra	red fescue
Holcus lanatus	yorkshire-fog
Hyacinthoides non-scripta	bluebell
Hypochaeris radicata	cat's-ear
Lotus corniculatus	common bird's-foot-trefoil
Luzula campestris	field wood-rush
Orchis mascula	early-purple orchid
Pimpinella saxifraga	burnet-saxifrage
Potentilla sterilis	barren strawberry
Primula veris	cowslip
Pteridium aquilinum	bracken
Ranunculus ficaria	lesser celandine

Table continued…

Species	Common name
Rubus fruticosus agg.	bramble
Stachys officinalis	betony
Taraxacum officinale agg.	dandelion
Trifolium pratense	red clover
Trifolium repens	white clover
Veronica chamaedrys	germander speedwell
Veronica serpyllifolia	thyme-leaved speedwell
Viola riviniana	common dog-violet

Table 40 Grassland vascular plant species found beside the stream in Colston Farm Orchards

Species	Common name
Alnus glutinosa	alder
Angelica sylvestris	wild angelica
Apium nodiflorum	fool's-water-cress
Athyrium filix-femina	lady-fern
Blechnum spicant	hard-fern
Cardamine pratensis	cuckooflower
Carex panicea	carnation sedge
Chrysosplenium oppositifolium	opposite-leaved golden-saxifrage
Cirsium arvense	creeping thistle
Cirsium palustre	marsh thistle
Epilobium palustre	marsh willowherb
Festuca rubra	red fescue
Filipendula ulmaria	meadowsweet
Glechoma hederacea	ground-ivy
Juncus effusus	soft-rush
Juncus inflexus	hard rush
Lamiastrum galeobdolon	yellow archangel
Mentha aquatica	water mint
Oenanthe crocata	hemlock water-dropwort
Phalaris arundinacea	reed canary-grass
Plantago lanceolata	ribwort plantain

Table continued…

Species	Common name
Potentilla anserina	silverweed
Potentilla reptans	creeping cinquefoil
Potentilla sterilis	barren strawberry
Primula vulgaris	primrose
Pteridium aquilinum	bracken
Pulicaria dysenterica	common fleabane
Ranunculus acris	meadow buttercup
Rubus fruticosus agg.	bramble
Silene dioica	red campion
Taraxacum officinale agg.	dandelion
Trifolium repens	white clover
Verbascum thapsus	great mullein
Veronica beccabunga	brooklime
Viola sp.	a violet

Table 41 Vascular plant species in the boundaries of Colston Farm Orchards

Species	Common name	Central wall	Defunct wall	Northern hedge	Eastern wall	South eastern wall	South western hedge
Acer pseudoplatanus	sycamore						x
Achillea millefolium	yarrow		x				
Ajuga reptans	bugle	x					
Allium ursinum	ramsons	x		x			x
Anthoxanthum odoratum	sweet vernal-grass			x			
Anthriscus sylvestris	cow parsley				x		
Arum maculatum	lords-and-ladies	x	x	x	x		x
Asplenium ruta-muraria	wall-rue				x		
Asplenium trichomanes	maidenhair spleenwort	x			x	x	
Cardamine flexuosa	wavy bitter-cress	x				x	

Table continued…

Species	Common name	Central wall	Defunct wall	Northern hedge	Eastern wall	South eastern wall	South western hedge
Cirsium arvense	creeping thistle			x			
Corylus avellana	hazel	x	x	x		x	x
Crataegus monogyna	hawthorn	x			x		
Digitalis purpurea	foxglove	x				x	
Dryopteris filix-mas	male-fern						x
Fraxinus excelsior	ash		x	x			
Galium aparine	cleavers	x	x		x		x
Galium mollugo	hedge bedstraw			x			
Geranium robertianum	herb-Robert	x	x	x	x	x	
Glechoma hederacea	ground-ivy	x	x	x	x		
Hedera helix	ivy	x	x		x	x	x
Ilex aquifolium	holly			x			
Lamiastrum galeobdolon	yellow archangel			x			
Lapsana communis	nipplewort	x					
Lonicera periclymenum	honeysuckle		x		x		
Mercurialis perennis	dog's mercury	x					x
Myosotis ramosissima	early forget-me-not				x		
Orchis mascula	early-purple orchid				x		
Origanum vulgare	wild marjoram			x			
Phyllitis scolopendrium	hart's-tongue		x	x			
Poa trivialis	rough meadow-grass	x					
Polystichum setiferum	soft shield-fern			x			

Table continued...

Species	Common name	Central wall	Defunct wall	Northern hedge	Eastern wall	South eastern wall	South western hedge
Potentilla sterilis	barren strawberry	x		x	x		
Primula vulgaris	primrose	x	x	x		x	
Prunus laurocerasus	cherry laurel	x					
Prunus spinosa	blackthorn	x	x	x			x
Pteridium aquilinum	bracken			x			
Quercus robur	pedunculate oak	x					
Ranunculus ficaria	lesser celandine			x			
Ranunculus repens	creeping buttercup		x				
Ribes uva-crispa	gooseberry						x
Rosa arvensis	field-rose		x	x			
Rosa canina	dog-rose	x					
Rubus fruticosus agg.	bramble	x	x	x	x	x	
Sambucus nigra	elder						x
Silene dioica	red campion			x			
Solanum dulcamara	bittersweet				x		
Stachys sylvatica	hedge woundwort	x					
Stellaria holostea	greater stitchwort			x	x		
Stellaria media	common chickweed						x
Symphoricarpos albus	snowberry				x		
Taraxacum officinale agg.	dandelion					x	
Teucrium scorodonia	wood sage			x			
Umbilicus rupestris	navelwort			x			
Urtica dioica	common nettle	x	x	x			x
Viola riviniana	common dog-violet	x		x	x		

Table continued...

Species	Common name	Central wall	Defunct wall	Northern hedge	Eastern wall	South eastern wall	South western hedge
				Outside of 30m sections			
Cardamine flexuosa	wavy bitter-cress			x			
Cirsium vulgare	spear thistle			x			
Conium maculatum	hemlock			x			
Digitalis purpurea	foxglove			x			
Lonicera periclymenum	honeysuckle			x			
Rosa canina	dog-rose			x			
Rumex obtusifolius	broad-leaved dock			x			
Salix caprea	goat willow			x			
Sambucus nigra	elder			x			
Sonchus oleraceus	smooth sow-thistle			x			
Veronica montana	wood speedwell			x			
Veronica persica	common field-speedwell			x			

Notes: x = present Species underlined = native woody species. Species in bold type = woodland species listed in the Hedgerow Regulations 1997.

Table 42 Lichen species recorded in Colston Farm Orchards

BLS No	Lichen taxa	Abundance	Evaluation & Rarity	Woodland Status
34	*Acrocordia gemmata*	R	LC	-
38	*Agonimia tristicula*	O	LC	-
212	*Amandinea punctata*	O	LC	-
48	*Anisomeridium biforme*	R	LC	-
49	*Anisomeridium polypori*	R	LC	-
56	*Arthonia didyma*	R	LC	-
68	*Arthonia punctiformis*	A	LC	-
69	*Arthonia radiata*	F	LC	-
1540	*Arthopyrenia analepta*	O	LC	-
164	*Bacidia rubella*	R	LC	-
207	*Buellia griseovirens*	R	LC	-
289	*Candelaria concolor*	O	LC	-
297	*Candelariella reflexa*	O	LC	-
410	*Cladonia pyxidata*	O	LC	-
449	*Collema furfuraceum*	R	LC	
511	*Evernia prunastri*	F	LC	-
987	*Flavoparmelia caperata*	A	LC	-
521	*Fuscidea lightfootii*	O	LC	-
533	*Graphis scripta*	O	LC	-
541	*Gyalecta truncigena*	R	LC	-
547	*Gyalideopsis anastomosans*	R	LC	-
582	*Hypogymnia physodes*	O	LC	-
583	*Hypogymnia tubulosa*	O	LC	-
1013	*Hypotrachyna revoluta*	A	LC	-
754	*Lecanora albella*	R	LC	-
639	*Lecanora chlarotera*	F	LC	-
1996	*Lecanora compallens*	R	**NS**	-
658	*Lecanora jamesii*	O	LC	NIEC
797	*Lecidella elaeochroma e.*	A	LC	-
848	*Leptogium teretiusculum*	O	LC	NIEC

Table continued...

BLS No	Lichen taxa	Abundance	Evaluation & Rarity	Woodland Status
997	*Melanelia fuliginosa subsp. g*	O	LC	-
1020	*Melanelia subaurifera*	F	LC	-
920	*Normandina pulchella*	F	LC	-
927	*Ochrolechia subviridis*	F	LC	-
938	*Opegrapha atra*	F	LC	-
965	*Opegrapha vermicellifera*	R	LC	-
943	*Opegrapha vulgata*	R	LC	-
1022	*Parmelia sulcata*	R	LC	-
1008	*Parmotrema chinense*	?	LC	-
1047	*Peltigera membranacea*	R	LC	-
1058	*Pertusaria amara amara*	O	LC	-
1079	*Pertusaria leioplaca*	R	LC	-
1087	*Pertusaria pertusa*	O	LC	-
1107	*Phaeophyscia orbicularis*	R	LC	-
1109	*Phlyctis argena*	O	LC	-
1113	*Physcia aipolia*	F	LC	-
1112	*Physcia tenella ten*	A	LC	-
732	*Placynthiella icmalea*	R	LC	-
1168	*Porina aenea*	R	LC	-
1011	*Punctelia reddenda*	R	LC	RIEC/NIEC
2070	*Punctelia subrudecta s. str*	A	LC	-
1989	*Punctelia ulophylla*	F	LC	-
1228	*Pyrrhospora quernea*	R	LC	-
1234	*Ramalina farinacea*	A	LC	-
1235	*Ramalina fastigiata*	O	LC	-
1243	*Ramonia chrysophaea*	R	**NT, IR**	NIEC(B)
1298	*Rinodina sophodes*	R	LC	-
1471	*Usnea subfloridana*	R	LC	-
1530	*Xanthoria parietina*	O	LC	-
1531	*Xanthoria polycarpa*	O	LC	

Notes: D = Dominant, A = Abundant, F = Frequent, O = Occasional, R = Rare. For explanation of BLS number see paragraph 2.17, for Evaluation & Rarity see paragraph 3.14 and for Woodland Status see paragraph 3.11.

Table 43 Bryophytes recorded in Colston Farm Orchards

Bryophyte taxa	Apple DAFOR	Obligate epiphytes
Amblystegium serpens	R	
Bryum capillare	R	
Cryphaea heteromalla	O	1
Dicranoweisia cirrata	R	
Eurynchium praelongum	R	
Frullania dilatata	F	1
Homalothecium sericeum	O	
Hypnum cupressiforme	F	
Hypnum resupinatum	A	
Isothecium myosuroides	R	
Leucodon sciuroides	R	1
Metzgeria furcata	A	
Metzgeria temperata	R	1
Microlejeunea ulicina	O	1
Neckera complanata	R	
Neckera pumila	R	1
Orthotrichum affine	R	1
Orthotrichum lyellii	R	1
Radula complanata	R	1
Rhynchostegium confertum	O	
Syntrichia laevipila	R	1
Ulota bruchii	R	1
Zygodon viridissimus	F	
Total	**23**	**11**

Notes: D = Dominant A = Abundant F = Frequent O = Occasional, R = Rare

Table 44 Number of bryophytes on individual trees in Colston Farm Orchards

Tree type	Girth cm	Number of species	Number of obligate epiphytes	Percent of species / tree obligate epiphytes
Apple	102	12	3	25
Apple	112	7	1	14.3
Apple	64	10	5	50
Apple	86	7	3	42.9
Apple	126	12	6	50
Apple	105	8	2	25
Apple	69	12	5	41.7
Apple	73	13	6	46.2
Apple	80	10	4	40
Apple	72	3	0	0
Apple	34	1	0	0
Apple	37	0	0	0
Apple	65	2	0	0
Apple	114	12	4	33.3
Average	**87.6**	**8.4**	**3.0**	**28.3**

Table 45 Fungus species recorded in Colston Farm Orchards

Latin name	Family	Associated habitat	Notes
Agaricus moelleri	Agaricaceae	Grassland + trees / scrub	2 fruitbodies under apple tree in grass
Armillaria mellea s.l.	Tricholomataceae	Wood	Rhizomorphs on dead cut apple log in wood pile
Boletus chrysenteron agg.	Boletaceae	Grassland + trees / scrub	25 fruitbodies under Oak tree
Boletus declivitatus	Boletaceae	Grassland + trees / scrub	3 fruitbodies, 14-16m from oak
Botryobasidium aureum	Botryobasidiaceae	Wood	Alysidium state on rotten, wet, dead, cut apple log in wood pile
Bovista nigrescens	Lycoperdaceae	Grassland	Two fruitbodies in grass
Camarophyllopsis schulzeri	Hygrophoraceae	Grassland	In grass
Clavulinopsis laeticolor	Clavariaceae	Grassland	9 fruitbodies in grass
Clavulinopsis luteoalba	Clavariaceae	Grassland	In grass
Cordyceps militaris	Cordycipitaceae	Lepidoptera larva	2 groups, in grass on buried moth (?) larvae
Dermoloma cuneifolium	Tricholomataceae	Grassland	5 fruitbodies in grass
Entoloma porphyrophaeum	Entolomataceae	Grassland	17 fruitbodies in grass
Geoglossum glutinosum	Geoglossaceae	Grassland	Group of sticky fruitbodies, deep in grass
Hygrocybe calyptriformis var. calyptriformis	Hygrophoraceae	Grassland	c. 50 fruitbodies, in grass
Hygrocybe citrinovirens	Hygrophoraceae	Grassland	6 fruitbodies in grass
Hygrocybe conica var. conica	Hygrophoraceae	Grassland	2 fruitbodies, in grass
Hygrocybe irrigata	Hygrophoraceae	Grassland	2 fruitbodies in grass
Hygrocybe persistens var. persistens	Hygrophoraceae	Grassland	In grass
Hygrocybe psittacina var. psittacina	Hygrophoraceae	Grassland	46 fruitbodies in 3m diameter half-ring in grass
Inocybe asterospora	Cortinariaceae	Grassland + trees / scrub	5 fruitbodies under oak
Inocybe cookei	Cortinariaceae	Grassland + trees / scrub	5 fruitbodies under oak
Lacrymaria lacrymabunda	Coprinaceae	Wood	Clump of old fruitbodies on dead Apple (?) stump

Table continued…

Latin name	Family	Associated habitat	Notes
Macrolepiota mastoidea	Lepiotaceae	Grassland	2 fruitbodies in grass under apple tree
Marasmius rotula	Tricholomataceae	Wood	1 fruitbodies on dead grass (?) stolon
Puccinia punctiformis	Pucciniaceae	Grassland	On creeping thistle
Puccinia sessilis	Pucciniaceae	Grassland	Aecia on Arum leaves
Rickenella fibula	Tricholomataceae	Grassland	2 fruitbodies, on moss in grass
Scleroderma verrucosum	Sclerodermataceae	Grassland + trees / scrub	10 fruitbodies, on bank, under oak at top
Trametes versicolor	Coriolaceae	Wood	On cut Apple log in woodpile
Vascellum pratense	Lycoperdaceae	Grassland	7 fruitbodies in grass

Table 46 Invertebrate species recorded in Colston Farm Orchards

Species	Family/Order	Assemblage	UK status	Notes
Gibbaranea gibbosa	Araneae	Canopy	Widespread	Beaten from apple blossom
Pisaura mirabilis	Araneae	Field layer	Widespread	
Misumena vatia	Araneida	Field layer	Widespread	Beaten from apple branches
Anobium punctatum	Col: Anobiidae	Saproxylic	Widespread	Flight interception trap, apple, three
Ptilinus pectinicornis	Col: Anobiidae	Saproxylic	Widespread	On lying dead trunk
Aphodius depressus	Col: Aphodiidae	Dung	Widespread	Flight interception trap, apple, one
Aphodius fimetarius/ A. pedellus	Col: Aphodiidae	Dung	Widespread	Flight interception trap
Aphodius pusillus	Col: Aphodiidae	Dung	Local	Flight interception trap
Aphodius sphacelatus	Col: Aphodiidae	Dung	Widespread	
Aphodius sticticus	Col: Aphodiidae	Dung	Widespread	
Protapion apricans	Col: Apionidae	Field layer	Widespread	Swept from grassland
Protapion fulvipes	Col: Apionidae	Field layer	Widespread	Swept
Apion frumentarium	Col: Apionidae	Field layer	Widespread	
Acanthephodes onopordi	Col: Apionidae	Field layer	Widespread	Swept from steeper banks
Neocoenorrhinus aequatus	Col: Attelabidae	Canopy	Widespread	Beaten from apple blossom
Bruchus rufipes	Col: Bruchidae	Field layer	Widespread	Beaten from apple branches

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Cantharis cryptica	Col: Cantharidae	Mosaic (C, F)	Widespread	Beaten from hawthorn
Malthinus balteatus	Col: Cantharidae	Saproxylic	Nb	Beaten from apple branches
Malthinus flaveolus	Col: Cantharidae	Saproxylic	Widespread	Beaten from apple branches
Malthodes marginatus	Col: Cantharidae	Saproxylic	Widespread	Swept from hedgerow
Rhagonycha lignosa	Col: Cantharidae	Canopy	Widespread	Swept from hedgerow
Bembidion properans	Col: Carabidae	Ground layer	Widespread	South facing grassland slope
Demetrias atricapillus	Col: Carabidae	Field layer	Widespread	Swept
Dromius quadrimaculatus	Col: Carabidae	Saproxylic	Widespread	Beaten from apple branches
Dromius quadrinotatus	Col: Carabidae	Saproxylic	Widespread	Beaten from apple branches
Notiophilus biguttatus	Col: Carabidae	Ground layer +	Widespread	Suction sample from trunk base
Clytus arietus	Col: Cerambycidae	Saproxylic	Widespread	On hedgebank
Grammoptera ruficornis	Col: Cerambycidae	Saproxylic	Widespread	
Pogonocherus hispidulus	Col: Cerambycidae	Saproxylic	Widespread	
Pogonocherus hispidus	Col: Cerambycidae	Saproxylic	Local	Beaten from apple branches
Cassida vibex	Col: Chrysomelidae	Field layer	Local	
Chaetocnema hortensis	Col: Chrysomelidae	Field layer	Widespread	Suction sample from steeper banks
Gastrophysa viridula	Col: Chrysomelidae	Field layer	Widespread	Swept from marshy grassland
Chilocorus 2-pustulatus	Col: Coccinellidae	Canopy	Widespread	
Chilocorus renipustulatus	Col: Coccinellidae	Canopy	Widespread	Beaten from apple blossom
Exochomus quadripustulatus	Col: Coccinellidae	Canopy	Widespread	Beaten from apple branches
Propylea 14-punctata	Col: Coccinellidae	Canopy	Widespread	Flight interception trap, apple, one
[Pycnomerus fuliginosus]	Col: Colydiidae	Saproxylic	Local	Dead apple trunk
Anthonomus pomorum	Col: Curculionidae	Canopy	Local	Larvae develop in buds of apple

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Barypeithes pellucidus	Col: Curculionidae	Ground layer +	Widespread	Suction sample from trunk base
Cionus alauda	Col: Curculionidae	Field layer	Widespread	Swept from marshy grassland
Curculio nucum	Col: Curculionidae	Canopy	Widespread	Beaten from apple branches
Rhinocyllus conicus	Col: Curculionidae	Field layer	Nb	Swept from marshy grassland
Scolytus mali	Col: Curculionidae	Saproxylic	Nb	Dead apple trunk
Sitona lineatus	Col: Curculionidae	Field layer	Widespread	Flight interception trap
Athous bicolor	Col: Elateridae	Field layer	Widespread	Swept from steeper banks
Microcara testacea	Col: Elodidae	Field layer	Widespread	Flight interception trap, apple, three
Sphaeridium lunatum	Col: Hydrophilidae	Dung	Widespread	Flight interception trap, apple, one
Orchesia micans	Col: Melandryidae	Saproxylic	Nb	Flight interception trap, apple, one
Oedemera nobilis	Col: Oedemeridae	Field layer	Widespread	Swept
Rhinosimus planirostris	Col: Salpingidae	Saproxylic	Widespread	Flight interception trap, apple, one
Onthophagus coenobita	Col: Scarabaeidae	Dung	Local	South facing grassland slope
Phyllopertha horticola	Col: Scarabaeidae	Field layer	Widespread	Swept
Anaspis frontalis	Col: Scraptiidae	Saproxylic	Widespread	
Anaspis maculata	Col: Scraptiidae	Saproxylic	Widespread	Beaten from apple branches
Drusilla canaliculata	Col: Staphylinidae	Ground layer +	Widespread	Suction sample from steeper banks
Cylindrinotus laevioctostriatus	Col: Tenebrionidae	Saproxylic	Local	Under bark on dead apple branch
Forficula auricularia	Dermaptera	Generalist	Widespread	Beaten from apple blossom
Bombylius major	Dip: Bombyliidae	Field layer	Widespread	South facing grassland slope
Leia fascipennis	Dip: Mycetophilidae	Unknown	Widespread	Det. P. J. Chandler; probably develops in birds nests in trees
Palloptera muliebris	Dip: Pallopteridae	Saproxylic	Widespread	Beaten from apple branches
Palloptera trimacula	Dip: Pallopteridae	Generalist (D)	Widespread	Flight interception trap, apple, one
Chrysopilus cristatus	Dip: Rhagionidae	Field layer	Widespread	Swept from marshy grassland
Rhagio scolopaceus	Dip: Rhagionidae	Field layer	Widespread	Swept

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Beris chalybata	Dip: Stratiomyiidae	Field layer	Widespread	Beaten from apple branches
Beris fuscipes	Dip: Stratiomyiidae	Field layer	N	Beaten from apple branches
Beris vallata	Dip: Stratiomyiidae	Field layer	Widespread	Flight interception trap, apple, one
Pachygaster atra	Dip: Stratiomyiidae	Saproxylic	Widespread	Beaten from apple branches
Pachygaster leechi	Dip: Stratiomyiidae	Saproxylic	Widespread	Flight interception trap, apple, one
Eupeodes nitens	Dip: Syrphidae	Canopy	N	Flight interception trap, apple, one female
Rhingia campestris	Dip: Syrphidae	Dung	Widespread	Grassland and scrub
Polyxenus lagurus	Diplopoda: Polyxenidae	Saproxylic	Local	Beaten in numbers from apple branches
Balea perversa/heydeni	Gastropoda	Epiphyte	Local	Beaten from apple branches
Lauria cylindracea	Gastropoda	Ground layer +	Widespread	On dead apple branch
Monacha cantiana	Gastropoda	Ground layer +	Widespread	Swept from marshy grassland
Succinea putris	Gastropoda	Ground layer +	Widespread	Swept from marshy grassland
Anthocoris nemorum	Hem: Anthocoridae	Canopy	Widespread	Beaten from apple branches
Cardiastethus fasciiventris	Hem: Anthocoridae	Saproxylic	Local	Beaten from apple branches
Temnostethus gracilis	Hem: Anthocoridae	Epiphyte	Local	Beaten from apple branches
Eriosoma lanigerum	Hem: Aphididae	Canopy	Widespread	Beaten from apple branches
Aphrophora alni	Hem: Cercopidae	Canopy	Widespread	Flight interception trap, apple, six
Tachycixius pilosus	Hem: Cixiidae	Canopy	Widespread	Flight interception trap, apple, seven
Coreus marginatus	Hem: Coreidae	Field layer	Widespread	Swept from marshy grassland
Cymus melanocephalus	Hem: Lygaeidae	Field layer	Widespread	Swept from marshy grassland
Drymus sylvaticus	Hem: Lygaeidae	Ground layer +	Widespread	Flight interception trap, apple, one

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Loricula elegantula	Hem: Microphysidae	Saproxylic*	Widespread	Beaten from apple branches
Acetropis gimmerthali	Hem: Miridae	Field layer	Widespread	Swept
Atractotomus mali	Hem: Miridae	Canopy	Widespread	Flight interception trap, apple, one
Deraeocoris lutescens	Hem: Miridae	Canopy	Widespread	Beaten from apple blossom
Deraeocoris ruber	Hem: Miridae	Field layer	Widespread	Flight interception trap, apple, eight
Liocoris tripustulatus	Hem: Miridae	Field layer	Widespread	Swept from nettles
Pachytomella parallela	Hem: Miridae	Field layer	Local	Swept
Phytocoris dimidiatus	Hem: Miridae	Canopy	Widespread	Beaten from apple branches
Phytocoris tiliae	Hem: Miridae	Canopy	Widespread	Beaten from apple branches
Psallus ambiguus	Hem: Miridae	Canopy	Widespread	
Stenodema laevigatum	Hem: Miridae	Field layer	Widespread	Swept
Palomena prasina	Hem: Pentatomidae	Canopy	Widespread	Swept from marshy grassland
Psylla mali	Hem: Psyllidae	Canopy	Widespread	Beaten from apple branches
Saldula c-album	Hem: Saldidae	Ground layer +	Widespread	Flight interception trap, apple, one
Tingis ampliata	Hem: Tingidae	Field layer	Widespread	Swept
Andrena cineraria	Hym: Andrenidae	Field layer	Local	
Andrena haemorrhoa	Hym: Andrenidae	Mosaic (G, F, C)	Widespread	Beaten from apple blossom
Andrena saundersella	Hym: Andrenidae	Field layer	Widespread	Water trap
Nomada goodeniana	Hym: Anthophoridae	Field layer	Widespread	South facing grassland slope
Nomada ruficornis	Hym: Anthophoridae	Field layer	Local	Swept from grassland
Apis mellifera	Hym: Apidae	Saproxylic	Widespread	Flight interception trap
Bombus lapidarius	Hym: Bombidae	Field layer	Widespread	
Lasius flavus	Hym: Formicidae	Ground layer	Widespread	Old anthills
Lasius niger sens. str.	Hym: Formicidae	Ground layer	Widespread	South facing grassland slope
Myrmica ruginodis	Hym: Formicidae	Ground layer	Widespread	Suction sample from trunk base
Myrmica scabrinodis	Hym: Formicidae	Ground layer	Widespread	South facing grassland slope

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Crossocerus megacephalus	Hym: Sphecidae	Saproxylic	Widespread	Flight interception trap
Tiphia minuta	Hym: Tiphiidae	Ground layer	Nb	Flight interception trap
Cleorodes lichenaria	Lep: Geometridae	Canopy	Widespread	Beaten from apple - larvae feed on lichen
Polyommatus icarus	Lep: Lycaenidae	Field layer	Widespread	Grassland
Axylia putris	Lep: Noctuidae	Field layer	Widespread	Suction sample from trunk base
Aglais urticae	Lep: Nymphalidae	Field layer	Widespread	General - larvae on Urtica spp.
Anthocharis cardamines	Lep: Pieridae	Field layer	Widespread	Grassland
Pieris rapae	Lep: Pieridae	Field layer	Widespread	Grassland
Galleria mellonella	Lep: Pyralidae	Nests (B)	Widespread	Flight interception trap
Parage aegeria	Lep: Satyridae	Field layer	Widespread	
Calopteryx virgo	Odonata	Freshwater	Local	Streamside vegetation
Porcellio scaber	Oniscoidea	Generalist	Widespread	In white-rotten apple heartwood
Dicranopalpus ramosus	Opiliones	Canopy	Widespread	Beaten from apple branches
Opilo saxatilis	Opiliones	Epiphyte	Widespread	Flight interception trap, apple, one
Leptophyes punctatissima	Orthoptera	Field layer	Widespread	Swept
Meconema thalassinum	Orthoptera	Canopy	Widespread	Flight interception trap, apple, one
Tetrix subulata	Orthoptera	Field layer	Widespread	Wet grassland
Tetrix undulata	Orthoptera	Field layer	Widespread	
Ectopsocus briggsi	Psocoptera	Epiphyte	Widespread	Beaten from apple branches
Elipsocus hyalinus	Psocoptera	Epiphyte	Widespread	Beaten from apple branches
Graphopsocus cruciatus	Psocoptera	Epiphyte	Widespread	Beaten from old hedgerow oak pollard
Loensia fasciata	Psocoptera	Epiphyte	Local	Flight interception trap, apple, one
Loensia variegata	Psocoptera	Epiphyte	Local	Flight interception trap, apple, five
Mesopsocus unipunctatus	Psocoptera	Epiphyte	Widespread	Beaten from apple branches

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Peripsocus phaeopterus	Psocoptera	Epiphyte	Widespread	Beaten from apple branches
Philotarsus parviceps	Psocoptera	Epiphyte	Widespread	Beaten from apple branches
Reuterella helvimacula	Psocoptera	Epiphyte	Local	Beaten from apple branches
Stenopsocus immaculatus	Psocoptera	Epiphyte	Widespread	Beaten from apple branches

Notes: see paragraphs 3.9 and 3.17 for explanations of assemblages and status categories.

* *Loricula elegantula*: difficult to assign to one assemblage. Classified as saproxylic by Alexander 2002a, but sometimes regarded as part of the epiphyte assemblage. It tended to occur among epiphytes in the current survey.

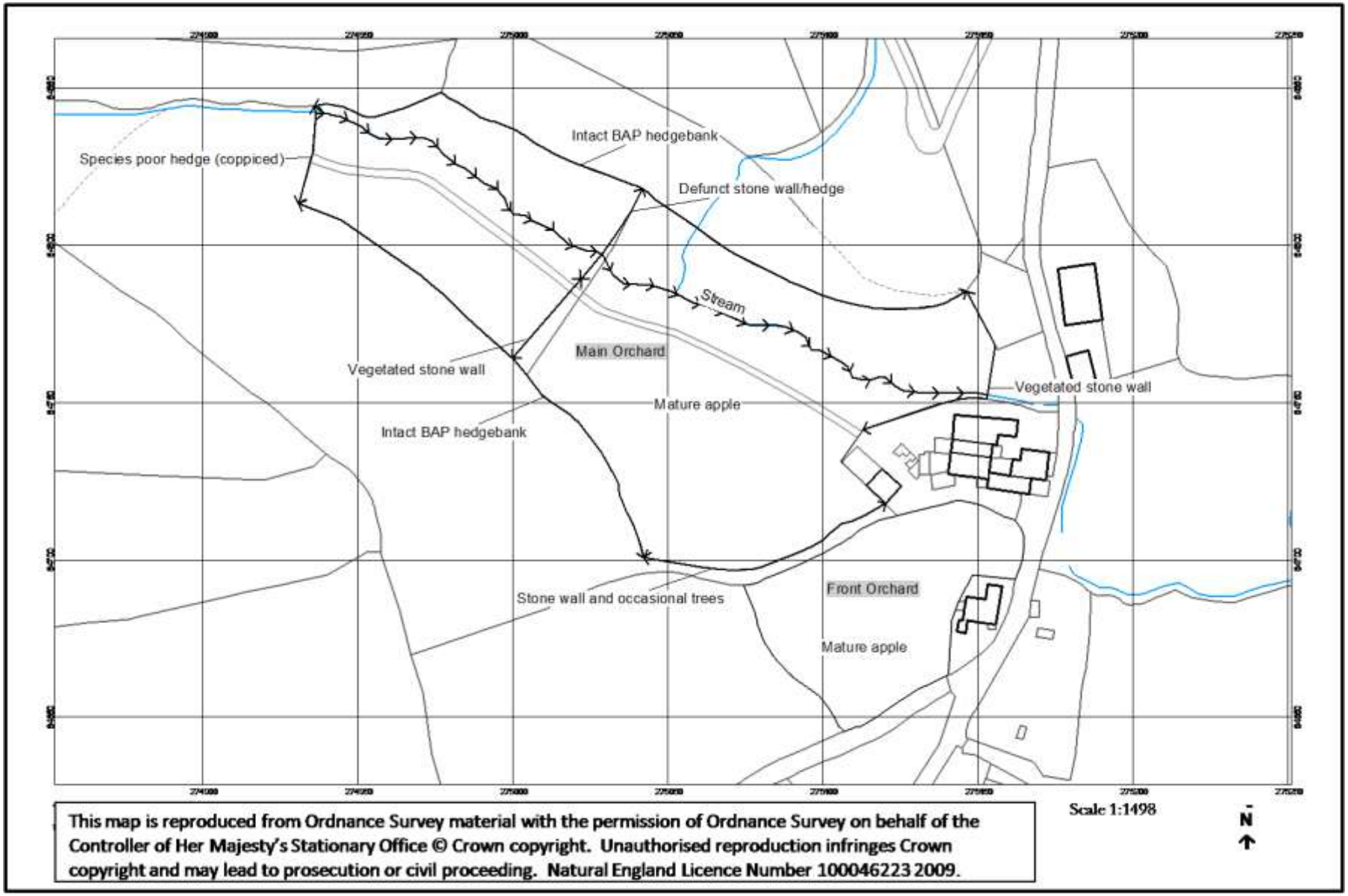

Figure 6 Map of Colston Farm Orchards (SX750648). Orchard type and boundaries map

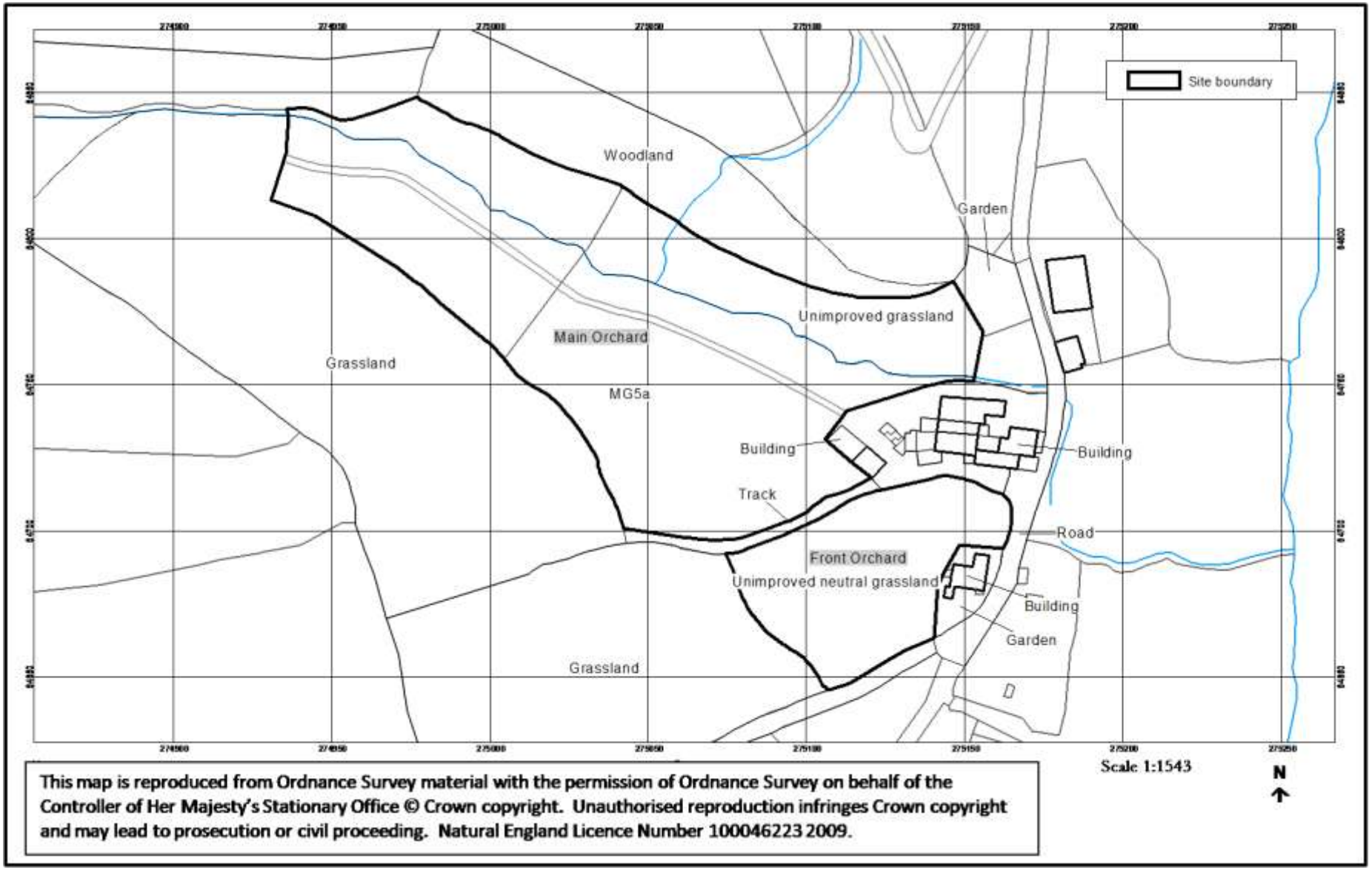

Figure 7 Map of Colston Farm Orchards (SX750648). Orchard floor, surrounding land use and compartments

7 Rummers Lane Orchards

Landscape setting

7.1 Rummers Lane Orchards are a block of orchards set in the flat Fenland landscape close to Wisbech St Mary in Cambridgeshire (Figure 8). The orchards are surrounded by arable land and intensively managed orchards (Figure 9). Ditches form the main field boundary features. There are very few hedgerows and tree lines, while woodlands are also scarce. However, a new broad-leaved woodland has been recently created on the south-eastern border of Rummers Lane Orchards. Gardens and a small 'parkland' lie along the north-western border of the orchards and form part of the settlement of Wisbech St Mary. The nearest traditional orchard to the site is a fragment adjacent to the site boundary. The area of orchards (69.7 ha) within or intersecting with a 1 km wide zone around the site is the second largest of all such areas around the study sites (Table 5), although the proportion judged to be traditional only amounted to 8.5 ha. On a national scale, Rummers Lane Orchards are in a low rainfall zone (Table 5), where low wet atmospheric deposition of sulphur and nitrogen occur (Table 5). Atmospheric dry deposition of these elements is relatively high but not as great as the zone containing Park Farm Orchard in Kent.

History and management

7.2 Rummers Lane Orchards cover 8.3 ha and contain a mix of fruit types and varieties. Apples predominate, plum is the next most abundant type and there are a few greengage plums, damsons, cherry plums and pears (Figure 8). There are about 2,700 trees in total, or an average of about 325 trees per hectare. At least 23 varieties of apple have been identified, including dessert apples and cooking apple such as Bramleys, and four varieties of plum. In contrast to the other study sites, most of the trees are not full standards with 2 m trunks. Quarter or half-standards make up the majority of the trees, with some trunks rather less than 1m and others slightly more than 1 m in height. In addition, large 'coppice' forms are present where no single trunk is visible, the massive main branches arising close to the ground surface.

7.3 The orchards are believed to be between 50-100 years old, with some of the apple trees estimated to be over 100 years old. The First Edition Ordnance Survey map of 1886-1888 (1:2500 scale) shows no orchards at the Rummers Lane site. Only a few tiny orchards are shown on the map in the surrounding 1 km wide zone around the site, amounting to 0.4 ha. One of these (in Wisbech St Mary) still exists. No woodlands are evident around the site. The small area of orchards present at the end of the nineteenth century compares with the area of 69.7 ha shown on the 2003 UKPerspectives aerial photographs.

7.4 The nearest ancient woodland site to Rummers Lane is 22 km away, in Norfolk (Spencer and Thomas 1992). However, the 1886-1888 map makers plotted individual trees and the map shows these trees were quite plentiful around Rummers Lane at that time. They occurred along ditches and roadsides and there were also scattered trees in 'parkland' arrangements in several areas, for example around Inham Hall. These parcels do not seem to have been orchards as the trees were widely scattered and irregular in distribution. The continuity of tree cover in the landscape in earlier times is unknown, though it seems unlikely that undrained fenland was completely devoid of trees or wet woodland.

7.5 The Rummers Lane Orchards are believed to have originated as small holdings, each parcel being about 2 to 5 hectares. In the Wisbech region, the tradition was to grow gooseberries under Bramley apples (Roach 1985). It may be that part or all of the Rummers Lane Orchards were managed in early years under a 'soft fruit under top fruit' system as the stature and growth form

of the trees would have made them susceptible to browsing by livestock if a grazed system had been contemplated.

7.6 The orchards had been neglected for about 10 years before the current site manager took over and began restoration management in 2001. Neglect had resulted in bramble almost covering many trees and the first task was to remove it. Much of the bramble has now been cleared and major restorative pruning of the fruit trees has been carried out. The site manager has some concerns about the long term survival of the trees that had been cleared of bramble. Some trees had died although others showed canopy regrowth. Planting of replacement trees was due to begin shortly after the site survey took place. Bramble control on the orchard floor continues by cutting and strimming.

7.7 Initially, the pruned material had been burnt, though chipping and removing those branches less than 8 inches in diameter had become the preferred option. Wood affected with silver leaf, canker and scab was removed from the site. Larger logs have been stacked on the orchard boundary, though these may be used for firewood in the future. Some of the dead trees are being left standing and some of the *Hedera helix* (ivy) on trees is left for cover for wildlife. There is a row of poplars along the south-west edge of the Area 1 (Figure 8) that are due to be removed, because they are shading the fruit trees. A new hedgerow is planned to take their place. A new pond was created on the eastern boundary of the site three years before the site survey took place.

7.8 The orchard floor grassland is sheep grazed from the end of March to October. The grazing is carried out on rotation, with a target height of 15 cm or less for the sward. Grazing levels are adjusted to avoid poaching the soil, which is wet for much of the year. The sheep also tend to nibble the tree bark a little, though this damage is not considered to be a problem. The only supplementary feeding provided are salt licks. In addition to grazing, the grassland is also cut once a year, after the sheep had been removed, and strimmed in the winter. Nettles and thistles are also topped. Whilst thistles were a minor problem the nettles required topping twice annually.

7.9 The orchards are managed organically and were due to be certified by the Soil Association in August 2004. No fertilisers or sprays are used. The orchards are also managed under the Countryside Stewardship Scheme. There is open access for the public, and educational visits were planned for 2005.

Fruit tree survey

Overview of fruit tree survey

7.10 The orchards were divided into 3 blocks of fruit trees (Figure 8). The south-eastern block (Area 1) was separated from the other blocks by a track and strip of grassland. The other two blocks were aligned longitudinally in a south-west to north-east direction and were separated by a grassland area (Figure 8). The central block and the north-west block were divided laterally into two roughly equal halves by a track. The resulting compartments have been numbered as shown on Figure 8.

7.11 The blocks varied in amount of tree canopy closure, but overall, the canopy was relatively continuous, especially among the larger apple trees. The smaller apple trees had been pruned into low, hollow pyramid shapes, with light canopies, to encourage fruit development.

7.12 The sample trees that were measured were mostly apples (Table 47). The ones with the largest girths occurred in Areas 1 and 7, medium sizes were found in Areas 4, 6 and 8, while the smallest girth sizes were found in Area 5, which also contained some small plums (Table 47). The plums had the lowest occurrence of possible veteran tree features across the sample (6%), followed by the apples in Area 5 (16%). The greatest occurrence of veteran tree features was in Area 1 (35%) but these features were also relatively frequent in Areas 4, 7 and 8 (Table 47).

South-eastern orchard block (Area 1)

7.13 This orchard block consisted mainly of large old Bramley apple trees. Average girth was 145 cm (Table 47). The canopy was more or less closed. Standing dead trees were rare. All of the trees sampled had at least one veteran tree feature. Of the living trees in the sample, 63% were judged to be quarter standards, 31% 'coppice' forms and 6% half-standard. Remarkably, five trees in the sample had epiphytic *Anthriscus sylvestris* (cow parsley) growing on them. *Poa pratensis* (smooth meadow-grass) and *Urtica dioica* (common nettle) also occurred as epiphytes, the presence of these three species suggesting highly enriched conditions at colonization sites on the trees.

Central orchard block (Areas 6 and 7)

7.14 Area 6 was mainly apple, though also included occasional plum, damson and pear trees. The rows were spaced 6 m apart, with the trees at 4 m intervals, and the trees formed a dense canopy. The sample apples had an average girth of 81 cm (Table 47). Most trees were quarter-standards though there were some full standards. The majority of the trees (80%) had at least one veteran tree feature, with 24% of the total possible occurrences of these features being present in the sample.

7.15 Area 7 was mainly comprised of Bramley apples, and contained some huge trees, especially in the two northerly rows. Most trees in the sample were quarter-standard though some had a 'coppice' form. Average girth size in the sample was 193 cm, the largest of all the compartments in Rummers Lane Orchards. Rows were spaced about 10 m apart, and the compartment had a more or less closed canopy, especially along the rows where trees were around 8 m apart. Most trees in the sample (90%) had at least one veteran tree feature, and 29% of the total possible occurrences of these features were present in the sample. Among the sampled trees, 20% had ivy growing on them.

North-western orchard block (Areas 4, 5 and 8)

7.16 Area 4 consisted of apple trees in rows spaced 6 m apart, with the trees planted 4 m apart. This density of planting had resulted in a fairly closed canopy. Tree form was a mix of quarter-standards, half-standards and 'coppice' types. Average girth in the sample was 91 cm. All trees in the sample had at least one veteran tree feature, and 32% of the total possible occurrences of these features were present in the sample. A quarter of the trees had ivy growing on them, and one tree had epiphytic *Anthriscus sylvestris* (cow parsley).

7.17 Area 5 was largely made up of apple trees along the north-western border of the block and a strip of plums (Figure 8). The apple tree rows were spaced 7 m apart, with the trees planted 4 m apart. The canopy was relatively closed, especially along the rows. A number of *Acer pseudoplatanus* (sycamore) trees had replaced the apples along part of the row closest to the site boundary. The sample included one pear tree (Table 47). Most of the trees were quarter-standards. Average girth of the apples in the sample was 57 cm, 82% had at least one veteran tree feature, but only 16% of the total possible occurrences of these features were present in the sample.

7.18 The plum rows in Area 5 were spaced 7 m apart, and the distance between trees was 4 m. Canopy cover was partial, the trees having quite an upright growth form. Most trees were half-standards. Average girth in the sample was 55 cm. Only 43% had at least one veteran tree feature, and 6% of the total possible occurrences of these features were present in the sample. These figures were the lowest among all the orchard compartments.

7.19 Area 8 was made up of apples in rows spaced about 6m apart, with the trees spaced at 8m intervals. The canopy was therefore mostly closed with slight gaps between the canopies of the trees. Average girth in the sample was 88 cm and the trees were quarter-standards. All trees in the sample had at least one veteran tree feature, and 29% of the total possible occurrences of these features were present in the sample.

Orchard floor habitats

South-eastern orchard block (Area 1)

7.20 Area 1 was cleared of dense scrub in the spring of 2004, so there were localised areas of bare ground at the time of the survey, in the form of tracks made by the machinery used for scrub clearance. The ground flora was species-poor, with species indicative of disturbance and enrichment (Table 48). *Urtica dioica* (common nettle) and *Anthriscus sylvestris* (cow parsley) were particularly abundant. The cover of nettles averaged 30%, increasing to 70% cover locally. This plant community was probably closest to OV24 *Urtica dioica-Galium aparine* community within the National Vegeation Classification (Rodwell 2000). Bare ground that was generally distributed through the sward amounted to about 1%, and litter was less than 1% in cover. About 5% of the area was more open and grassy, though *Urtica dioica* was still frequent in this area. In addition to those species in the main ground flora these grassy areas also contained occasional *Cirsium arvense* (creeping thistle), and more abundant *Holcus lanatus* (Yorkshire fog). This plant community was probably still closest to OV24 *Urtica dioica-Galium aparine* though had some resemblance to MG1 *Arrhenatherum elatius* grassland, *Urtica dioica* sub-community (Rodwell 1992).

Central orchard block (Areas 6 and 7)

7.21 The plant community in Area 6 and 7 resembled that in Area 4, that is, OV23 *Lolium perenne-Dactylis glomerata* community (Rodwell 2000). *Prunella vulgaris* (self-heal), which was rare in occurrence, was noted in Area 7.

North-western orchard block (Areas 4, 5 and 8)

7.22 The orchard floor in Area 4 was species-poor (Table 48) and contained much *Urtica dioica* especially around tree bases and where scrub had been recently cleared. Average cover of Urtica was 30%. Additional species noted in Area 4 during the bryophyte survey were *Rubus fruticosus* agg. (bramble), *Cirsium vulgare* (spear thistle), *Dactylis glomerata* (cock's foot) and *Galium aparine* (cleavers). This plant community was best matched to OV23 *Lolium perenne-Dactylis glomerata* open community (Rodwell 2000), though it will probably develop into MG7 *Lolium perenne* grassland with time.

7.23 The grassland in Area 5 and 8 was species-poor and herbs accounted for less than 1% of the vegetation cover, excluding *Urtica dioica*, which accounted for approximately 5%. There was rather less *Urtica dioica* around the bases of the trees in Area 8. Additional species noted during the bryophyte survey were *Rubus fruticosus* agg (bramble), *Cerastium fontanum* (common mouse-ear) and *Glechoma hederacea* (ground-ivy). The plant community was closest to MG9 *Deschampsia cespitosa* grassland, transitional to MG1 *Arrhenatherum elatius* grassland (Rodwell 1992). The sward was taller in this block than elsewhere in the orchards and reached up to 30cm in height.

Grassland between orchard blocks

Grassland between south-eastern block and central block (Area 2)

7.24 Area 2 was once arable but is now being reverted to grassland under the Countryside Stewardship Scheme and is fenced off from the orchard blocks (Figure 8). In 2004 it was predominantly grass dominated, with less than 1% herb cover (Table 49). It was best described as MG7 *Lolium perenne* grassland (Rodwell 1992). There was little litter in the grassland sward (less than 1%).

Grassland between central block and north-western block (Area 3)

7.25 Area 3 is also being reverted to grassland from arable under the Countryside Stewardship Scheme. It is not fenced off from the orchard blocks and forms one grazing unit with them (Figure

8). The vegetation was species-poor in 2004 (Table 49). *Holcus lanatus* (Yorkshire-fog) was dominant and the community was closest to OV25 *Urtica dioica-Cirsium arvense* community (Rodwell 2000), though it will probably develop into a National Vegetation Classification grassland community as the arable reversion continues.

Orchard boundaries

South-eastern orchard block (Area 1)

7.26 Area 1 was separated from the grassland area (Area 2) by fences, a track, a ditch and a newly planted hedgerow (Figure 8). Other boundaries of Area 1 were fenced but, in addition, there was a line of poplars along the south-western boundary. The ditch alongside the north-eastern fence contained *Arrhenatherum elatius* (false oat-grass), *Urtica dioica*, (common nettle), *Lolium perenne* (perennial rye-grass) and *Galium aparine* (cleavers). The ditch between Area 1 and Area 2 contained the following species: *Brassica napus* (rape), *Calystegia sepium* (hedge bindweed), *Chamerion angustifolium* (rosebay willowherb), *Cirsium arvense* (creeping thistle), *Conium maculatum* (hemlock), *Dipsacus fullonum* (wild teasel), *Epilobium* species (a willowherb), *Galium aparine* (cleavers), *Phragmites australis* (common reed), *Rubus fruticosus* agg. (bramble) and *Sambucus nigra* (elder).

Boundaries around central and north-western blocks

7.27 The boundary around these blocks consisted of fences, and, in places, ditches. A line of trees occurred along the north-western boundary (Figure 8). Species noted along this boundary included: *Acer pseudoplatanus* (sycamore), *Arrhenatherum elatius* (false oat-grass), *Cirsium arvense* (creeping thistle), *Hedera helix* (ivy), *Holcus lanatus* (Yorkshire-fog), *Malus domestica* (apple), *Rubus fruticosus* agg. (bramble) and *Urtica dioica* (common nettle).

7.28 The south-western boundary was fenced and also had a grassy wet ditch about 4 m across and 3 m deep. The ditch had steep, grass-dominated, banks with *Arrhenatherum elatius* (false oat-grass), *Cirsium arvense* (creeping thistle), *Dactylis glomerata* (cock's-foot), and *Elytrigia repens* (common couch).

Epiphytic lichens

Community characteristics

7.29 Forty-four lichen species were recorded in Rummers Lane Orchards (Table 50). Ten species were seen only once or twice, thus giving a core population for the site of 34 taxa. The main lichen communities were the *Xanthorion* (twigs and branches), which indicates nutrient-enriched bark, and which was frequent, and the *Parmelion* (boughs and thicker branches). The *Graphidion* and *Lecanorion* were very poorly represented while the *Usneion* was absent. Dominant or abundant species were *Parmelia sulcata* (*Parmelion*) and *Physcia tenella* (*Xanthorion*). The tree trunk lichen cover was represented by one dominant species, *Anisomeridium polypori*, occasionally joined by *Dimerella pineti*.

7.30 The general impression was that the lichen flora represented an invasion phase following a long period of air pollution by sulphur dioxide. The site is in a zone of relatively high dry deposition of sulphur (Table 5). Historically, the levels were also high, being around 60-125 micrograms of sulphur dioxide per cubic metre (on a scale ranging from less than 30 to over 170) in zones described by Hawksworth and Rose (1970). As a result, the lichen flora recorded in 2004 was generally poor in species when compared with many other parts of the country, and it was made up almost entirely of the most common lichen epiphytes. This was exemplified with reference to species of the *Parmelion* that were rare or occasional (that is, they may have been beginning to re-establish), such as *Flavoparmelia caperata* and *Hypotrachyna revoluta*. Other species present which may have been re-invading and which have been infrequently recorded in Cambridgeshire were *Parmelina tiliacea* (noted once), *Parmotrema chinense* (seen once) *Candelaria concolor,*

Lecanora symmicta and *Usnea subfloridana* (a few plants seen on two trees). No Indicators of Ecological Continuity were recorded, perhaps reflecting the lack of ancient woodland in the vicinity, but the high historic pollution levels may have obscured any relationships to habitat continuity.

Lichen species of special interest

7.31 ***Bacidia adastra*** (Nationally Rare): This lichen was described as new to Western Europe in 2003. The Rummers Lane record is the second British record for this species. It was present in the site on tree trunks and twigs. It may be an indicator of climate change and may increase in occurrence over time.

Bryophytes

Associations and characteristics

7.32 Rummers Lane Orchards had the richest bryophyte flora of all the sites surveyed (Table 51). Forty-two species were recorded, comprising four records from an original list made by the Cambridge Bryology Group in 2003 and 38 made in 2004 during the current study (see Table 51). Although the four species found by the Cambridge Group were not seen in 2004, they are unlikely to have disappeared. Eight new species were added to the original list by the 2004 survey (Table 51). The reasons why Rummers Lane Orchards had more species than other sites are not clear. The smaller stature of some trees might have aided inspection, although other sites, such as Luscombe Farm Orchards, also had apples of small stature. Rummers Lane Orchards received rather greater survey effort compared to other sites, so more trees may have been examined, but bryophyte numbers per tree were still greater than in other sites. Perhaps the more shaded conditions, including during the phase of scrub invasion in the past, favoured some species which were not found elsewhere, even in orchards that had the same fruit type. It is possible that remnant fen scrub or woodland in the landscape were rich sources of potential colonizers. Or there might be some competitive interaction with lichen species, which are present in lower abundances in Rummers Lane Orchards than sites like Colston Farm Orchards. Bates and others (2004) suggest that some bryophytes might be able to take advantage of habitats where epiphytes have been reduced by historical sulphur dioxide pollution, and, now that levels of this pollutant have fallen, be able to invade habitats free from competition. *Ulota phyllantha* is suggested as a possible species responding in this way, and it was found at Rummers Lane Orchards.

7.33 In 2004, plums and apples were examined and lists made for each fruit tree type and for the various compartments, as well an overall list for the site (Table 51). Area 8 and the majority of area 5 were excluded as they consisted of fairly young apples with little bryophyte cover. Two sets of individual apple trees, one each from Areas 6 and 7, were recorded in detail. Numbers of species and obligate epiphyte species are shown for these trees in Table 52.

7.34 Areas 1, 4 and 6 contained trees with high bryophyte cover. Areas 1 and 6 had the most species (24 and 27 species respectively). Table 52 shows that numbers of species per tree varied widely, from 3 to 13. On average, Area 6 had more species per tree (11) than Area 7 (6.45). The sample apple trees at Rummers Lane Orchards had the highest species richness per tree of any apples sampled during the study (Table 13). The study site is smaller than Broadway Farm Orchards (Table 1), yet had more species overall on apple trees (Table 11), suggesting that there is not a simple relationship between species richness and number of available apple trees, although the latter factor is likely to have some influence on species number.

7.35 The bryophyte flora on the plums was very limited (Table 51). Most trees had no bryophytes. Those bryophytes that were present were mainly located at the base of branches where these abutted on to the trunk, or on the few branch surfaces which were relatively level. Other trees only had a little cover of *Eurhynchium praelongum* and *Brachythecium rutabulum* at the base of the trunk.

7.36 Ground bryophytes recorded were as follows: *Brachythecium rutabulum, Eurhynchium hians, Eurhynchium praelongum* and *Leptodictyum riparium*.

Bryophyte species of special interest

7.37 The survey in 2004 found 2 species that were new vice-county records, and thus can be regarded as locally rare: *Sanionia uncinata* and *Pylaisia polyantha*. According to Bates and others (1997) another species recorded at Rummers Lane Orchards, *Leucodon sciuroides*, has appeared to decline in its occurrences as an epiphyte in southern England.

Fungi

Habitat associations and characteristics

7.38 Most of the species recorded were associated with wood, especially dead wood (Table 53). However, grassland species made a significant contribution through the existence of a small area of waxcap grassland. This grassland was located between the ditch alongside Rummers Lane and the edge of the orchard trees in Areas 5, 8 and 7 and the edge of the grassland in Area 3. The strip, which was only about 5 metres wide, continued alongside the south-eastern edge of Area 7 and 6. Given the small size of this waxcap grassland, the occurrence of 5 waxcap species there was exceptional.

7.39 The windbreak of old poplars along the south-western boundary of Area 1 provided several records of fungi associated with wood, including a Provisional Red Data List species (see below). The wood pruned from the orchards had been piled along the northeast boundaries of Area 4 and Area 6, forming two piles 46 and 29 metres long respectively, by 2.5m wide and up to 2m high. These wood piles provided a few records but were probably too exposed or too recently disturbed to be very fruitful. Overall, the orchards had many fruitbodies of dead wood fungi, although generally these were common species. *Pleurotus dryinus* was frequent on apple and poplar trunks.

Fungus species of special interest

7.40 ***Clavaria kreiglsteineri*** (BMSFRD: 6): This fungus was found in the narrow strip of waxcap grassland. This taxon probably includes what has been recorded elsewhere as *Clavaria tenuipes* (BMSFRD: 69).

7.41 ***Schizophyllum amplum*** (Provisional Red Data List, BMSFRD: 25): This species was found on a dead fallen poplar twig in the row of poplars.

7.42 ***Stropharia inuncta*** (BMSFRD: 217): This fungus was located in the narrow strip of waxcap grassland.

Invertebrates

General overview of assemblages and characteristics

7.43 The canopy fauna in Rummers Lane Orchards was the largest of the sites surveyed, though it is possible that the relatively small stature of many trees made sampling easier than in other sites (Table 15). The fauna associated with epiphytic lichens and bryophytes was limited, despite extensive bryophyte cover on some trees. The saproxylic fauna was in the middle range of the sites surveyed, but included three Nationally Scarce species and one Indicator of Ecological Continuity (see below). The field layer fauna was also of relatively moderate diversity, reflecting the varied sward structure, but species-poor composition, of the orchard floor vegetation (Table 15).

Canopy and mosaic fauna

7.44 The canopy fauna of the old apple trees was found to be of moderate abundance in terms of numbers of individuals, with the jumping plant louse *Psylla mali* present in large numbers. The plant bug *Atractotomus mali* was also widely present. Its main host plants are hawthorn and apple and it is partly predatory. While scale insects were not identified, specialist predators were well represented. The ladybirds *Chilocorus renipustulatus* and *Exochomus quadripustulatus* were both present in high numbers. These species also feed on soft-bodied invertebrates and may have been feeding on *Psylla*. Another abundant predatory insect was the plant bug *Deraeocoris lutescens*. As with the other sites, the common early mining bee *Andrena haemorrhoa* (mosaic assemblage) was numerous.

Epiphyte fauna

7.45 The fauna associated with epiphytic lichens and bryophytes had a limited diversity, even though bryophyte cover in places was high. Only six species of barkfly (Psocoptera) were detected in the orchards and these were predominantly species that feed on the micro-flora encrusting leaves rather than wood. Gilbert (1971) noted that barkflies feed preferentially on algae and fungal spores rather than lichens, though he made no reference to bryophytes. The relatively dry climate of the Cambridgeshire Fenland may be a factor affecting species numbers if algae and fungal spores are reduced by the low humidity.

Saproxylic fauna

7.46 Several factors may have influenced the moderate diversity of saproxylic invertebrates found in the site. The history of dense scrub cover (since cleared), may have caused a period of damp, shady conditions that were not suitable for many saproxylic species. The high degree of canopy closure may also have been a factor, as might the lack of veteran tree features in some compartments, especially among the plums. However, other compartments have a relative abundance of veteran tree features. The lack of ancient woodland nearby could have influenced the fauna, but historically, open grown trees might have been available, as discussed in pargraph 7.2 above, and could have been important in allowing one Indicator of Ecological Continuity to colonize the orchards (see below), along with other species. However, the presence of only one Indicator is not of much significance is assessing continuity of tree cover. Rummers Lane Orchards are an interesting contrast with Luscombe Farm Orchards and Colston Farm Orchards, where there was strong historical and spatial continuity of woodland and orchard habitat, but the trees did not have a similar quantity of veteran tree features compared to Rummers Lane Orchards and thus had a more limited saproxylic fauna.

7.47 Among the species present, the longhorn beetle, *Tetrops praeustus* develops in the dead twigs of woody Rosaceae in particular and is often a characteristic inhabitant of old orchards. It is a fairly localised species across lowland Britain and is best known from old hedgerow situations. Larvae of a snakefly (Raphidioptera) were present beneath dead bark on some of the apple trees but the species could not be identified without an adult specimen. This group is predatory and is often characteristic of old cultivated apple trees in England (Paul Whitehead pers obs). The local false scorpion *Chernes cimicoides* was present in the red-rotten heartwood of one old apple tree, and is a wood decay specialist species. The local *Magdalis ruficornis* was present in small numbers through the plum orchard. The larvae of these weevils most usually occur in degraded wood of small diameter twigs and fruit bud spurs of dead and dying twigs, and have a strong association with plants in the family Rosaceae (Paul Whitehead pers obs). *Ochina ptinoides* was another local beetle found in these orchards, but it develops in old dead ivy stems rather than in fruit trees.

7.48 Workers of the local wood-nesting ant *Temnothorax nylanderi* were found on sawn ends of apple boughs and on the trunk bases. This ant is widespread in Gloucestershire and Worcestershire including in orchards.

7.49 Standing dead trunks featured within the orchards and these provided sunny deadwood particularly attractive to dead-wood-nesting wasps such as digger wasps (Sphecidae) and the ruby-tail wasps (Chrysididae). The only chrysid recorded from the site was *Chrysis angustula* (allocated to nest assemblage), which parasitises the stem-nesting eumenid wasp *Ancistrocerus trifasciatus* and ground-nesting *Crabro* species (Morgan 1984), neither of which were recorded during the current survey. Relatively few sphecid wasps were recorded in Rummers Lane Orchards. Species found included three species that typically nest in the abandoned holes of wood-boring beetles in decaying wood. The wasps were *Crossocerus megacephalus*, *Pemphredon lugubris* and *Passaloecus corniger*. The last species is a "cuckoo" bee which parasitises the nests of *Psenulus pallipes* and other *Passaloecus* species (Richards 1980), none of which were recorded at this site.

Saproxylic species of special interest

7.50 ***Scolytus mali*** (Nationally Scarce, Category B): This bark beetle is a specialist of trees in the family Rosaceae and occurs widely in traditional orchards.

7.51 ***Phymatodes testaceus*** (Indicator of Ecological Continuity, Category 3): A single specimen of this local longhorn beetle was taken in one of the flight interception traps operated in the old apple orchard. This species frequently occurs in dead boughs and trunks of oak trees and is occasionally found in cultivated trees of the family Roscaeae in Britain (Whitehead, 2005) as well as on other broad-leaved trees.

7.52 ***Magdalis cerasi*** (Nationally Scarce, Category B): This weevil was taken in one of the flight interception traps in the centre of the old apple orchard as well as beaten from trees in the plum orchard. The species develops in dead and dying twigs on trees and especially woody plants in the family Rosaceae although the larvae of *M. cerasi* feed on oak as well as Rosaceae.

7.53 ***Lasius brunneus*** (Nationally Scarce, Category A): This species, also known as the brown ant, or tree ant was found nesting in apple red-rot. This species has a limited distribution in the south of England and Rummers Lane Orchards was the first site at which it had been found in Cambridgeshire, as well as being the most northerly site (Edwards 1998). This species usually nests within decaying heartwood in old open-grown trees and is a common feature of the orchards in Gloucestershire and Worcestershire.

Field and ground layer fauna

7.54 The orchard floor vegetation was species-poor and was of limited interest for invertebrates. Three widespread dung beetle species were present: *Aphodius ater, A. depressus* and *A. luridus*. The common digger wasp (Sphecidae) *Crossocerus quadrimaculatus*, was also recorded. This species nests in soil amongst the roots of fallen trees (Richards, 1980). A single species of nomad bee also occurred, the locally common *N. flavoguttata*, a "cuckoo" bee which parasitises the nests of several *Andrena* species. Bumblebees were fairly abundant but only common species were recorded.

Other fauna

7.55 Birds recorded at Rummers Lane in 2001 by Val Perrin of the Cambridgeshire Orchard Group (pers comm) included turtle dove (Red List, BAP species), yellowhammer (Red List), cuckoo (Amber List), green woodpecker (Amber List), willow warbler (Amber List), chiffchaff, tawny owl and whitethroat. Red and Amber bird species are of conservation concern in the UK and are listed in Anon (2002).

Table 47a Fruit tree survey at Rummers Lane Orchards - Area 1: apples

Fruit tree type	Girth cms	Height	Distance to nearest neighbour	Canopy live %	Hollow trunk / branch	Cracks / splits	Rot holes	Rot sites	Bark missing	Bark split	Sap runs
Apple	200	6	4	100	1		1	1	1		
Apple	217	5	7	97	1		1	1			
Apple	189	5	4	97			1	1		1	
Apple	169	6	4	98			1	1		1	
Apple	61	7.5	4	100				1	1		
Apple	73	6	4	99				1	1		
Apple	125	6	5	99			1	1			
Apple	95	6	3.5	99			1	1		1	
Apple	95	6		100				1			
Apple	168	7	5.5	99			1				
Apple	188	6	6	100			1	1		1	
Apple	58	5	3	95			1	1			
Apple	156	7	8	95			1	1			
Apple	203	6	8	98			1			1	
Apple	170	7	8	98				1	1	1	
Apple	150	5	6	98			1	1		1	
Average	**145**	**6**	**5**	**98**							
Percent					**13**	**0**	**75**	**88**	**25**	**44**	**0**

Percent of all trees with a veteran character - 100

All trees % of possible number of veteran character occurrences - 35

Note: 18 trees recorded, one a stump 0.7 m high, one a dead sapling. Data from remaining 16 trees

Table 47b Fruit tree survey at Rummers Lane Orchards - Area 4: apples

Fruit tree type	Girth cms	Height	Distance to nearest neighbour	Canopy live %	Hollow trunk / branch	Cracks / splits	Rot holes	Rot sites	Bark missing	Bark split	Sap runs
Apple	108	6	4	98			1				
Apple	90	5	4	98			1	1		1	
Apple	83	4	4	30	1		1	1		1	
Apple	61	4	4	50			1	1			
Apple	81	5	5	98			1	1			
Apple	133	7	4	98			1	1			
Apple	65	4	5	98				1	1		
Apple	85	4	4	98				1			
Apple	100	5	4	20	1		1	1			
Apple	88	5	4	75				1	1		
Apple	64	5	4	75			1	1	1		
Apple	134	7	5	98			1	1			
Average	**91**	**5**	**4**	**78**							
Percent					**17**	**0**	**75**	**92**	**25**	**17**	**0**

Percent of all trees with a veteran character - 100

All trees % of possible number of veteran character occurrences - 32

Table 47c Fruit tree survey at Rummers Lane Orchards - Area 5: plums

Fruit tree type	Girth cms	Height	Distance to nearest neighbour	Canopy live %	Hollow trunk / branch	Cracks / splits	Rot holes	Rot sites	Bark missing	Bark split	Sap runs
Plum	54	3	4	90							
Plum	66	5	4	98				1			
Cherry plum	83	7	4	100							
Plum	77	6	4	70				1			
Plum	60	5	4	98						1	
Plum	56	5	4	95						1	
Plum	55	6	4	99							
Plum	61	5	4	99							1
Plum	42	4.5	4	90							
Plum	37	5	4	99							1
Plum	49	5.5	4	99							
Plum	37	3	4	99							
Plum	45	4	4	99							
Plum	50	5	4	99							
Average	**55**	**5**	**4**	**95**							
Percent					**0**	**0**	**0**	**14**	**0**	**14**	**14**

Percent of all trees with a veteran character - 43

All trees % of possible number of veteran character occurrences - 6

Note: Cherry plum, stems growing from ground. Largest one measured. One stump 1m high. Remaining 14 trees measured

Table 47d Fruit tree survey at Rummers Lane Orchards - Area 5: apples & pear

Fruit tree type	Girth cms	Height	Distance to nearest neighbour	Canopy live %	Hollow trunk / branch	Cracks / splits	Rot holes	Rot sites	Bark missing	Bark split	Sap runs
Apple	79	4	4	99					1		
Apple	43	3	4	99							
Apple	64	5	3	99					1		
Apple	26	3	4	100			1		1		
Apple	65	5	4	100					1	1	
Apple	50	4	4	99							
Apple	26	3	4	100						1	
Apple	70	7	5	99					1	1	
Apple	79	5	4	100					1		
Apple	64	7	3	100					1		
Pear	60	6	3	100					1		
Average all	**57**	**5**	**4**	**100**							
Percent					**0**	**0**	**9**	**0**	**73**	**27**	**0**

Av girth apple - 57

Percent of all trees with a veteran character - 82

All trees % of possible number of veteran character occurrences - 16

Table 47e Fruit tree survey at Rummers Lane Orchards - Area 6: apples & pear

Fruit tree type	Girth cms	Height	Distance to nearest neighbour	Canopy live %	Hollow trunk / branch	Cracks / splits	Rot holes	Rot sites	Bark missing	Bark split	Sap runs
Apple	86	5	4	99			1	1	1		
Apple	84	6	5	100							
Apple	100	5	4	99	1			1	1		
Apple	82	4	5	99				1			
Apple	104	5	4	99			1	1		1	
Apple	78	5	3	95	1		1	1			
Apple	55	6	4	99				1			
Apple	69	4	4	99				1			
Apple	69	6	4	99							
Pear	135	6	4	99			1	1			
Average all	**86**	**5**	**4**	**99**							
Percent					**20**	**0**	**40**	**80**	**20**	**10**	**0**

Av girth apple - 81

Percent of all trees with a veteran character - 80

All trees % of possible number of veteran character occurrences - 24

Table 47f Fruit tree survey at Rummers Lane Orchards - Area 7: apples

Fruit tree type	Girth cms	Height	Distance to nearest neighbour	Canopy live %	Hollow trunk / branch	Cracks / splits	Rot holes	Rot sites	Bark missing	Bark split	Sap runs
Apple	190	8	10	99	1		1	1			
Apple	280	8	9								
Apple	148	9	10	100				1		1	
Apple	152	7	8	100				1			
Apple	130	7	8	100				1	1		
Apple	167	8	8	99	1		1	1			
Apple	290	6	9	99	1		1	1			
Apple	120	7	7	100					1		
Apple	140	8	8	100				1	1		
Apple	310	7	6	100	1		1	1			
Total	1927	75	83	897	4	0	4	8	3	1	0
Average	**193**	**8**	**8**	**90**							
Percent					**40**	**0**	**40**	**80**	**30**	**10**	**0**

Percent of all trees with a veteran character - 90

All trees % of possible number of veteran character occurrences - 29

Notes: One tree (no 2) has canopy, branches and trunk obscured by ivy so no veteran characters noted.

Table 47g Fruit tree survey at Rummers Lane Orchards - Area 8: apples

Fruit tree type	Girth cms	Height	Distance to nearest neighbour	Canopy live %	Hollow trunk / branch	Cracks / splits	Rot holes	Rot sites	Bark missing	Bark split	Sap runs
Apple	85	6	8	99			1	1	1		
Apple	90	5	8	99			1			1	
Apple	79	5	9	99				1	1		
Apple	81	6	10	99					1		
Apple	105	7	8	99				1	1		
Average	**88**	**6**	**9**	**99**							
Percent					**0**	**0**	**40**	**60**	**80**	**20**	

Percent of all trees with a veteran character - 100

All trees % of possible number of veteran character occurrences - 29

Note: In all above tables, 1 = veteran tree character present.

Table 48 Vascular plant species lists for orchard floor vegetation in Rummers Lane Orchards

Species	Common name	Area 1 Abundance	Area 4 Abundance	Area 5 & 8 Abundance
Agrostis stolonifera	creeping bent	F		
Agrostis spp	a bent		A	
Anthriscus sylvestris	cow parsley	A	O	
Arrhenatherum elatius	false oat-grass	O		D
Cirsium arvense	creeping thistle	O		F
Cirsium vulgare	spear thistle	R		
Convolvulus arvensis	field bindweed	R		
Deschampsia cespitosa	tufted hair-grass	O		A
Glechoma hederacea	ground-ivy	O		
Heracleum sphondylium	hogweed	O		
Holcus lanatus	yorkshire-fog	LF	A	
Lolium perenne	perennial rye-grass		F	A
Poa spp.	a meadow grass		A	
Poa trivialis	rough meadow-grass	F	F	F
Rumex obtusifolius	broad-leaved dock	O		
Urtica dioica	common nettle	A - LD	A	

Notes: D = Dominant, A = Abundant, F = Frequent, O = Occasional, R = Rare, L= Locally (used to modify other categories)

Table 49 Vascular plant species in grassland between orchard blocks at Rummers Lane

Species	Common name	Area 2 Abundance	Area 3 Abundance
Agrostis spp.	a bent		D
Arrhenatherum elatius	false oat-grass		O
Bromus hordeaceus	soft brome		O
Cirsium arvense	creeping thistle	R	F
Cirsium vulgare	spear thistle		F
Convolvulus arvensis	field bindweed		R
Cynosurus cristatus	crested dog's-tail		F
Dactylis glomerata	cock's-foot		P
Holcus lanatus	Yorkshire-fog		D
Lolium perenne	perennial rye-grass	D	
Rubus fruticosus agg.	bramble		F
Rumex crispus	curled dock	R	
Rumex obtusifolius	broad-leaved dock	O	
Taraxacum officinale agg.	dandelion	R	
Trifolium pratense	red clover	O	
Tripleurospermum inodorum	scentless mayweed	R	
Urtica dioica	common nettle	R	O

Notes: D = Dominant, A = Abundant, F = Frequent, O = Occasional, R = Rare, P = Present

Table 50 Lichen species recorded at Rummers Lane Orchards

BLS No	Lichen taxa	Abundance	Evaluation & rarity	Woodland status
212	*Amandinea punctata*	F	LC	-
49	*Anisomeridium polypori*	A	LC	-
68	*Arthonia punctiformis*	F	LC	-
69	*Arthonia radiata*	O	LC	-
None	*Bacidia adastra*	O	**NR**	-
261	*Caloplaca holocarpa*	R	LC	-
289	*Candelaria concolor*	R	LC	-
297	*Candelariella reflexa*	O-F	LC	-
384	*Cladonia fimbriata*	R	LC	-
429	*Cliostomum griffithii*	R	LC	-
489	*Dimerella pineti*	O	LC	-
511	*Evernia prunastri*	O-F	LC	-
987	*Flavoparmelia caperata*	O	LC	-
547	*Gyalideopsis anastomosans*	R	LC	-
582	*Hypogymnia physodes*	F	LC	-
583	*Hypogymnia tubulosa*	O	LC	-
1013	*Hypotrachyna revoluta*	O	LC	-
613	*Lecania cyrtella*	R	LC	-
639	*Lecanora chlarotera*	R-O	LC	-
643	*Lecanora conizaeoides*	O	LC	-
649	*Lecanora expallens*	F	LC	-
688	*Lecanora symmicta*	O	LC	-
797	*Lecidella elaeochroma e.*	O	LC	-
2330	*Lepraria incana s. lat.*	F	LC	-
1629	*Lepraria lobificans*	O	LC	-
1020	*Melanelia subaurifera*	F	LC	-
938	*Opegrapha atra*	O	LC	-
1022	*Parmelia sulcata*	A	LC	-
1024	*Parmelina tiliacea*	R	LC	
1008	*Parmotrema chinense*	R	LC	-
1107	*Phaeophyscia orbicularis*	F	LC	-

Table continued...

BLS No	Lichen taxa	Abundance	Evaluation & rarity	Woodland status
1112	*Physcia adscendens*	A	LC	-
1112	*Physcia tenella ten*	D	LC	-
1127	*Physconia grisea*	O	LC	-
732	*Placynthiella icmalea*	R	LC	-
1145	*Platismatia glauca*	R	LC	-
2070	*Punctelia subrudecta s. str*	O	LC	-
1989	*Punctelia ulophylla*	O	LC	-
1234	*Ramalina farinacea*	O	LC	-
1322	*Scoliciosporum umbrinum*	O	LC	-
1471	*Usnea subfloridana*	R	LC	-
1527	*Xanthoria candelaria*	F	LC	-
1530	*Xanthoria parietina*	F	LC	-
1531	*Xanthoria polycarpa*	F	LC	

Notes: D = Dominant, A = Abundant, F = Frequent, O = Occasional, R = Rare. For explanation of BLS number see paragraph 2.17, for Evaluation & Rarity see paragraph 3.14 and for Woodland Status see paragraph 3.11.

Table 51 Bryophytes recorded in Rummers Lane Orchards

Bryophyte taxa	Area 5: Plum DAFOR	All Apple DAFOR	Area 1: Apple DAFOR	Area 4: Apple DAFOR	Area 6: Apple DAFOR	Area 7: Apple DAFOR	Obligate epiphytes
Amblystegium serpens	R	O	O	O	F	O	
Brachythecium rutabulum	O	O	F	O	O	O	
Brachythecium velutinum		O	O			F	
Bryum argenteum		R			R		
Bryum capillare		F	O-LF	O	O	O	
Bryum subelegans		R	R				1
Campylopus introflexus		R					
Ceratodon purpureus		O	R		O	R	
Cryphaea heteromalla		R			R		1
Dicranoweisia cirrata	F	F	O	O	A	F	
Dicranum scoparium		R	R				
Eurhynchium praelongum	F	O			R		
Frullania dilatata		R	R		R	R	1
Grimmia pulvinata		R			R		
Homalothecium sericeum		F	O	O	O	O	
Hypnum cupressiforme		A	A	A	F	A	

Table continued...

Bryophyte taxa	Area 5: Plum DAFOR	All Apple DAFOR	Area 1: Apple DAFOR	Area 4: Apple DAFOR	Area 6: Apple DAFOR	Area 7: Apple DAFOR	Obligate epiphytes
Hypnum lacunosum	R	R	R				
Hypnum resupinatum	F	A	A	A	A	A	
Isothecium myosuroides		R	R	VR			
Leptodictyum riparium		R	R			R	
Leskea polycarpa		R			R		
Leucodon sciuroides		R			R		1
Lophocolea bidentata		R					
Lophocolea heterophylla		R					
Metzgeria furcata		R	R				
Orthotrichum affine	R	F	R	O	A	O	1
Orthotrichum diaphanum	F	F	O	O	O	O	
Orthotrichum lyellii		O		R	R	R	1
Orthotrichum pulchellum		R				R	1
Pylaisia polyantha+		R	R			R	1
Radula complanata		R	VR				1
Rhynchostegium confertum	R	F	F	F	O	F	

Table continued...

Bryophyte taxa	Area 5: Plum DAFOR	All Apple DAFOR	Area 1: Apple DAFOR	Area 4: Apple DAFOR	Area 6: Apple DAFOR	Area 7: Apple DAFOR	Obligate epiphytes
Sanionia uncinata+		R				R	
Syntrichia intermedia		R			R		
Syntrichia laevipila	R	O	R	VR	F	R	1
Syntrichia papillosa		O			O		1
Syntrichia virescens		R			R		
Tortula muralis		R			R		
Ulota bruchii		R	R		R	R	1
Ulota phyllantha		R			R		1
Zygodon conoideus		R					1
Zygodon viridissimus		O	R	R	R	R	
Total	**10**	**42**	**24**	**14**	**27**	**21**	**14**

Notes: Species+ = new Vice County record, Species = Previously recorded (2003), **Species** = recorded for the first time in 2004

Table 52 Number of bryophytes on individual trees in Rummers Lane Orchards

Area	Fruit tree type	Girth cm	Number of species	Number of obligate epiphytes	Percent of species / tree obligate epiphytes
6	Apple	100	10	3	30
6	Apple	88	8	2	25
6	Apple	81	10	1	10
6	Apple	60	7	2	28.6
6	Apple	106	13	4	30.8
6	Apple	85	13	2	15.4
6	Apple	77	10	2	20
6	Apple	74	11	2	18.2
6	Apple	74	7	2	28.6
6	Apple	77	10	6	60
7	Apple	234	1	0	0
7	Apple	209	8	1	12.5
7	Apple	218	3	0	0
7	Apple	226	11	3	27.3
7	Apple	203	5	2	40.0
7	Apple	209	5	1	20.0
7	Apple	208	4	0	0.0
7	Apple	250	3	1	33.3
7	Apple	183	11	1	9.1
7	Apple	179	8	1	12.5
7	Apple	118	12	4	33.3
	Average	**145.7**	**8.1**	**1.9**	**21.6**

Table 53 Fungus species recorded in Rummers Lane Orchards

Latin name	Family	Associated habitat	Notes
Abortiporus biennis	Bjerkanderaceae	Wood	On old cut end of trunk of apple pollard
Agaricus arvensis	Agaricaceae	Grassland + trees / scrub	On ground in apple orchard
Agaricus silvaticus	Agaricaceae	Grassland + trees / scrub	Around dead, fallen apple? trunk
Armillaria mellea s.l.	Tricholomataceae	Wood	Base of dead, standing apple/pear trunk
Ascocoryne sarcoides	Helotiaceae	Wood	On dead cut bough ends on apple tree
Auricularia auricula-judae	Auriculariaceae	Wood	2 fruitbodies on cut end of live apple trunk
Auricularia mesenterica	Auriculariaceae	Wood	Occasional fruitbodies on apple tree
Bjerkandera adusta	Coriolaceae	Wood	On fallen poplar and stumps
Chondrostereum purpureum	Meruliaceae	Wood	2 brackets on dead trunk and bough of apple tree
Clavaria kreiglsteineri	Clavariaceae	Grassland	Scattered, in grass
Clavulinopsis laeticolor	Clavariaceae	Grassland	2 clusters in grass
Coprinus atramentarius	Coprinaceae	Wood	Under apple tree
Coprinus micaceus	Coprinaceae	Wood	4 clusters at base of live apple tree
Coprinus xanthothrix	Coprinaceae	Wood	12 fruitbodies on cut wood of poplar
Crepidotus variabilis	Crepidotaceae	Wood	On dead bramble stem
Crinipellis scabella	Tricholomataceae	Grassland	1 fruitbody in grass
Cyathus olla	Nidulariaceae	Grassland	On ground in clearing in apple orchard
Galerina laevis	Cortinariaceae	Grassland	1 patch in grass
Ganoderma australe	Ganodermataceae	Wood	On dead cut apple stump
Hebeloma pallidoluctuosum	Cortinariaceae	Grassland	In grass near wood pile
Hygrocybe conica var conica	Hygrophoraceae	Grassland	In grass
Hygrocybe mucronella	Hygrophoraceae	Grassland	In short grass
Hygrocybe virginea var. virginea	Hygrophoraceae	Grassland	In grass
Hypomyces aurantius	Nectriaceae	Wood	A few immature perithecia on orange subiculum on old Polyporus on cut logs

Table continued…

Latin name	Family	Associated habitat	Notes
Inonotus hispidus	Hymenochaetaceae	Wood	On Apple trunks
Lachnella alboviolascens	Tricholomataceae	Wood	Patch of fruitbodies on fallen poplar twig
Lepista saeva	Tricholomataceae	Grassland + trees / scrub	7 fruitbodies, in grass under apple trees
Marasmius oreades	Tricholomataceae	Grassland	In grass
Merismodes anomala	Crepidotaceae	Wood	1 colony on cut decorticate apple log
Monilinia fructigena	Sclerotiniaceae	Wood	Imperfect stage on fallen apples
Mycena galericulata	Tricholomataceae	Wood	On dead plum trunk
Mycena luteoalba	Tricholomataceae	Grassland	6 fruitbodies, in grass
Nectria cinnabarina	Nectriaceae	Wood	Imperfect stage on poplar twigs
Nectria peziza	Nectriaceae	Wood	Patch of numerous perithecia on split, fallen, rotten, waterlogged, soft apple (?) trunk
Peziza repanda	Pezizaceae	Wood	Occasional fruitbodies on cut apple logs
Phellinus pomaceus	Phellinaceae	Wood	27 fruitbodies on dead Prunus stump and cut trunk nearby
Pholiota squarrosa	Strophariaceae	Wood	1 clump at base of live apple tree
Pleurotus dryinus	Lentinaceae	Wood	On live apple trees
Polyporus leptocephalus	Polyporaceae	Wood	1 very old dead fruitbody on dead apple branch
Polyporus squamosus	Polyporaceae	Wood	4 old fruitbodies on boughs of live apple tree
Psathyrella candolleana	Coprinaceae	Wood	Under apple trees
Psathyrella cernua/olympiana	Coprinaceae	Wood	8 fruitbodies on fire site
Psathyrella microrhiza	Coprinaceae	Wood	On piles of apple wood chip
Puccinia punctiformis	Pucciniaceae	Grassland	on creeping thistle
Rosellinia mammiformis	Xylariaceae	Wood	1 colony on dead ivy trunk
Schizophyllum amplum	Schizophyllaceae	Wood	2 fruitbodies on fallen poplar twig
Stereum rugosum	Stereaceae	Wood	1 infected dead apple stump
Stropharia coronilla	Strophariaceae	Grassland	3 fruitbodies in short grass
Stropharia inuncta	Strophariaceae	Grassland	5 fruitbodies in grass

Table continued…

Latin name	Family	Associated habitat	Notes
Trametes versicolor	Coriolaceae	Wood	Occasional fruitbodies on cut apple logs
Tubaria aff. confragosa	Crepidotaceae	Wood	On wood chip pile
Tubaria conspersa	Crepidotaceae	Wood	Large troop of hundreds of toadstools around dead apple stump
Tubaria furfuracea	Crepidotaceae	Wood	On apple wood chip pile
Xylaria hypoxylon	Sphaeriaceae	Wood	On half-buried branch

Table 54 Invertebrate species recorded in Rummers Lane Orchards

Species	Family/Order	Assemblage	UK status	Notes
Dysdera crocata	Araneae	Ground layer	Widespread	Under bark hunts woodlice
Gibbaranea gibbosa	Araneae	Canopy	Widespread	Beaten from apple blossom
Anobium punctatum	Col: Anobiidae	Saproxylic	Widespread	Under bark on dead apple tree
Ochina ptinoides	Col: Anobiidae	Saproxylic	Local	Beaten from Ivy on apple tree
Ptilinus pectinicornis	Col: Anobiidae	Saproxylic	Widespread	Beaten from apple foliage
Anthicus antherinus	Col: Anthicidae	Field layer	Widespread	Swept from grassland
Aphodius ater	Col: Aphodiidae	Dung	Widespread	Flight interception trap
Aphodius depressus	Col: Aphodiidae	Dung	Widespread	Flight interception trap
Aphodius luridus	Col: Aphodiidae	Dung	Widespread	Flight interception trap
Cantharis cryptica	Col: Cantharidae	Mosaic (C, F)	Widespread	Beaten from apple foliage
Cantharis pallida	Col: Cantharidae	Field layer	Widespread	Flight interception trap, north, one
Malthodes marginatus	Col: Cantharidae	Saproxylic	Widespread	Beaten from apple foliage
Malthodes minimus	Col: Cantharidae	Saproxylic	Widespread	Swept nettles
Rhagonycha lignosa	Col: Cantharidae	Canopy	Widespread	Beaten from apple foliage
Amara aenea	Col: Carabidae	Ground layer +	Widespread	Flight interception trap, south, one
Amara familiaris	Col: Carabidae	Ground layer	Widespread	Flight interception trap
Dromius meridionalis	Col: Carabidae	Saproxylic	Widespread	Beaten from plum foliage
Dromius quadrinotatus	Col: Carabidae	Saproxylic	Widespread	Beaten from apple branch
Notiophilus biguttatus	Col: Carabidae	Ground layer +	Widespread	Flight interception trap
Grammoptera ruficornis	Col: Cerambycidae	Saproxylic	Widespread	Beaten from apple foliage
Phymatodes testaceus	Col: Cerambycidae	Saproxylic	Local	Flight interception trap, south, one
Pogonocherus hispidus	Col: Cerambycidae	Saproxylic	Local	On ground under apple tree
Tetrops praeustus	Col: Cerambycidae	Saproxylic	Local	Beaten from plum tree
Phaedon tumidulus	Col: Chrysomelidae	Field layer	Widespread	Swept
Phratora vulgatissima	Col: Chrysomelidae	Canopy	Widespread	Swept from grassland

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Adalia bipunctata	Col: Coccinellidae	Canopy	Widespread	Beaten from plum foliage
Calvia 14-guttata	Col: Coccinellidae	Canopy	Widespread	Beaten from apple foliage
Chilocorus renipustulatus	Col: Coccinellidae	Canopy	Widespread	Beaten from apple tree
Coccinella septempunctata	Col: Coccinellidae	Canopy	Widespread	Flight interception trap
Exochomus quadripustulatus	Col: Coccinellidae	Canopy	Widespread	Beaten from apple foliage
Propylea 14-punctata	Col: Coccinellidae	Canopy	Widespread	Flight interception trap
Thea 22-punctata	Col: Coccinellidae	Canopy	Widespread	Suction sampler from tree base
[Euophryum confine]	Col: Curculionidae	Saproxylic	Widespread	Red-rot debris in old apple tree
Barypeithes pellucidus	Col: Curculionidae	Ground layer +	Widespread	Suction sampler from tree base
Magdalis cerasi	Col: Curculionidae	Saproxylic	Nb	Beaten from plum tree
Magdalis ruficornis	Col: Curculionidae	Saproxylic	Local	Beaten from plum tree
Scolytus mali	Col: Curculionidae	Saproxylic	Nb	Dead apple trunk
Sitona lineatus	Col: Curculionidae	Field layer	Widespread	Grassland
Adrastus pallens	Col: Elateridae	Field layer	Local	Flight interception trap, one
Melanotus villosus sensu lato	Col: Elateridae	Saproxylic	Widespread	Red-rot in apple tree
Dorcus parallelipipedus	Col: Lucanidae	Saproxylic	Local	Red-rot debris in old apple tree
Rhizophagus bipustulatus	Col: Monotomidae	Saproxylic	Widespread	Under moist bark on dead apple wood
Glischrochilus hortensis	Col: Nitidulidae	Saproxylic	Widespread	Flight interception trap
Pyrochroa serraticornis	Col: Pyrochroidae	Saproxylic	Widespread	Beaten from cherry tree
Metoecus paradoxus	Col: Rhipiphoridae	Nests (W)	Local	Flight interception trap, plum, one
Rhinosimus planirostris	Col: Salpingidae	Saproxylic	Widespread	Beaten from plum twigs
Anaspis maculata	Col: Scraptiidae	Saproxylic	Widespread	Beaten from dead apple twigs in canopy
Anaspis regimbarti	Col: Scraptiidae	Saproxylic	Widespread	Beaten from Ivy on apple tree
Forficula auricularia	Dermaptera	Generalist	Widespread	Under bark
Bellardia agilis	Dip: Calliphoridae	Carrion	Widespread	

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Beris chalybata	Dip: Stratiomyidae	Field layer	Widespread	Beaten from apple foliage
Pachygaster atra	Dip: Stratiomyidae	Saproxylic	Widespread	Beaten from plum branches
Pachygaster leechi	Dip: Stratiomyidae	Saproxylic	Widespread	Beaten from ivy on apple tree
Cheilosia latifrons	Dip: Syrphidae	Field layer	Widespread	Grassland
Epistrophe eligans	Dip: Syrphidae	Canopy	Widespread	Swept from grassland
Melanostoma mellinum	Dip: Syrphidae	Generalist	Widespread	Grassland
Neoascia podagrica	Dip: Syrphidae	Field layer	Widespread	Water trap
Platycheirus albimanus	Dip: Syrphidae	Canopy	Widespread	Grassland
Platycheirus nielseni	Dip: Syrphidae	Field layer	Widespread	Grassland
Sphaerophoria scripta	Dip: Syrphidae	Field layer	Widespread	Grassland
Volucella pullecens	Dip: Syrphidae	Field layer	Widespread	Seen in flight
Xylota segnis	Dip: Syrphidae	Saproxylic	Widespread	Swept from bramble scrub
Tipula flavolineata	Dip: Tipulidae	Saproxylic	Widespread	On bramble foliage
Proteroiulus fuscus	Diplopoda	Saproxylic	Widespread	Under bark on dead apple branch
Discus rotundatus	Gastropoda	Ground layer +	Widespread	Suction sampler from tree base; found in rot-hole on apple tree
Helix aspersa	Gastropoda	Ground layer +	Widespread	Suction sampler from tree base
Monacha cantiana	Gastropoda	Ground layer +	Widespread	Swept
Oxychilus alliarius	Gastropoda	Ground layer +	Widespread	In wood mould within hollow apple tree
Anthocoris confusus	Hem: Anthocoridae	Canopy	Widespread	
Anthocoris nemorum	Hem: Anthocoridae	Canopy	Widespread	Beaten from apple foliage
Orius laticollis	Hem: Anthocoridae	Field layer	Local	
Orius vicinus	Hem: Anthocoridae	Field layer	Widespread	
Tachycixius pilosus	Hem: Cixiidae	Canopy	Widespread	Flight interception trap, plum tree, one
Heterogaster urticae	Hem: Lygaeidae	Field layer	Widespread	Beaten from plum foliage
Scolopostethus thomsoni	Hem: Lygaeidae	Field layer	Widespread	Suction sampler from tree base

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Atractotomus mali	Hem: Miridae	Canopy	Widespread	Flight interception trap, south, four
Calocoris norvegicus	Hem: Miridae	Field layer	Widespread	Swept nettles
Deraeocoris lutescens	Hem: Miridae	Canopy	Widespread	Beaten from apple foliage
Leptopterna dolabrata	Hem: Miridae	Field layer	Widespread	Swept from nettles
Liocoris tripustulatus	Hem: Miridae	Field layer	Widespread	Swept from grassland
Notostira elongata	Hem: Miridae	Field layer	Widespread	Grassland species
Psallus ambiguus	Hem: Miridae	Canopy	Widespread	
Himacerus apterus	Hem: Nabidae	Canopy	Widespread	Beaten from pear tree
Pentatoma rufipes	Hem: Pentatomidae	Canopy	Widespread	Beaten from pear tree
Psylla mali	Hem: Psyllidae	Canopy	Widespread	Beaten from apple foliage
Andrena haemorrhoa	Hym: Andrenidae	Mosaic (G,F,C)	Widespread	Flight interception trap
Nomada flavoguttata	Hym: Anthophoridae	Field layer	Widespread	Water trap
Apis mellifera	Hym: Apidae	Saproxylic	Widespread	Seen in flight
Bombus lucorum	Hym: Bombidae	Field layer	Widespread	Seen in flight
Bombus pascuorum	Hym: Bombidae	Field layer	Widespread	Flight interception trap
Chrysis angustula	Hym: Chrysididae	Nests (W, B)	Widespread	Flight interception trap
Lasius brunneus	Hym: Formicidae	Saproxylic	Na	Red rot in old apple tree
Temnothorax nylanderi	Hym: Formicidae	Saproxylic	Local	Active on apple stump
Crossocerus megacephalus	Hym: Sphecidae	Saproxylic	Widespread	
Crossocerus quadrimaculatus	Hym: Sphecidae	Ground layer	Widespread	Swept from grassland (around log piles)
Passaloecus corniger	Hym: Sphecidae	Saproxylic	Widespread	
Pemphredon lugubris	Hym: Sphecidae	Saproxylic	Widespread	Flight interception trap
Vespula vulgaris	Hym: Vespidae	Generalist	Widespread	Flight interception trap
Celastrina argiolus	Lep: Lycaenidae	Canopy	Widespread	Hedgerow
Orgyia antiqua	Lep: Notodontidae	Field layer	Widespread	Beaten from cherry tree
Aglais urticae	Lep: Nymphalidae	Field layer	Widespread	Hedgerow

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Vanessa atalanta	Lep: Nymphalidae	Field layer	Widespread	Hedgerow
Pieris napi	Lep: Pieridae	Field layer	Widespread	General
Pieris rapae	Lep: Pieridae	Field layer	Widespread	General
Chrysoperla carnea	Neuroptera	Canopy	Widespread	Flight interception trap
Hemerobius lutescens	Neuroptera	Canopy	Widespread	Flight interception trap
Wesmaelius subnebulosus	Neuroptera	Canopy	Widespread	Flight interception trap
Aeshna mixta	Odonata	Freshwater	Widespread	Individuals flying in canopy
Sympetrum striolatum	Odonata	Freshwater	Widespread	
Oniscus asellus	Oniscoidea	Ground layer +	Widespread	Suction sampler from tree base
Philoscia muscorum	Oniscoidea	Ground layer +	Widespread	Suction sampler from tree base
Porcellio scaber	Oniscoidea	Generalist	Widespread	Under bark on dead apple branch
Mitostoma chrysomelina	Opiliones	Field layer	Widespread	Suction sampler from tree base
Chernes cimicoides	Pseudoscorpiones	Saproxylic	Local	In red-rot debris within apple trunk
Caecilius flavidus	Psocoptera	Epiphyte	Widespread	Beaten from apple branches
Ectopsocus briggsi	Psocoptera	Epiphyte	Widespread	Beaten from apple foliage
Ectopsocus petersi	Psocoptera	Epiphyte	Widespread	Beaten from apple branches
Elipsocus hyalinus	Psocoptera	Epiphyte	Widespread	Beaten from apple foliage
Graphopsocus cruciatus	Psocoptera	Epiphyte	Widespread	Beaten from apple foliage
Lachesilla pedicularis	Psocoptera	Epiphyte	Local	Beaten from apple foliage

Notes: see paragraphs 3.9 and 3.17 for explanations of assemblages and status categories.

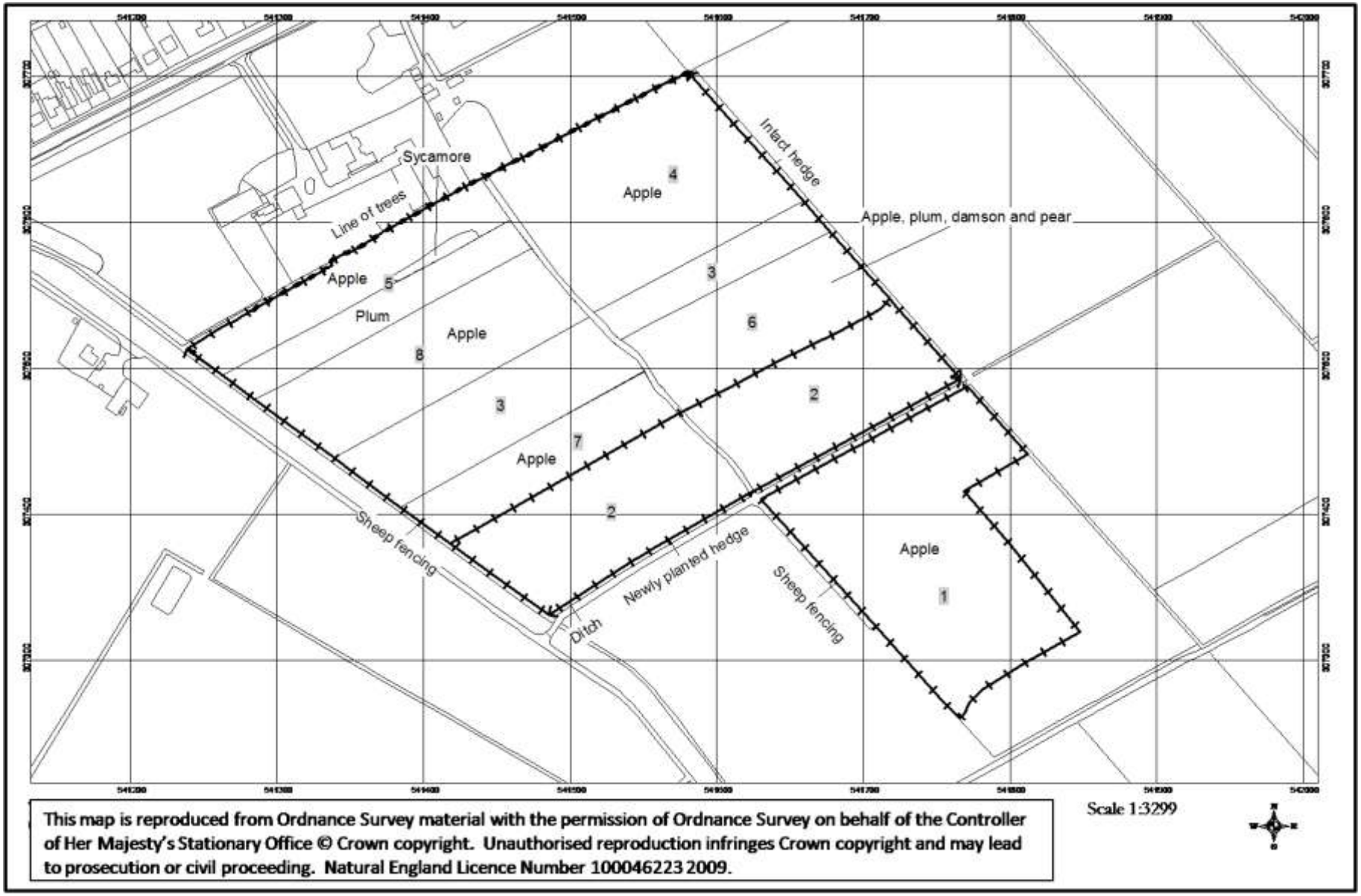

Figure 8 Map of Rummers Lane Orchards (TF415075). Orchard type and boundaries map

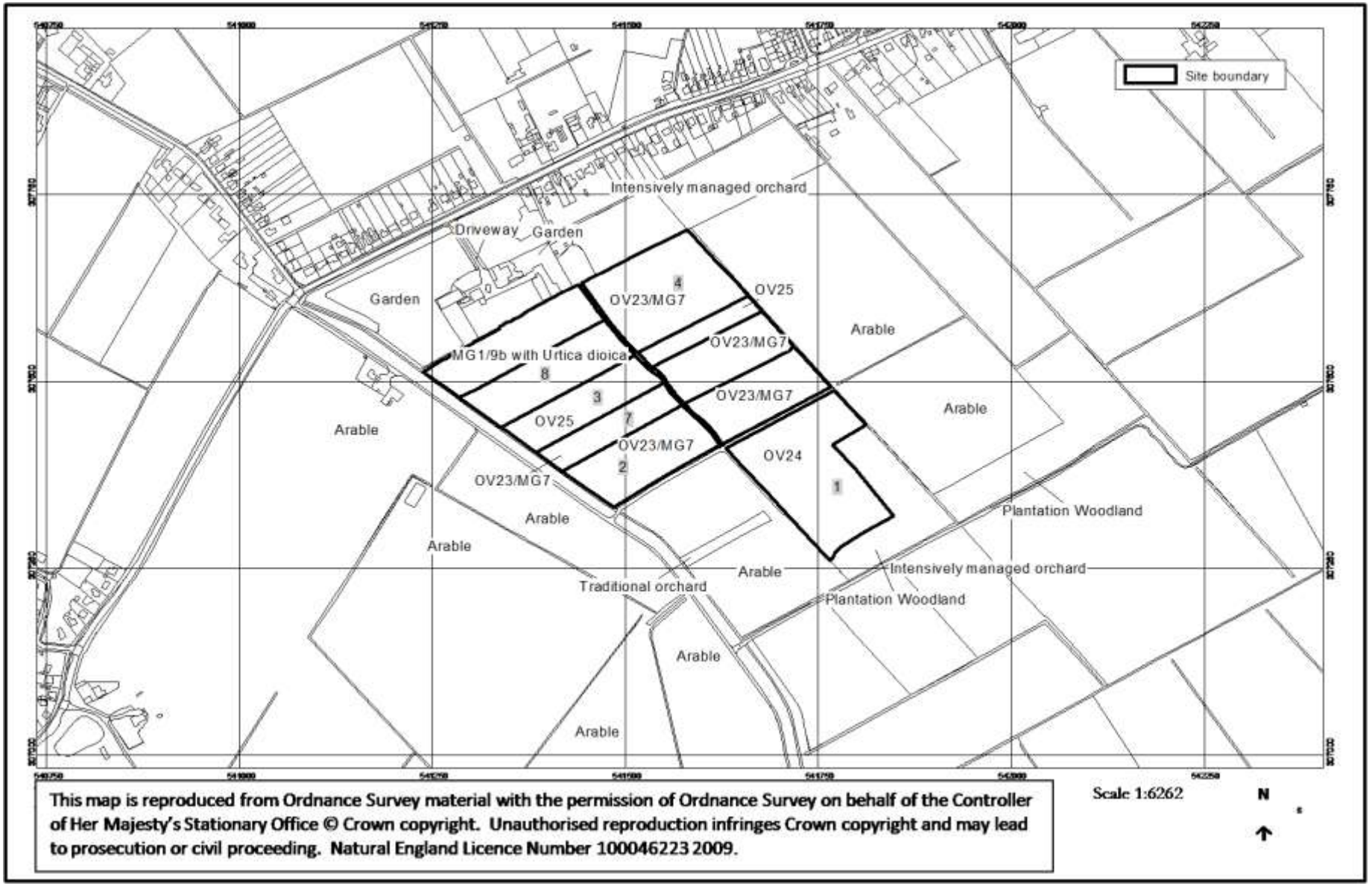

Figure 9 Map of Rummers Lane Orchards (TF415075). Orchard floor, surrounding land use and compartments map

8 Park Farm Orchard

Landscape setting

8.1 Park Farm Orchard is located on the southern edge of the village of Lynsted, near Sittingbourne, in Kent (Figure 10). The orchard is on level to gently sloping ground on the east-facing side of a shallow dry valley that runs northwards from Park Farm. The landscape is a mix of grassland and arable, with significant blocks of orchards. These are mostly intensively managed bush or dwarf orchards but a scatter of traditional standard orchards remain. Hedgerows and small broadleaved woodlands are features in the landscape, although some field boundaries appear to have been removed or are now fenced. Park Farm Orchard is connected, across a lane, to a small woodland (2.2 ha) by the hedgerow which runs along the northern boundary of the orchard. The immediate surrounds of the orchard are largely grassland, and across adjacent roads on the northern side are gardens, and to the west, arable land (Figure 11). The closest orchard to Park Farm Orchard is a traditional orchard 0.3 km away. Among the study sites, Park Farm Orchard has the largest area of orchard in the surrounding 1 km zone (Table 5) but 75% is intensively managed orchard. On a national scale, Park Farm Orchard is in a zone with the highest dry deposition of sulphur dioxide and the lowest wet deposition of sulphur and nitrogen among the study sites. Along with Rummers Lane Orchards, the site is in a zone of relatively low annual rainfall (Table 5).

History and management

8.2 Park Farm Orchard is a classic Kent cherry orchard. Kent has been important as a cherry-growing area for centuries (Roach 1985), especially as good transport links to London provided ready access to a large market. Park Farm Orchard itself is of relatively recent date. Trees present now date from the 1950s, along with younger trees planted in 1977. The First Edition Ordnance Survey 1:10560 map of 1872 shows no orchard on the site, but orchards extend from the north-west corner of the site, to the west of the road, into the village of Lynsted. The 1894 1:2500 map also shows no orchard on the site. The extent of orchards in the surrounding landscape was less in 1872 than is the case now, but the 1872 orchards are in a well-dispersed pattern of patches, each a few hectares in size, clustered around settlements and farms. Woodland cover was greater in 1872, most notably a large woodland (21 ha) called Pett Wood 0.6 km to the west. This woodland has now completely disappeared. Although it is not on the Kent Ancient Woodland Inventory (Pritchard and others 1994), it has a shape suggesting ancient woodland (Dr Keith Kirby, Senior Woodland Ecologist, English Nature, pers comm). It may have been cleared before the cut off date (1930) when woodlands had to be present to be included in the compilation of the inventory. Park Farm Orchard is still connected, across a lane, by a hedgerow to a woodland (see para 8.1), which is listed as an existing ancient woodland in the Kent inventory (Pritchard and others 1994). This woodland is at a distance of 0.14 km from the orchard.

8.3 Commercial harvesting of cherries has not been done at Park Farm Orchard for some time. It is now in a Countryside Stewardship Scheme and is developing into a community orchard, with educational visits, wildlife surveys and celebrations of events such as blossom time. Management of the orchard includes leaving dead trees after trimming them to head-high stumps, and leaving some log piles for wildlife. Other dead wood is removed in May and June and used for firewood. Planting of replacement trees is planned. Hedgerows around the site are regularly trimmed. The orchard floor is grazed short by sheep, which are on the grassland from September to June, including lambing season. They are supplementary-fed in winter and during lambing. This practice has been in place at least as long as the present orchard trees have been present and the system is similar to the classic ‘traditional’ management of cherry orchards described by

Grubb (1949). Except for occasional spot spraying of thistles where appropriate, no sprays are used and have not been used for many years.

Fruit tree survey

8.4 Standard cherries are the only fruit trees in the orchard. A sample was measured and the results are shown in Table 55. The canopy of the orchard was patchily closed, in places the canopies of adjacent trees touched. Standing dead wood was locally frequent, particularly along the western edge of the orchard, and cut logs were occasional on the orchard floor. A high proportion of the trees sampled had veteran tree features (90%) and the overall amount of veteran tree features was relatively high (33%). Sap runs were a particular feature, being present on 90% of trees sampled. Some trees had vascular plants growing as epiphytes, these included *Ilex aquifolium* (holly), *Sambucus nigra* (elder), and *Crataegus monogyna* (hawthorn).

Orchard floor habitats

8.5 The orchard floor grassland, which was species-poor, resembled MG7 *Lolium perenne* grassland (Rodwell 1992), or perhaps a species-poor MG6 *Lolium perenne- Cynosurus cristatus* grassland, but it also has some ruderal elements which suggested similarities to vegetation more affected by disturbance, that is, OV23c *Lolium perenne-Dactylis glomerata* community, *Plantago major-Trifolium repens* sub-community (Rodwell 2000). Species present included species such as *Poa annua* (annual meadow grass), *Stellaria media* (common chickweed) and *Capsella bursa-pastoris* (shepherd's purse), which respond to disturbance (Table 56). The sward was slightly more species-rich in places, especially where there were gaps in the tree canopy. A few areas beneath the fruit trees were occupied by clumps of *Urtica dioica* (common nettle). On average, there was about 10% herb cover and the sward was uniformly short-grazed to an average sward height of 2 cm, though the occasional *Urtica dioica* patches were taller. Localised bare ground was present where the sheep were congregating, though overall bare ground accounted for less than 1% of the site. There was virtually no dead plant litter in the grassland.

Orchard boundaries

8.6 The orchard boundaries consisted of species rich native hedgerows, a hedge of conifers (Leyland cypress, x *Cupressocyparis leylandii*) and fences (Figure 10). The northern boundary consisted of an overgrown hedgerow with hedgerow trees. A 30 m sample of the hedgerow in this section contained 7 native woody species (Table 57). Based on this feature, the hedgerow was identified as a species-rich hedgerow qualifying under pre-2007 criteria as a priority BAP hedgerow habitat. Hedgerow trees included a large *Acer campestre* (field maple), which had a hollow trunk. There were a number of well-rotted fallen logs along the hedgerow on the road side.

8.7 The western boundary was a wide hedgerow with hedgerow trees. These included a veteran oak tree which was *Quercus petraea* (sessile oak), or possibly the hybrid *Q*. x *rosacea*. It was hollow with a large opening on one side. A 30 m sample of the hedgerow in this section had six native woody species and was therefore identified as a species-rich hedgerow under the pre-2007 BAP criterion. The ground flora of the western boundary hedgerow was more diverse than that of the northern boundary (Table 57).

8.8 The southern boundary consisted of a fence and a flowerbed running alongside a gravel drive. Between two farm buildings to the southeast was a Leyland cypress hedge and sheep fencing (Figure 10). The ground beneath the hedge was heavily shaded and hence very species-poor and mostly bare. The other boundaries consisted of farm buildings and a fence (Figure 10).

Epiphytic lichens

Community characteristics

8.9 Fifty-two lichens were recorded (Table 58), twenty-two of these were noted only once or twice, so the core population amounted to approximately 30 taxa. The biomass of lichens at Park Farm Orchard was the lowest of all the sites visited. Some of the dead standing trees had virtually no lichen cover. Lichen communities were poorly developed, other than the *Xanthorion*, which was occasionally present, and *Lecanorion* lichen communities. Both the *Graphidion* and pre-*Lobarion* were absent. There was a developing *Parmelion* of leafy macrolichens comprising mainly juvenile thalli of *Evernia prunastri, Flavoparmelia caperata, Hypogymnia physodes, Parmelia sulcata* and *Punctelia ulophylla* on several of the older, more mature trees. Dominant or abundant species were *Amandinea punctata (Xanthorion)* and *Physcia tenella (Xanthorion).*

8.10 Two factors appeared to be influencing the epiphytic lichen flora at Park Farm Orchard. The first factor was air pollution. This part of the county is still recovering from the moderate air pollution of the 1970's that would have impacted on the older trees in the orchard. Hawksworth and Rose (1970), identified zones in the vicinity of the orchard that had 60-125 micrograms of sulphur dioide per cubic metre of air and the site is within the zone of highest current sulphur dioxide deposition among the study sites (Table 5). The lichen flora at Park Farm Orchard appeared to be in a recovery phase with re-invasion taking place. Although the air pollution indicator lichen *Lecanora conizaeoides* was frequent on the trunks and branches of the older trees there was a significant element of small, newly colonising, crustose lichens especially on the twigs and root plate.

8.11 The second factor affecting the flora was nutrient enrichment. Lichen presence appeared to be most heavily concentrated around two areas: the top of the tree trunk where the main branches join the trunk and at the base of the tree, associated with the swollen root plate. The first area was where rain collected in the pedestal-like hollows formed by the branching pattern of the tree. Overflow areas caused conspicuous seepage tracks to develop which provided an additional nutrient source for *Xanthorion* species of the *Physciacea* family, which included occasional plants of *Phaeophyscia orbicularis* and *Hyperphyscia adglutinata*. The second area, the root plate, appeared to have a higher degree of nutrient enhancement than the rest of the tree. This was possibly due to a combination of factors such as sheep trampling, dust accumulation and increased water retention of the mainly horizontal root surfaces. Species suited to colonising this microhabitat included two nitrophyte species, that is, species favoured by high nitrogen levels, *Bacidia neosquamulosa* and *Lecanora barkmaniana*. These species were described for the first time relatively recently and may be spreading in Europe, perhaps aided by climate change. The root plate community was characterised by *Amandinea punctata*, *Bacidia neosquamulosa, Candelariella vitellina, Fellhanera subtilis* (seen once), *Flavoparmelia soredians* (seen once), *Lecanora barkmaniana* and *Melanelia elegantula. A. punctata* and three other species present, *Lecidella elaeochroma, Physconia grisea* and *Xanthoria parietina* have also been identified as nitrophytes that respond to agricultural eutrophication (Wolsey and James 2002, quoted in Stapper 2004). No Indicators of Ecological Continuity were recorded, which was not surprising given the pollution history of the area.

Lichen species of special interest

8.12 ***Bacidia brandii*** (Nationally Rare): This lichen was recorded as new to Britain in Park Farm Orchard. Elsewhere it is known from the Netherlands, Belgium, northern France and Lithuania. It was found on the root plate of cherry, in a fertile state with red-brown fruits.

8.13 ***Bacidia neosquamulosa*** (Nationally Scarce): This species was described new to science in 1999. It has been known in the sterile state for several years but is now regularly found fertile.

8.14 ***Bacidia viridescens*** (Nationally Scarce): This species was found on plant debris on the root plate of cherry.

8.15 ***Fellhanera subtilis*** (Nationally Rare): This lichen was found on the base of one cherry. It has the appearance of speckled white spots, which are pycnidia not true fruits (apothecia).

8.16 ***Lecanora barkmaniana*** (Nationally Scarce): This species was also described new to science in 1999. It is a nitrophyte usually found in the sterile sorediate state (as at Park Farm Orchard) but has a distinctive appearance and chemistry.

8.17 ***Lecanora compallens*** (Nationally Scarce): This species (also described in 1999) was considered a much-overlooked species on trees. It is not a nitrophyte and is easily mistaken in the field for *Lecanora expallens*, which is quite common on tree bark.

8.18 ***Lecanora persimilis*** (Nationally Scarce) and ***Lecanora saligna***, which is scarce in Kent, were also recorded.

Bryophytes

8.19 Very few bryophytes were recorded, perhaps due to the same factors affecting the lichen flora, coupled with the smooth bark of cherry, which may be less favourable for colonization by bryophytes than the bark of other fruit tree species (Table 59). Bryophytes present were either growing on protruding roots at the base of the trunk (*Brachythecium rutabulum* and *Ceratodon purpureus*) or associated with the point at which branching began (all other species). The vast majority of trees had no bryophytes growing on them at all and individual sample trees were not recorded. However, a rapid inspection was made of each tree and a tally made of each bryophyte species occurrence. According to the 1999 UKPerspectives aerial photograph of the area, there appeared to be about 165 trees in the orchard. Using this figure a percentage calculation of frequency was made (Table 59).

8.20 Bryophytes recorded on the ground included the following species: *Eurhynchium praelongum, Brachythecium rutabulum, Funaria hygrometrica, Ceratodon purpureus* and *Tortula acaulon*.

Fungi

Habitat associations and characteristics

8.21 There was a good range of fungi associated with dead wood and a varied group of grassland fungi that differed in character to the other study sites (Table 60). Several common species of pasture fungi were recorded, including two waxcap fungi. *Melanoleuca excissa* var. *iris* was seen during both spring and autumn visits. A single old cap of a *Dermoloma* with amyloid spores, presumably *Dermoloma pseudocuneifolium*, was collected. The greatest number of fungi associated with dung was found in Park Farm Orchard, probably because of the high stocking density of sheep (Table 14). The grassland fungi are likely to be suited by the current grazing level. Interestingly, a wider range of species was found in spring compared to autumn. The relaxation of grazing during the summer (paragraph 8.2) perhaps allowed a longer sward to develop that was less favourable to the autumn fungi and reduced the amount of dung present. Fungi associated with wood were concentrated amongst the standing dead stumps and associated cut wood on the ground. The hedgerow on the western boundary was unproductive in terms of fungi. The hedgerow trees on the north side were slightly better, but little of interest was found.

Fungus species of special interest

8.22 ***Dermoloma pseudocuneifolium*** (BMSFRD: 28): A single old cap of a *Dermoloma* with amyloid spores, presumably *Dermoloma pseudocuneifolium*, was collected. It may have been *D. josserandii* (BMSFRD: 14), although this woodland species is less likely.

8.23 ***Flammulaster carpophilus* var. *subincarnatus*** (BMSFRD: 36): This species was found on a fallen wood fragment.

8.24 ***Melanoleuca excissa* var. *iris*** (BMSFRD: 15): This agaric, which grows on soil in grasslands, was seen during both spring and autumn visits.

8.25 ***Pluteus cinereofuscus*** (BMSFRD: 122): This fungus was present on a buried fragment of cherry wood.

8.26 **Adjacent habitat: *Agaricus moelleri*** (BMSFRD: 64) grew across the lane to the north of the orchard.

Invertebrates

General overview of assemblages and characteristics

8.27 The saproxylic fauna in Park Farm Orchard was particularly diverse, and included eight Nationally Scarce/ Red Data Book species and six Indicators of Ecological Continuity (Table 61, Table 17, Table 18). The presence of such species invites comparison with the fauna of old wood pasture, and the assemblage may have significance at county level. Wood-decay fauna included species relying directly on decaying wood, nest-building species and predators. The relatively high amounts of veteran tree characters (Table 55), combined with the historical continuity of woodland and orchards in the vicinity (paragraph 8.2), were likely to have been important factors in influencing the richness of the saproxylic fauna. The heavy grazing of the orchard floor grassland may explain the relatively low numbers of field layer species (Table 15) in Park Farm Orchard compared to others sites. The relatively high number of ground-dwelling invertebrates found in Park Farm Orchard compared to the other sites (Table 15) may be because of the number of logs on the orchard floor. These logs provided cover during the day for nocturnally-active species, and made these species easy to find. The low cover of bryophytes and lichens did not favour the development of a diverse epiphytic fauna, possibly coupled with the relatively dry climate. Gilbert (1971) noted that barkflies feed preferentially on algae and fungal spores rather than lichens. The relatively dry climate of Kent may be a factor affecting species numbers if algae and fungal spores are reduced by the low humidity. The hedgerows added to the diversity of the site, contributing species to the canopy, field and ground layer assemblages.

Canopy and mosaic fauna

8.28 Sampling revealed very low numbers of invertebrates associated with cherry foliage. Species present were widespread species. Beehives were present along the northern boundary of the orchard at the time of the survey so honey bees recorded on cherry blossom were probably domestic rather than feral bees. The cherry blossom attracted numerous bee species, particularly trees in more sunny situations. Mining bees (*Andrena* species) were numerous. Common species from the mosaic assemblage, such as *A. haemorrhoa* and *A. fulva* were accompanied to a lesser extent by *A. helvola*. The hedgerow vegetation also provided a valuable nectar resource for bees and other invertebrates. The common wasp *Vespula vulgaris* and Norwegian wasp *Dolichovespula norvegica* were both frequent. The ivy hopper *Issus coleoptratus* was a representative of the canopy assemblage found in the hedgerow.

Epiphyte fauna

8.29 The fauna associated with epiphytes growing on the trees was found to be very restricted. One of the species noted in Devon also occurred here, the predatory bug *Loricula elegantula*. The barkflies (*Psocoptera*) recorded from the orchard were all widespread species, such as *Ectopsocus briggsi*, that feed mainly on the micro-flora encrusting leaves rather than branches. The hawthorn lacebug *Physatocheila dumetorum* occurred in the hedgerow.

Saproxylic fauna

Wood-decay species

8.30 Among the invertebrates which rely directly on wood-decay was the lesser stag beetle *Dorcus parallelipipedus*, the larvae of which were boring through white-rotten wood. The bark beetle *Scolytus rugulosus*, which often develops in smaller canopy branches was also present.

Wood-decay species of special interest

8.31 ***Anaspis thoracica*** (Nationally Scarce, Category A): This localised species belongs to a family of beetles which develop in rotten wood, and in the midlands has a tendency to favour lowland riparian situations.

8.32 ***Ischnodes sanguinicollis*** (Nationally Scarce, Category A, Indicator of Ecological Continuity, Category 2): This click beetle of the Elateridae family develops in the decaying heartwood of old broad-leaved trees, including those with bird nests in cavities that provide a rain of nutrient-rich materials into the otherwise nutrient-poor decayed wood below. It is largely a speciality of ancient wood pastures of midland, southern and eastern England.

8.33 ***Tomoxia bucephala*** (Nationally Scarce, Category A, Indicator of Ecological Continuity, Category 3): This species is a tumbling flower beetle in the family Mordellidae. One adult *T. bucephala* was attracted to the standing dead cherry trunks. This beetle is a species very much confined to the extreme south-east of England, and primarily to areas of relict wood pasture, where it develops in the galleries of wood boring beetles deep in the decaying heartwood of open-grown trees.

8.34 ***Melasis buprestoides*** (Nationally Scarce, Category B, Indicator of Ecological Continuity, Category 3): This species is a false click beetle (*Eucnemidae*). One individual was taken in a flight interception trap. This species primarily develops in decaying crownwood and has been found on a wide variety of broad-leaved tree species, generally in old wood pasture. This species is found in orchards in both Worcestershire and Gloucestershire (Whitehead 2005).

8.35 ***Prionychus ater*** (Nationally Scarce, Category B, Indicator of Ecological Continuity, Category 3): This species is a darkling beetle (*Tenebrionidae*). Larvae were found within wood mould inside a hollow living cherry tree of 221 cm in girth. It was mainly known from old open-grown trees in old wood pastures but has been found frequently in old orchards by Paul Whitehead (pers comm), especially in apple trees.

8.36 ***Scolytus mali*** (Nationally Scarce, Category B): This large bark beetle of the family Curculionidae is a speciality of trees in the family Rosaceae and is most widespread in old traditional orchards where the larvae develop in the moist bark and are often most numerous in freshly dead trunks and larger boughs.

8.37 ***Ptinomorphus imperialis*** (Nationally Scarce, Category B): This beetle of the family Anobiidae is found in dead stems of woody plants in the family Rosaceae but also in a wide variety of other woody species such as oak and hornbeam (Paul Whitehead pers obs).

8.38 ***Lucanus cervus*** (Nationally Scarce, Category B, priority BAP species): Two stag beetle larvae were recorded in a very rotten stump, and the owners of the orchard reported that stag beetles had been seen in the orchard in previous years. In addition, fragments of stag beetle were found in and around one dead standing cherry trunk and appeared to be the remains left after the beetle(s) had been eaten by a little owl. Stag beetle larvae develop in moist decaying wood near or below the soil surface, generally in open situations. Development sites tend to be tree stumps, and even fence posts in field systems or gardens.

Nest species and predators

8.39 Nests of the local wood-nesting ant *Temnothorax nylanderi* were found beneath bark on the cherry logs. Worker ants of this species were also found by suction sampling at the trunk bases

of the cherry trees. The local dasytid beetle *Dasytes aeratus* was found amongst canopy foliage, but the larvae are associated with trunks and boughs, as part of the saproxylic assemblage. The larvae appear to feed on dead invertebrates. A further species of note was the predatory bug *Xylocoris cursitans*, which often cohabits with *Bitoma crenata*.

8.40 A range of solitary wasps, predominately Sphecidae species, was recorded around the piles of sawn cherry logs close to the site's western boundary and from the water and interception traps located around the site. The species recorded are nearly all known to nest either in dead or decaying wood or in the evacuated burrows of wood-boring beetles, and most are predators of bugs (Homoptera) and barkflies (Psocoptera). The solitary wasp *Stigmus solskyi* (Sphecidae) is a predator of aphids and it also utilises the emergence holes of wood-boring beetles for nesting. Another solitary wasp, *Passaloecus corniger*, a sphecid with a slightly different biology, though sharing a similar habitat, is worthy of mention. It parasitises the wasp *Psenulus pallipes*, which nests in hollow stems and deadwood (Richards 1980). Hymenoptera species included a local spider-hunting wasp (Pompilidae) *Dipogon subintermedius*, which was frequently observed hunting amidst piles of sawn deadwood.

Nest and predator species of special interest

8.41 ***Nitela borealis*** (Formerly classified as RDB3 (Shirt 1987), Falk (1991a) revised the status to RDBK that is, 'insufficiently known'): This species was first recorded in the UK during the early 1980s in a garden in Smarden near Maidstone (Felton 1987). It may be a recent colonist and its status is unclear. It is associated with warm, sunny locations and it nests in disused beetle holes in dead wood and other habitats. The larval cells are provisioned with barkfly (Psocoptera) species.

8.42 ***Stenagostus rhombeus*** (Indicator of Ecological Continuity, Category 3): The predatory larvae of this click beetle develop under loose bark of deadwood.

8.43 ***Bitoma crenata*** (Indicator of Ecological Continuity, Category 3): This beetle was found under bark on a cherry log. It is generally found on wood in the early stages of decay when the wood is still sappy. It belongs to a family of beetles (Colydiidae) which are mainly predatory.

Field and ground layer fauna

8.44 Close sheep grazing during the survey period meant that the grassland was very short and little or no flowering was possible within the sward. Together with the low plant species richness, this factor affected the number of field layer invertebrate species found. These were confined to areas of nettle and the hedgerow bottoms. The assemblage was dominated by common and widespread species, particularly nettle associates. Typical inhabitants of the nettle patches were the nettle groundbug *Heterogaster urticae* and speckled bush-cricket *Leptophyes punctatissima*. The presence of macropterous Roesel's Bush-cricket *Metrioptera roeselii* in the outer (road-side) edge of the hedgerow is noteworthy. However, in common with the other survey sites, only widespread Orthopteran species were recorded in Park Farm Orchard.

8.45 Park Farm Orchard had a high number of ground-dwelling species in comparison with those from the other study sites, probably reflecting the number of logs which, as described above, acted as easily-inspected refugia (Table 15). Sampling revealed that soil and surface-active fauna did have some interest, including the ant-guest woodlouse *Platyarthrus hoffmannseggi* in ants' nests and the terrestrial flatworm *Microplana terrestris*. Both are widespread but scattered in lowland England. The ant *Lasius platythorax* should also be mentioned here, as it is a ground nesting species, often found beneath logs. The distribution of this species in the UK is incompletely known, though here it was found to be quite abundant. It was also beaten from the canopy where it appeared to have been feeding from sap runs.

8.46 Three dung beetle species were noted: *Aphodius ater, A. fimetarius/A. pedellus* and the somewhat localised *Onthophagus coenobita*. A locally common species of ground-nesting

solitary wasp *Tiphia femorata* (Tiphiidae) was observed; the larvae of this species parasitise the larvae of scarabaeid beetles including dung beetles (Richards 1980).

8.47 The northern hedgerow had not been trimmed for some years and provided moister and shadier ground conditions. A carabid beetle *Syntomus obscuroguttatus* that typically occurs amongst litter in damp grasslands was recorded from leaf litter at the base of this hedgerow. Another species associated with the hedgerow at this site was the snail *Pomatias elegans*, a local species associated with calcareous soils with a friable structure into which it burrows.

Other fauna

8.48 Birds noted during the surveys included green woodpecker (Amber List) and great spotted woodpecker. Amber bird species are of conservation concern in the UK and are listed in Anon (2002).

Table 55 Fruit tree survey at Park Farm Orchard

Obs no	Fruit tree type	Girth cms	Height	Distance to nearest neighbour	Canopy live %	Hollow trunk / branch	Cracks / splits	Rot holes	Rot sites	Bark missing	Bark split	Sap runs
1	Cherry	82	7	4	99				1			1
2	Cherry	86	7.5	4.5	100				1			1
3	Cherry	172	9	9	99	1		1	1	1		1
4	Cherry	146	8	9	100				1			1
5	Cherry	179	8	9	100			1	1			1
6	Cherry	86	6	5	100			1	1	1		1
7	Cherry	75	6	4	100				1			1
8	Cherry	86	6	4.5	100							
9	Cherry	151	9	5	85				1			1
10	Cherry	167	9	9	97				1		1	1
11	Cherry	180	8	5	98			1	1		1	1
12	Cherry	136	9	5	80	1			1	1		1
13	Cherry	186	10	10	90						1	1
14	Cherry	192	9	10	98				1			1
15	Cherry	90	7	5	100				1			1
16	Cherry	85	7	10	100							
17	Cherry	94	5	8	100				1			1
18	Cherry	117	4.5	8	100				1			1

Table continued...

Obs no	Fruit tree type	Girth cms	Height	Distance to nearest neighbour	Canopy live %	Hollow trunk / branch	Cracks / splits	Rot holes	Rot sites	Bark missing	Bark split	Sap runs
19	Cherry	113	9	10	100							1
	Average	**128**	**8**	**7**	**97**							
	Percent					**11**	**0**	**21**	**79**	**16**	**16**	**89**

Percent of all trees with a veteran character - 89

All trees % of possible number of veteran character occurrences - 33

Note: Of 20 trees recorded one was a stump 2 m in height, remaining trees were measured as shown above. 1 = veteran tree character present.

Table 56 Grassland vascular plant species list for Park Farm Orchard

Species	Common name	Abundance
Achillea millefolium	yarrow	O
Agrostis stolonifera	creeping bent	A
Arum maculatum	lords-and-ladies	F
Bellis perennis	daisy	F
Capsella bursa-pastoris	shepherd's-purse	R
Cardamine hirsuta	hairy bitter-cress	O
Cerastium fontanum	common mouse-ear	R
Cerastium glomeratum	sticky mouse-ear	O
Cirsium vulgare	spear thistle	O
Coronopus squamatus	swine-cress	O
Dactylis glomerata	cock's-foot	F
Geranium molle	dove's-foot crane's-bill	R
Lolium perenne	perennial rye-grass	A
Plantago lanceolata	ribwort plantain	R
Poa annua	annual meadow-grass	F
Poa pratensis	smooth meadow-grass	O
Ranunculus ficaria	lesser celandine	O
Ranunculus repens	creeping buttercup	F
Rumex obtusifolius	broad-leaved dock	F
Stellaria media	common chickweed	O
Taraxacum officinale agg.	dandelion	O
Trifolium repens	white clover	A
Urtica dioica	common nettle	O
Urtica urens	small nettle	R
Veronica chamaedrys	germander speedwell	O
Veronica persica	common field-speedwell	R

Notes: D = Dominant, A = Abundant, F = Frequent, O = Occasional, R = Rare

Table 57 Vascular plant species in the boundary hedgerows of Park Farm Orchard

Species	Common name	North	West
Acer campestre	field maple	x	
Acer pseudoplatanus	sycamore	x	x
Alliaria petiolata	garlic mustard	x	x
Arum maculatum	lords-and-ladies	x	x
Brachypodium sylvaticum	wood false-brome	x	
Corylus avellana	hazel	x	
Crataegus monogyna	hawthorn	x	x
Euonymus europaeus	spindle		x
Fagus sylvatica	beech	x	
Galium aparine	cleavers	x	x
Hedera helix	ivy	x	x
Ilex aquifolium	holly	x	
Mercurialis perennis	dog's mercury	x	x
Prunus avium	domesticated cherry	x	x
Ranunculus ficaria	lesser celandine	x	
Rosa arvensis	field-rose		x
Rosa canina	dog-rose	x	x
Rubus fruticosus agg.	bramble	x	x
Sambucus nigra	elder	x	x
Symphoricarpos albus	snowberry		x
Urtica dioica	common nettle	x	x
Outside of 30 m sections			
Acer campestre	field maple		x
Achillea millefolium	yarrow		x
Anthriscus sylvestris	cow parsley		x
Arrhenatherum elatius	false oat-grass		x
Brachypodium sylvaticum	wood false-brome		x
Cardamine hirsuta	hairy bitter-cress		x
Festuca pratensis	meadow fescue		x
Festuca rubra	red fescue	x	
Fragaria vesca	wild strawberry		x

Table continued…

Species	Common name	North	West
Geranium molle	dove's-foot crane's-bill		x
Geum urbanum	wood avens		x
Glechoma hederacea	ground-ivy	x	
Lamium album	white dead-nettle	x	x
Lamium purpureum	red dead-nettle	x	x
Lonicera periclymenum	honeysuckle	x	
Malva sylvestris	common mallow		x
Quercus petraea	sessile oak		x
Rumex acetosa	Common Sorrel		x
Stachys sylvatica	hedge woundwort		x
Stellaria holostea	greater stitchwort		x
Stellaria media	common chickweed	x	x
Taraxacum officinale agg.	dandelion		x
Veronica persica	common field-speedwell		x

Notes: x = present. Species underlined = native woody species. Species in **bold type** = woodland species listed in the Hedgerow Regulations 1997.

Table 58 Lichen species recorded in Park Farm Orchard

BLS No	Lichen taxa	Abundance	Evaluation & Rarity	Woodland Status
212	*Amandinea punctata*	A	LC	-
68	*Arthonia punctiformis*	O	LC	-
69	*Arthonia radiata*	R	LC	-
1542	*Arthopyrenia punctiformis*	R	LC	-
NEW	*Bacidia brandii*	R	**NR**	-
130	*Bacidia neosquamulosa*	R	**NS**	-
1623	*Bacidia viridescens*	R	**NS**	-
207	*Buellia griseovirens*	R	LC	-
271	*Caloplaca obscurella*	O	LC	-
297	*Candelariella reflexa*	O	LC	-
298	*Candelariella vitellina*	R	LC	-
429	*Cliostomum griffithii*	O	LC	-
489	*Dimerella pineti*	R	LC	-
491	*Diploicia canescens*	O	LC	-
511	*Evernia prunastri*	F	LC	-
1754	*Fellhanera subtilis*	R	**NR**	-
987	*Flavoparmelia caperata*	O	LC	-
1018	*Flavoparmelia soredians*	R	LC	-
1125	*Hyperphyscia adglutinata*	R	LC	-
582	*Hypogymnia physodes*	F	LC	-
583	*Hypogymnia tubulosa*	R	LC	-
1013	*Hypotrachyna revoluta*	O	LC	-
2121	*Lecanora barkmaniana*	O	**NS**	-
639	*Lecanora chlarotera*	O	LC	-
1996	*Lecanora compallens*	R	**NS**	-
641	*Lecanora confusa*	R	LC	-
643	*Lecanora conizaeoides*	F	LC	-
649	*Lecanora expallens*	O	LC	-
1836	*Lecanora persimilis*	R	**NS**	
675	*Lecanora saligna*	R	LC	-

Table continued...

BLS No	Lichen taxa	Abundance	Evaluation & Rarity	Woodland Status
688	*Lecanora symmicta*	F	LC	-
797	*Lecidella elaeochroma e.*	O	LC	-
2330	*Lepraria incana s. lat.*	F	LC	-
993	*Melanelia elegantula*	R	LC	-
997	*Melanelia fuliginosa subsp. g*	R	LC	-
1020	*Melanelia subaurifera*	F	LC	-
885	*Micarea nitschkeana*	R	LC	-
1015	*Parmelia saxatilis*	R	LC	-
1022	*Parmelia sulcata*	F	LC	-
1107	*Phaeophyscia orbicularis*	O	LC	-
1112	*Physcia adscendens*	O	LC	-
1113	*Physcia aipolia*	R	LC	-
1112	*Physcia tenella ten*	A	LC	-
1127	*Physconia grisea*	F	LC	-
732	*Placynthiella icmalea*	F	LC	-
2070	*Punctelia subrudecta s. str*	O	LC	-
1989	*Punctelia ulophylla*	F	LC	-
1234	*Ramalina farinacea*	O	LC	-
1235	*Ramalina fastigiata*	R	LC	-
1527	*Xanthoria candelaria*	F	LC	-
1530	*Xanthoria parietina*	F	LC	-
1531	*Xanthoria polycarpa*	F	LC	

Notes: D = Dominant, A = Abundant, F = Frequent, O = Occasional, R = Rare. For explanation of BLS number see paragraph 2.17, for Evaluation & Rarity see paragraph 3.14 and for Woodland Status see paragraph 3.11.

Table 59 Bryophyte species recorded in Park Farm Orchard

Bryophyte taxa	Cherry DAFOR	Percent frequency across all trees	Obligate epiphytes
Brachythecium rutabulum	O	Not calculated	
Ceratodon purpureus	O	Not calculated	
Dicranoweisia cirrata	O	5.50%	
Eurynchium praelongum	R	0.50%	
Hypnum cupressiforme	F	7.00%	
Hypnum resupinatum	F	14.00%	
Metzgeria furcata	R	0.50%	
Orthotrichum affine	R	2.50%	1
Orthotrichum diaphanum	F	6.50%	
Rhynchostegium confertum	R	0.50%	
Ulota bruchii	R	0.50%	1
Ulota phyllantha	R	0.50%	1
Total	**12**		**3**

Notes: D = Dominant A = Abundant F = Frequent O = Occasional, R = Rare

Table 60 Fungus species recorded in Park Farm Orchard

Latin name	Family	Associated habitat	Notes
Agrocybe erebia	Bolbitiaceae	Wood	13 fruitbodies in 4 clumps on buried cherry (?) stick in grass
Agrocybe pediades	Bolbitiaceae	Soil & dung	On soil near sheep dung
Agrocybe praecox	Bolbitiaceae	Grassland + trees / scrub	By cut cherry trunk segments
Armillaria mellea s.l.	Tricholomataceae	Wood	At base of dead, cut, standing 3m tall, cherry stumps
Auricularia auricula-judae	Auriculariaceae	Wood	5 fb on dead branch on elder tree
Basidioradulum radula	Schizoporaceae	Wood	Single fb on dead cherry branch
Bjerkandera adusta	Coriolaceae	Wood	On cut cherry branch
Bolbitius titubans	Bolbitiaceae	Grassland	Occasional fruit bodiess scattered across the site
Bovista plumbea	Lycoperdaceae	Grassland	1 mature fruitbody in grass
Calocybe gambosa	Tricholomataceae	Grassland	26 fruitbodies in a ring, amongst grass
Calvatia gigantea	Lycoperdaceae	Grassland	6 old fruitbodies blowing about.

Table continued…

Latin name	Family	Associated habitat	Notes
Chondrostereum purpureum	Meruliaceae	Wood	1 cluster on base of dead cherry
Clavulinopsis helvola	Clavariaceae	Grassland	Scattered fruitbodies in grass
Collybia erythropus	Tricholomataceae	Wood	In grass (presumably on buried wood)
Collybia ocior	Tricholomataceae	Soil	7 toadstools on soil, in grass
Conocybe mesospora	Bolbitiaceae	Grassland	Amongst grass
Conocybe pulchella	Bolbitiaceae	Soil	On soil
Coprinus aff. galericuliformis	Coprinaceae	Soil	3 toadstools on soil
Coprinus ellisii	Coprinaceae	Wood	1 button on dead, rotting 2.5cm by 16cm cherry pole
Coprinus micaceus	Coprinaceae	Wood	15 fruitbodies at base of fence post in weed-killer sprayed grass
Coprinus plicatilis	Coprinaceae	Grassland	4 fruitbodies in grass
Daedaleopsis confragosa	Coriolaceae	Wood	On dead, cut cherry sections
Dermoloma pseudocuneifolium	Tricholomataceae	Grassland	1 fruitbody in grass
Flammulaster carpophilus var. subincarnata	Cortinariaceae	Wood	On dead cherry? wood fragment
Ganoderma australe	Ganodermataceae	Wood	
Hygrocybe insipida	Hygrophoraceae	Grassland	Five sticky fruitbodies in grass
Hygrocybe virginea	Hygrophoraceae	Grassland	2 very small fruitbodies in grass
Hypholoma fasciculare	Strophariaceae	Wood	At foot of and around dead cherry trunk
Hypoxylon fuscum	Sphaeriaceae	Wood	On dead branch on hazel tree
Melanoleuca excissa var. iris	Tricholomataceae	Grassland	6 white toadstools in grass on the ground under cherry trees
Mycena luteoalba	Tricholomataceae	Grassland	On grass culms
Mycena galericulata	Tricholomataceae	Wood	12 fruitbodies on dead, cut 2m cherry stump
Mycena haematopus	Tricholomataceae	Wood	On dead, fallen cherry twig.
Mycena leptocephala	Tricholomataceae	Grassland	Amongst grass
Panaeolus fimicola	Strophariaceae	Soil	Small toadstool on soil near dead cherry in sheep-grazed orchard
Panaeolus papilionaceus var. papilionaceus	Strophariaceae	Soil & dung	3 fruitbodies on soil/sheep dung

Table continued…

Latin name	Family	Associated habitat	Notes
Peniophora lycii	Peniophoraceae	Wood	On dead branch on hazel tree
Peziza repanda	Pezizaceae	Wood	2 fruitbodies beside cut branches of cherry
Peziza vesiculosa	Pezizaceae	Wood	By cut cherry branch
Phellinus aff. pomaceus	Phellinaceae	Wood	On trunks of two living cherry trees
Phellinus ferreus	Phellinaceae	Wood	Fruitbody on fallen, dead, rotten, cherry branch
Phlebia radiata	Meruliaceae	Wood	On cut up sections of cherry branches
Pholiota gummosa	Strophariaceae	Wood	Near dead, cut cherry sections
Pholiota highlandensis	Strophariaceae	Fire site	3 toadstools on old bonfire site
Pholiota squarrosa	Strophariaceae	Wood	Between each pair of roots at base of cherry
Pleurotus ostreatus	Lentinaceae	Wood	On dead, cut cherry sections
Pluteus cinerofuscus	Pluteaceae	Wood	Single toadstool on buried cherry wood fragment
Polyporus ciliatus	Polyporaceae	Wood	Single fruitbody on cut branch of cherry
Psathyrella candolleana	Coprinaceae	Wood	On buried cherry roots
Psathyrella spadiceogrisea	Coprinaceae	Grassland	3 fruitbodies in grass
Psilocybe subviscida var velata	Strophariaceae	Grassland + trees / scrub	5 toadstools on ground under cherry in sheep-grazed orchard
Schizopora paradoxa	Hyphodermataceae	Wood	On rotten, hollow cherry trunk
Stereum hirsutum	Stereaceae	Wood	Colony on cut branch of cherry
Trametes versicolor	Coriolaceae	Wood	On cut branches of cherry
Vascellum pratense	Lycoperdaceae	Grassland	3 fruitbodies in grass

Table 61 Invertebrate species recorded in Park Farm Orchard

Species	Family/Order	Assemblage	UK status	Notes
Nuctenea umbratica	Araneae	Saproxylic	Widespread	Beneath loose bark on decaying mature cherry
Anobium punctatum	Col: Anobiidae	Saproxylic	Widespread	Active on standing trunk of dead cherry
Hedobia (Ptinomorphus) imperialis	Col: Anobiidae	Saproxylic	Nb	Beaten from cherry foliage
Ptilinus pectinicornis	Col: Anobiidae	Saproxylic	Widespread	In decaying cherry trunk
Aphodius ater	Col: Aphodiidae	Dung	Widespread	Flight interception trap
Aphodius fimetarius/A. pedellus	Col: Aphodiidae	Dung	Widespread	Flight interception trap, cherry tree, one
Oxystoma pomonae	Col: Apionidae	Field layer	Widespread	Beaten from hedgerow
Cantharis decipiens	Col: Cantharidae	Canopy	Widespread	Beaten from elder foliage
Amara aenea	Col: Carabidae	Ground layer +	Widespread	Flight interception trap, cherry tree, one
Amara ovata	Col: Carabidae	Ground layer +	Widespread	
Amara plebeja	Col: Carabidae	Ground layer	Widespread	Beneath logs at base of tree
Amara similata	Col: Carabidae	Ground layer	Widespread	Beneath logs at base of tree
Badister bipustulatus	Col: Carabidae	Ground layer	Widespread	Beneath logs at base of tree
Calathus piceus	Col: Carabidae	Ground layer	Widespread	Beneath logs at base of tree
Carabus violaceus	Col: Carabidae	Ground layer	Widespread	Found under logs near hedgerow
Demetrias atricapillus	Col: Carabidae	Field layer	Widespread	Numerous; beaten from hedgerow
Dromius meridionalis	Col: Carabidae	Saproxylic	Widespread	Beaten from cherry foliage
Harpalus rufipes	Col: Carabidae	Ground layer +	Widespread	Under logs
Microlestes maurus	Col: Carabidae	Ground layer +	Widespread	
Nebria brevicollis	Col: Carabidae	Ground layer	Widespread	Beneath logs at base of tree
Pterostichus madidus	Col: Carabidae	Ground layer	Widespread	Beneath logs at base of tree
Pterostichus melanarius	Col: Carabidae	Ground layer	Widespread	Found under logs near hedgerow
Metabletus (Syntomus) obscuroguttatus	Col: Carabidae	Ground layer	Local	Beneath logs at base of tree

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Grammoptera ruficornis	Col: Cerambycidae	Saproxylic	Widespread	Beaten from hedgerow
Adalia 10-punctata	Col: Coccinellidae	Canopy	Widespread	Flight interception trap, cherry tree, one
Adalia bipunctata	Col: Coccinellidae	Canopy	Widespread	Flight interception trap
Halyzia 16-punctata	Col: Coccinellidae	Canopy	Widespread	Flight interception trap
Propylea 14-punctata	Col: Coccinellidae	Canopy	Widespread	Beaten from ivy on apple tree
Psyllobora 22-punctata	Col: Coccinellidae	Field layer	Widespread	Favours grassland and meadows
Bitoma crenata	Col: Colydiidae	Saproxylic	Local	Under bark on cherry log
Anthonomus rubi	Col: Curculionidae	Canopy	Widespread	Beaten from Rosa in hedge
Barypeithes pellucidus	Col: Curculionidae	Ground layer +	Widespread	Under logs
Scolytus mali	Col: Curculionidae	Saproxylic	Nb	
Scolytus rugulosus	Col: Curculionidae	Saproxylic	Local	Beaten from cherry branch
Sitona lineatus	Col: Curculionidae	Field layer	Widespread	Flight interception trap
Dasytes aeratus	Col: Dasytidae	Saproxylic	Local	Beaten from cherry foliage
Agriotes pallidulus	Col: Elateridae	Field layer	Widespread	Beaten from elder foliage
Dalopius marginatus	Col: Elateridae	Field layer	Widespread	Beneath logs at base of tree
Ischnodes sanguinicollis	Col: Elateridae	Saproxylic	Na	Alighted on me in cherry orchard
Melanotus villosus sensu lato	Col: Elateridae	Saproxylic	Widespread	In decaying cherry trunk
Stenagostus rhombeus	Col: Elateridae	Saproxylic	Local	Under bark on sawn cherry logs
Dacne bipustulata	Col: Erotylidae	Saproxylic	Local	Under bark on cherry log
Melasis buprestoides	Col: Eucnemidae	Saproxylic	Nb	Flight interception trap, cherry, one
Dorcus parallelipipedus	Col: Lucanidae	Saproxylic	Local	Head capsule & galleries in white-rotted cherry trunk; beneath decaying cherry log
Lucanus cervus	Col: Lucanidae	Saproxylic	Nb	In decaying cherry trunk
Malachius bipustulatus	Col: Malachiidae	Saproxylic	Widespread	Beaten from cherry foliage
Tomoxia bucephala	Col: Mordellidae	Saproxylic	Na	Active on standing trunk of dead cherry

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Neocoenorrhinus aequatus	Col: Rhynchitidae	Canopy	Widespread	Beaten from hawthorn
Onthophagus coenobita	Col: Scarabaeidae	Dung	Local	Flight interception trap
Anapsis costai	Col: Scraptiidae	Saproxylic	Widespread	
Anaspis maculata	Col: Scraptiidae	Saproxylic	Widespread	Beaten from hawthorn
Anaspis regimbarti	Col: Scraptiidae	Saproxylic	Widespread	Beaten from hawthorn
Anaspis thoracica	Col: Scraptiidae	Saproxylic	Na	Beaten from Rosa blossom
Nicrophorus humator	Col: Silphidae	Carrion	Widespread	Flight interception trap
Drusilla canaliculata	Col: Staphylinidae	Ground layer +	Widespread	Under logs
Ocypus olens	Col: Staphylinidae	Ground layer	Widespread	Beneath logs at base of tree
Scaphidium quadrimaculatum	Col: Staphylinidae	Saproxylic	Local	Under bark on sawn cherry logs
Cylindrinotus laevioctostriatus	Col: Tenebrionidae	Saproxylic	Local	Deadwood on cherry tree
Prionychus ater	Col: Tenebrionidae	Saproxylic	Nb	In wood mould in hollow cherry
Forficula auricularia	Dermaptera	Generalist	Widespread	Under bark
Medetera truncorum	Dip: Dolichopodidae	Saproxylic	Widespread	Active on standing trunk of dead cherry
Dasysyrphus venustus	Dip: Syrphidae	Canopy	Widespread	Flight interception trap
Episyrphus balteatus	Dip: Syrphidae	Generalist	Widespread	Flight interception trap
Myathropa florea	Dip: Syrphidae	Saproxylic	Widespread	At wet wood mould in branch scar cavity on cherry trunk
Scaeva pyrastri	Dip: Syrphidae	Canopy	Widespread	Flight interception trap
Xylota segnis	Dip: Syrphidae	Saproxylic	Widespread	Log piles near hedge
Aegopinella nitidula	Gastropoda	Ground layer +	Widespread	Under logs
Clausilia bidentata	Gastropoda	Epiphyte	Widespread	Under logs
Cochlicopa lubrica	Gastropoda	Ground layer +	Widespread	Found beneath decaying log
Deroceras reticulatus	Gastropoda	Ground layer +	Widespread	Under logs
Oxychilus helveticus	Gastropoda	Ground layer	Widespread	Found beneath decaying log
Pomatias elegans	Gastropoda	Ground layer	Local	Found beneath decaying log
Trichia hispida	Gastropoda	Ground layer +	Widespread	Found beneath decaying log

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Trichia striolata	Gastropoda	Ground layer +	Widespread	Found beneath decaying log
Acanthosoma haemorrhoidale	Hem: Acanthosomatidae	Canopy	Widespread	Hedgerow
Anthocoris nemorum	Hem: Anthocoridae	Canopy	Widespread	Flight interception trap
Xylocoris cursitans	Hem: Anthocoridae	Saproxylic	Local	Under bark on cherry logs
Issus coleoptratus	Hem: Issidae	Canopy (Subterranean larvae)	Local	Beaten from ivy on apple tree
Heterogaster urticae	Hem: Lygaeidae	Field layer	Widespread	Beaten from cherry foliage
Loricula elegantula	Hem: Microphysidae	Saproxylic*	Widespread	On cherry log
Deraeocoris lutescens	Hem: Miridae	Canopy	Widespread	Beaten from field maple in hedge
Deraeocoris ruber	Hem: Miridae	Field layer	Widespread	Flight interception trap
Liocoris tripustulatus	Hem: Miridae	Field layer	Widespread	Hedgerow: bramble/field maple
Pithanus maerkeli	Hem: Miridae	Field layer	Widespread	Hedgerow
Palomena prasina	Hem: Pentatomidae	Canopy	Widespread	Hedgerow: bramble/field maple
Physatocheila dumetorum	Hem: Tingidae	Epiphyte	Widespread	Beaten from hawthorn
Tingis cardui	Hem: Tingidae	Field layer	Widespread	Flight interception trap
Andrena fulva	Hym: Andrenidae	Mosaic (G, F, C)	Widespread	Ground nesting grassland
Andrena haemorrhoa	Hym: Andrenidae	Mosaic (G, F, C)	Widespread	Flight interception trap
Andrena helvola	Hym: Andrenidae	Mosaic (G, F, C)	Widespread	Flight interception trap
Apis mellifera	Hym: Apidae	Saproxylic	Widespread	General
Bombus lapidarius	Hym: Bombidae	Field layer	Widespread	Grassland
Bombus pascuorum	Hym: Bombidae	Field layer	Widespread	Grassland
Lasius flavus	Hym: Formicidae	Ground layer	Widespread	
Lasius platythorax	Hym: Formicidae	Ground layer+	Unknown	Beaten from cherry tree
Temnothorax nylanderi	Hym: Formicidae	Saproxylic	Local	Suction sample from base of cherry trunk
Myrmica rubra	Hym: Formicidae	Ground layer	Widespread	Beneath cherry logs
Myrmica ruginodis	Hym: Formicidae	Ground layer	Widespread	Beneath cherry logs

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Myrmica scabrinodis	Hym: Formicidae	Ground layer	Widespread	Beneath cherry logs
Anoplius nigerrimus	Hym: Pompilidae	Ground layer	Widespread	Swept from log pile/grassland
Dipogon subintermedius	Hym: Pompilidae	Saproxylic	Widespread	Flight interception trap
Crossocerus megacephalus	Hym: Sphecidae	Saproxylic	Widespread	
Ectemnius (Clytochrysus) continuus	Hym: Sphecidae	Saproxylic	Widespread	Swept from log pile/grassland
Nitela borealis	Hym: Sphecidae	Saproxylic	RDBK	
Passaloecus corniger	Hym: Sphecidae	Saproxylic	Widespread	Flight interception trap
Pemphredon inornata	Hym: Sphecidae	Saproxylic	Widespread	Swept from log pile/grassland
Pemphredon lugubris	Hym: Sphecidae	Saproxylic	Widespread	Flight interception trap
Psenulus pallipes	Hym: Sphecidae	Generalist (D)	Widespread	Flight interception trap
Stigmus solskyi	Hym: Sphecidae	Saproxylic	Widespread	Flight interception trap
Tiphia femorata	Hym: Tiphiidae	Ground layer	Locally common	Flight interception trap
Dolichovespula norwegica	Hym: Vespidae	Generalist	Widespread	Flight interception trap
Vespula vulgaris	Hym: Vespidae	Generalist	Widespread	Flight interception trap
Chiasmia clathrata clathrata	Lep: Geometridae	Field layer	Widespread	Grassland
Celastrina argiolus	Lep: Lycaenidae	Canopy	Widespread	Hedgerow ivy
Calliteara pudibunda	Lep: Lymantriidae	Canopy	Widespread	Larva
Pieris brassicae	Lep: Pieridae	Field layer	Widespread	General
Maniola jurtina	Lep: Satyridae	Field layer	Widespread	Grassland
Chrysoperla carnea	Neuroptera	Canopy	Widespread	Flight interception trap
Nineta flava	Neuroptera	Canopy	Widespread	Flight interception trap
Aeshna mixta	Odonata	Freshwater	Widespread	Numerous individuals flying in canopy
Sympetrum striolatum	Odonata	Freshwater	Widespread	
Armadillidum vulgare	Oniscoidea	Ground layer +	Widespread	Under logs
Oniscus asellus	Oniscoidea	Ground layer +	Widespread	Under logs
Philoscia muscorum	Oniscoidea	Ground layer +	Widespread	Under logs

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Platyarthrus hoffmannseggi	Oniscoidea	Ground layer +	Widespread	In Myrmica nest under log
Porcellio scaber	Oniscoidea	Generalist	Widespread	Deadwood on cherry tree
Chorthippus brunneus	Orthoptera	Field layer	Widespread	Grassland
Leptophyes punctatissima	Orthoptera	Field layer	Widespread	Swept from nettles
Meconema thalassinum	Orthoptera	Canopy	Widespread	Hedgerow: oak
Metrioptera roeseli	Orthoptera	Field layer	Widespread	Macropterous adults in hedgerow
Tetrix subulata	Orthoptera	Field layer	Widespread	Found in grassland
Microplana terrestris	Planaria	Ground layer +	Widespread	Under logs
Ectopsocus briggsi	Psocoptera	Epiphyte	Widespread	Beaten from cherry foliage
Graphopsocus cruciatus	Psocoptera	Epiphyte	Widespread	Beaten from cherry foliage

Notes: see paragraphs 3.9 and 3.17 for explanations of assemblages and status categories.

* *Loricula elegantula*: difficult to assign to one assemblage. Classified as saproxylic by Alexander 2002a, but sometimes regarded as part of the epiphyte assemblage. It tended to occur among epiphytes in the current survey.

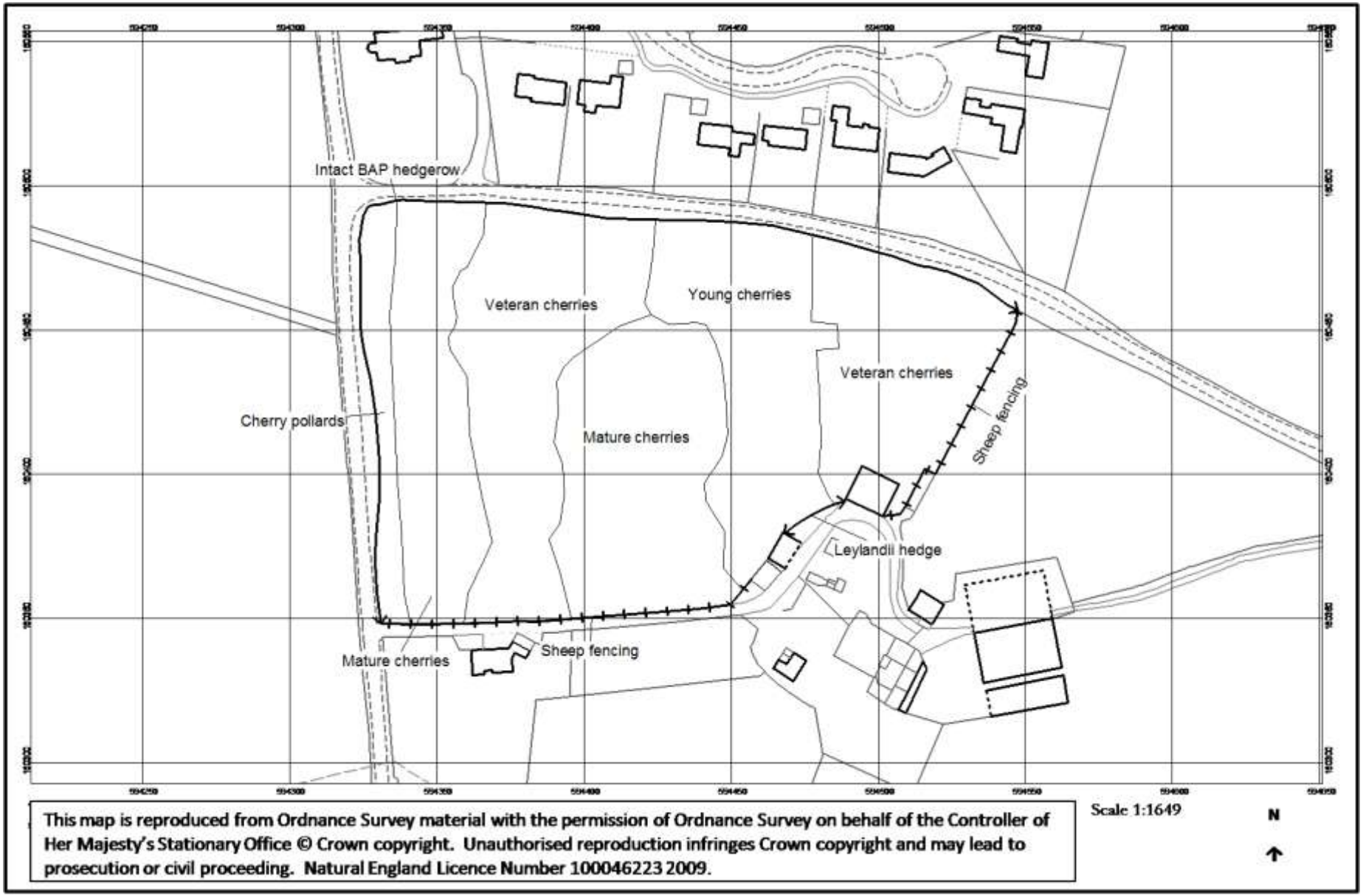

Figure 10 Map of Park Farm Orchard (TQ944604). Orchard type and boundaries map

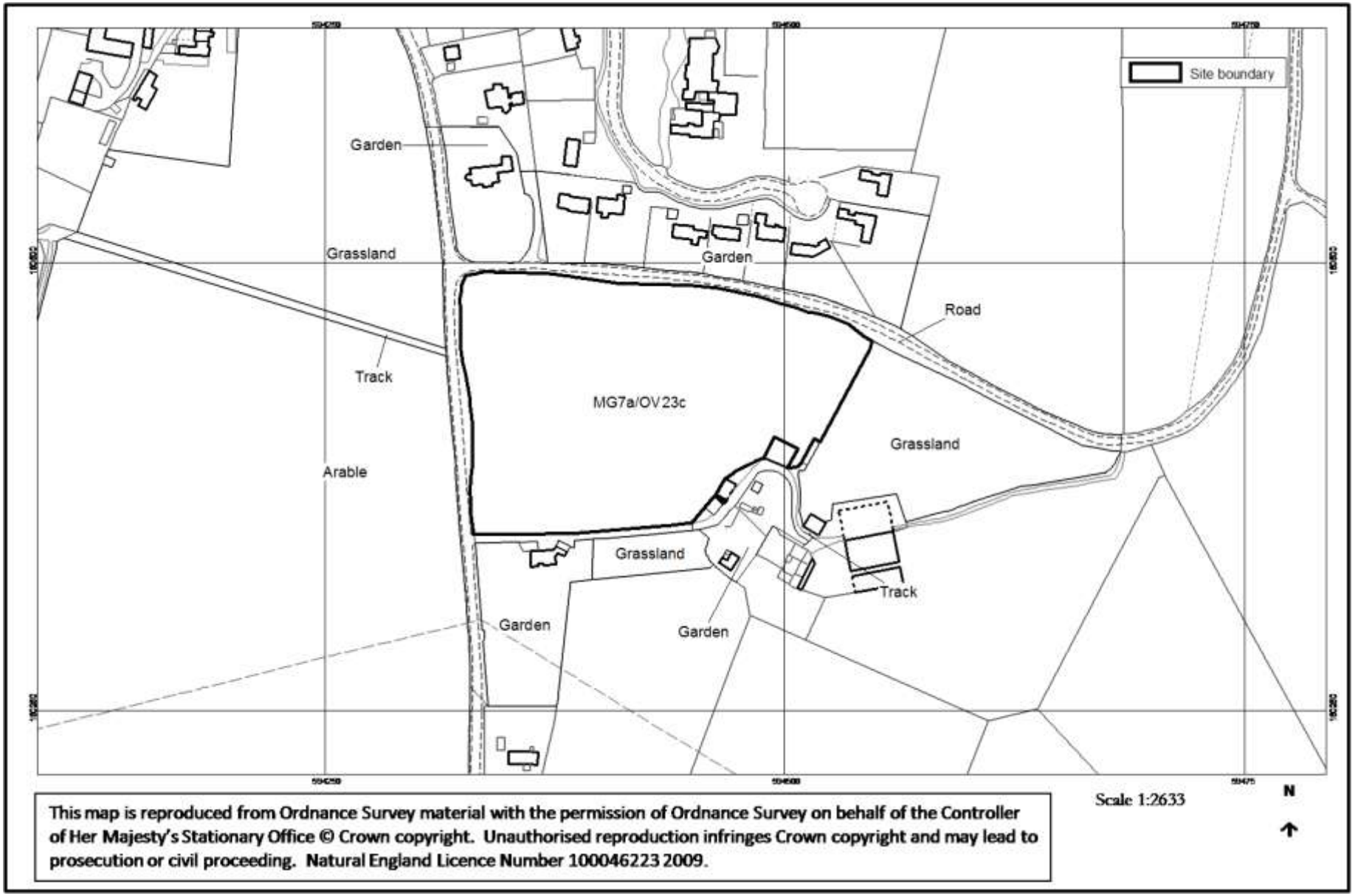

Figure 11 Map of Park Farm Orchard (TQ944604).Orchard floor, surrounding land use and compartments map

9 Broadway Farm Orchards

Landscape setting

9.1 Broadway Farm Orchards form an extensive block of orchards (21 ha) situated on the western floodplain of the River Severn, 3 km east of Westbury-on-Severn in Gloucestershire (Figure 12). The fields which make up the site have been numbered for the purposes of the survey (Figure 12) and it should be noted that Area 9, which is grassland not orchard, was not surveyed. The orchards lie on more or less level ground, below 10 m in altitude, between the river embankment and higher ground to the west. The landscape on the western side of the River Severn is dominated by grassland, with relatively little arable land, while a mixture of grassland and arable is characteristic of the eastern side of the river. There are many small traditional orchards in the landscape, the nearest one is adjacent to Broadway Farm Orchards (Figure 13). The site has the largest area (53.7 ha) of traditional orchards in the surrounding 1 km zone compared to the other study sites (Table 5). There are very few areas of woodland in the landscape, although parts of Broadway Farm Orchards have developed into dense scrub. Hedgerows form the main field boundaries and include a scattering of hedgerow trees. Broadway Farm Orchards are connected to other orchards and to the trees and scrub along the river bank either directly or by the hedgerow network. On a national scale, the site is in rainfall and atmospheric deposition zones that are mid-way in range compared to the other study sites (Table 5).

History and management

9.2 Broadway Farm Orchards contain apple, plum, damson and pear trees and have been managed by the same family for the past 122 years. One of the fields, Coronation Orchard (Area 8), was first planted in the 1850's, while Long Marsh Orchard (Area 7) is believed to be about 200 years old. Gloucestershire has had a long orchard history. Cider apples have been a feature since at least the start of the fifteenth century (Roach 1985) and production peaked in the period from the mid-seventeenth to mid-eighteenth century (Morgan and Richards 1993). Perry pears were planted in the sixteenth century and reached a peak in poularity at the end of the seventeenth and early eighteenth centuries (Luckwill and Pollard 1963). Gloucestershire was also part of the Midland plum growing area (Taylor 1949).

9.3 The First Edition Ordnance Survey map at 1:10560 scale, published in 1888-1889, shows orchards in all fields, including those that are now grassland. The map shows that orchards in the surrounding landscape were even more extensive at that time than at present, with more or less continuous orchards extending north and south on both sides of the river. Woodland was as scarce at that time as it is today. The closest ancient woodland in the inventory for Gloucestershire (Spencer and Thomas 1991) is an existing ancient woodland (3 ha) 0.67 km to the east, across the river from Broadway Farm Orchards. The closest ancient woodland on the western side of the river is 2.28 km away from the site.

9.4 Historically, Broadway Farm Orchards were managed commercially for fruit production, with the grassland being grazed by beef cattle and cut for hay. The orchard floor had received some spraying with herbicide in the past, but has not been treated for some years. Fruit was harvested for cider and juice into the 1980s but has not been collected for a number of years and there has been little other recent management apart from sheep grazing in Areas 2, 3 and 10. However, the site is now within a Countryside Stewardship Scheme agreement and a management plan for orchard restoration is being implemented. A priority is making the boundaries stockproof so that grazing can be re-introduced more extensively. The plan also includes scrub control and restorative pruning of the fruit trees. There are eight ponds in the orchards, located on field boundaries for watering of stock. The density of ponds (8 in one square kilometre) is considerably

greater than the UK average of 1.4 ponds per square km (Oldham and Swan 1997). Pond restoration is part of the management plan.

Fruit tree survey

Overview of the fruit tree survey

9.5 The fruit tree survey was carried out in 2003 by Dr Keith Alexander. His results are incorporated into the current report, together with some additional notes made by Mike Lush and Dr Eleanor Hewins during the 2004 habitat survey. The 2003 survey took the form of an almost complete census of all trees, but veteran tree feature recording was restricted to searching for evidence of heartwood decay, indicated by the presence of hollows in trunks and branches. The most comparable data to that collected for other sites are shown in Table 62a-h. Summary results by compartment and by fruit species are shown in Tables 63 and 64 and girth size distribution graphs shown in Figures 14 - 16. Area 10 was not included in the 2003 survey. The presence of mistletoe was recorded on each tree in 2003 and showed that only apple had mistletoe (11% of all apple trees). There was occasional fallen dead wood across the site and dead trees comprised 7% of the total censused. While not strictly comparable to the other sites, the veteran tree feature reached 47% of the potential occurrences, which is a high incidence of a major veteran tree feature. Scrub cover was more extensive than in other orchard sites (Table 7).

Area characteristics of fruit trees

9.6 **Area 1** contained some of the largest and probably oldest trees on the whole site, including the largest plum, one of the largest pears, and the second and third largest apples. *Rubus fruticosus* agg (bramble) was swamping some of the trees, and growing over the canopy in a few cases. Also, some of the mature plums were producing suckers, which were growing to form dense scrubby stands. The fruit tree canopy was patchy, but mostly open.

9.7 **Area 2** had trees that were generally comparatively small. The canopy was open in the east and west portions of the field, and more closed in the centre. One of the pears appeared to have spines. This may indicate that it may have been an older variety, or re-growth from a wild root-stock, although *Pyrus communis*, the wild pear, and its cultivars, can occur with and without spines (Aldasoro and others 1996). In addition to the fruit trees, there was a large amount of *Rosa arvensis* (field rose) and *Fraxinus excelsior* (ash) scrub.

9.8 **Area 3** (Home Orchard), which was composed of plums, contained only relatively small trees, compared to other Areas, except for a few non-fruit trees such as ash (*Fraxinus excelsior*). The canopy was very open.

9.9 **Area 4** was a small remnant orchard containing four apple trees and a plum tree.

9.10 **Area 5** was another remnant orchard of three apples and some plum trees (Table 62e), and dense stands of suckering plum which were not measured. Many of the plums outside of the suckering stands were leaning, dead or hollow.

9.11 **Area 6** had sparse individual trees, including three apples and some plums, as well as dense stands of suckering plums.

9.12 **Area 7** (Long Marsh Orchard) contained apple, pear and plum trees. Some of the pears in this orchard reached 11m high. Much of the western quarter of the orchard lacked fruit trees and fruit tree distribution was patchy in other areas. The canopy was predominantly open, but closed in places, especially where dense suckering plum occurred. In addition many trees were swamped by *Rubus fruticosus* agg. (bramble) and *Sambucus nigra* (elder) scrub. The fruit tree survey showed that Area 7 had the highest proportion of trees in dense scrub (32%) among the Areas surveyed.

9.13 **Area 8** (Coronation Orchard) contained mainly apple, with some pear and plum trees. A number of the apple trees appeared to be very old and some were leaning or had fallen, though they still appeared to be growing. The tallest apple tree recorded in this site was found in this orchard, with an estimated height of 12 m. The tree canopy was mainly open, and some areas had few trees. *Rubus fruticosus* agg. (bramble) was swamping many trees, and scrub was particularly dense on the southern side of the orchard. Other trees not cultivated for fruit that were present within this orchard included *Sambucus nigra* (elder), whitebeam (*Sorbus* species) and a non-native variety of *Populus nigra* (identified as 'Plantierensis' by Paul Whitehead on 11/02/02).

9.14 **Area 10** was a small orchard area mostly covered with dense suckering plum, mixed with *Sambucus nigra* (elder), on rather damp ground. Associated species found in this scrub were: *Rubus fruticosus* agg. (bramble), *Arum maculatum* (lords-and-ladies), *Brachypodium sylvaticum* (wood false-brome), *Cardamine pratensis* (cuckooflower), *Filipendula ulmaria* (meadowsweet), *Galium aparine* (cleavers), *Glechoma hederacea* (ground-ivy), *Rumex obtusifolius* (broad-leaved dock), *Urtica dioica* (common nettle) and *Veronica chamaedrys* (germander speedwell). The eastern side was more open and had a few apple pear and plum trees.

Orchard floor habitats

Previous grassland survey in 1987

9.15 The grasslands of Broadway Farm Orchards were surveyed in 1987, with the exception of Area 3 (Nature Conservancy Council, unpublished data). At that time, all fields were cut for hay, and aftermath grazed, except for Areas 1 and 2 which were cattle-grazed. Ridge and furrow topography was evident over all fields surveyed. The grasslands were mostly MG5 *Cynosurus cristatus-Centaurea nigra* grassland (Rodwell 1992). Area 1 and 8 had elements of damper grassland likely to have been similar to MG8 *Cynosurus cristatus-Caltha palustris* grassland. Area 2 was heavily grazed and was probably transitional to MG6 *Lolium perenne-Cynosurus cristatus* grassland. The grasslands were diverse, with up to 30 species per metre square. Species recorded included *Ophioglossum vulgatum* (adder's tongue fern), *Listera ovata* (twayblade), *Dactylorhiza fuchsii* (common spotted-orchid) and *Dactylorhiza praetermissa* (southern marsh-orchid). Either one or both of the latter two species occurred in every field.

Grasslands in 2003 and 2004

9.16 Most of the grasslands were ungrazed at the time of the 2003 and 2004 orchard surveys, and, through lack of grazing and cutting resembled MG1 *Arrhenatherum elatius* grassland (Rodwell 1992). Coarse, tussocky, grasses such as *Dactylis glomerata* (cock's foot), *Deschampsia cespitosa* (tufted hair-grass) and *Arrhenatherum elatius* (false oat-grass) were characteristic and broadleaved herbs such as *Centuarea nigra* (common knapweed) and *Lathyrus pratensis* (meadow vetchling) generally rare. However, in some places, remnants of MG5 grassland remained, which had greater cover of finer-leaved grasses, such as *Festuca rubra* (red fescue) and herbs like *Lotus corniculatus* (bird's foot trefoil) and *Luzula campestris* (field woodrush). *Ophioglossum vulgatum* (adder's tongue fern) was re-found during the fungal survey in one small patch in Area 1. Locally, areas of damper grassland remained, probably derived from MG8, and supported species such as *Filipendula ulmaria* (meadowsweet), *Juncus inflexus* (hard rush), *Dactylorhiza fuchsii* (common spotted-orchid), *Dactylorhiza praetermissa* (southern marsh-orchid), *Lotus pedunculatus* (greater bird's foot trefoil) and *Carex ovalis* (oval sedge). Furrows were still faintly discernable, marked by species such as *Potentilla anserina* (silverweed). Herb cover overall varied quite widely, from 1% to 30% cover. The sward was generally around 40 cm in height, sometimes reaching up to 100 cm, especially by the autumn, during the fungal survey. Shorter patches of turf of 5-10 cm occurred, probably maintained by rabbit grazing. Dead plant litter in the sward ranged from 5 to 30% and there was little or no bare ground (less than 1%).

9.17 A minority of areas were grazed or mown and had swards resembling MG6 *Lolium perenne-Cynosurus cristatus* grassland, and in places where ground had been disturbed, ruderal species were evident. Herb cover was around 10%, rising to 70% where species such as *Urtica dioica*

(common nettle), *Anthriscus sylvestris* (cow parsley) and *Cirsium arvense* (creeping thistle) were locally abundant. Sward heights were around 3 to 20 cm and litter cover less than 1%.

9.18 Species lists from selected areas to illustrate the characteristic composition of grassland types in Broadway Farm Orchards are given in Table 65. Note that these lists do not include every species recorded in the compartments of the site. Overall, the core of the 1987 species list is represented, with some notable absentees such as *Rhinanthus minor* (yellow rattle), though those species that were still present occurred mostly at very low frequencies. Restoration of grazing and cutting should encourage these species to increase in abundance once more.

Area characteristics of grasslands

9.19 **Area 1** had grassland that was fairly typical of the ungrazed grasslands, but with noticeably more *Filipendula ulmaria* (meadowsweet). Other additional species included *Lysimachia nummularia* (creeping-Jenny) and *Tanacetum vulgare* (tansy), whilst *Primula veris* (cowslip) was frequent in places. Area 1 also contained a small patch with *Dactylorhiza praetermissa* (southern marsh-orchid) and *Ophioglossum vulgatum* (adder's tongue fern). A pond was situated on the western boundary of this orchard. It was approximately 4 m by 30 m in size. Trees, including *Salix fragilis* (crack willow), grew around it and it was choked with algae.

9.20 **Area 2** was sheep grazed, and appeared to be mainly damp MG6 *Lolium perenne-Cynosurus cristatus* grassland (Table 65). In places the grassland became dominated by *Potentilla anserina* (silverweed) and *Potentilla reptans* (creeping cinquefoil), especially at the eastern end of the orchard. In 2002, Paul Whitehead found patches of *Trifolium fragiferum* (strawberry clover) in Area 2.

9.21 **Area 3** was grazed and comprised a mixture of species-poor grassland, probably MG6 *Lolium perenne-Cynosurus cristatus* grassland, but with patches of ruderal vegetation that may have resembled OV 24 *Urtica dioica-Galium aparine* community (Rodwell 2000) and which amounted to around 70% of the compartment. *Urtica dioica* (common nettle) accounted for 25% of the cover in these areas. Other plant species present included *Anthriscus sylvestris* (cow parsley), *Potentilla anserina* (silverweed), *Cirsium arvense* (creeping thistle), *Galium aparine* (cleavers), *Rumex obtusifolius* (broad-leaved dock) and *Lolium perenne* (perennial rye-grass).

9.22 **Area 4** was typical of the ungrazed grasslands in the majority of the orchards. Remnants of MG5 with *Primula veris* (cowslip), *Centaurea nigra* (common knapweed) and *Luzula campestris* (field woodrush) and MG8 elements with *Filipendula ulmaria* occurred here.

9.23 **Area 5** was divided into two parts. The western end had been mown and the grassland appeared to be fairly species-poor with ruderals prominent (Table 65). The grassland towards the eastern end was typical of the ungrazed parts of the site, and appeared to be MG1 *Arrhenatherum elatius* grassland. Species present indicated that it may once have been MG5 *Cynosurus cristatus-Centaurea nigra* or MG8 *Cynosurus cristatus-Caltha palustris* grassland (Table 65), although species such as *Centaurea nigra* (common knapweed) and *Lotus pedunculatus* (greater bird's foot trefoil) were in low abundances. Herb cover in this part of Area 5 was about 20%, while litter was between 5 and 10% cover. Bare ground was less than 1%. The sward was rather tussocky, ranging in height from 5 cm to 10 cm, with some tussocks reaching 40 cm.

9.24 **Area 6** was typical of grassland found over much of the rest of the site. Recent scrub clearance in this grassland had lead to the development of patches of ruderal communities.

9.25 **Area 7** was ungrazed and had grassland that was fairly typical of grassland in other parts of the site (Table 65). Although it was mainly tussocky MG1 *Arrhenatherum elatius* grassland, it had patches of more species-rich grassland closer to MG5 *Cynosurus cristatus-Centaurea nigra* or MG8 *Cynosurus cristatus-Caltha palustris* grasslands. Many of these more species rich areas appeared to be maintained by rabbit grazing. Despite containing these richer patches, the grassland had herb cover of only 1% overall, while litter covered about 30%. There was no significant bare ground, except a small amount caused by rabbits. There was large variation in

sward height, due mainly to tussocks of *Dactylis glomerata* (cock's-foot) but overall, sward height reached around 100 cm.

9.26 **Area 8** was ungrazed and had grassland similar to the majority of compartments (Table 65). Within the grassland, herbs were very rare, accounting for about 1% cover. There were, however, occasional patches of more species-rich grassland with species such as *Primula veris*. The grassland contained very little bare ground (less than 1%) while litter was abundant and accounted for 20% cover.

9.27 **Area 10** was grazed by sheep, as part of the same grazing unit as Area 2. The grassland was similar in character to Area 2, however, probably due to the proximity to the river, the grassland was damper. It contained *Alopecurus pratensis* (meadow foxtail), *Juncus inflexus* (hard rush), *Carex hirta* (hairy sedge) and *Festuca arundinacea* (tall fescue) tussocks. It was fairly heavily grazed with sward heights of between 3 and 20 cm.

Orchard boundaries

9.28 The boundaries of the fields that made up Broadway Farm Orchards were largely overgrown hedgerows, with some sections of fencing (Figure 12). The hedgerows had expanded in many places to form bands of scrub several metres wide. Bramble and suckering plum contributed to this scrub, for example in Area 5. Hawthorn (*Crataegus monogyna*) and blackthorn (*Prunus spinosa*) were prominent species. A typical 30 m section of hedgerow in Area 5 had five native woody species and would therefore qualify as a species-rich hedgerow under pre-2007 BAP criteria. The woody species present were hawthorn, hazel (*Corylus avellana*), field-rose (*Rosa arvensis*), crack-willow (*Salix fragilis*) and elder (*Sambucus nigra*). Elm (*Ulmus* sp), field maple (*Acer campestre*) and naturalised apple and plums also occurred in the hedgerows. Hedgerow trees included a large veteran crack-willow.

Epiphytic lichens

Community characteristics

9.29 About four-fifths of Broadway Farm Orchards were surveyed for lichens. Of the 56 taxa recorded, 18 species were seen just once or twice, so consequently 38 taxa comprise the core biomass of lichens. Though relatively thinly scattered throughout, the species fall into four main lichen communities, namely those of the *Parmelion, Xanthorion, Pertusarion* and *Calicion*. The *Xanthorion*, which is indicative of nutrient-enriched bark, was frequent. Dominant or abundant species were *Physcia tenella* (*Xanthorion*) and *Punctelia ulophylla* (*Parmelion*). Not unexpectedly, damp bark communities occurred only rarely. They were present in sheltered, often quite deeply shaded parts of the site, where trees growing in close proximity had created a mostly closed canopy above poorly drained ground. These lichen communities had some affinities to an association of the *Graphidion* community called the *Pyrenuletum nitidae* (James and others 1977). Component species included *Bacidia rubella, Lauderlindsaya acroglypta* and *Opegrapha vermicellifera* and various other *Opegrapha* species and *Porina aenea*, which also favour shade, but are more generally smooth bark colonisers. Isolated, exposed, hollowed-out trees, many supporting pendulous clumps of *Viscum album* (mistletoe), occasionally provided important dry bark habitat or trunks with missing bark, for various species belonging to the species-poor *Calicion* community. These species included *Calicium glaucellum, Calicium salicinum* and *Hypocenomyce scalaris* together with the air pollution tolerant lichen, *Lecanora conizaeoides*.

9.30 The typical *Graphidion* community was virtually absent, probably reflecting a history of moderate air pollution. Broadway Farm Orchards lie in a zone mapped by Hawksworth and Rose (1970) as having moderate sulphur dioxide amounts at that time, that is 40-50 micrograms of sulphur dioxide per cubic metre. Current dry and wet atmosheric deposition amounts are in the middle range among the study sites (Table 5). Wolsey and James (2004) suggest that the *Calicion*

develops in areas that have suffered from industrial pollution. The lack of any Indicators of Ecological Continuity, despite the long history of orchard cover, is not surprising given the historic pollution levels. The frequency of the *Xanthorion* is interesting, as neither the Broadway Farm Orchards nor the surrounding orchards are managed in an agriculturally intensive way.

Lichen species of special interest

9.31 ***Lauderlindsaya acroglypta*** (Nationally Scarce): This lichen was found on the shaded bark of an apple.

9.32 ***Anisomeridium biforme, Candelaria concolor*** (found on apple, possibly a new Vice-County record) and ***Calicium salicinum***: These species appear to be uncommon in this area of the Severn Estuary, according to the British Lichen Society Mapping Scheme.

Bryophytes

9.33 The trees in Broadway Farm Orchards posed some survey problems. Because of the very neglected and overgrown nature of much of the site, it was physically impossible to examine many trees. Also, as most trees were tall, and branched at 2 metres or above, the epifloras of the upper branches were, by necessity, poorly sampled. Area 3 was not examined.

9.34 The cover of bryophytes on apple trees was generally higher than on pear trees, while the branches of plums were often bryophyte-free and the frequency of bryophyte occurrence was low overall on plum trees. The architecture of the fruit trees in Broadway Farm Orchards seemed to make bryophyte colonization difficult. Branches tended to arise from trunks at acute angles. Bryophytes mainly occurred at the bases of trunks or on branch surfaces that were relatively level. Bryophytes recorded from the ground included *Brachythecium rutabulum, Amblystegium serpens* and *Plagiomnium undulatum*.

9.35 The species recorded on each fruit tree type are listed in Table 67. Apple had the largest number of bryophyte species. The fruit tree survey showed that apple made up the bulk of the trees at Broadway Farm Orchards, and therefore might be expected to have the highest total number of bryophyte species. However, the samples of individual trees showed that more species per tree occurred on apple than on pear or plum (Table 68). Individual plums trees were sampled in Areas 6 and 7. In the latter area, sample trees were mature, well-grown, isolated plums growing in the open, not in thickets of suckers, and had an average girth size of 87.8 cm. Area 6 sample trees were generally smaller, their average girth size was 52.1 cm. There were slightly more species on average on the trees in Area 6 (2.7 per tree compared to 1.1 species per tree). There was a strong negative correlation between girth size and number of species, using the pooled data from both samples (significant at $p < 0.01$ for ranked values and actual values). No obligate epiphyte species were present on trees in Area 7, in contrast to Area 6. The reason for poorer bryophyte floras on larger plums is not clear, it may relate to site differences rather than size of plum. Area 6 is closer to the river and may have a damper, more favourable micro-climate.

Fungi

Habitat associations and characteristics

9.36 This large site had a good number of old trees and was the richest for fungi found on wood among the study sites (Table 14). Fungi associated with wood occurred scattered through the site and included species found on poplar or willow (Table 69). Some species were found at the base of hedgerows but often these habitats were dark and dry and had no fungi. Scrub and bramble patches made accessibility for survey difficult. A range of grassland fungi were found (Table 69) but swards were too tall for most species. In particular, Areas 1, 5, 7 and 8 had swards that reached 100 cms and had few fungi. One species which can grow on dead grass or straw was found; *Volvariella gloiocephala*. Area 2 was sheep-grazed and the grass sward was shorter.

Common pasture fungi were recorded here. A short sward area in Area 1 had *Psathyrella clivensis* (see below).

Fungus species of special interest

9.37 ***Agrocybe cylindracea*** (BMSFRD: 220): This fungus was found during both the spring and autumn visits on a half-buried poplar root on the western boundary of Area 3 (Home Orchard).

9.38 ***Geastrum triplex*** (Collared Earthstar) (BMSFRD: 934): This species was found in an old hedge line where a new fence line along the southern border of Area 5 allowed access. Gloucestershire is the stronghold of this fungus.

9.39 ***Hemimycena candida*** (BMSFRD: 29): This fungus was found growing at the base of senescent comfrey (*Symphytum officinale*) along the boundary of the orchards adjacent to the lane. It is probably under-recorded in Britain.

9.40 ***Psathyrella clivensis*** (BMSFRD: 30): This species was recorded in the grassland near the *Ophioglossum vulgatum* (adder's tongue fern) plants seen in Area 1 in the spring.

9.41 ***Ramaria gracilis*** (BMSFRD: 26): This species was found in an old hedge line where a new fence line along the southern border of Area 5 allowed access. This fungus is probably under-recorded in Britain.

Invertebrates

General overview of assemblages and characteristics

9.42 The initial work was conducted by Paul Whitehead as part of the People's Trust for Endangered Species/English Nature noble chafer studies during 2001, and was continued by him on a more limited scale in 2002. Paul Whitehead's information and the survey undertaken by Dr Keith Alexander in 2003 are the main sources of data (Table 70). Incidental records made by Mike Lush and Dr Malcolm Storey in 2004 are also incorporated. As discussed in paragraphs 2.36 - 2.38, the 2001-2003 surveys at Broadway Farm Orchards differed somewhat to the surveys at other study sites. The saproxylic and epiphyte assemblages were the focus of the work and records made for species in other assemblages were incidental. Suction sampling, water traps and flight interception traps were not used at Broadway Farm Orchards in contrast to other sites. Thus the records for Broadway Farm Orchards are not strictly comparable with the results from the rest of the study sites, although, despite less intensive sampling methods being deployed at Broadway Farm Orchards, the richest saproxylic fauna and the most Red Data Book and nationally scarce species were found here (Table 15, Table 17). The priority BAP species *Gnorimus nobilis* (noble chafer beetle) was present, along with a range of other beetles that are Indicators of Ecological Continuity. The veteran tree assessment is not strictly comparable to other sites but the frequent incidence of hollows showed that wood decay habitat was abundant in the Broadway Farm Orchards. As explained above, the site also had historical and landscape continuity, with orchards present on the site and extensively in the surrounding landscape over a long period of time. While the abundant bramble and associated scrub undoubtedly has value for invertebrates as a food resource, and for nesting and shelter, the swamping of orchard trees by scrub is likely to be deleterious for many of the saproxylic species (Ranius and Jansson 2000). *Gnorimus nobilis* in particular seems to be associated with heartwood in warm, well-lit tree trunks (Dr Keith Alexander pers obs), although Paul Whitehead (pers obs) notes that larvae have been found in other situations, such as under the bark of fallen wood.

9.43 The fauna associated with epiphytes was rich, despite the amount of cover provided by lichens and bryophytes not matching that of the Devon sites. Broadway Farm Orchards had an additional dimension to its fauna through the presence of mistletoe in the tree canopies. Mistletoe has a specialised invertebrate fauna, representatives of which were found at Broadway Farm Orchards.

Canopy fauna

9.44 The mistletoe fauna is included under this assemblage, although the fauna does not directly rely on the canopy habitat but on the semi-parasitic vascular plant mistletoe which grows in tree canopies.

Canopy species of special interest

9.45 ***Anthocoris visci*** (Nationally Scarce, Category B): This predatory bug associated with mistletoe may have declined towards Red Data Book status (Alan Stubbs pers comm, Whitehead, 1996). However in the past decade there has been evidence of a spasmodic resurgence in some parts of the English midlands (Paul Whitehead, pers obs)

9.46 ***Ixapion variegatum*** (Recently recorded in Britain): This rare weevil develops in the stems of mistletoe. It may possibly be a long-term resident in Britain which has been overlooked in the past (Foster and others 2001). The conservation status of *Ixapion variegatum* has not been formally assessed as yet. Foster and others (2001) suggest that it may be a candidate for Red Data Book status, more recently Paul Whitehead has suggested the Nationally Scarce Category A may be appropriate (pers comm 2006).

Epiphyte fauna

9.47 Broadway Farm Orchards have an excellent variety of barkflies (Psocoptera), which are species that feed on the micro-flora encrusting bark and foliage. Twelve species were noted from the three visits. The national status of individual Psocoptera has not been formally assessed but two of the species concerned are scarce locally and possibly nationally: *Loensia variegata* and *Metylophorus nebulosus*. Another uncommon microflora browser present is bristly millipede *Polyxenus lagurus*, although this species is assigned to the saproxylic assemblage (Alexander 2002a) as it is most often found under the bark of dead timber or within dry-rotted heartwood in inland situations.

9.48 The predatory bug fauna is also relatively species-rich, reflecting both the species-richness and abundance of prey such as barkflies. Both *Temnostethus gracilis* and *T. pusillus* (Anthocoridae) are present, the latter is much the rarer of the two in Gloucestershire. *Loricula elegantula* (Microphysidae), a predatory species which feeds on barkflies, is also present in good numbers. The localised jumping spider *Salticus cingulatus* also occurs on the tree trunks.

Saproxylic fauna

Wood-decay species

9.49 There is a good range of species relying directly on wood-decay, including local species such as *Rhinosimus planirostris*, which is found under bark on branches or trunks in the early stages of decay, and *Scolytus rugulosus*, the fruit bark beetle, which develops in smaller canopy branches, and was encountered across the orchards. The lesser stag beetle, *Dorcus parallelepipedus*, was recorded from a red-rot cavity in an apple in Area 8. The local tumbling flower beetle *Mordellochroa abdominalis*, which develops in the dry sapwood of dead trees was beaten from mistletoe on apple in Area 8. The fauna includes many species of special interest, detailed below in order of national status.

Wood-decay species of special interest

9.50 ***Gnorimus nobilis*** (RDB2, BAP Priority species, Indicator of Ecological Continuity, Category 1): The first Gloucestershire breeding population of the noble chafer was recognised by Paul Whitehead on 28 July 2000 and subsequently widely at Broadway Farm Orchards on 20 September 2001 as well as in 2002. The distinctive faecal pellets and skeletal fragments of this beetle were found in numerous plum trees and two apple tree. In 2003 the noble chafer beetle was detected in trees across the orchards. Faecal pellets were found in four plum trees and one apple tree, as well as body fragments in one of the plum trees and the apple tree. The key UK

population for this species is scattered across a wide area of Gloucestershire, Worcestershire and Herefordshire. The sites are predominantly old orchards and the larvae develop in the decaying heartwood of the older generation fruit trees.

9.51 ***Prionychus melanarius*** (RDB2, Indicator of Ecological Continuity, Category 1): Paul Whitehead first confirmed the breeding of this species at Broadway Farm Orchards on 21 September 2001 when larvae, pupae and dead articulated adult beetles were found in apple wood that had been reduced to minute particles. In 2003, this darkling beetle was also confirmed as developing in the decaying heartwood of two apple trees within Area 8. In one case it had been reared from larvae, while body fragments were found in another tree. Both trees were being decayed by the fungus chicken-of-the-woods, *Laetiporus sulphureus*, which degrades the cellulose of the central dead heartwood and forms a red-rot. Wood of apple trees is more often decayed by the weeping polypore *Inonotus hispidus*, which degrades both cellulose and lignin, forming a white-rot. As with noble chafer, the most important UK populations of this species occur in Gloucestershire, Worcestershire and Herefordshire, (Alexander 2003a) and it has proved to be widespread in the old orchards (Whitehead & Whitehead 2000, 2001; Alexander 2002b, 2003a). Elsewhere in the UK it is known from Sherwood Forest, West Sussex, East Suffolk and Somerset (Whitehead, 2005). It is a relict old-growth species, being absent from such classic sites as Windsor Great Park and Forest, the New Forest, Epping Forest and Moccas Park.

9.52 ***Gracilia minuta*** (RDB2): Two specimens of this longhorn beetle were beaten from dead branches of a fallen plum tree in Area 7 in 2003. The larvae develop in dry dead twigs and small branches, including old bramble stems, and the beetle is best known from wickerwork and has been called the Basket Longhorn (Alexander 2002a). The species was formerly widely scattered across lowland Britain. Published distribution information suggests that the species has undergone a severe decline, although Paul Whitehead (pers obs) comments that it may be more common than originally thought and that it occurs in several localities in Gloucestershire.

9.53 ***Anaspis thoracica*** (Nationally Scarce, Category A): This localised species belongs to a family of beetles which develop in rotten wood, and in the midlands has a tendency to favour lowland riparian situations.

9.54 ***Anisoxya fuscula*** (Nationally Scarce, Category A, Indicator of Ecological Continuity, Category 3): This false darkling beetle was beaten from dead apple branches in Areas 1 and 8, and also found at meadowsweet (*Filipendula ulmaria*) blossom in Area 1 in 2003. It occurs in old wood pastures and also in large rural gardens (Paul Whitehead pers obs). It is widely scattered across lowland England, extending into south east Wales. It is an uncommon species in Gloucestershire and Worcestershire, where it has been found in other old orchards (Whitehead 2000).

9.55 ***Mycetochara humeralis*** (Nationally Scarce, Category A, Indicator of Ecological Continuity, Category 2): This darkling beetle was found by Paul Whitehead in 2001 under the bark of a large hollow apple tree. It is mainly known from the wood pastures of the East Midlands, East Anglia and south east England. All known sites in Gloucestershire are traditional orchards.

9.56 ***Cossonus parallelepipedus*** (Nationally Scarce, Category B, Indicator of Ecological Continuity, Category 3): This weevil was found by Paul Whitehead in 2001 in decaying heartwood of a large white willow (*Salix alba*). It is found mainly on floodplains in central and eastern England and can occur in riverside trees (Paul Whitehead pers obs).

9.57 ***Hadrobregmus denticollis*** (Nationally Scarce, Category B): This wood-boring beetle is found in fruit trees in old orchards in Gloucestershire, Worcestershire and Herefordshire. One beetle was found on the trunk of an old plum tree in Area 7 in 2003. The species does occur in other tree species and is thinly scattered across southern and south-eastern England.

9.58 ***Melandrya caraboides*** (Nationally Scarce, Category B, Indicator of Ecological Continuity, Category 3): This false darkling beetle was found by Paul Whitehead in 2001 as fragments of two individuals in a large hollow apple stump. It develops in relatively moist, white-rotted wood of

boughs, trunks and stumps. It is mostly associated with ancient woodlands and wood pastures, including linear riverside woodlands.

9.59 ***Pseudocistela ceramboides*** (Nationally Scarce, Category B, Indicator of Ecological Continuity, Category 2): This darkling beetle was found by Paul Whitehead in 2001 in the soft wood of plum. Larvae of this species develop in wood-mould of hollow trees, sometimes beneath bird nests. It is found in old orchards, isolated cultivated fruit trees, and in wood pastures in central, southern and eastern England.

9.60 ***Scolytus mali*** (Nationally Scarce, Category B): This bark beetle is a speciality of trees in the family Rosaceae and is widespread in traditional orchards.

9.61 ***Gnophomyia viridipennis*** (Nationally Scarce): Newly emerged adults of this fly were found in 2004 by Dr Malcolm Storey on the bark of a large fallen willow or poplar tree. The larvae develop in the fibrous cambial layer beneath the bark of recently felled trees, usually poplar.

Fungus associates

9.62 The fungus fruiting bodies present on many of the trees support a variety of saproxylic beetles. Three local species beaten from *Laetiporus sulphureus* bracket fungus on plum in Area 1 in 2003 were the beetles *Dacne bipustulata, D. rufifrons* and *Mycetophagus multipunctatus*.

Species of special interest associated with fungi

9.63 ***Dorcatoma dresdensis*** (Nationally Scarce, Category A, Indicator of Ecological Continuity, Category 2): This fungus-boring beetle develops in the very hard woody brackets of certain wood-decay fungi. It was found in the fungus *Phellinus pomaceus* on a plum tree in Area 6 in 2003. This fungus is widespread on the dead boughs and trunks of old plum trees. The beetle was first reported from *Phellinus pomaceus* in 1999 (Alexander 2002c) and was noted on old plum trees in 2002 (Alexander 2002b). It was also found in *Phellinus pomaceus* on plum by Whitehead (2004). It has a thinly scattered distribution across central southern England. It is a rare species in Gloucestershire with most records from old orchards (Alexander 2002b).

9.64 ***Eledona agricola*** (Nationally Scarce, Category B, Indicator of Ecological Continuity, Category 3): This beetle was found in *Laetiporus sulphureus* bracket fungus on plum in Area 1 in 2003. It develops in the fruiting body of this fungus and is well known from old wood pastures.

9.65 ***Hallomenus binotatus*** (Nationally Scarce, Category B, Indicator of Ecological Continuity, Category 3): This false darkling beetle was found by Paul Whitehead in 2001 in red heartwood of plum marked with network-like patterns by the ant *Lasius brunneus*. Larvae of this species develop in fruiting bodies of large polypore fungi such as *Laetiporus sulphureus*. It is thinly scattered over much of Britain and is scarcest in the west.

9.66 ***Quedius fulgidus*** (syn *Q. assimilis* in Alexander 2002a) (Nationally Scarce, Category B): This beetle was beaten from *Laetiporus sulphureus* bracket fungus on plum in Area 1 in 2003. It is a species that is also found in rot holes.

9.67 ***Sepedophilus testaceus*** (Nationally Scarce): This beetle was found by Paul Whitehead in 2001 on plum. It belongs to a group which feeds on fungal mycelia rather than fruiting bodies, and is associated primarily with ancient broad-leaved woodland.

Nesting species, scavengers and predators

9.68 A range of species that prey on invertebrates of wood decay habitats or nest in these habitats were represented at Broadway Farm Orchards. *Nuctenea umbratica* is a predatory spider which was found under loose bark of plum in Area 7 in 2003. *Subilla confinis*, a snakefly which is localised in Gloucestershire, was found in 2003 at elder blossom and beaten from a dead plum branch. The larvae of this species are predatory. A local ant, *Temnothorax nylanderi*, which forms colonies under bark on dead trunks or stumps, was found in Area 7 in 2003 nesting in a plum tree

which had lost its bark. More restricted species present in Broadway Farm Orchards are described below.

Nesting species, scavengers and predators species of special interest

9.69 ***Lasius brunneus*** (Nationally Scarce, Category A): This species, also known as the brown ant or tree ant, was found across the orchards by Paul Whitehead and Dr Keith Alexander. It was nesting in apple heartwood. This species has a limited distribution in the south of England. It usually nests within decaying heartwood in old open-grown trees and is a common feature of the old orchards in Gloucestershire and Worcestershire.

9.70 ***Lissodema denticolle*** (syn *L. quadripustulata*) (Nationally Scarce, Category B): This narrow-waisted bark beetle was beaten from apple branches in Area 1 in 2003. It is a predator of other insects and is associated with dead wood habitats of a wide variety of tree species.

9.71 ***Megatoma undata*** (Nationally Scarce, Category B): Larvae of this beetle were found by Paul Whitehead in 2001 under plum bark. It is a scavenger in the nests and burrows of other insects and in spider webs, feeding on cast skins and remnants of pupae of insects. It is most frequent in south east England and the Midlands.

9.72 ***Tipula peliostigma*** (Nationally Scarce, Category B): Craneflies of this species were reared from larvae and pupae found in two old apple trees in Areas 4 and 8 in 2003. They were found amongst debris in hollow trunks which also contained old stick nests, probably of jackdaws. Stubbs (1992) describes this as a scarce species of southern woods and hedgerows, and so this would appear to be the first orchard record. It has been reared from birds' nest debris elsewhere and this seems to be its characteristic habitat. Only a few records are known, thinly scattered across central southern and south-eastern England, especially in East Anglia.

9.73 ***Ctesias serra*** (Nationally Scarce, Category B): This beetle, known as the common cobweb beetle, was found by Paul Whitehead in 2001 under plum bark. The larvae live in spider webs under loose bark on tree trunks. It is relatively widespread and more frequent than its status suggests, having been found in nearly 150 ten kilometre squares.

9.74 ***Thanasimus formicarius*** (Indicator of Ecological Continuity, Category 3): This local checkered beetle was found widely across the orchards by Paul Whitehead and on a plum trunk in Area 5 by Dr Keith Alexander. Larvae and adults feed on larvae of bark and other beetles in hard dead wood. It is most widespread in central and eastern England.

Other fauna

9.75 Broadway Farm Orchards also proved to support an interesting breeding bird assemblage in 2003. The old hollowing trees provided valuable nesting habitat for woodpeckers and both great spotted and green woodpeckers (Amber List) were present in good numbers. Treecreeper is also present. Other tree-nesting species present include redstart (Amber List), song thrush (Red List, priority BAP species), chaffinch, goldcrest (Amber List), and blue, great and long-tailed tits, while the bramble patches provided nest sites and cover for birds such as dunnock (Amber List), blackcap and chiffchaff. Paul Whitehead noted that barn owl (Amber List) occured with some regularity at Broadway Farm Orchards. Red and Amber bird species are of conservation concern in the UK and are listed in Anon (2002).

9.76 The presence of the pond network, rough grassland, fallen logs, scrub and hedgerows in the orchards indicate the potential of the site for great crested newt (Priority BAP species), which requires a mosaic of these habitats (Langton and others 2001), as long as the ponds can be restored so that they provide unshaded open water habitat.

Table 62a Fruit tree survey at Broadway Farm Orchards - Area 1

Type	Girth cm	Vitality	Features	Hollow
apple	62	live	no access to interior	unknown
apple	67	live	no access to interior	unknown
apple	68	live	no access to interior	unknown
apple	70	live	no access to interior	unknown
apple	70	live	dense bramble	unknown
apple	78	live	no access to interior	unknown
apple	80	live	no access to interior	unknown
apple	80	live	dense bramble	unknown
apple	80	live	no access to interior	unknown
apple	84	live	no access to interior	unknown
apple	88	live	rot holes	yes
apple	89	live	no access to interior	unknown
apple	90	live	top gone	yes
apple	90	live	dense bramble	unknown
apple	90	live	dense bramble	unknown
apple	90	live	no access to interior	unknown
apple	92	live	exposed hollow	yes
apple	92	live	no access to interior	unknown
apple	95	live	hollow trunk	yes
apple	96	live	split in trunk	yes
apple	96	live	no access to interior	unknown
apple	98	live	no access to interior	unknown
apple	99	live	no access to interior	unknown
apple	100	live	ripped limbs	yes
apple	100	live	hollow trunk	yes
apple	100	live	hollow trunk	yes
apple	100	live	dense bramble	unknown
apple	100	live	dense bramble	unknown
apple	100	live	limb cavity	yes
apple	102	live	no access to interior	unknown
apple	103	live	no access to interior	unknown

Table continued...

Type	Girth cm	Vitality	Features	Hollow
apple	104	live	no access to interior	unknown
apple	104	live	no access to interior	unknown
apple	104	live	no access to interior	unknown
apple	104	live	no access to interior	unknown
apple	104	live	no access to interior	unknown
apple	105	live	no access to interior	unknown
apple	107	live	no access to interior	unknown
apple	107	live	no access to interior	unknown
apple	108	live	very hollow	yes
apple	108	live	main stem dead	yes
apple	108	live	no access to interior	unknown
apple	108	live	no access to interior	unknown
apple	108	live	no access to interior	unknown
apple	109	live	no access to interior	unknown
apple	110	live	no access to interior	unknown
apple	110	live	no access to interior	unknown
apple	115	live	top gone	yes
apple	116	live	no access to interior	unknown
apple	118	almost dead	no access to interior	unknown
apple	118	live	no access to interior	unknown
apple	119	live	empty hollow trunk	yes
apple	120	live	none	unknown
apple	120	live	in dense scrub	unknown
apple	120	live	no access to interior	unknown
apple	120	live	in bramble	yes
apple	120	live	ivy covered	unknown
apple	120	live	no access to interior	unknown
apple	120	live	branch scar rot hole	yes
apple	120	live	no access to interior	unknown
apple	122	live	rot holes	yes
apple	123	live	no access to interior	unknown
apple	123	live	no access to interior	unknown

Table continued...

Type	Girth cm	Vitality	Features	Hollow
apple	124	live	cavity in trunk	yes
apple	125	live	white rot	yes
apple	127	live	lots of rot	yes
apple	130	live	no access to interior	unknown
apple	130	live	dense bramble	unknown
apple	130	live	empty hollow trunk	yes
apple	130	live	dense bramble	unknown
apple	132	live	hollow trunk	yes
apple	132	live	cavities in trunk	yes
apple	133	live	top gone	yes
apple	135	live	no access to interior	unknown
apple	136	live	no access to interior	unknown
apple	140	live	rampant ivy	unknown
apple	144	live	rot holes at branch stubs	yes
apple	145	live	ripped out limbs	yes
apple	146	live	no access to interior	unknown
apple	150	live	no access to interior	unknown
apple	154	live	top gone	yes
apple	165	live	part of trunk gone	yes
apple	190	live	trunk hollow open	yes
apple	201	live	top limb dead & hollow	yes
apple	no access	live	dense scrub	unknown
apple	no access	live	dense bramble	unknown
apple	no access	live	dense bramble	unknown
apple	no access	live	dense bramble	unknown
apple	no access	live	dense bramble	unknown
apple	no access	live	dense bramble	unknown
apple	no access	live	dense bramble	unknown
apple	no access	live	dense bramble	unknown
apple	no access	live	dense bramble	unknown
apple	no access	live	plum thicket	unknown
apple	no access	live	dense bramble	unknown
apple	no access	live	dense bramble	unknown

Table continued...

Type	Girth cm	Vitality	Features	Hollow
apple	no access	live	dense bramble	unknown
apple	no access	live	dense bramble	unknown
apple	no access	live	dense bramble	unknown
apple	no access	live	dense bramble	unknown
apple	no access	live	dense bramble	unknown
pear	61	live	no access to interior	unknown
pear	70	live	dense bramble	unknown
pear	90	live	no access to interior	unknown
pear	90	live	dense bramble	unknown
pear	120	live	split in top	probably
pear	122	live	hollow trunk	yes
pear	130	live	large limb ripped out	no
pear	137	live	no access to interior	unknown
pear	145	live	dieback in top	unknown
pear	148	live	branch scar rot hole	yes
pear	150	live	dense bramble	unknown
pear	165	live	no access to interior	unknown
pear	185	live	multistem at 1m	unknown
pear	214	live	no access to interior	unknown
pear	220	live	multistem at 1m	unknown
pear	no access	live	dense bramble	unknown
pear	no access	live	dense bramble	unknown
pear	no access	live	dense bramble	unknown
pear	no access	live	dense bramble	unknown
plum	73	live	no access to interior	unknown
plum	80	live	dense bramble	unknown
plum	83	live	hollow trunk	yes
plum	93	live	no access to interior	unknown
plum	100	live	large cavity in side	yes
plum	102	live	rot holes & top gone	yes
plum	104	live	gash in trunk	yes
plum	107	live	no access to interior	unknown

Table continued...

Type	Girth cm	Vitality	Features	Hollow
plum	112	live	no access to interior	unknown
plum	112	live	early hollowing	yes
plum	130	live	dense bramble	unknown
plum	155	live	main trunk broken off	yes
plum	no access	live	in dense scrub	unknown
plum	no access	live	dense bramble	unknown
plum	no access	live	dense bramble	unknown
plum	no access	live	dense bramble	unknown
plum	no access	live	dense bramble	unknown
plum	no access	live	dense bramble	unknown
plum	no access	live	dense bramble	unknown

Table 62b Fruit tree survey at Broadway Farm Orchards - Area 2

Type	Girth cm	Vitality	Features	Hollow
apple	80	live	trunk bark-stripped	unknown
apple	84	live	branch scar rot hole	yes
apple	91	live	bark-stripping	unknown
apple	93	live	major branch scar	yes
apple	98	live	woodpecker hole	yes
apple	100	live	woodpecker hole	yes
apple	102	live	branch scar rot hole	yes
apple	105	live	branch scar rot hole	yes
apple	108	live	branch scar rot hole	yes
apple	108	live	no access to interior	unknown
apple	114	live	no access to interior	unknown
apple	117	live	branch scar rot hole	yes
apple	120	live	white rot	yes
apple	120	live	branch scar rot hole	yes
apple	122	live	woodpecker hole	yes
apple	122	live	no access to interior	unknown
apple	124	live	no access to interior	unknown
apple	125	live	branch scar rot hole	yes

Table continued...

Type	Girth cm	Vitality	Features	Hollow
apple	125	live	branch scar rot hole	yes
apple	127	live	branch scar rot hole	yes
apple	129	live	no access to interior	unknown
apple	132	live	branch scar rot hole	yes
apple	135	live	no access to interior	unknown
apple	136	live	no access to interior	unknown
apple	136	live	branch scar rot hole	yes
apple	137	live	branch scar rot hole	yes
apple	140	live	ivy covered	unknown
apple	140	live	dense bramble	unknown
apple	143	live	ripped branch scar	unknown
apple	143	live	branch scar rot hole	yes
apple	143	live	top gone	yes
apple	149	live	no access to interior	unknown
apple	154	live	no access to interior	unknown
apple	no access	live	dense bramble	unknown
apple	no access	live	dense bramble	unknown
apple	no access	live	dense bramble	unknown
apple	no access	live	dense bramble	unknown
apple	no access	live	no access to interior	unknown
apple	no access	live	dense bramble	unknown
apple	no access	live	dense bramble	unknown
apple	no access	live	dense bramble	unknown
pear	78	live	no access to interior	unknown
pear	86	live	no access to interior	unknown
pear	118	live	branch scar rot hole	yes
pear	140	live	in hawthorn scrub	unknown
pear	144	live	no access to interior	unknown
pear	158	live	empty hollow trunk	yes
pear	172	dying	red rot; woodpecker holes	yes
pear	no access	live	dense bramble	unknown
plum	60	live	no access to interior	unknown

Table continued...

Type	Girth cm	Vitality	Features	Hollow
plum	65	live	no access to interior	unknown
plum	70	live	no access to interior	unknown
plum	71	live	branch scar rot hole	yes
plum	72	live	main limb hollow; spiral decay below	yes
plum	74	live	no access to interior	unknown
plum	75	live	multistem at 1m	unknown
plum	82	live	Phellinus pomaceus	unknown
plum	84	live	no access to interior	unknown
plum	85	live	top gone; Gnorimus faecal pellets	yes
plum	89	live	small patch rot	yes
plum	100	live	no access to interior	unknown
plum	101	live	no access to interior	unknown
plum	107	live	bark-stripping	unknown
plum	130	live	red rot	yes
plum	no access	live	dense bramble	unknown
plum	no access	live	dense bramble	unknown
unknown	no access	dead	dense bramble	unknown
unknown	no access	dead	dense bramble	unknown

Table 62c Fruit tree survey at Broadway Farm Orchards - Area 3

Type	Girth cm	Vitality	Features	Hollow
plum	51	live	cavity in trunk	yes
plum	70	live	no access to interior	unknown
plum	71	live	no access to interior	unknown
plum	73	live	cavity in trunk	yes
plum	76	live	no access to interior	unknown
plum	76	live	no access to interior	unknown
plum	94	live	cavity in trunk	yes
plum	95	live	cavity in trunk	yes

Table 62d Fruit tree survey at Broadway Farm Orchards - Area 4

Type	Girth cm	Vitality	Features	Hollow
apple	97	live	white rot	yes
apple	100	live	cavity in trunk	yes
apple	109	live	white rot	yes
apple	109	live	white rot	yes
plum	83	live	branch scar rot hole	yes

Table 62e Fruit tree survey at Broadway Farm Orchards - Area 5

Type	Girth cm	Vitality	Features	Hollow
apple	125	live	branch scar rot hole	yes
apple	130	live	no access to interior	unknown
apple	148	live	no access to interior	unknown
plum	51	live	twin stem	unknown
plum	65	live	no access to interior	unknown
plum	77	live	no access to interior	unknown
plum	78	live	no access to interior	unknown
plum	86	live	branch scar rot hole	yes
plum	86	live	no access to interior	unknown
plum	87	live	hollow boughs	yes
plum	96	dying	hollow trunk	yes
plum	113	live	hollow trunk	yes
plum	114	live	cavity in trunk	yes

Table 62f Fruit tree survey at Broadway Farm Orchards - Area 6

Type	Girth cm	Vitality	Features	Hollow
apple	93	live	no access to interior	unknown
apple	115	live	no access to interior	unknown
apple	116	live	branch scar rot hole	yes
apple	119	live	no access to interior	unknown
apple	135	live	branch scar rot hole	yes
plum	85	live	no access to interior	unknown
plum	92	live	Phellinus pomaceus	unknown
plum	93	live	cavity in trunk	yes

Table continued...

Type	Girth cm	Vitality	Features	Hollow
plum	94	live	branch scar rot hole	yes
plum	95	live	branch scar rot hole	yes
plum	95	live	branch scar rot hole	yes
plum	100	live	no access to interior	unknown

Table 62g Fruit tree survey at Broadway Farm Orchards - Area 7

Type	Girth cm	Vitality	Features	Hollow
apple	59	live	empty hollow trunk	yes
apple	70	live	dense bramble	unknown
apple	79	live	empty hollow trunk	yes
apple	80	live	dense bramble	unknown
apple	87	live	partly de-barked	unknown
apple	89	live	dense bramble	unknown
apple	90	live	dense bramble	unknown
apple	90	live	woodpecker hole	yes
apple	92	live	branch scar rot hole	yes
apple	93	live	bark split & rot debris	unknown
apple	94	live	no access to interior	unknown
apple	94	live	no access to interior	unknown
apple	94	live	dense bramble	unknown
apple	94	live	no access to interior	unknown
apple	96	live	empty hollow trunk	yes
apple	98	dead	hollow trunk	yes
apple	98	live	branch scar rot hole	yes
apple	100	live	dense bramble	unknown
apple	107	live	no access to interior	unknown
apple	117	live	branch scar rot hole	yes
apple	120	live	top gone; In.hispidus	yes
apple	120	live	top gone; good bushing	unknown
apple	120	live	hollow	yes
apple	127	live	empty hollow trunk	yes
apple	129	live	empty hollow trunk	yes

Table continued...

Type	Girth cm	Vitality	Features	Hollow
apple	134	live	branch scar rot hole	yes
apple	139	dead	exposed heartwood	unknown
apple	150	live	dense bramble	unknown
apple	155	live	cavity in trunk	yes
apple	no access	dead	no access to interior	unknown
apple	no access	live	dense bramble	unknown
apple	no access	live	dense bramble	unknown
apple	no access	live	dense bramble	unknown
apple	no access	live	dense bramble	unknown
apple	no access	live	empty hollow trunk	yes
apple	no access	live	empty hollow trunk	yes
pear	100	dying	dense bramble	unknown
pear	104	live	top declining	unknown
pear	111	live	no access to interior	unknown
pear	149	live	no access to interior	unknown
pear	162	live	no access to interior	unknown
pear	220	live	major limbs ripped	unknown
pear	no access	live	dense bramble	unknown
pear	no access	dead	dense bramble	unknown
pear	no access	live	dense bramble	unknown
pear	no access	live	dense bramble	unknown
pear	no access	live	dense bramble	unknown
pear	no access	dead	dense bramble	unknown
plum	51	live	no access to interior	unknown
plum	52	live	Gnorimus pellets	yes
plum	62	live	no access to interior	unknown
plum	68	live	no access to interior	unknown
plum	68	live	no access to interior	unknown
plum	71	live	dense bramble	unknown
plum	71	live	dense bramble	unknown
plum	71	live	exposed heartwood	unknown
plum	72	live	no access to interior	unknown

Table continued...

Type	Girth cm	Vitality	Features	Hollow
plum	76	dying	branch scar rot hole	yes
plum	77	live	no access to interior	unknown
plum	79	dying	no access to interior	unknown
plum	80	live	dense bramble	unknown
plum	80	live	dense bramble	unknown
plum	80	live	dense bramble	unknown
plum	80	dead	no access to interior	unknown
plum	82	live	top blown; spiral split	unknown
plum	88	dead	empty hollow trunk	yes
plum	89	live	no access to interior	unknown
plum	89	live	no access to interior	unknown
plum	90	live	dense bramble	unknown
plum	90	live	top gone; red-ror	yes
plum	92	live	exposed heartwood	unknown
plum	92	live	branch scar rot hole	yes
plum	96	live	cavity; red-rot	yes
plum	96	live	no access to interior	unknown
plum	97	live	branch scar rot hole	yes
plum	97	live	branch scar rot hole	yes
plum	99	live	hollow; exposed heartwood	yes
plum	99	live	Phellinus pomaceus	unknown
plum	102	dead	red-rot	yes
plum	104	dead	branch scar rot hole	yes
plum	110	live	red-rot in trunk	yes
plum	114	live	no access to interior	unknown
plum	120	live	red-rot branch spiral	yes
plum	122	dead	cavity red-rot	yes
plum	145	live	no access to interior	unknown
plum	no access	dead	no access to interior	unknown
plum	no access	dying	dense bramble	unknown
plum	no access	dead	dense bramble	unknown
plum	no access	dying	dense bramble	unknown

Table continued...

Type	Girth cm	Vitality	Features	Hollow
plum	no access	dead	dense bramble	unknown
plum	no access	dead	dense bramble	unknown
plum	no access	live	dense bramble	unknown
plum	no access	dead	dense bramble	unknown
plum	no access	live	dense bramble	unknown
plum	no access	dead	decorticated	unknown
plum	no access	dead	no access to interior	unknown
plum	no access	dead	no access to interior	unknown
plum	no access	dead	decorticated	unknown
plum	no access	dead	woodpecker hole	yes
plum		dead	no access to interior	unknown

Table 62h Fruit tree survey at Broadway Farm Orchards - Area 8

Type	Girth cm	Vitality	Features	Hollow
apple	65	live	no access to interior	unknown
apple	72	live	rotted base	unknown
apple	72	live	decayed interior	yes
apple	81	live	cavity in trunk	yes
apple	85	live	branch scar rot hole	yes
apple	86	live	cavity early rot	yes
apple	90	live	no access to interior	unknown
apple	90	live	empty hollow trunk	yes
apple	92	live	no access to interior	unknown
apple	92	live	no access to interior	unknown
apple	97	live	no access to interior	unknown
apple	97	live	ripped limb cavity	yes
apple	98	live	no access to interior	unknown
apple	99	live	no access to interior	unknown
apple	99	live	branch scar rot hole	yes
apple	100	live	no access to interior	unknown
apple	101	live	no access to interior	unknown
apple	101	live	no access to interior	unknown

Table continued...

Type	Girth cm	Vitality	Features	Hollow
apple	101	live	branch scar rot hole	yes
apple	102	live	no access to interior	unknown
apple	102	live	branch scar rot hole	yes
apple	104	live	no access to interior	unknown
apple	105	live	branch scar rot hole	yes
apple	105	live	hollow	yes
apple	105	live	branch scar rot hole	yes
apple	106	live	no access to interior	unknown
apple	106	live	no access to interior	unknown
apple	106	dying	no access to interior	unknown
apple	106	live	branch scar rot hole	yes
apple	107	live	no access to interior	unknown
apple	107	live	no access to interior	unknown
apple	108	live	branch scar rot hole	yes
apple	108	live	empty hollow trunk	yes
apple	109	live	no access to interior	unknown
apple	110	live	no access to interior	unknown
apple	110	dead	no access to interior	unknown
apple	110	live	top blown; hollow	yes
apple	110	live	branch scar rot hole	yes
apple	111	live	white-rot	yes
apple	113	live	no access to interior	unknown
apple	116	live	hollow aerial boughs	yes
apple	118	live	no access to interior	unknown
apple	118	live	empty hollow trunk	yes
apple	118	live	branch scar rot hole	yes
apple	119	live	no access to interior	unknown
apple	119	live	branch scar rot hole	yes
apple	120	live	branch scar rot hole	yes
apple	120	live	hollow aerial boughs	yes
apple	120	live	dense bramble	unknown
apple	120	live	no access to interior	unknown

Table continued...

Type	Girth cm	Vitality	Features	Hollow
apple	120	live	no access to interior	unknown
apple	123	live	exposed heartwood	unknown
apple	123	live	no access to interior	unknown
apple	123	live	no access to interior	unknown
apple	123	live	hollow branch stubs	yes
apple	123	live	no access to interior	unknown
apple	123	live	no access to interior	unknown
apple	124	live	hollow trunk	yes
apple	125	live	branch scar rot hole	yes
apple	125	live	branch scar rot hole	yes
apple	126	live	branch scar rot hole	yes
apple	127	live	top gone, hollow interior	yes
apple	127	live	branch scar rot hole	yes
apple	128	live	empty hollow trunk	yes
apple	128	live	white-rot	yes
apple	128	live	no access to interior	unknown
apple	130	live	no access to interior	unknown
apple	130	live	no access to interior	unknown
apple	130	live	dense bramble	unknown
apple	130	live	branch scar rot hole	yes
apple	130	live	cavity in trunk	yes
apple	130	live	no access to interior	unknown
apple	131	live	branch scar rot hole	yes
apple	131	live	no access to interior	unknown
apple	131	live	hollow with rot	yes
apple	132	live	empty hollow trunk	yes
apple	132	live	branch scar rot hole	yes
apple	138	live	no access to interior	unknown
apple	139	live	cavity in trunk	yes
apple	140	live	no access to interior	unknown
apple	143	live	branch scar rot hole	yes
apple	145	live	trunk cavity	yes

Table continued...

Type	Girth cm	Vitality	Features	Hollow
apple	149	live	branch scar rot hole	yes
apple	151	live	branch scar rot hole	yes
apple	151	live	branch scar rot hole	yes
apple	154	live	branch scar rot hole	yes
apple	155	live	empty hollow trunk	yes
apple	155	live	branch scar rot hole	yes
apple	156	live	branch scar rot hole	yes
apple	158	live	white-rot	yes
apple	170	live	branch scar rot hole	yes
apple	171	live	dead hollow limbs	yes
apple	173	live	branch scar rot hole	yes
apple	176	live	red-rot	yes
apple	182	live	branch scar rot hole	yes
apple	202	live	large bough cavity	yes
apple	no access	live	no access to interior	unknown
apple	no access	live	no access to interior	unknown
apple	no access	live	dense bramble	unknown
apple	no access	live	dense bramble	unknown
apple	no access	live	branch scar rot hole	yes
apple	no access	dead	empty hollow trunk	yes
apple	no access	live	Laetiporus sulphureus	yes
apple	no access	dead	not hollow	no
apple	no access	dead	no access to interior	unknown
apple	no access	live	dense bramble	unknown
apple	no access	live	no access to interior	unknown
apple	no access	live	dense bramble	unknown
apple	no access	live	hollow	yes
apple	no access	live	no access to interior	unknown
apple	no access	live	dense bramble	unknown
pear	102	live	no access to interior	unknown
pear	133	dead	no access to interior	unknown
pear	150	live	dense bramble	unknown

Table continued...

Type	Girth cm	Vitality	Features	Hollow
pear	184	live	no access to interior	unknown
pear	no access	live	dense bramble	unknown
pear	no access	live	dense bramble	unknown
pear	no access	live	dense bramble	unknown
pear	no access	live	dense bramble	unknown
plum	56	live	branch scar rot hole	yes
plum	62	live	trunk cavity	yes
plum	90	dead	no access to interior	unknown
plum	90	live	dense bramble	unknown
plum	96	live	branch scar rot hole	yes
plum	106	live	branch scar rot hole	yes
plum	no access	dead	dense bramble	unknown
plum	no access	live	dense bramble	unknown
plum	no access	dead	dense bramble	unknown
plum	no access	dead	dense bramble	unknown

Table 63 Summary of fruit tree survey by Area

Area number	Extent (ha)	Number of trees	Density / ha	% trees in scrub
1	3.9	138	35.0	30
2	2.3	68	29.6	21
3	0.4	c.34	c.81.9	0
4	0.9	5	5.6	0
5	2.3	14 + plum thicket	6.1	0 (outside thicket)
6	1.4	23 + plum thicket	16.6	0 (outside thicket)
7	4.4	106	24.1	32
8	4.4	129	28.8	13
10	0.5	Plum thicket	NA	NA

Table 64 Summary of fruit tree survey by type

Fruit tree type	Total trees recorded	Total with girth measure*	Average girth cm (Range in girth cm)	% with hollows*	% dead trees
Apple	300	254	116 (59-202)	52	3
Pear	47	32	136 (61-220)	16	6
Plum	124	96	88 (51-155)	46	16

Note: * only accessible trees measured and assessed for hollows

Table 65 Grassland vascular plant species lists for Broadway Farm Orchards

Species	Common name	Area 2	Area 5 grazed	Area 5 ungrazed	Area 7	Area 8
Achillea millefolium	yarrow				x	x
Agrimonia eupatoria	agrimony			R		
Anthoxanthum odoratum	sweet vernal-grass			F	x	
Anthriscus sylvestris	cow parsley	x	F	R	x	x
Arrhenatherum elatius	false oat-grass			F		
Arum maculatum	lords-and-ladies					x
Bellis perennis	daisy	x				
Brachypodium sylvaticum	wood false-brome				x	
Cardamine pratensis	cuckooflower		R		x	x
Carex sp.	a sedge				x	
Centaurea nigra	common knapweed			R		
Cerastium fontanum	common mouse-ear	x		R		
Cirsium arvense	creeping thistle	x	F	F		x
Cirsium sp	a thistle				x	
Cirsium vulgare	spear thistle	x				
Corylus avellana	hazel					x
Crataegus monogyna	hawthorn				x	
Dactylis glomerata	cock's-foot	x	A	A	x	x
Deschampsia cespitosa	tufted hair-grass			O	x	x
Epilobium sp	a willowherb					x
Festuca rubra	red fescue			A	x	
Filipendula ulmaria	meadowsweet			R	x	x
Galium aparine	cleavers		O		x	x
Glechoma hederacea	ground-ivy		O			x
Hedera helix	ivy					x
Heracleum sphondylium	hogweed		O	O	x	x
Lathyrus pratensis	meadow vetchling			R	x	
Lolium perenne	perennial rye-grass	x	F	O		
Lotus corniculatus	common bird’s foot trefoil				x	

Table continued…

Species	Common name	Area 2	Area 5 grazed	Area 5 ungrazed	Area 7	Area 8
Lotus sp	bird's foot trefoil			R		
Lysimachia nummularia	creeping-jenny	x				
Plantago lanceolata	ribwort plantain			O	x	
Poa pratensis	smooth meadow-grass				x	
Potentilla anserina	silverweed		F	F	x	
Potentilla reptans	creeping cinquefoil			F	x	
Primula veris	cowslip		R	R	x	
Ranunculus acris	meadow buttercup			R		
Ranunculus ficaria	lesser celandine	x	F	F	x	x
Ranunculus repens	creeping buttercup			F	x	
Rubus fruticosus agg	bramble		F		x	x
Rumex acetosa	common sorrel			F	x	
Rumex obtusifolius	broad-leaved dock	x	F	O	x	
Rumex sanguineus	wood dock				x	x
Stachys officinalis	betony				x	
Tanacetum vulgare	tansy				x	
Taraxacum officinale agg.	dandelion	x		R		
Trifolium pratense	red clover			O	x	
Trifolium repens	white clover	x		O		
Urtica dioica	common nettle	x	F	R	x	x
Vicia sp	a vetch				x	x

Notes: x = present. DAFOR abundance for Area 5: D = Dominant, A = Abundant, F = Frequent, O = Occasional, R = Rare.

Table 66 Lichen species recorded in Broadway Farm Orchards

BLS No	Lichen taxa	Abundance	Evaluation & Rarity	Woodland Status
212	*Amandinea punctata*	F	LC	-
48	*Anisomeridium biforme*	R	LC	-
49	*Anisomeridium polypori*	R	LC	-
1542	*Arthopyrenia punctiformis*	R	LC	-
164	*Bacidia rubella*	O	LC	-
225	*Calicium glaucellum*	R	LC	-
228	*Calicium salicinum*	R	LC	-
289	*Candelaria concolor*	R	LC	-
297	*Candelariella reflexa*	O	LC	-
298	*Candelariella vitellina*	O	LC	-
344	*Chaenotheca ferruginea*	R	LC	-
375	*Cladonia coniocraea*	R	LC	-
429	*Cliostomum griffithii*	F	LC	-
491	*Diploicia canescens*	O	LC	-
511	*Evernia prunastri*	O	LC	-
987	*Flavoparmelia caperata*	O	LC	-
521	*Fuscidea lightfootii*	O	LC	-
1125	*Hyperphyscia adglutinata*	F	LC	-
578	*Hypocenomyce scalaris*	R	LC	-
582	*Hypogymnia physodes*	O	LC	-
1013	*Hypotrachyna revoluta*	F	LC	-
1946	*Lauderlindsaya acroglypta*	R	**NS**	-
613	*Lecania cyrtella*	R	LC	-
639	*Lecanora chlarotera*	F	LC	-
643	*Lecanora conizaeoides*	R	LC	-
649	*Lecanora expallens*	F	LC	-
797	*Lecidella elaeochroma e.*	A	LC	-
2330	*Lepraria incana s. lat.*	O	LC	-
1629	*Lepraria lobificans*	F	LC	-
997	*Melanelia fuliginosa subsp. g*	O	LC	-
1020	*Melanelia subaurifera*	F	LC	-

Table continued...

BLS No	Lichen taxa	Abundance	Evaluation & Rarity	Woodland Status
927	*Ochrolechia subviridis*	O	LC	-
938	*Opegrapha atra*	F	LC	-
964	*Opegrapha varia*	R	LC	-
965	*Opegrapha vermicellifera*	R	LC	-
943	*Opegrapha vulgata*	O	LC	-
1015	*Parmelia saxatilis*	O	LC	-
1022	*Parmelia sulcata*	F	LC	-
1056	*Pertusaria albescens alb.*	O	LC	-
1058	*Pertusaria amara amara*	R	LC	-
1107	*Phaeophyscia orbicularis*	O	LC	-
1109	*Phlyctis argena*	O	LC	-
1112	*Physcia adscendens*	O	LC	-
1112	*Physcia tenella ten*	D	LC	-
1127	*Physconia grisea*	R	LC	-
732	*Placynthiella icmalea*	R	LC	-
1145	*Platismatia glauca*	R	LC	-
1168	*Porina aenea*	O	LC	-
2070	*Punctelia subrudecta s. str*	F	LC	-
1989	*Punctelia ulophylla*	A	LC	-
1228	*Pyrrhospora quernea*	O	LC	-
1234	*Ramalina farinacea*	O	LC	-
692	*Trapeliopsis flexuosa*	R	LC	-
1527	*Xanthoria candelaria*	R	LC	-
1530	*Xanthoria parietina*	F	LC	-
1531	*Xanthoria polycarpa*	F	LC	

Notes: D = Dominant, A = Abundant, F = Frequent, O = Occasional, R = Rare. For explanation of BLS number see paragraph 2.17, for Evaluation & Rarity see paragraph 3.14 and for Woodland Status see paragraph 3.11.

Table 67 Bryophytes recorded in Broadway Farm Orchards

Bryophyte taxa	Area 1: Apple DAFOR	Areas 2-8: Apple DAFOR	Area 1: Pear DAFOR	Areas 2-8: Pear DAFOR	Areas 2-8: Plum DAFOR	Obligate epiphytes
Amblystegium serpens		R	R			
Brachythecium rutabulum		O	O		O	
Bryum capillare	F	O	F	R		
Bryum subelegans		R				1
Campylopus introflexus		R	R			
Dicranoweisia cirrata		R	O		R	
Eurynchium praelongum	R	R		R	O	
Frullania dilatata		O			R	1
Homalothecium sericeum	F	O	F			
Hypnum cupressiforme		O	O	F	A	
Hypnum lacunosum		R				
Hypnum resupinatum	A	F	A	O	F	
Leucodon sciuroides		R				1
Metzgeria furcata					R	
Orthotrichum affine	O	O	O	O	O	1
Orthotrichum diaphanum	R	R	F		R	
Radula complanata					R	1
Rhynchostegium confertum	R	O		O	R	
Syntrichia intermedia		O				
Syntrichia laevipila		O	O	R		1
Tortula muralis		R				
Ulota bruchii	R				R	1
Ulota phyllantha	R					1
Zygodon viridissimus	O	F	F	O		
Total	**10**	**20**	**12**	**8**	**12**	**9**

Total species in site = 24 Total species on apple = 23

Total species on pear = 14 Total species on plum = 12

Notes: Area 3 not examined. D = Dominant A = Abundant F = Frequent O = Occasional, R = Rare

Table 68 Number of bryophytes on individual trees in Broadway Farm Orchards

Area	Fruit tree type	Girth cm	Number of species	Number of obligate epiphytes	Percent of species / tree obligate epiphytes
Area 8	Apple	113	2	0	0.0
Area 8	Apple	141	2	0	0.0
Area 8	Apple	164	4	1	25.0
Area 8	Apple	113	5	0	0.0
Area 8	Apple	118	6	2	33.3
Area 8	Apple	127	1	0	0.0
Area 8	Apple	160	7	1	14.3
Area 8	Apple	110	6	2	33.3
Area 8	Apple	159	3	0	0.0
Area 8	Apple	120	4	0	0.0
Area 8	Apple	120	5	2	40.0
Area 8	Apple	136	7	2	28.6
Area 8	Apple	137	4	0	0.0
Area 8	Apple	164	4	0	0.0
Area 8	Apple	103	5	0	0.0
Area 8	Apple	130	3	1	33.3
	Average	**132.2**	**4.3**	**0.7**	**13.0**
Area 7	Pear	130	0	0	
Area 7	Pear	120	1	0	0.0
Area 8	Pear	200	1	0	0.0
Area 7	Pear	164	2	0	0.0
Area 7	Pear	228	2	0	0.0
Area 7	Pear	158	3	1	33.3
	Average	**166.7**	**1.5**	**0.2**	**6.7**
Area 6	Plum	57	3	0	0.0
Area 6	Plum	12	4	3	75.0
Area 6	Plum	70	4	1	25.0
Area 6	Plum	62	4	1	25.0
Area 6	Plum	63	4	1	25.0

Table continued...

Area	Fruit tree type	Girth cm	Number of species	Number of obligate epiphytes	Percent of species / tree obligate epiphytes
Area 6	Plum	34	3	1	33.3
Area 6	Plum	81	1	0	0.0
Area 6	Plum	90	1	0	0.0
Area 7	Plum	80	1	0	0.0
Area 7	Plum	92	1	0	0.0
Area 7	Plum	97	1	0	0.0
Area 7	Plum	72	2	0	0.0
Area 7	Plum	80	0	0	
Area 7	Plum	97	1	0	0.0
Area 7	Plum	110	1	0	0.0
Area 7	Plum	84	2	0	0.0
Area 7	Plum	71	1	0	0.0
Area 7	Plum	95	1	0	0.0
	Average	**74.8**	**1.9**	**0.4**	**10.8**

Table 69 Fungus species recorded in Broadway Farm Orchards

Latin name	Family	Associated habitat	Notes
Agrocybe cylindracea	Bolbitiaceae	Wood	2 clumps of 10 old fruitbodies on exposed poplar root
Agrocybe paludosa	Bolbitiaceae	Grassland	2 fruitbodies in live grass
Armillaria mellea s.l.	Tricholomataceae	Wood	Several toadstools on ground around field maple
Auricularia auricula-judae	Auriculariaceae	Wood	3 fruitbodies on fallen willow/poplar? twigs
Bjerkandera adusta	Coriolaceae	Wood	On dead decorticate poplar/willow stump
Bjerkandera fumosa	Coriolaceae	Wood	On dead Prunus (?) stumps
Bolbitius titubans	Bolbitiaceae	Grassland	1 fruitbody
Calocybe carnea	Tricholomataceae	Grassland	4 fruitbodies in grass
Calvatia gigantea	Lycoperdaceae	Grassland	8 old fruitbodies among nettles in Prunus scrub
Chondrostereum purpureum	Meruliaceae	Wood	2 patches on fallen willow/poplar trunk

Table continued…

Latin name	Family	Associated habitat	Notes
Claviceps purpurea	Clavicipitaceae	Grassland	1 infected rye-grass inflorescence
Clitocybe phyllophila	Tricholomataceae	Grassland + trees / scrub	Two fruitbodies at base of apple tree
Coprinus disseminatus	Coprinaceae	Wood	Troop of fruitbodies on upturned apple root plate
Coprinus ellisii	Coprinaceae	Wood	1 button with ozonium stage on cut poplar/willow branch
Coprinus lagopus	Coprinaceae	Wood	62 fruitbodies growing on sawdust in long grass
Coprinus micaceus	Coprinaceae	Wood	4 fruitbodies under apple tree
Coprinus miser	Coprinaceae	Dung	Single fruitbody under cleared bramble - probably on dung
Coprinus plicatilis	Coprinaceae	Grassland	Single fruitbody under Prunus and bramble
Crepidotus lundellii	Crepidotaceae	Wood	10 fruitbodies on fallen willow/poplar? twigs under nettles
Epichloe typhina	Clavicipitaceae	Grassland	On two stunted tussocks of cocksfoot
Flammulina velutipes var. velutipes	Tricholomataceae	Wood	10 fruitbodies on fallen willow/poplar log
Geastrum triplex	Geastraceae	Grassland + trees / scrub	In hedge bottom under field maple
Gloeophyllum sepiarium	Coriolaceae	Wood	4 fruitbodies on dead charred log with ozonium stage
Hemimycena candida	Tricholomataceae	Grassland	Several toadstools at base of comfrey
Hygrocybe conica var conica	Hygrophoraceae	Grassland	Single fruitbody in grass
Hypholoma fasciculare	Strophariaceae	Wood	
Inonotus hispidus	Hymenochaetaceae	Wood	Very old fallen fruitbody under apple
Lepiota boudieri	Lepiotaceae	Grassland + trees / scrub	On leaf litter in ditch under hawthorn
Lepiota cristata	Lepiotaceae	Grassland + trees / scrub	1 fruitbody under Prunus
Lepista nuda	Tricholomataceae	Grassland + trees / scrub	In Nettles under grey sallow
Lepista saeva	Tricholomataceae	Grassland + trees / scrub	2 fruitbodies under Prunus

Table continued…

Latin name	Family	Associated habitat	Notes
Macrocystidia cucumis	Tricholomataceae	Grassland + trees / scrub	2 fruitbodies among nettles in Prunus scrub
Melanoleuca grammopodia	Tricholomataceae	Grassland	4 fruitbodies in rank grass
Melanoleuca polioleuca	Tricholomataceae	Grassland + trees / scrub	Under Prunus
Mitrophora semilibera	Morchellaceae	Grassland + trees / scrub	1 fruitbody under clump of Prunus sp.
Monilinia fructigena	Sclerotiniaceae	Wood	Imperfect stage on plums
Mycena acicula	Tricholomataceae	Grassland + trees / scrub	2 fruitbodies under Prunus and Bramble
Mycena galericulata	Tricholomataceae	Wood	On wood pile in corner of field
Mycena pura	Tricholomataceae	Wood	In hedge bottom among dead bramble cuttings
Mycena speirea	Tricholomataceae	Wood	2 fruitbodies on fallen twig under Prunus sp.
Phellinus ferruginosus	Hymenochaetaceae	Wood	2 fruitbodies on dead, fallen Prunus branch
Phellinus pomaceus	Hymenochaetaceae	Wood	18 fruitbodies on dead branches on Prunus
Pluteus salicinus	Pluteaceae	Wood	On end of rotten post
Polyporus leptocephalus	Polyporaceae	Wood	1 fruitbodies on live Apple trunk 2m above ground
Psathyrella candolleana	Coprinaceae	Wood	Single fruitbody at base of apple tree
Psathyrella clivensis	Coprinaceae	Grassland	7 fruitbodies in grass
Psathyrella corrugis	Coprinaceae	Wood	9 fb on sawdust and wood fragments near cut willow. Poplar logs
Puccinia phragmitis	Pucciniaceae	Grassland	Aecia on underside of red patches on living dock leaves
Puccinia punctiformis	Pucciniaceae	Grassland	1 infected creeping thistle
Ramaria gracilis	Ramariaceae	Grassland + trees / scrub	In hedge bottom under field maple
Rhodotus palmatus	Tricholomataceae	Wood	5 fruitbodies on 2 dead, fallen Prunus (?) logs
Stropharia coronilla	Strophariaceae	Grassland	Single fruitbody in grass
Trametes gibbosa	Coriolaceae	Wood	2 fruitbodies on poplar (?) stump
Trametes versicolor	Coriolaceae	Wood	On dead, piled poplar/willow logs

Table continued…

Latin name	Family	Associated habitat	Notes
Tremella mesenterica	Tremellaceae	Wood	On dead, fallen Prunus twig
Tubaria conspersa	Crepidotaceae	Wood	Over 50 fruitbodies under Prunus and bramble
Tubaria furfuracea	Crepidotaceae	Wood	On woody debris under apple
Typhula phacorrhiza	Typhulaceae	Wood	Single fruitbody growing from sclerotium on dead leaf fragment
Vascellum pratense	Lycoperdaceae	Grassland	18 fruitbodies in grass
Volvariella gloiocephala	Pluteaceae	Grassland	Single fruitbody in grass
Xylaria hypoxylon	Sphaeriaceae	Wood	On two small stumps

Table 70 Invertebrate species recorded in Broadway Farm Orchards

Species	Family/Order	Assemblage	UK status	Notes
Nuctenea umbratica	Araneae	Saproxylic	Widespread	Under loose bark on plum trunk; beaten from dead apple branches
Salticus cingulatus	Araneae	Epiphyte	Local	Beaten from apple branches
Salticus scenicus[PW]	Araneae	Epiphyte	Widespread	On apple bole
Strigamia crassipes[PW]	Chil: Dignathodontidae	Generalist	Local	Woodmould of apple
Anobium punctatum	Col: Anobiidae	Saproxylic	Widespread	Beaten from dead apple and plum branches; hollow trunk of apple; branches of dead plum tree
Dorcatoma dresdensis	Col: Anobiidae	Saproxylic	Na	Galleries in *Phellinus pomaceus* bracket on plum
Hadrobregmus denticollis	Col: Anobiidae	Saproxylic	Nb	On plum trunk
Ptilinus pectinicornis	Col: Anobiidae	Saproxylic	Widespread	On standing dead apple trunk; on apple trunk
Aphodius granarius[PW]	Col: Aphodiidae	Dung	Widespread	In woodmould of plum
Ixapion variegatum	Col: Apionidae	Canopy (P)	Not assessed**	Beaten from mistletoe on apple
Cantharis cryptica	Col: Cantharidae	Mosaic (C, F)	Widespread	Beaten from hawthorn blossom; at blossom of meadowsweet
Cantharis decipiens	Col: Cantharidae	Canopy	Widespread	Beaten from hawthorn and apple blossom

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Cantharis nigra	Col: Cantharidae	Field layer	Widespread	Amongst grasses
Cantharis nigricans	Col: Cantharidae	Mosaic (C, F)	Widespread	Beaten from hawthorn and apple blossom
Malthodes pumilus	Col: Cantharidae	Saproxylic	Local	Swept from meadowsweet blossom
Rhagonycha limbata	Col: Cantharidae	Field layer	Widespread	Beaten from hawthorn blossom
Abax parallelepipedus[PW]	Col: Carabidae	Ground layer	Widespread	Naturalised plum thickets
Bembidion lunulatum[PW]	Col: Carabidae	Ground layer	Widespread	Woodmould of plum
Bembidion obtusum[PW]	Col: Carabidae	Ground layer	Widespread	On fallen plum; tussocks
Clivina fossor[PW]	Col: Carabidae	(Under) Ground layer	Widespread	Fragments in apple woodmould
Dromius quadrimaculatus[PW]	Col: Carabidae	Saproxylic	Widespread	On fallen plum
Dromius quadrinotatus	Col: Carabidae	Saproxylic	Widespread	On plum trunks and boughs; beaten from dead plum and pear branches; beaten from apple branches and mistletoe on apple
Harpalus rufipes[PW]	Col: Carabidae	Ground layer+	Widespread	Fragments in plum woodmould
Microlestes maurus[PW]	Col: Carabidae	Ground layer+	Widespread	In herbage
Tachys (Paratachys) bistriatus[PW]	Col: Carabidae	Ground layer	Nb	In woodmould of plum
Pterostichus diligens[PW]	Col: Carabidae	Ground layer	Widespread	In cut grass
Pterostichus madidus	Col: Carabidae	Ground layer	Widespread	In red-rot debris in hollow plum trunk; in grass litter
Pterostichus melanarius[PW]	Col: Carabidae	Ground layer	Widespread	In woodmould in plum tree
Pterostichus vernalis[PW]	Col: Carabidae	Ground layer	Widespread	Under fallen wood
Metabletus (Syntomus) obscuroguttatus[PW]	Col: Carabidae	Ground layer	Local	In grass litter
Catops nigricans[PW]	Col: Catopidae	Ground layer	Widespread	In apple woodmould associated with rodent nests

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Gracilia minuta	Col: Cerambycidae	Saproxylic	RDB2	Beaten from branches of dead plum tree
Grammoptera ruficornis	Col: Cerambycidae	Saproxylic	Widespread	Beaten from hawthorn blossom; beaten from apple blossom and mistletoe on apple
Leiopus nebulosus	Col: Cerambycidae	Saproxylic	Local	Beaten from dead apple branches
Tetrops praeustus	Col: Cerambycidae	Saproxylic	Local	Beaten from plum branches
Cerylon ferrugineum[PW]	Col: Cerylonidae	Saproxylic	Widespread	Under bark of plum
Altica lythri[PW]	Col: Chrysomelidae	Field layer	Widespread	Fragments on apple
Crepidodera fulvicornis[PW]	Col: Chrysomelidae	Field layer	Widespread	Fragments in woodmould of willow
Oulema obscura[PW]	Col: Chrysomelidae	Field layer	Widespread	Subcortical hibernant on orchard fruit trees
Phratora vitellinae[PW]	Col: Chrysomelidae	Canopy	Widespread	Fragments in woodmould of willow; also on Lombardy Poplar *P. nigra 'Plantierensis'*
Cis nitidus	Col: Ciidae	Saproxylic	Local	Bracket fungi on apple
Opilo mollis[PW]	Col: Cleridae	Saproxylic	Nb	On apple bole
Thanasimus formicarius	Col: Cleridae	Saproxylic	Local	On plum trunk; larvae on plum and apple (PW)
Rhyzobius litura[PW]	Col: Coccinellidae	Field layer	Widespread	In cut grass litter
Tytthaspis sedecimguttata[PW]	Col: Coccinellidae	Ground layer	Widespread	In cut grass litter
Subcoccinella 24-punctata	Col: Coccinellidae	Field layer	Local	Amongst grass
Sericoderus lateralis[PW]	Col: Corylophidae	Generalist (D)	Widespread	In cut grass
Atomaria rubella[PW]	Col: Cryptophagidae	Generalist (D)	Widespread	In grass litter
Cryptophagus pilosus	Col: Cryptophagidae	Generalist (D)	Widespread	Wood mould in hollow apple trunk
Ephistemus globulus[PW]	Col: Cryptophagidae	Generalist (D)	Widespread	In cut grass
Cossonus parallelepipedus[PW]	Col: Curculionidae	Saproxylic	Nb	In willow woodmould

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Dorytomus longimanus[PW]	Col: Curculionidae	Canopy	Local	On poplar *Populus nigra 'Plantierensis'*
[Euophryum confine]	Col: Curculionidae	Saproxylic	Widespread	In red-rot of plum trunk
Hypera pollux[PW]	Col: Curculionidae	Ground layer +	Local	Under bark of plum
Hypera zoilus[PW]	Col: Curculionidae	Ground layer	Local	Fragment in apple woodmould
Scolytus mali	Col: Curculionidae	Saproxylic	Nb	Galleries beneath bark on many plum trunks; beaten from branches of dead plum tree; galleries in apple trunks and branch; galleries in dead fallen trunk
Scolytus rugulosus	Col: Curculionidae	Saproxylic	Local	Galleries in fallen plum branch; beaten from plum and apple branches; beaten from dead apple branches and plum tree; emerging from dead roots of up-ended plum trunk
Tychius picirostris[PW]	Col: Curculionidae	Field layer	Widespread	Orchard herbage
Zacladus geranii	Col: Curculionidae	Field layer	Local	On meadow cranesbill
Ctesias serra[PW]	Col: Dermestidae	Saproxylic	Nb	One larva on plum
Megatoma undata[PW]	Col: Dermestidae	Saproxylic	Nb	Many larvae on plum
Denticollis linearis[PW]	Col: Elateridae	Saproxylic	Local	Naturalised plum thickets
Athous haemorrhoidalis[PW]	Col: Elateridae	Ground layer	Widespread	Pupa in apple woodmould
Hemicrepidius hirtus	Col: Elateridae	Saproxylic	Local	Beaten from elder blossom
Melanotus villosus	Col: Elateridae	Saproxylic	Widespread	Elytra in wood mould in hollow apple, plum and willow trees
Dacne bipustulata	Col: Erotylidae	Saproxylic	Local	Beaten from *Laetiporus sulphureus* bracket fungus on plum
Dacne rufifrons	Col: Erotylidae	Saproxylic	Local	Beaten from *Laetiporus sulphureus* bracket fungus on plum
Dendrophilus punctatus[PW]	Col: Histeridae	Saproxylic	Local	In woodmould of plum
Gnathoncus nanus	Col: Histeridae	Saproxylic	Local	In old dry bracket fungus *Laetiporus sulphureus* on plum
Hister merdarius	Col: Histeridae	Nests	Local	In old dry bracket fungus *Laetiporus sulphureus* on plum

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Paromalus flavicornis[PW]	Col: Histeridae	Saproxylic	Widespread	On plum
Sphaeridium scarabaeoides[PW]	Col: Hydrophilidae	Dung	Widespread	Fragments in apple woodmould
Corticaria impressa[PW]	Col: Latridiidae	Generalist (D)	Local	In cut grass; usually in damp places
Corticarina fuscula[PW]	Col: Latridiidae	Generalist (D)	Widespread	In cut grass litter
Encimus histrio[PW]	Col: Latridiidae	Generalist (D)	Widespread	In cut grass litter
Dorcus parallelipipedus	Col: Lucanidae	Saproxylic	Local	In red-rot cavity on apple and in woodmould of plum
Sinodendron cylindricum[PW]	Col: Lucanidae	Saproxylic	Local	In decayed apple wood and fragments in woodmould
Anisoxya fuscula	Col: Melandryidae	Saproxylic	Na	Beaten from apple branches; beaten from dead apple branches; swept from meadowsweet blossom
Hallomenus binotatus[PW]	Col: Melandryidae	Saproxylic	Nb	In heartwood of plum reticulated by Tree Ant; fragments in plum woodmould
Melandrya caraboides[PW]	Col: Melandryidae	Saproxylic	Nb	Fragments of two in decayed apple
Axinotarsus marginatus	Col: Malachiidae	Saproxylic	Recent arrival	Beaten from dead pear branch
Axinotarus ruficollis	Col: Malachiidae	Saproxylic	Local	On hollow apple trunk
Malachius bipustulatus	Col: Malachiidae	Saproxylic	Widespread	Beaten from plum branches
Mordellochroa abdominalis	Col: Mordellidae	Saproxylic	Local	Beaten from mistletoe on apple
Mycetophagus multipunctatus	Col: Mycetophagidae	Saproxylic	Local	Beaten from *Laetiporus sulphureus* bracket fungus on plum
Mycetophagus quadripustulatus	Col: Mycetophagidae	Saproxylic	Local	Beaten from *Laetiporus sulphureus* bracket fungus on plum; in cut grass litter
Pyrochroa serraticornis	Col: Pyrochroidae	Saproxylic	Widespread	Swept from grass beneath plum tree; bramble thicket
Involvulus caeruleus[PW]	Col: Rhynchitidae	Canopy	Widespread	Fragments in apple woodmould; on apple twigs
Involvulus germanicus[PW]	Col: Rhynchitidae	Canopy	Widespread	On apple twigs

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Neocoenorrhinus aequatus	Col: Rhynchitidae	Canopy	Widespread	Beaten from hawthorn
Lissodema denticolle	Col: Salpingidae	Saproxylic	Nb	Beaten from apple branches
Rhinosimus planirostris	Col: Salpingidae	Saproxylic	Widespread	Beaten from apple and plum branches; beaten from dead apple branches
Gnorimus nobilis	Col: Scarabaeidae	Saproxylic	RDB2, BAP	Faecal pellets in hollow trunk of plum trees; faecal pellets & body parts in black wood mould in hollow apple trunk; faecal pellets & body parts in red-rot debris in hollow plum trunk
Melolontha melolontha	Col: Scarabaeidae	Field layer	Widespread	Beaten from hawthorn blossom; fragments in apple woodmould
Onthophagus coenobita[PW]	Col: Scarabaeidae	Dung	Local	Fragments in plum woodmould
Anaspis frontalis	Col: Scraptiidae	Saproxylic	Widespread	Blossom
Anaspis garneysi	Col: Scraptiidae	Saproxylic	Widespread	Blossom
Anaspis humeralis	Col: Scraptiidae	Saproxylic	Widespread	Beaten from apple blossom
Anaspis lurida	Col: Scraptiidae	Saproxylic	Local	Mistletoe on apple; blossom
Anaspis maculata	Col: Scraptiidae	Saproxylic	Widespread	Beaten from hawthorn blossom; at blossom of meadowsweet
Anaspis pulicaria	Col: Scraptiidae	Saproxylic	Widespread	
Anaspis regimbarti	Col: Scraptiidae	Saproxylic	Widespread	Beaten from apple blossom
Anaspis thoracica	Col: Scraptiidae	Saproxylic	Na	
Silpha atrata	Col: Silphidae	Generalist (D)	Widespread	In rot debris in hollow plum and apple trunks; hibernants in woodmould of plum
Ahasverus advena[PW]	Col: Silvanidae	Generalist (D)	Local	In grass litter
Alaobia trinotata[PW]	Col: Staphylinidae	Generalist (D)	Widespread	In grass litter
Aloconota gregaria[PW]	Col: Staphylinidae	Ground layer +	Widespread	Woodmould of apple
Atrecus affinis[PW]	Col: Staphylinidae	Saproxylic	Widespread	In heartwood of plum
Autalia impressa	Col: Staphylinidae	Saproxylic	Widespread	Beaten from *Laetiporus sulphureus* bracket fungus on plum
Gabrius pennatus[PW]	Col: Staphylinidae	Generalist (D)	Widespread	In cut grass
Lathrobium brunnipes[PW]	Col: Staphylinidae	Ground layer	Widespread	In woodmould in apple

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Lithocharis nigriceps[PW]	Col: Staphylinidae	Generalist (D)	Local	In cut grass litter
Megarthrus bellevoyei[PW]	Col: Staphylinidae	Generalist (D)	Widespread	In cut grass
Nehemitropia sordida[PW]	Col: Staphylinidae	Generalist (D)	Widespread	In cut grass
Philonthus fimetarius[PW]	Col: Staphylinidae	Generalist (D)	Widespread	In cut grass
Ocypus olens[PW]	Col: Staphylinidae	Ground layer	Widespread	Naturalised plum thickets
Platystethus nitens[PW]	Col: Staphylinidae	Wetland (Ground layer)	Local	
Quedius cruentus[PW]	Col: Staphylinidae	Generalist	Widespread	Woodmould of apple and plum
Quedius fulgidus	Col: Staphylinidae	Saproxylic	Nb	Beaten from *Laetiporus sulphureus* bracket fungus on plum
Quedius molochinus[PW]	Col: Staphylinidae	Ground layer	Local	In grass litter
Rugilus orbiculatus[PW]	Col: Staphylinidae	Generalist (D)	Widespread	In cut grass
Rugilus rufipes[PW]	Col: Staphylinidae	Ground layer	Local	In cut grass
Sepedophilus testaceus[PW]	Col: Staphylinidae	Saproxylic	N	Naturalised plum thickets
Stenus clavicornis[PW]	Col: Staphylinidae	Ground layer	Widespread	Tussock
Sunius propinquus[PW]	Col: Staphylinidae	Generalist (D)	Widespread	Tussock; woodmould of willow; in cut grass litter
Eledona agricola	Col: Tenebrionidae	Saproxylic	Nb	Beaten from *Laetiporus sulphureus* bracket fungus on plum
Mycetochara humeralis[PW]	Col: Tenebrionidae	Saproxylic	Na	Fragments in apple woodmould
Prionychus ater[PW]	Col: Tenebrionidae	Saproxylic	Nb	Fragments in fallen apple tree
Prionychus melanarius	Col: Tenebrionidae	Saproxylic	RDB2	Larvae in red rot debris in cavity in apple; elytron in red-rot cavity in apple; many larvae and pupae with adults in woodmould of apple and plum in 2001
Pseudocistela ceramboides[PW]	Col: Tenebrionidae	Saproxylic	Nb	Pupae in plum woodmould

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Nemasoma varicorne	Diplopoda	Saproxylic	Local	Red-rot cavity in plum trunk
Polyxenus lagurus	Diplopoda: Polyxenidae	Saproxylic	Local	Red-rot inside plum trunk; exposed heartwood on plum trunk; in red-rot debris in hollow plum trunk; beaten from apple branches. 100+ on apple trees (PFW 2001)
Pegohylemyia dissecta	Dip: Anthomyiidae	Field layer	Unknown	Larvae mining choke on cock's-foot grass
Chrysotoxum bicinctum[PW]	Dip: Syrphidae	Field layer	Local	Lush herbage
Myathropa florea[PW]	Dip: Syrphidae	Saproxylic	Widespread	Flying in orchard
Pyrophaena rosarum[PW]	Dip: Syrphidae	Field layer	Local	Lush herbage
Gnophomyia viridipennis	Dip: Tipulidae	Saproxylic	N	A few imagines with serried ranks of pupal exuvia protruding through cracks in bark of large fallen willow/poplar
Medetera truncorum	Dip: Dolichopodidae	Saproxylic	Widespread	On apple trunks
Neurigona pallida	Dip: Dolichopodidae	Saproxylic	Local	At rest on apple trunk
Rhagio lineola	Dip: Rhagionidae	Field layer	Widespread	At hollow apple trunk
Rhagio scolopaceus	Dip: Rhagionidae	Field layer	Widespread	
Tipula flavolineata	Dip: Tipulidae	Saproxylic	Widespread	At hollow apple trunk
Tipula peliostigma	Dip: Tipulidae	Saproxylic	N	Pupae in apple wood mould; larva in hollow apple trunk
Aneurus laevis	Hem: Aneuridae	Saproxylic	Local	Dead apple branch
Anthocoris visci	Hem: Anthocoridae	Canopy (P)	Nb	Beaten from mistletoe and dead branches on apple
Cardiastethus fasciiventris	Hem: Anthocoridae	Saproxylic	Local	Beaten from hawthorn and apple branches
Orius laevigatus	Hem: Anthocoridae	Mosaic (C, F)	Widespread	Beaten from dead plum branch
Temnostethus gracilis	Hem: Anthocoridae	Epiphyte	Local	Beaten from dead apple, pear and plum branches; beaten from apple and plum branches
Temnostethus pusillus	Hem: Anthocoridae	Epiphyte	Local	Beaten from dead plum branches

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Anoscopus flavostriatus[PW]	Hem: Cicadellidae	Ground layer	Widespread	Swept from low open herbage
Loricula elegantula	Hem: Microphysidae	Saproxylic+	Widespread	Beaten from live and dead apple, pear, and plum branches
Deraeocoris lutescens	Hem: Miridae	Canopy	Widespread	Beaten from apple blossom
Orthops viscicola[PW]	Hem: Miridae	Canopy (P)	Widespread	Breeding on mistletoe
Physatocheila dumetorum	Hem: Tingidae	Epiphyte	Widespread	Beaten from mistletoe on apple; beaten from plum branches
Andrena fulva	Hym: Andrenidae	Mosaic (G, F, C)	Widespread	Resting in long grass
Nomada ruficornis	Hym: Anthophoridae	Field layer	Local	Resting on long grass
Haltichella rufipes[PW]	Hym: Chalcididae	Saproxylic*	Not assessed**	On ash tree
Chrysis impressa[PW]	Hym: Chrysididae	Generalist	Widespread	Under bark of apple tree
Lasius brunneus	Hym: Formicidae	Saproxylic	Na	Nest in apple heartwood; on hollow apple trunks; beaten from dead apple branches; on apple and plum trunks; red-rot cavity in plum; beaten from hawthorn blossom; in cut grass litter
Lasius fuliginosus[PW]	Hym: Formicidae	Saproxylic	Local	Single large nest in plum (PW 2001)
Temnothorax nylanderi	Hym: Formicidae	Saproxylic	Local	On decorticated plum trunk
Trichoniscoides albidus[PW]	Iso: Trichoniscidae	Ground layer	Nb	In litter after overbank flooding
Eupithecia subfuscata[PW]	Lep: Geometridae	Canopy	Widespread	Larva on apple foliage
Glyphipterix simpliciella	Lep: Glyphipterigidae	Field layer	Widespread	At hogweed flower
Euthrix potatoria	Lep: Lasiocampidae	Field layer	Widespread	Caterpillar
Inachis io	Lep: Nymphalidae	Field layer	Widespread	
Polygonia c-album	Lep: Nymphalidae	Field layer	Widespread	
Anthocharis cardamines	Lep: Pieridae	Field layer	Widespread	
Gonepteryx rhamni	Lep: Pieridae	Canopy	Widespread	

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Aphantopus hyperantus	Lepidoptera	Field layer	Widespread	
Maniola jurtina	Lepidoptera	Field layer	Widespread	
Melanargia galathea	Lepidoptera	Field layer	Widespread	
Ochlodes venata	Lepidoptera	Field layer	Widespread	
Succinea putris	Gastropoda	Ground layer+	Widespread	On trunk of leaning apple tree
Trichia striolata	Gastropoda	Ground layer+	Widespread	On trunk of leaning apple tree
Micromus variegatus[PW]	Neuroptera: Hemerobiidae	Field Layer	Widespread	Swept from herbage
Porcellio scaber	Oniscoidea	Generalist	Widespread	Beaten from dead apple branches
Oligolophus hanseni[PW]	Opiliones: Phalangiidae	Canopy	Local	On mistletoe
Leptophyes punctatissima	Orthoptera	Field layer	Widespread	Beaten from mistletoe on apple
Meconema thalassinum	Orthoptera	Canopy	Widespread	Beaten from apple and plum branches
Chernes cimicoides	Pseudoscorpiones	Saproxylic	Local	Red-rot cavity in plum trunk; under bark on fallen plum trunk
Amphigerontia contaminata	Psocoptera	Epiphyte	Local	Beaten from dead apple branches
Caecilius flavidus	Psocoptera	Epiphyte	Widespread	Beaten from pear branches
Ectopsocus briggsi	Psocoptera	Epiphyte	Widespread	Beaten from mistletoe and dead branches on apple; beaten from plum branches
Elipsocus hyalinus	Psocoptera	Epiphyte	Widespread	Beaten from apple and plum branches
Graphopsocus cruciatus	Psocoptera	Epiphyte	Widespread	Beaten from mistletoe on apple; beaten from pear branches
Loensia variegata	Psocoptera	Epiphyte	Local	Beaten from pear branches and dead plum branches
Mesopsocus unipunctatus	Psocoptera	Epiphyte	Widespread	Beaten from plum branches
Metylophorus nebulosus	Psocoptera	Epiphyte	Local	Beaten from apple branches
Peripsocus subfasciatus	Psocoptera	Epiphyte	Local	Beaten from apple branches

Table continued...

Species	Family/Order	Assemblage	UK status	Notes
Philotarsus parviceps	Psocoptera	Epiphyte	Widespread	Beaten from apple and plum branches; beaten from branches of dead plum tree
Stenopsocus immaculatus	Psocoptera	Epiphyte	Widespread	Beaten from elder blossom
Stenopsocus stigmaticus	Psocoptera	Epiphyte	Widespread	Beaten from plum branches
Subilla confinis	Raphidioptera	Saproxylic	Local	Elder blossom; beaten from dead plum branch
Ceratophyllus gallinae	Siphonaptera	Mosaic	Widespread	Beaten from elder blossom
Deroceras reticulatus melanic[PW]	Stylomm: Agriolimacidae	Ground layer+	Local	Riparian periphery of orchards
Arianta arbustorum[PW]	Stylomm: Helicidae	Ground layer +	Widespread	Naturalised plum thickets
Monacha cantiana[PW]	Stylomm: Helicidae	Ground layer +	Widespread	In open and weedy herbage
Clausilia bidentata[PW]	Stylomm: Clausiliidae	Epiphyte	Widespread	Naturalised plum thickets
Lehmannia marginata[PW]	Stylomm: Limacidae	Epiphyte	Widespread	
Zonitoides nitidus[PW]	Stylomm: Zonitidae	Ground layer	Widespread	Shells rafted by overbank flooding

Notes: see paragraphs 3.9 and 3.17 for explanations of assemblages and status categories.

* Not in Alexander 2002a but considered to be a saproxylic species (Paul Whitehead 2006, Dr Roger Key pers comm 2008).

** Not formally assessed as yet, likely to be rare in the UK.

[PW] = Recorded by Paul Whitehead in 2001/ 2002 but not by the other surveyors in 2003 / 2004

+ *Loricula elegantula*: difficult to assign to one assemblage. Classified as saproxylic by Alexander 2002a, but sometimes regarded as part of the epiphyte assemblage. It tended to occur among epiphytes in the current survey.

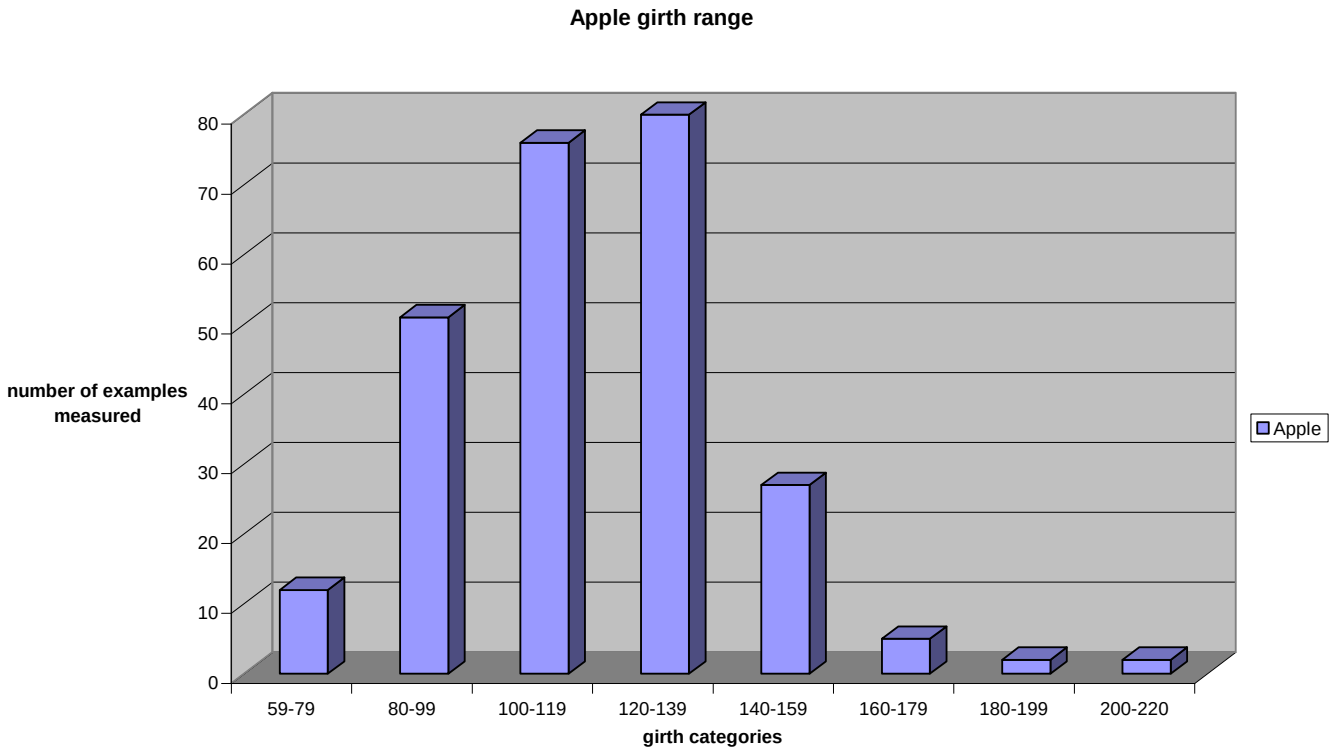

Figure 12 Graph of size class distribution of apple trees in Broadway Farm Orchards

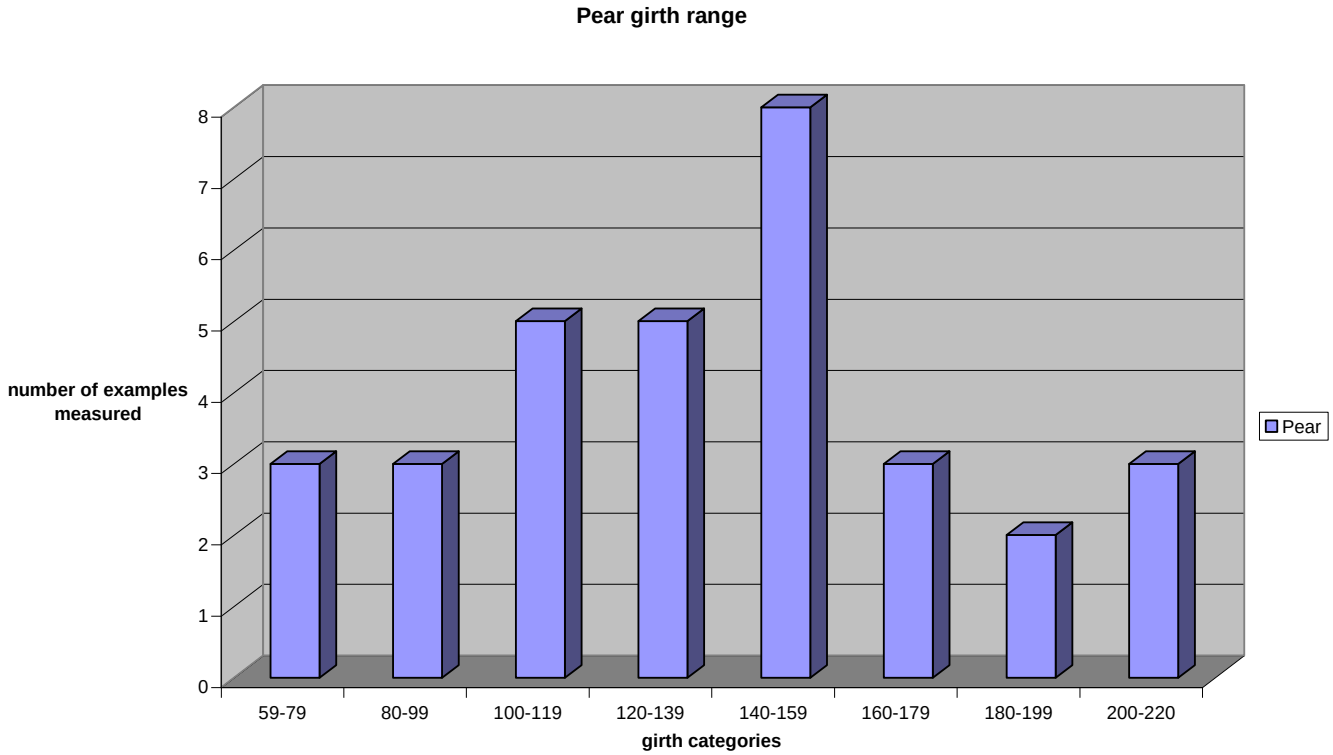

Figure 13 Graph of size class distribution of pear trees in Broadway Farm Orchards

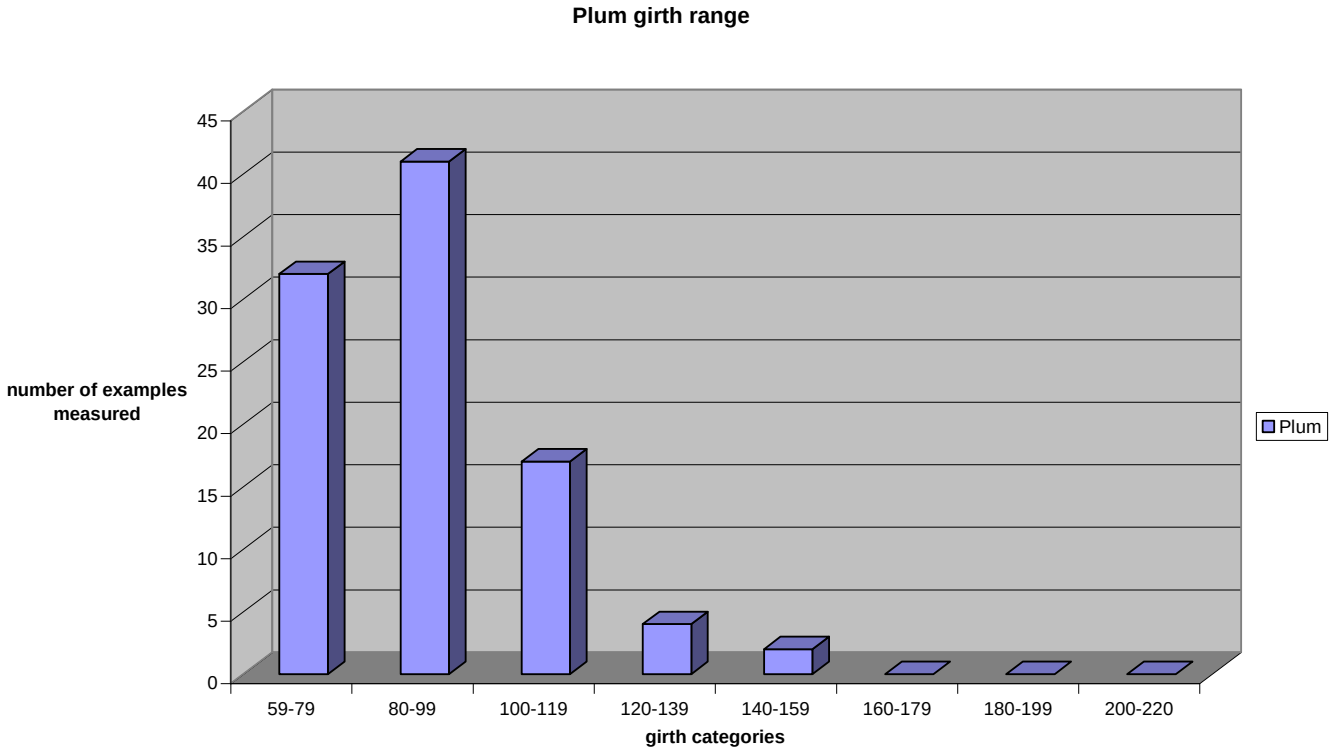

Figure 14 Graph of size class distribution of plum trees in Broadway Farm Orchards

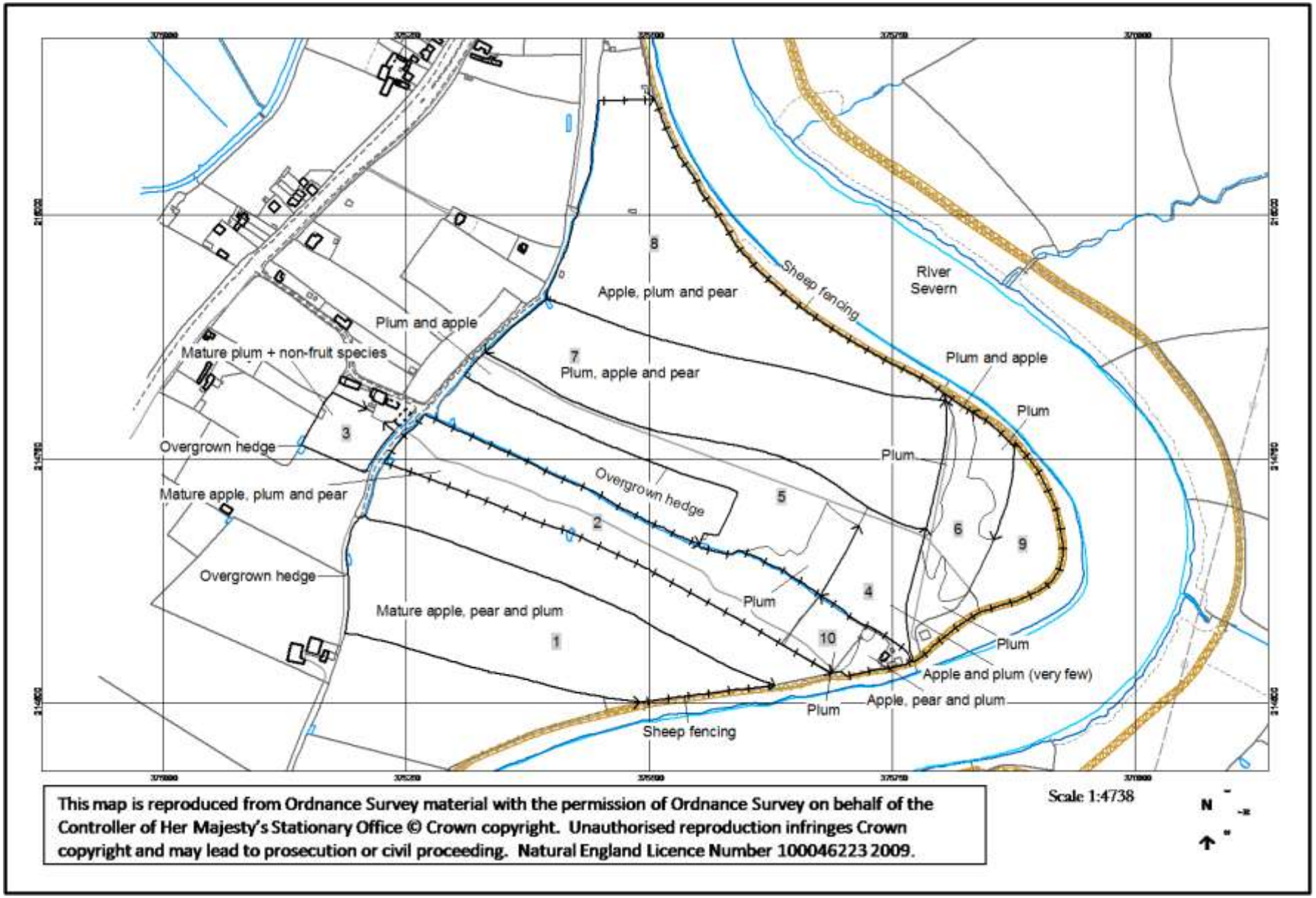

Figure 15 Map of Broadway Farm Orchards (SO755148). Orchard type and boundaries map

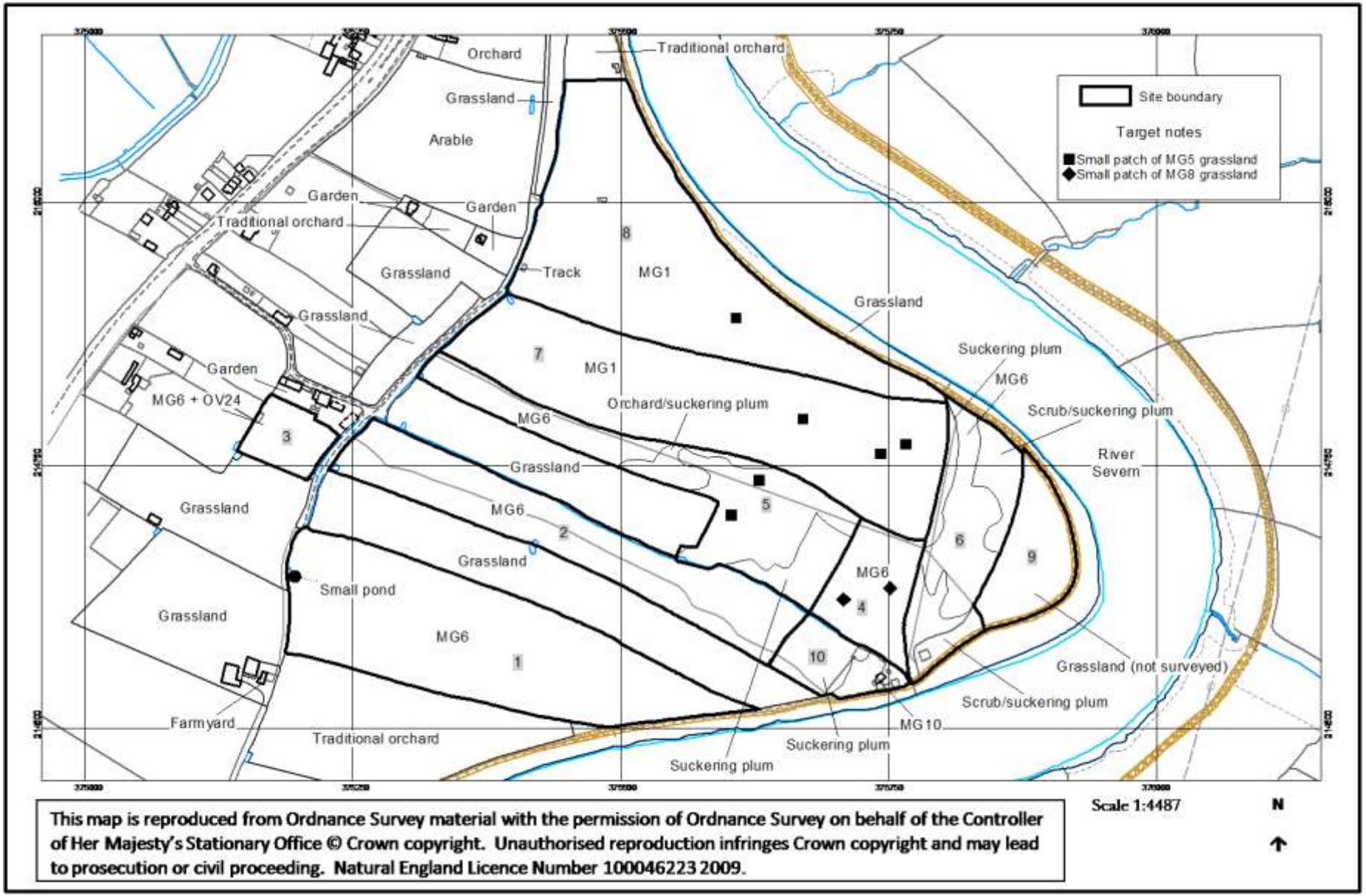

Figure 16 Map of Broadway Farm Orchards (SO755148). Orchard floor, surrounding land use and compartments map

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