

High Weald

Area of Outstanding Natural Beauty

Biodiversity Statement



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**A report produced by: High Weald AONB Unit
For: High Weald Joint Advisory Committee**

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Contents

1. Introduction	1
2. The duty of local authorities with respect to biodiversity	1
3. Choosing what to conserve: a value judgement	3
4. Conservation in the High Weald AONB: designated sites, land ownership, land management, and priority habitats and species	4
<i>4.1 Designated sites</i>	<i>4</i>
<i>4.2 Sites owned and managed by conservation organisations</i>	<i>7</i>
<i>4.3 Privately owned land managed for nature conservation</i>	<i>9</i>
<i>4.4 UK Biodiversity Action Plan habitats and species</i>	<i>11</i>
5. Landscape features and habitats of special biodiversity value in the High Weald AONB	14
<i>5.1 Ancient woodland</i>	<i>14</i>
<i>5.2 Wet woodland</i>	<i>17</i>
<i>5.3 Gills</i>	<i>20</i>
<i>5.4 Sandstone outcrops</i>	<i>24</i>
<i>5.5 Ancient routeways</i>	<i>30</i>
<i>5.6 Hedgerows & shaws</i>	<i>33</i>
<i>5.7 Wood-pasture, parkland & veteran trees</i>	<i>39</i>
<i>5.8 Traditional orchards</i>	<i>45</i>
<i>5.9 Lowland heath</i>	<i>48</i>

5.10 Lowland meadows, lowland dry acid grassland, and semi-improved grassland	55
5.11 Rivers	59
5.12 Ponds	63
5.13 Wetlands	66
5.14 Coastal cliff & shingle	76
6. What's special about the High Weald AONB in particular?	72
6.1 Uniqueness and rarity	72
6.2 Difference	74
6.3 Ancientness	75
6.4 Connectivity and resilience	77
7. Unknown and potential biodiversity	80
8. Conclusion	81
References	82
Appendices	
Appendix A: Species conservation status definitions	94
Appendix B: UK Biodiversity Action Plan priority species that have been recorded in the High Weald AONB (currently only includes records for the parts of Sussex and Kent portions of the High Weald AONB, excluding Surrey)	95
Appendix C: Protected species that have been recorded in the High Weald AONB. These species are all protected under various Schedules of either the Wildlife and Countryside Act 1981 (WCA 1981), the Bern Convention, the Bonn Convention, the Habitat Directive, or the Convention in International Trade in Endangered Species	

(CITES) (currently only includes records for the parts of Sussex and Kent portions of the High Weald AONB, excluding Surrey)	101
Appendix D: Bat species that have been recorded in the High Weald AONB (currently only includes records for the Sussex and Kent portions of the High Weald AONB, excluding Surrey)	104
Appendix E: Invasive non-native species that have been recorded in the High Weald AONB (currently only includes records for the Sussex and Kent portions of the High Weald AONB, excluding Surrey)	105
Appendix F: Vascular and non-vascular plants associated with Wealden gills. All information taken from Rose and Patmore (1997 pp.16-21)	107
Appendix G: 130 priority BAP species known to have significant associations with hedgerows (NB: these species have not necessarily been recorded in the High Weald AONB, although it is likely that many of them are present in the region's hedgerows)	113
Appendix H: Notable invertebrates associated with ancient and species-rich hedgerows (NB: these species have not necessarily been recorded in the High Weald AONB, although it is likely that many of them are present in the region's hedgerows)	118
Appendix I: River Ouse biological survey data for portions surveyed within the High Weald AONB, as well as an explanation and key to the Biological Monitoring Working Party (BMWP) scoring system (all biological survey data supplied by John St. Pierre, Vice Chairman of The Ouse and Ardur Rivers Trust)	121
Appendix J: Definitions of the terrestrial and freshwater biodiversity broad habitat types. All definitions are taken from "Report 307 – Guidance on the interpretation of the Biodiversity Broad Habitat Classification (terrestrial and freshwater types): Definitions and the relationship with other classifications" (Jackson, 2000). Report available from: http://jncc.defra.gov.uk/page-2433#1763)	138

1. Introduction

The High Weald AONB contains a range of habitats and landscape features that collectively support a diversity of species. The importance of the region's biodiversity stems not only from the rarity and variety of these species, but also from the ancientness, interconnectedness and heterogeneity of the habitats that support them. Indeed, it is the essentially medieval origin of the High Weald landscape (and, in some cases, its prehistoric origin), along with the existence of a patchwork of small-scale and linear landscape features created through long-standing human-environment interactions, which combine to significantly enhance the region's ecological connectivity and, ultimately, its resilience. In the case of the High Weald, the biodiversity value of its landscape really is greater than the sum of its parts.

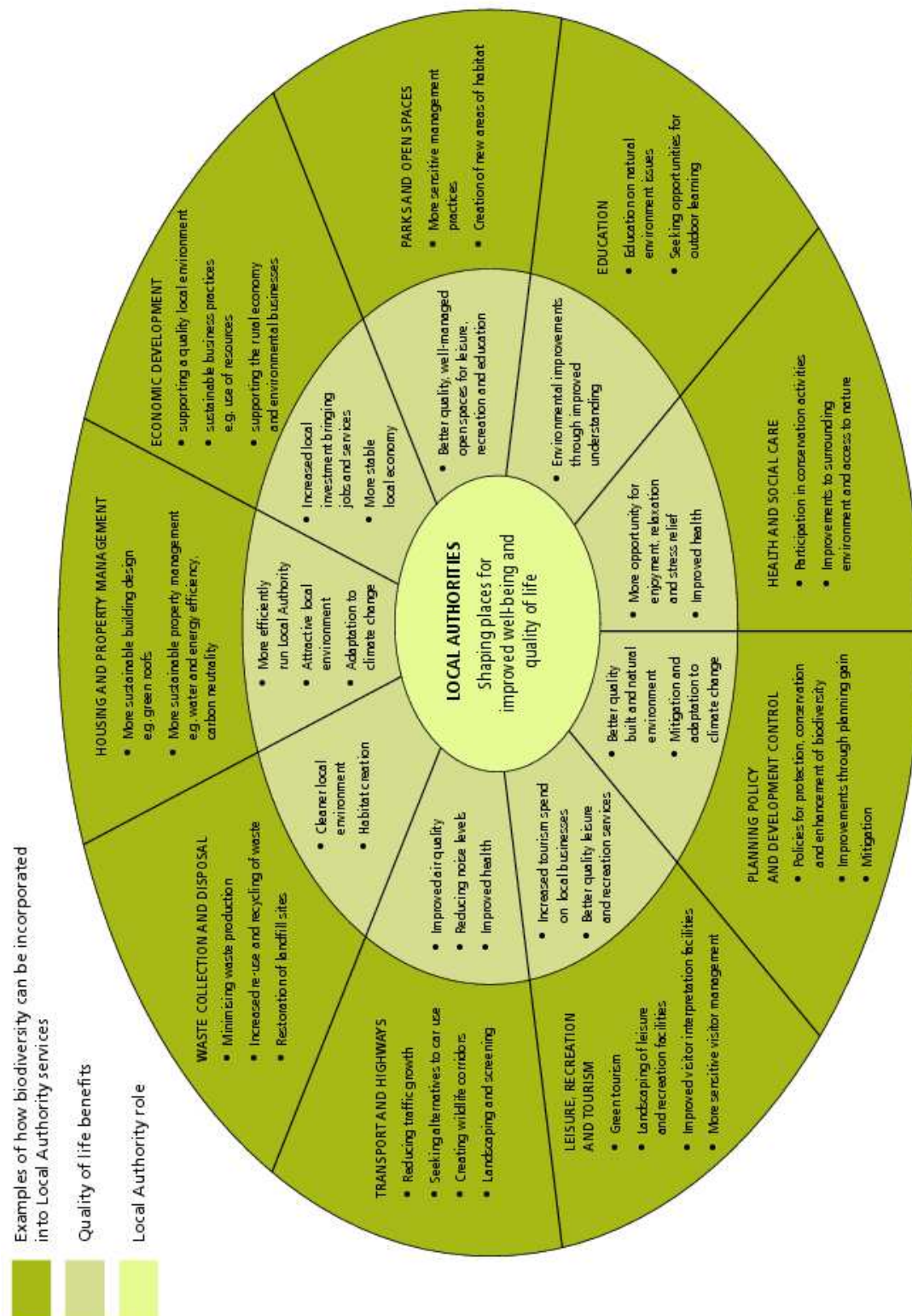
2. The duty of local authorities with respect to biodiversity

The Natural Environment and Rural Communities (NERC) Act came into force on 1st Oct 2006. Section 40 of the Act (see: <http://www.legislation.gov.uk/ukpga/2006/16/section/40>) requires all public bodies, including local authorities (i.e. unitary, county, district, metropolitan, and community, parish and town councils) to have regard to biodiversity conservation when carrying out their functions. This is commonly referred to as the "biodiversity duty".

Section 40 of the 2006 NERC Act extends the biodiversity duty of section 74 of the Countryside and Rights of Way (CROW) Act 2000 (which placed the biodiversity duty on Government and Ministers – see: <http://www.legislation.gov.uk/ukpga/2000/37/section/74>) to all public bodies. The aim of the biodiversity duty is to raise the profile of biodiversity in England and Wales, so that the conservation of biodiversity becomes properly embedded in all relevant policies and decisions made by public authorities.

In recognition of the key role local authorities play with regard to conserving and enhancing biodiversity, Defra has produced two sets of guidance. These may be downloaded by clicking on the links at the bottom of the following webpage: <http://www.naturalengland.org.uk/ourwork/conservation/biodiversity/protectandmanage/duty.aspx>. Also, see Figure 1, p.2, for a visual representation of how local authority functions and services can relate to biodiversity.

Figure 1. Local authority functions and services and their relationship to biodiversity.



Source: Defra (2007 p.177).

3. Choosing what to conserve: a value judgement

Before attempting to provide an inventory of the important habitats, landscape features and associated species in the High Weald AONB, it is important to recognise at the outset that decisions about what to conserve inevitably involve judgements about what we – as individuals and a society – value. Scientific facts and data about what exists, its rarity or ubiquity, and its vulnerability to extinction or local extirpation can inform our conservation decisions, but ultimately we have to make choices about which components of the natural environment we consider to be of the greatest value and thus worthy of conservation action.

One of the main reasons that our valuations of the natural world are a critical part of biodiversity conservation, is that biodiversity is not a purely stipulated term (i.e. its meaning is not fixed by a precise, singular definition, like, for example, the word “chair”). Rather, biodiversity is a complex and multifaceted term that is defined in part by biological facts (which, much like the medical facts that help to pin down the difficult-to-define concept of human health, change as new discoveries are made – cf. the new and increasingly important concept of phylogenetic diversity (e.g. Forest et al., 2007)) and in part by what we value (Wright, 2011). As the environmental philosopher Bryan Norton argues, in order to be useful in a public policy context, biodiversity should not only refer to those aspects of natural variety that are considered by scientists to be ecologically important, but also those aspects “that are socially important enough to obligate protection... for future generations” (Norton, 2006 p.53).

Moreover, ethical valuations of the natural world are necessary in order to make the leap from scientific data and evidence, to conservation action. As David Hume pointed out in his *A Treatise of Human Nature* almost 300 years ago, one cannot decide what one *should* do simply on the basis of what *is* (i.e. the facts). Rather, an ethical argument that takes these facts into account must be constructed before this gap can be bridged. And whether we like it or not, whenever we make the leap from a set of facts about the world to a particular action or set of actions in the world, we are making normative judgements (albeit usually unconsciously) about how we think the world should be, or can be better than it currently is. Although we usually sidestep, whether deliberately or unthinkingly, the potentially “messy” ethical issues and assumptions embodied within our actions, it is a mistake to think that we escape them.

Crucially, however, recognising the ethical dimension of conservation does not mean the abandonment of reason, or an acceptance that conservation action must be underpinned with purely subjective and arbitrary opinion; on the contrary, rigorous and rational arguments about what we value and why become even more important in the support of our conservation efforts. Indeed, it is critical that we are explicit about our valuations of the natural world and how these inform our conservation actions, and are prepared to present cogent, well-reasoned cases for these actions. By doing so, we will be better able to avoid the disagreements which often arise simply as a result of failing to be explicit about the ways in which we are valuing certain aspects of the natural world.

In the context of the High Weald AONB, there are two fundamental facts that must be used to inform these ethical arguments about what to conserve: i) the fact that the High Weald’s landscape is thoroughly cultural and represents the outcome of millennia of human-environment interactions, and ii) the fact that many of the species that are present in the region today – as well as the habitats and landscape features upon which they depend – are there largely because of these long-term human-environment interactions. Thus, on the basis of these facts, there is a powerful argument to be made that, insofar as we value the species we have inherited from these long-term human-environment interactions, the habitats and landscape features upon which they depend merit

careful conservation. After all, it is only through such conservation that we can ensure their continued survival.

In many cases, this conservation will be best achieved through the traditional management practices that produced and shaped these habitats and landscape features in the first place – i.e. the management of woodland through coppicing, and the management of grassland and arable land through small-scale, mixed, low-intensity agriculture. Indeed, the critical importance of traditional management in maintaining our biological inheritance is starkly illustrated by the recent history of woodland management, which, after experiencing a rapid decline following the Second World War, had the effect of causing a significant reduction in species dependent on open areas within woodlands for their survival.

Crucially, the case for continuing traditional management practices does not rest only on the fact that their cessation may lead to the decline of certain species. In addition to helping conserve our biological inheritance, such traditional management has the added benefits of preserving our cultural heritage, enriching our contemporary societies, and contributing to our rural economies.

4. Conservation in the High Weald AONB: designated sites, land ownership, land management, and priority habitats and species

In order to gain an overview of the High Weald AONB's importance for biodiversity conservation, as well as how the landscape is currently being managed in order to enhance this biodiversity, the following sections provide information about relevant designations, land ownership and management, and priority habitats and species. It should be noted that in some cases there will be a degree of spatial overlap between these different categories, with one site potentially being both owned and managed by a conservation organisation, and designated as a Site of Special Scientific Interest (as in the case of the SSSI that also comprises part of the RSPB's Fore Wood nature reserve, for example).

4.1 Designated sites

The High Weald AONB contains a wide range of sites designated for nature conservation – both statutory (i.e. enshrined in law and typically nationally, or internationally, designated) and non-statutory (i.e. not enshrined in law and locally designated). In terms of statutory designations, these include: 51 Sites of Special Scientific Interest (protected under the Wildlife and Countryside Act 1981 and hereafter referred to as SSSIs), five Local Nature Reserves (protected under the National Parks and Access to the Countryside Act 1949 and the Natural Environment and Rural Communities Act 2006, and hereafter referred to as LNRs), two Special Areas of Conservation (Ashdown Forest and Hastings Cliffs, both of which are protected under the EC Habitats Directive and hereafter referred to as SACs) and one Special Protection Area (Ashdown Forest, which is protected under the EC Birds Directive and hereafter referred to as an SPA) (High Weald AONB Joint Advisory Committee, 2014; JNCC, 2013; Natural England, 2013).

There are also 202 sites with non-statutory designations, identified and selected at the local-level for their nature conservation value. Although there are a variety of terms for these local sites (see Table 1, p.5, for the range of terms that may be encountered across the country), the generic term which has been promoted in England since 2006 is Local Wildlife Sites (hereafter LWSs) (The Wildlife Trusts, 2012).

Table 1. The various names which may be used to describe Local Wildlife Sites in England.

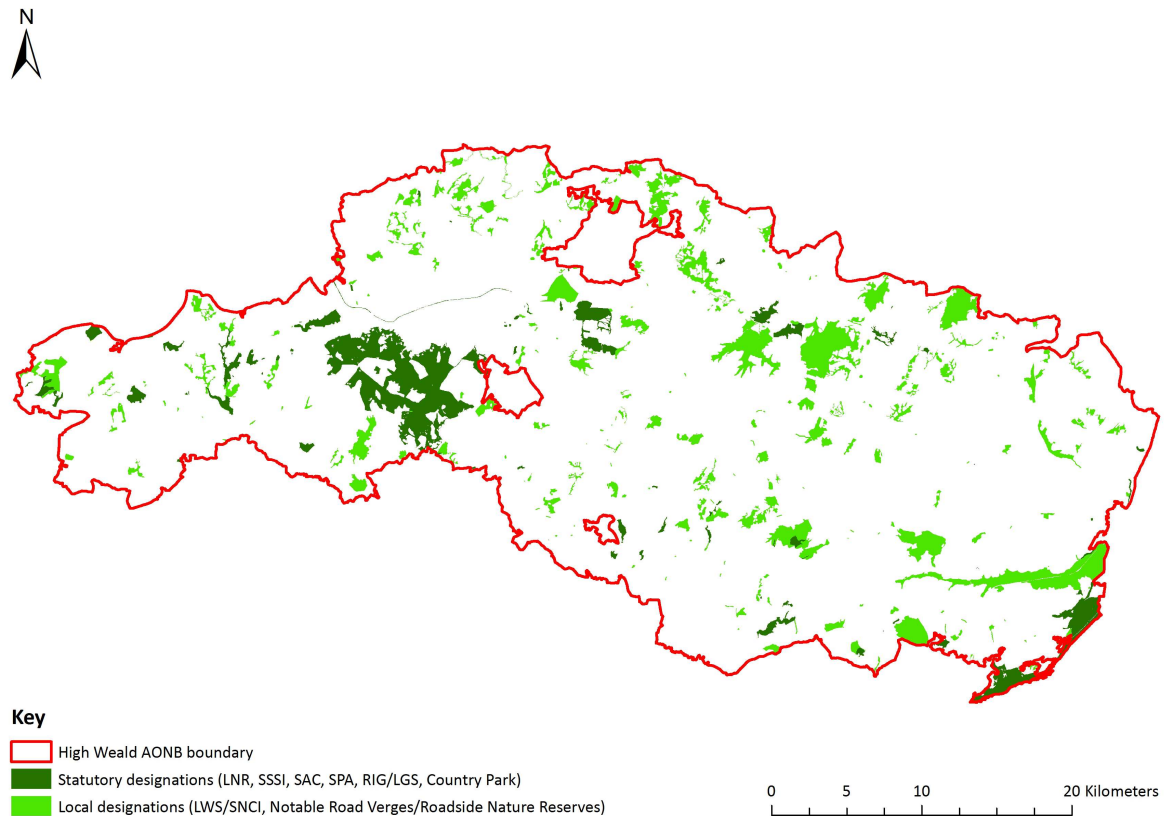
Generic term	Variations
Local Wildlife Site	County Wildlife Site
	Wildlife Site
	Special Wildlife Site
	Key Wildlife Site
	Site of Importance for Nature Conservation
	Site of Nature Conservation Importance
	Site of Nature Conservation Interest
	Site of Local Importance for Nature Conservation
	Site of Biological Interest
	Biodiversity Alert Site
	Biological Heritage Site

Source: The Wildlife Trusts (2012).

It is important to recognise that these designations do not fully capture the biodiversity of the High Weald AONB; indeed, it is notable that ancient woodland – the most abundant and, arguably, most biologically important feature of the High Weald’s landscape – is significantly underrepresented in these designations, with the vast majority of ancient woodlands in the region having no official nature conservation designation.

Nevertheless, these designated sites do help to illustrate the spatial extent of sites officially acknowledged for their biodiversity importance (see Figure 2, p.6, for a map illustrating the location and spatial extent of these designations).

Figure 2. Sites designated for nature conservation – statutory and non-statutory – within the High Weald AONB.



Data sources: Natural England's statutory designations datasets (LNR, SAC, SPA, SSSI and Country Park), Sussex Biodiversity Records Centre's and Kent & Medway Biological Records Office's local designations datasets, and Natural England's AONBs (England) boundary data.

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4.2 Sites owned and managed by conservation organisations

In addition to areas formally designated for nature conservation, there are 54 sites (covering a total area of 2956 ha) in the High Weald AONB that are owned and managed by conservation organisations (see Table 2, below).

Table 2. Number and area of sites/reserves owned by conservation organisations in the High Weald AONB

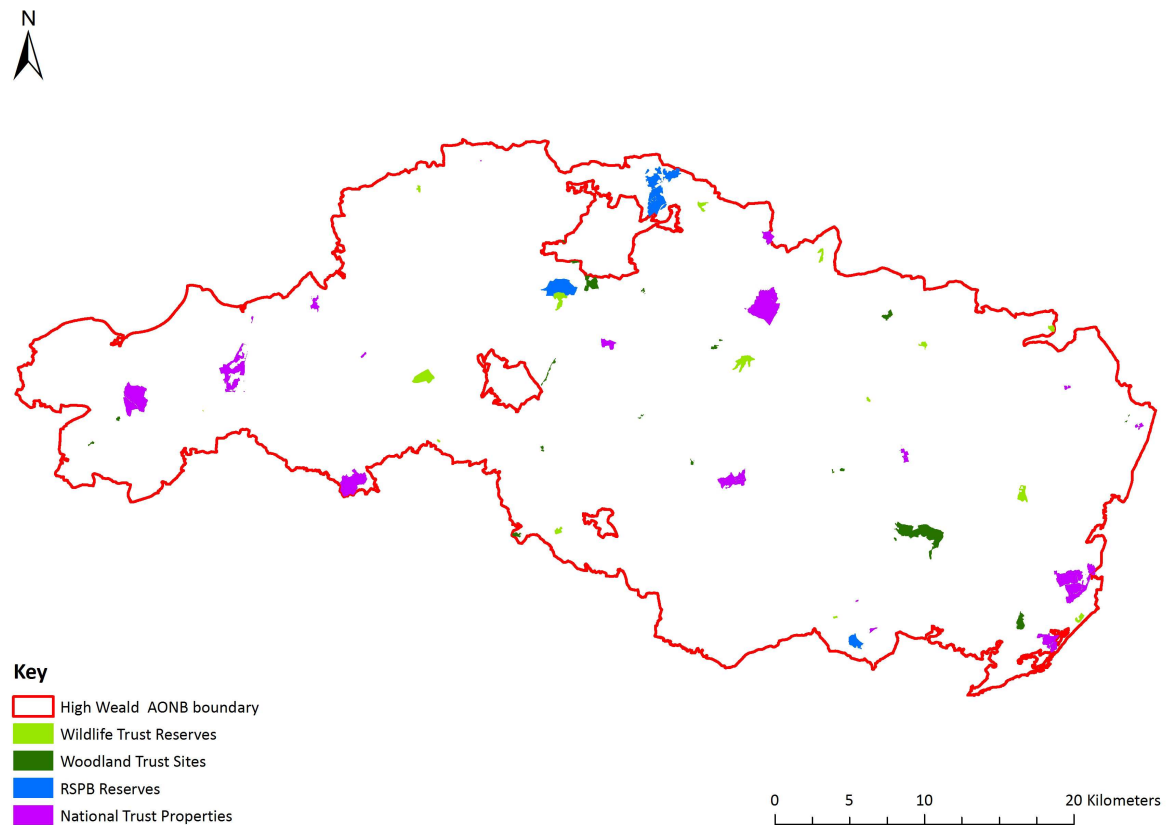
Conservation organisation	Number of sites/reserves	Area (ha)
Wildlife Trusts	15	289
Woodland Trust	18	478
RSPB	3	539
National Trust	18	1650
Total	54	2956

Source: Sussex and Kent Wildlife Trusts*, The Woodland Trust, The RSPB, and The National Trust.

NB: None of the Surrey Wildlife Trust's Reserves fall within the High Weald AONB boundary

Although Table 2 certainly does not include all such organisations, these represent the region's principle land owning organisations concerned (at least in large part) with the conservation of biodiversity. Figure 3, p.8, illustrates the location and spatial extent of land in the High Weald AONB that is owned and managed by these organisations.

Figure 3. Sites owned and managed by nature conservation organisations in the High Weald AONB.



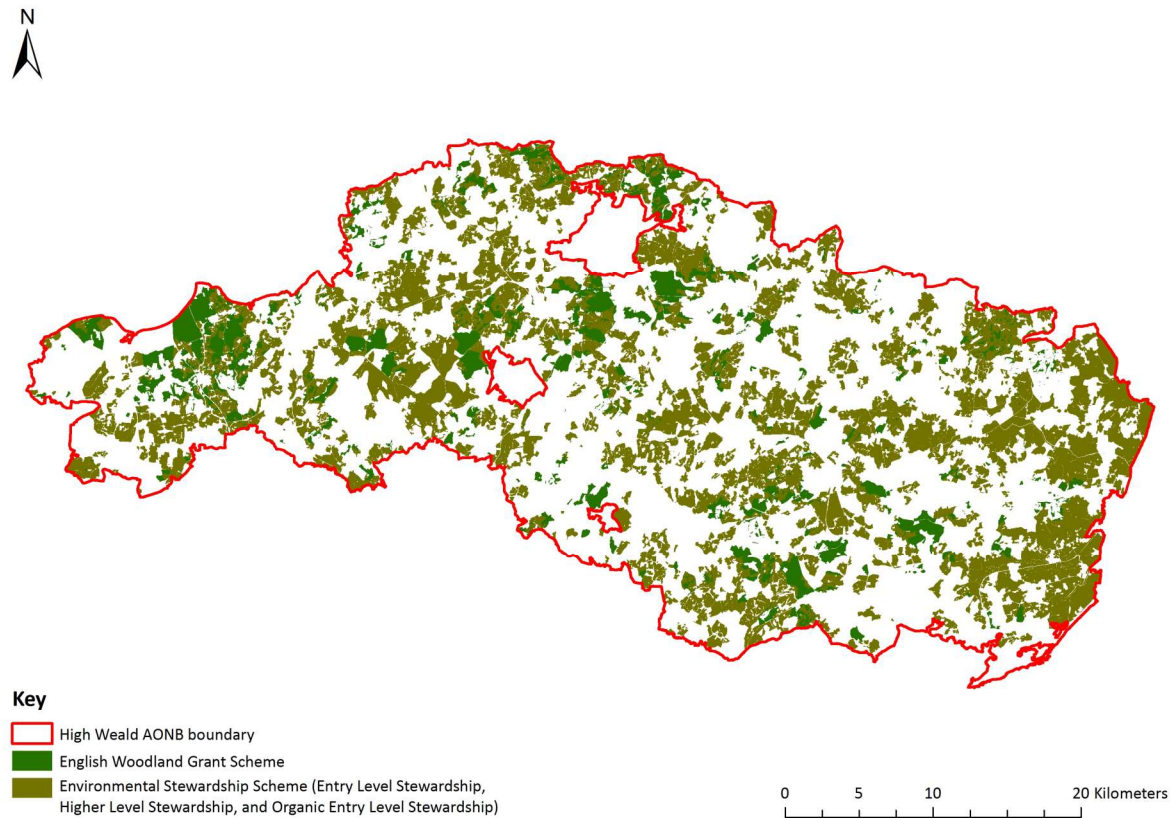
Data sources: National Trust Land dataset, RSPB UK reserves dataset, Wildlife Trust Reserves dataset (Sussex, Kent and Surrey) Woodland Trust Sites dataset, and Natural England's AONBs (England) boundary data.
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4.3 Privately owned land managed for nature conservation

A significant area of the High Weald AONB (69,239ha, or 47.37% of the AONB's total area) is in some form of government-funded scheme with the aim – or at least the partial aim – of managing land in an environmentally sensitive way that is beneficial to biodiversity (Natural England, 2013a). In the High Weald, these schemes primarily take the form of either Environmental Stewardship grants (Entry Level and Higher Level) aimed at farmland, or English Woodland Grant Scheme grants aimed at woodland. Figure 4, p.10, illustrates the location and spatial extent of land in the High Weald AONB that is currently under some form of environmental grant scheme.

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Figure 4. Land under some form of environmental grant scheme in the High Weald AONB.



Data sources: Natural England's Environmental Stewardship data, The Forestry Commission's English Woodland Grant Scheme data, and Natural England's AONBs (England) boundary data.

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NB: Not all the land in these schemes is managed for the benefit of biodiversity; however, certain features are explicitly targeted for conservation management and cross-compliance requirements should minimise detrimental operations elsewhere.

4.4 UK Biodiversity Action Plan habitats and species

Finally, in addition to sites formally designated for nature conservation, there are also a range of species and habitats found within the High Weald AONB that have been recognised as conservation priorities. Listed in the UK Biodiversity Action Plan (created in response to the 1992 Convention on Biological Diversity (CBD), revised in 2007 and hereafter referred to as the UK BAP), they comprise those habitats and species considered to be of greatest conservation concern due to their “international importance, rapid decline, high risk, and, in the case of habitats, their importance for the survival of key species” (JNCC, 2013a).

Although the UK BAP has now been superseded by the UK Post-2010 Biodiversity Framework, UK BAP species and habitats still form the basis of much biodiversity work in the UK and remain part of the everyday language of biodiversity conservation. Indeed, the Post-2010 replacement terminology – species and habitats of “principal importance”, as identified under the 2006 Natural Environment and Rural Communities Act – lists exactly the same species and habitats as those identified under the UK BAP, with the sole exception being the hen harrier, which is listed as a species of “principle importance” but not as a UK BAP priority species (definitions of all the key terms describing the conservation status of species in the UK may be found in Appendix A p.94) (JNCC and Defra, 2012).

For a list of the UK BAP priority species found in the High Weald AONB, please refer to Appendix B, pp.95-100, for a list of the UK BAP priority habitats found in the High Weald AONB, please refer to Table 3, p.12, and for a map showing the location and spatial extent of these UK BAP priority habitats refer to Figure 5, p.13.

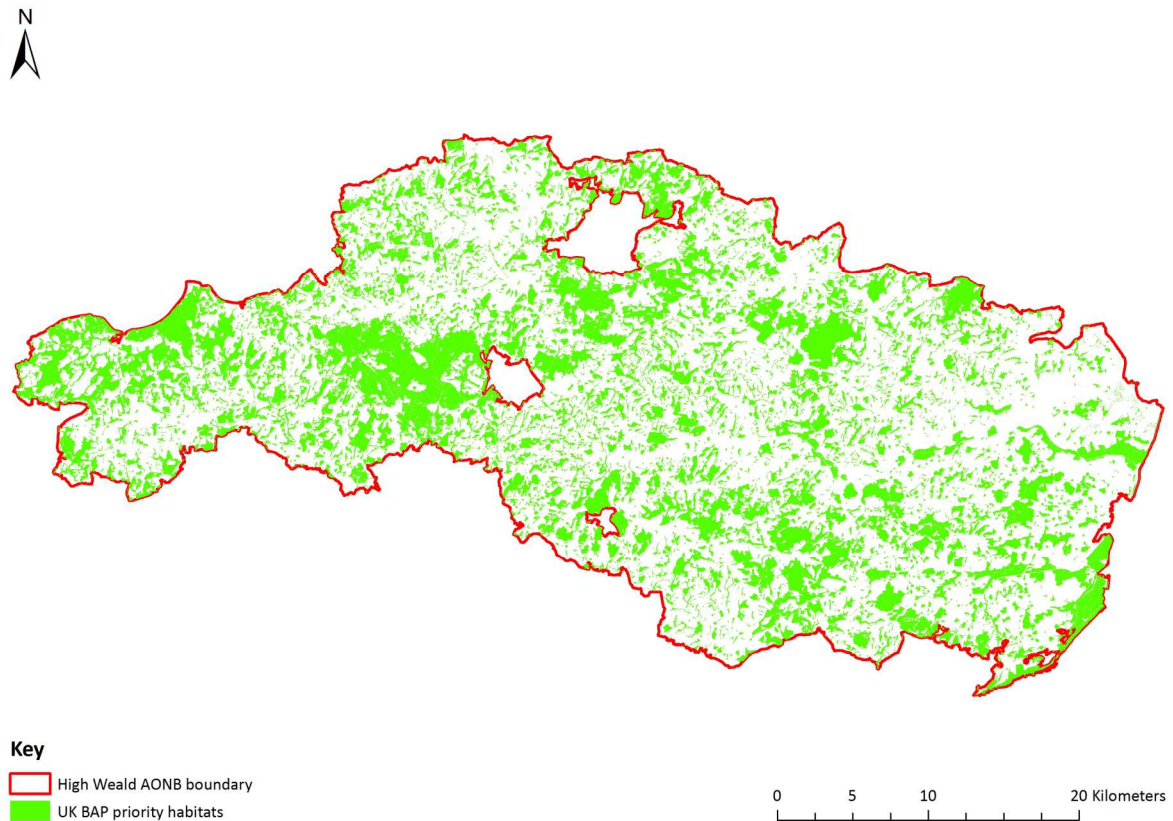
Table 3. UK BAP habitat types present in the High Weald AONB, along with the % of AONB coverage and the % of the national (i.e. England-wide rather than UK-wide) habitat resource.

UK BAP priority habitat	Total Area within the High Weald AONB (ha)	Percent coverage of High Weald AONB	Percent of national (i.e. England-wide) UK BAP priority habitat resource within the High Weald AONB
Coastal and Floodplain Grazing Marsh	1,926.06	1.3%	0.9%
Coastal Vegetated Shingle	0.62	0.0%	0.0%
Deciduous Woodland	29,012.61	19.8%	3.9%
Lowland Dry Acid Grassland	142.12	0.1%	0.9%
Lowland Fens	1.39	0.0%	0.0%
Lowland Heathland	2,344.88	1.6%	4.1%
Lowland Meadows	772.40	0.5%	2.1%
Maritime Cliff and Slopes	43.56	0.0%	0.4%
Purple Moor Grass and Rush Pastures	12.36	0.0%	0.1%
Reedbeds	44.49	0.0%	0.6%
Traditional Orchards	298.10	0.2%	1.9%
Arable Field Margins	?	?	?
Hedgerows	?	?	?
Ponds	?	?	?
Wet Woodland	?	?	?
Wood-Pasture and Parkland	?	?	?
Total	34,598.59		

Source: Natural England's Priority Habitat Inventory AONB data.

NB: These figures are based on Natural England's "Priority Habitat Inventory", which provides updated data on 21 of the 65 current UK BAP priority habitats, and should reflect the picture in the High Weald AONB as of 31st March 2013. However, it should be noted that this table does not represent a comprehensive list of UK BAP priority habitats in the High Weald AONB. Several UK BAP priority habitats that are known to be present in the High Weald AONB (including, but not limited to, Arable Field Margins, Hedgerows, Lowland Calcareous Grassland, Ponds, Wet Woodland and Wood-Pasture and Parkland) are currently not included in this Natural England dataset and therefore are omitted from the above table.

Figure5. The extent of UK BAP priority habitats within the High Weald AONB.



Data sources: Natural England's Priority Habitats Inventory, Sussex Biodiversity Records Centre's UK BAP priority habitats data, Kent & Medway Biological Records Office's UK BAP priority habitats data, Natural England's Ancient Woodland Inventory (ASNW and PAWS), The Weald & Downs Ancient Woodland Survey data, and Natural England's AONBs (England) boundary data.

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5. Landscape features and habitats of special biodiversity value in the High Weald AONB

Although the aforementioned nature conservation designations and priority species and habitats illustrate the significant value of the High Weald's landscape for biodiversity conservation, they are by no means exhaustive. Indeed, there are a number of habitats and special landscape features found within the High Weald AONB that are not fully captured by these categories and that add significantly to the region's capacity to support a rich diversity of flora and fauna. These include ancient woodland, lowland and wooded heath, unimproved and semi-improved grassland, hedgerows, shaws and ancient routeways. Through their intimate association and proximate spatial arrangement in what is essentially a medieval landscape, these essentially small-scale landscape features endow the High Weald with special value for biodiversity. Moreover, they have the effect of enhancing connectivity, heterogeneity and permeability on a landscape-scale, thus helping to ensure its resilience to future environmental change.

5.1 Ancient woodland

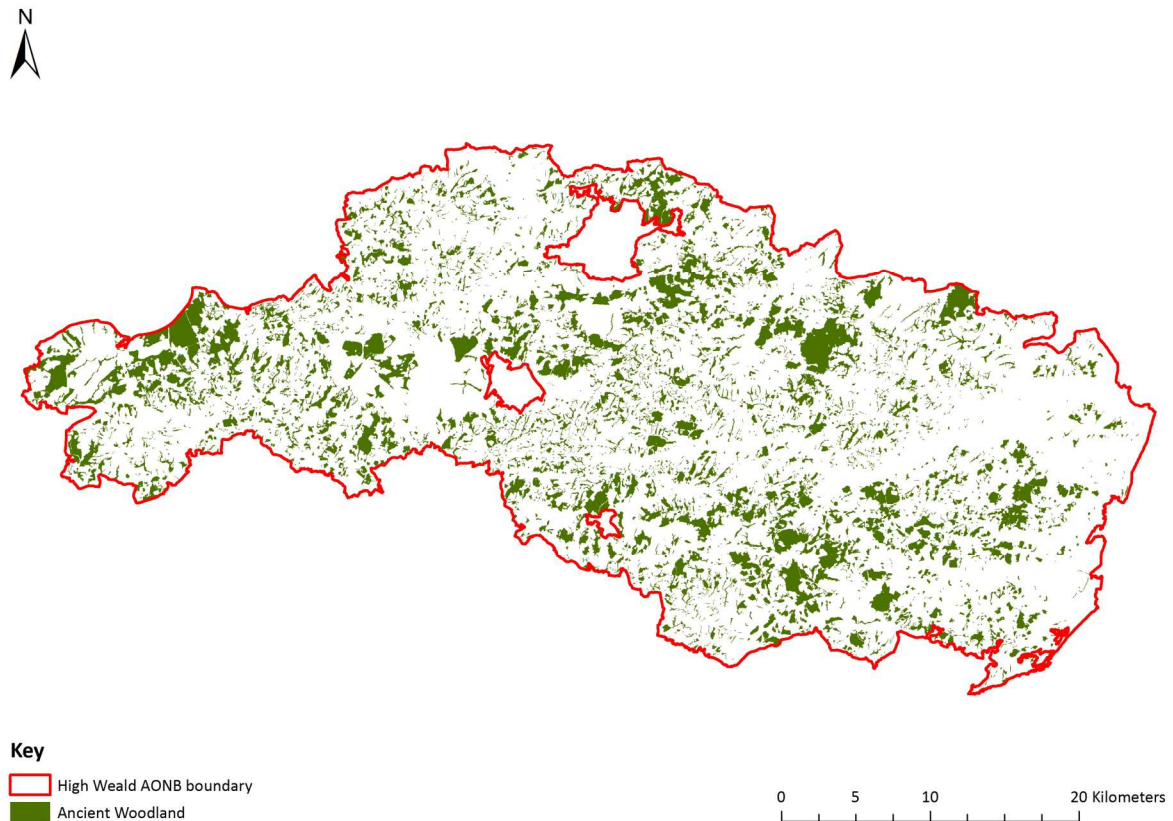
Defined as land that has supported continuous woodland cover since at least 1600 AD, ancient woodland may be divided into two broad categories: Ancient Semi-Natural Woodland (hereafter ASNW) and Plantations on Ancient Woodland Sites (hereafter PAWS) (Natural England, 2012; Natural England, 2013b). ASNW retains native trees and shrubs that have not been planted, although they may have been managed by coppicing and/or felling and allowed to regenerate naturally. PAWS, in contrast, comprises areas where the original tree cover has been felled and replaced by planting, often with conifers and usually over the last century (Natural England, 2012; Natural England, 2013b).

Ancient woodland in the region covers 27,676ha (18.7% of the AONB's total area), compared to a national average cover of just 2.68%

Not only does ancient woodland contribute significantly to the region's character – indeed, woodland is one of the five key character components identified in the Management Plan (High Weald AONB Joint Advisory Committee, 2014) – but it is perhaps the most outstanding feature of the High Weald AONB in terms of its value for biodiversity.

In large part this is due to the fact that the ancient woodland resource in the High Weald is so large; indeed, following the High Weald AONB Unit's Weald & Downs Ancient Woodland Survey, which included sub-two hectare woodlands for the first time, ancient woodland in the region is estimated to cover 27,276ha – an increase of 3,494ha since the previous Ancient Woodland Inventory (Sansum, 2013). This revised area represents 18.7% of the entire AONB, compared to a national average ancient woodland cover of just 2.68%. Of this total area, around 67% is thought to be ASNW, with the remaining 33% constituting PAWS (Sansum, 2013). For an illustration of the extent of ancient woodland cover in the High Weald AONB, see Figure 6, p.15.

Figure 6. The extent of ancient woodland (ASNW and PAWS) in the High Weald AONB.



Data source: Natural England's Ancient Woodland Inventory (Ancient Semi-Natural Woodland and Plantation on Ancient Woodland Sites), The Weald & Downs Ancient Woodland Survey data, and Natural England's AONBs (England) boundary data.

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However, the fact that ancient woodland is home to more rare and threatened species than any other habitat in the UK (Forestry Commission, 2013; Woodland Trust, 2013a), also contributes significantly to its biodiversity value.

The High Weald's nationally significant ancient woodland resource is characterised by predominantly small, scattered woodlands (the vast majority of which are less than 2ha in size) that often trace the intricate topographic features present in the landscape, such as gill valleys, spring lines, ancient routeways and abandoned mine pits (Samsun, 2013). Crucially, it is the ecological continuity of ancient woodland – what may be described as its “ancientness” – that affords it a particularly special value for biodiversity. Indeed, the existence of relatively continuous woodland cover in the High Weald, over centennial and possibly millennial timescales, has provided the conditions for rich assemblages of plant species – many of which have relatively poor dispersal abilities, such as wood anemone *Anemone nemorosa*, coralroot *Cardamine bulbifera*, thin spired wood-sedge *Carex strigosa* and butcher's broom *Ruscus aculeatus* – to colonise and accumulate in woodlands over time (Rose, 1999; Thompson et al., 2003; Sansum, 2013 personal communication).

Biodiversity Box 1

Ancient woodland example: Darwell Wood

Located in the central southern part of the High Weald AONB, this site consists of a relatively large area of broadleaved woodland deeply dissected by a number of streams which drain into Darwell Reservoir to the north. Darwell Wood has developed over formations of the Ashdown Sands, Purbeck Beds and Wadhurst Clay. The resulting variation in geology has influenced the types of plants which are able to grow in different areas. The site probably represents the best example of hornbeam coppice with oak standards in Sussex, and also supports a number of other woodland types which are rare in the national context. The following species information provides an overview of this woodland's significant biodiversity value:

- The majority of the site is dominated by mature hornbeam *Carpinus betulus* coppice with oak *Quercus robur* standards. Under the dense canopy the ground flora is sparse and consists mainly of mosses, although occasionally bluebells *Hyacinthoides non-scripta*, bramble *Rubus fruticosus* and wood sorrel *Oxalis acetosella* form a more dense cover
- On higher ground the oak/hornbeam woodland gives way to more open silver birch *Betula pendula*–oak woodland, often with hazel *Corylus avellana* and some sweet chestnut *Castanea sativa* coppice. The ground flora here includes wood sage *Teucrium scorodonia*, bracken *Pteridium aquilinum* and sanicle *Sanicula europea*. In the west of the site calcareous soils support an ash *Fraxinus excelsior*/hazel *Corylus avellana* wood with a ground flora comprised of plants indicative of base rich soils, amongst them ramsons *Allium ursinum*, bee and pyramidal orchids *Ophrys apifera* and *Anacamptis pyramidalis*, as well as several calcicolous mosses
- The streams which traverse the site have cut deeply into the underlying rock to produce steep sided valleys. The valley floors are dominated by alder *Alnus glutinosa*, with local abundances of grey willow *Salix cinerea* above a ground flora of pendulous sedge *Carex pendula*, water mint *Mentha aquatica*, opposite-leaved golden saxifrage *Chrysosplenium oppositifolium* and ragged robin *Lychnis flos-cuculi*
- The woodland supports a rich community of breeding birds which includes woodcock *Scolopax rusticola*, green woodpecker *Picus viridis*, sparrowhawk *Accipiter nisus* and tawny owl *Strix aluco*

(Information from the Darwell Wood SSSI citation, available from:

http://www.sssi.naturalengland.org.uk/special/sssi/sssi_details.cfm?sssi_id=1002162).

In addition to the diverse range of plant species found in ancient woodlands – many of which are considered to be “ancient woodland indicator” (AWI) species, and are used as an ecological means to distinguish ancient woodland from non-ancient woodland (Rose, 1999) – they also support an array of animal and fungi species.

In terms of birds, the species associated with ancient woodland may include: the tree pipit *Anthus trivialis*, the spotted flycatcher *Muscicapa striata* and the lesser spotted woodpecker *Dendrocopos minor* (RSPB, 2013; The Wildlife Trusts, 2013a) – the latter two of which are classified as Red List species under the Birds of Conservation Concern review and as a priority species under the UK BAP (Eaton et al., 2009; JNCC, 2013c; RSPB, 2013).

A variety of mammals also utilise the valuable habitat that ancient woodland provides. For example, badgers *Meles meles*, red foxes *Vulpes vulpes*, the common shrew *Sorex araneus*, and the UK BAP priority West European hedgehog *Erinaceus europaeus* and dormouse *Muscardinus avellanarius* all frequent ancient woodland. Moreover, the High Weald’s ancient woodland resource also supports a diverse invertebrate fauna. Indeed, butterflies like the silver-washed fritillary *Argynnis paphia*, white admiral *Limenitis camilla*, pearl-bordered fritillary *Boloria euphrosyne* and small pearl-bordered fritillary *Boloria selene* (the latter three of which are classified as UK BAP priority species (JNCC, 2013c)) may all be found in the region’s ancient woodland, with all being heavily dependent upon the traditional cycle of coppice management with which ancient woodlands have historically been associated. In addition, a huge variety of beetles *Coleoptera*, slugs, snails *Gastropoda*, centipedes *Chilopoda*, millipedes *Diplopoda*, bees, wasps, ants *Hymenoptera*, flies *Diptera*, spiders *Araneae* and moths *Lepidoptera* make their home in ancient woodland; indeed, it would not be unusual for a single oak woodland in the High Weald to harbour in excess of 300 species of moth, including rare species like the UK BAP priority small square-spot moth *Diarsia rubi* (JNCC, 2013c; Woodland Trust, 2013b).

Finally, due in part to their ecological continuity and their relatively stable climatic conditions, ancient woodlands also support a diversity of fungi. Species of fungi that may be encountered in the ancient woodlands of the High Weald include: ghost bolete *Leccinum holopus*, *Inonotus radiatus*, *Tremella foliacea* and *Russula alnetorum* (Sussex Rare Species Inventory, 2013).

5.2 Wet woodland

As noted by Sansum (2013), wet woodland is frequently encountered in High Weald, whether in the form of wetter patches of a larger wood, or as smaller, isolated stands centred on a watercourse, spring or water-filled topographical depression, such as an old marl pit. Indeed, the region’s underlying geology means that junctions between relatively permeable and relatively impermeable strata (i.e. sandstone and clay) are a frequent occurrence on valley slopes, forcing groundwater to the surface and creating flushes (i.e. areas of shallow running water, often over bogs and depressions (Reed and Reed, 2007)) and springs that feed the rivers and streams below.

In the High Weald AONB, wet woodland is usually characterised by alder *Alnus glutinosa*, ash *Fraxinus excelsior* and yellow pimpernel *Lysimachia nemorum* (i.e. National Vegetation Classification community W7), with a ground flora characterised by opposite-leaved golden-saxifrage *Chrysosplenium oppositifolium*, remote sedge *Carex remota*, pendulous sedge

Wet woodland is frequently encountered in the High Weald and is an important habitat for the animals and plants of both woodlands and wetlands

Carex pendula and cardamine *Cardamine amara* (Maddock, 2008; Sansum, 2013; JNCC, 2013b). Smooth-stalked sedge *Carex laevigata* may also be present in these wet woodland plant communities, representing a regionally distinctive species that is not commonly found elsewhere in the south east England (Sansum, 2013).

Another distinct variant of wet woodland may also be found in the High Weald AONB – that characterised by alder *Alnus glutinosa* and greater tussock-sedge *Carex paniculata* (i.e. National Vegetation Classification community W5). This type may be found in waterlogged gill valleys, where localised accumulations of peat occur (Sansum, 2013). Although it appears to be relatively uncommon, it is unclear whether this due to genuine scarcity or to under-recording (Hall, 1997; Sansum, 2013).

Due in part to the scarcity of wet woodland in the post-improvement, post-drainage English landscape (Rackham, 1995; Sansum, 2013), as well as the fact that wet woodland provides habitat for the animals and plants of both woodlands and wetlands, the value of wet woodland for biodiversity is significant. Plants associated with the aforementioned types of wet alder woodlands include trees like birch *Betula* spp. and willow *Salix* spp., ground flora like marsh marigold *Caltha palustris* and marsh fern *Thelypteris palustris* (often a relic of more open wetlands), and shrubs like alder buckthorn *Frangula alnus* – a species associated with ancient woodland and heathland and which appears to have significantly declined since the 19th century (Maddock, 2008; Sansum, 2013; The Wildlife Trusts, 2013f). The high humidity and damp barks also favours the growth of spongy mosses and liverworts (Maddock, 2008; The Wildlife Trusts, 2013f).

Moreover, wet woodlands are often extremely rich in invertebrates, supporting a large number of species, like beetles *Coleoptera*, that are now rare in the UK. Indeed, there are a suit of invertebrates specifically associated with alder, birch and willow, and the combination of dead wood with water provides a specialised habitat not found in many woodlands – for example, the fly *Lipsothrix nigristigma* (classified as a UK BAP species and recorded in the High Weald AONB at Burwash, Beckley and Ardingly (National Biodiversity Network, 2013)) is associated with log jams in streams (Maddock, 2008).

In addition, wet woodland provides vital cover and breeding areas for mammals like the otter *Lutra lutra* which has suffered from the loss of other types of wetland habitat. It may also support numerous bat species, including pipistrelle *Pipistrellus pipistrellus*, brown long-eared *Plecotus auritus* and noctule *Nyctalus noctula* bats (the latter two of which are UK BAP priority species), as well as a variety of birds such as the siskin *Carduelis spinus*, the willow tit *Poecile montanus*, the marsh tit *Poecile palustris*, the lesser-spotted woodpecker *Dendrocopos minor* and lesser redpoll *Carduelis cabaret* (the latter four of which are UK BAP priority species and classified as Red List species under the Birds of Conservation Concern review and as a priority species under the UK BAP (Eaton et al., 2009; JNCC, 2013c; RSPB, 2013)).

The biological significance of these wet woodlands may be further enhanced when they occur on river floodplains. These “floodplain forests”, which in some cases may also be ancient (see the section on ancient woodland, pp.14-17), are of special importance due to their rarity; indeed, recent surveys found that, due to intensive management of the region’s river catchments over the last few 100 years, only small pockets of this valuable habitat remain, with a total of only 1419.1ha of floodplain woodland identified in all major river catchments of Sussex (Cook et al., 2004 p.44; Cook et al., 2005 p.87; Sussex Otters and Rivers Project, 2010) (see Table 4, p.19, for a list of species that may be found in Wealden floodplain woodlands).

Table 4. Species that may be found in Wealden floodplain woodland.

	Latin name	Common name
Canopy	<i>Alnus glutinosa</i>	Alder
	<i>Salix fragilis</i>	Crack willow
	<i>Quercus robur</i>	Oak
	<i>Populus nigra ssp. Betulifolia</i>	Black poplar
	<i>Betula pueescens</i>	Downy birch
	<i>Fraxinus excelsior</i>	Ash
	<i>Salix alba</i>	Salix alba
Understory	<i>Salix cinerea</i>	Grey willow
	<i>Salix viminalis</i>	Osier
	<i>Crataegus monogyna</i>	Hawthorne
	<i>Ulnus glabra</i>	Wych elm
	<i>Sambucus nigra</i>	Elder
	<i>Salix caprea</i>	Goat willow
	<i>Ilex aquilifolium</i>	Holly
	<i>Corylus avellana</i>	Hazel
	<i>Viburnum opulus</i>	Guelder rose
	<i>Prunus spinosa</i>	Blackthorn

Source: Cook et al. (2005 p.44).

Due in part to the ecological dynamism of these habitats (through, for example, the erosion and deposition that constantly occurs adjacent to a river channel), and the ecotonal diversity (i.e. the many transitional zones between different habitats, such as between riverine and woodland habitat, riparian and meadow, and wetland and woodland), floodplain woodlands often support a number of species of conservation interest. These include flora like black poplar *Populus nigra ssp. betulifolia* (the most uncommon timer tree in Britain and listed as Rare under section 13 of the Wildlife and Countryside Act, 1981), water avens *Geum rivale*, marsh dock *Rumex palustris*, tufted *Carex elata*, elongated *Carex elongate* and fox sedges *Carex vulpina*; mammals like barbastelle bat *Barbastella barbastellus*, otter *Lutra lutra*, water vole *Arvicola amphibius* (all of which are classified as UK BAP priority species); and numerous Red Data Book invertebrates including moths *Lepidoptera*, craneflies *Tipulidae* and beetles *Coleoptera* (Cook et al., 2004; Cook et al., 2005).

Finally, it is worth nothing that management of these wet woodlands by people may have been essential to their continued existence – and, by extension, the continued existence of the biodiversity that they support (Maddock, 2008; The Wildlife Trusts, 2013f). Indeed, many alder woods are ancient and have a long history of coppice management which has determined their structure, and in some situations it appears that this practice has maintained alder as the dominant species and impeded succession to drier woodland communities. Consequently, any local industries or crafts that have contributed to the management of these wet woodlands (such as the

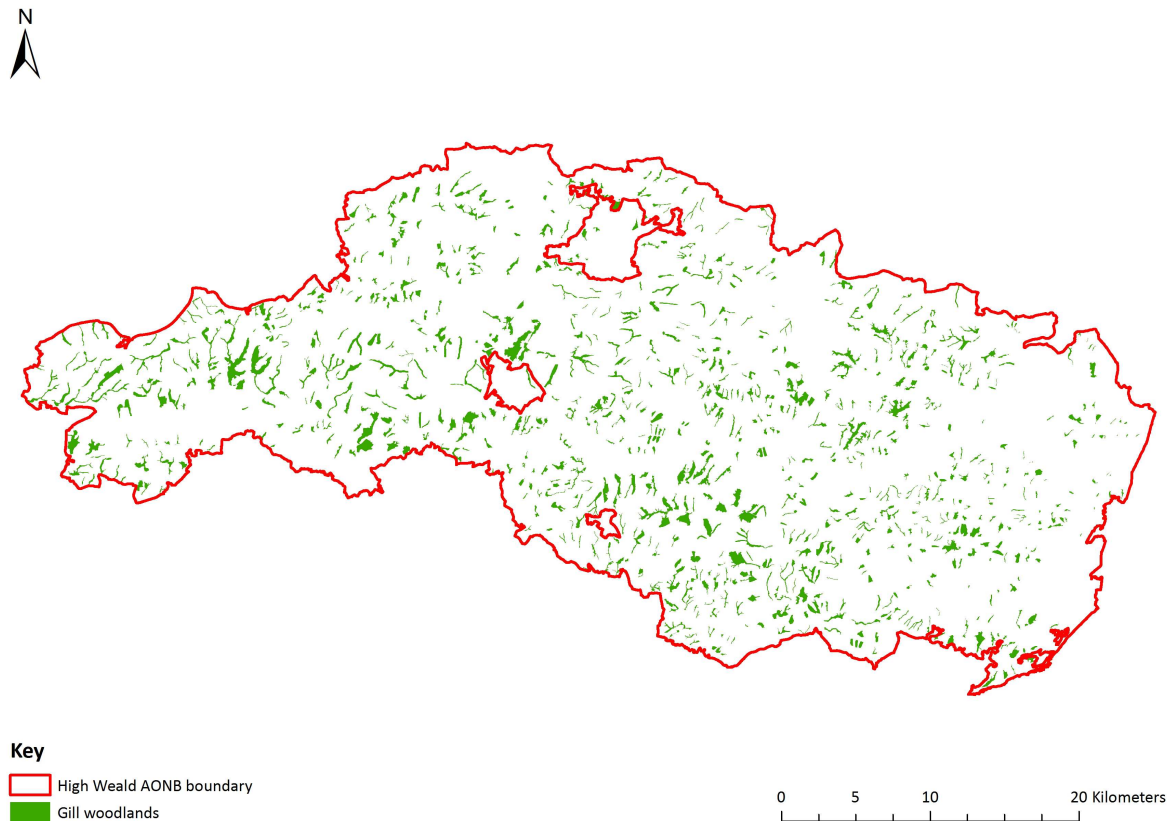
management of willow for weaving and cricket bat manufacture) may play a key role in the conservation of their biodiversity.

5.3 Gills

Often encompassed within larger parcels of ancient woodland, gills are defined as deeply incised, usually wooded ravines that have been eroded by the streams flowing along their base (Rose and Patmore, 1997). They are characteristic features of the region's landscape, with Rose and Patmore (1997) estimating that there are upwards of 1,000 gill-like features in the High Weald (see Figure 7, below, for a map displaying the extent of gill woodlands in the High Weald AONB).

“They support a community of plants, vascular and non-vascular, not found all together anywhere else in Europe nor probably the world”
– Rose and Patmore (1997 p.3)

Figure 7. The extent of gill woodlands in the High Weald AONB.



Data sources: Dr Francis Rose's gill woodland data (digitised by Sussex Biodiversity Records Centre) and Natural England's AONBs (England) boundary data.

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Crucially, from a conservation perspective, many gill woodlands are species-rich and support a number of rarities. Indeed, gills are known to support nationally and internationally important assemblages of plants, particularly lichens, mosses, liverworts and ferns (Rose and Patmore, 1997; Burnside et al., 2006; Sansum, 2013). As Rose and Patmore (1997 p.3) state: “they [gills] support a community of plants, vascular and non-vascular, not found all together anywhere else in Europe nor probably the world”.

Species of vascular plants that may be found in the gills of the High Weald AONB include: hay-scented buckler fern *Dryopteris aemula*, Tunbridge filmy-fern *Hymenophyllum tunbrigense*, ivy-leaved bellflower *Wahlenbergia hederacea*, round-leaved crowfoot *Ranunculus omiophyllus*, coralroot *Cardamine bulbifera*, wood fescue *Festuca altissima* and spiked rampion *Phyteuma spicatum* – a species which, in the United Kingdom, is endemic to East Sussex (with many of these sites occurring within the boundary of the High Weald AONB), as well as being deemed Nationally Rare, listed as Endangered on the Vascular Plant Red List for Great Britain, considered a Species of Principle Importance under the Natural Environment and Rural Communities Act 2006, covered by Schedule 8 of the Wildlife & Countryside Act (1981), and classified as a priority species under the UK Biodiversity Action Plan (Rose and Patmore, 1997; Rich and Rumsey, 2004; Cheffings and Farrell, 2005; Rumsey et al., 2011; Plantlife, n.d.).

Species of non-vascular plants include: common smoothcap *Atrichum undulatum*, Creeping Feather-moss *Amblystegium serpens*, Rounded Pygmy-moss *Acaulon muticum*, anomodon moss *Anomodon viticulosus*, Zygodon Moss *Zygodon conoideus*, Freiberg's screw-moss *Tortula freibergii*, lesser notchwort *Lophozia bicrenata*, whorled tufa-moss *Eucladium verticillatum*, wood fingerwort *Kurzia sylvatica* and river pocket-moss *Fissidens rivularis* (for a more complete list of plant species associated with the gills of the High Weald, see Appendix F, pp.107-112).

Biodiversity Box 2

Gill example 1: Fairlight Glen

Fairlight Glen is a narrow, heavily shaded coastal gill in the far south eastern part of the High Weald AONB. Long-studied for its rare assemblages of bryophytes, Fairlight Glen illustrates the significant biodiversity value of High Wealden gills. The following species information – derived from a 2012 species survey by Joyce Pitt and Jan Hendy – provides a flavour of the range of flora that may be found in Fairlight Glen:

- The steep sides of the gill are heavily wooded with broadleaved species, including pedunculate/English oak *Quercus robur*, holly *Ilex aquifolium*, hazel *Corylus avellana*, birch *Betula* sp. and alder *Alnus glutinosa*
- Due to its steeply incised and sheltered nature, the gill maintains a humid and cool microclimate with a number of vertical exposures of sandstone. These features, characteristic of many gills in the High Weald, create an environment well-suited to a range of lower plant species
- Notably, the gill at Fairlight Glen supports a collection of important and rare bryophytes, including river-pocket moss *Fissidens rivularis*, Dumortier's liverwort *Dumortiera hirsuta* (which, in all of lowland England, only occurs at this site) and Freiberg's screw-moss *Tortula freibergii* – the latter two of which are UK BAP priority species (JNCC, 2013b)

Information from Pitt and Hendy (2012 pp.17-21).

In addition to these internationally significant plant assemblages, it is possible some of the gills found in the High Weald represent relict fragments of primary woodland – i.e. remains of the woodland that colonised Britain in the mid-Holocene, after the end of the last glacial period (Rose and Patmore, 1997; Burnside et al., 2006; Sansum, 2013). This possibility is supported by the presence of now regionally scarce species, such as small-leaved lime *Tilia cordata*, (Sansum and Ryland, 2013), that were once common in woodlands of the region, as well as plant assemblages indicative of an “oceanic”, or “Atlantic” climate (a climate type now restricted to the wetter, western parts of the British Isles) (Rose and Patmore, 1997). Indeed, the cool and damp microclimatic conditions that are characteristic of gill woodlands and that act to buffer the species they contain from their surroundings, could be the key to explaining how these apparently relict species assemblages have survived several thousand years of environmental change.

*“Wealden gills (of which the majority are in the High Weald AONB) are of national, and probably international, importance for their biodiversity”
– Sansum (2013 p.8)*

The potentially prehistoric ecological nature of gills is not only important in terms of the vegetation that they support, but also in terms of associated animal species. Indeed, Burnside et al. (2006) suggest that due to the rich plant assemblages supported by gills, there are likely to be generally high levels of associated biodiversity – particularly in terms of invertebrate species. Tantalising clues to a rich gill invertebrate fauna are provided by evidence like the presence of the rare beetle *Hydraena pygmaea* in a gill stream at Fairlight Glen, and the discovery in Wealden gills of a mollusc fauna (including the English chrysalis snail (*Leiostryla anglica*)) indicative of an oceanic, or Atlantic, climate (Rose and Patmore, 1997). Moreover, it seems likely that many of these associated invertebrate species are relatively scarce and of conservation concern. This may be due to the fact that, like gill flora, they have been insulated from wider environmental changes by the relatively stable climatic conditions found in these ravines over the past several thousand years (Rose and Patmore, 1997; Woodland Trust, 2000; Burnside et al., 2006).

Biodiversity Box 3

Gill example 2: Combwell Wood

Located in the north central part of the High Weald AONB, Combwell Wood is an ancient wood on Tunbridge Wells Sandstone, with deep-stream valleys (gills) in which peat has accumulated. Much of the site has traditionally been managed as coppice, but undisturbed woodland cover has probably persisted continuously along the steep sided gills, maintaining the moist mild climate suitable for the 'Atlantic' bryophytes. The wood has a large number of plants that are typical of south-eastern ancient woodlands, these being particularly associated with the gills and the open rides. The following species information provides an overview of this gill's significant biodiversity value:

- The coppiced part of the wood contains much sweet chestnut *Castanea sativa* with both silver and hairy birch *Betula pendula* and *B. pubescens*, and scattered oak *Quercus robur* standards. The ground flora contains much bramble *Rubus fruticosus* and bracken *Pteridium aquilinum*, but it is on the rides and open glades that particularly diverse plant communities occur. Here heather *Calluna vulgaris* is abundant, with several species that are scarce in Kent* such as saw-wort *Serratula tinctoria*, allseed *Radiola linoides*, lesser centaury *Centaurium pulchellum* and the Nationally Rare (i.e. a species recorded from 15 or less 10km squares in Britain) moss *Atrichum angustatum*
- The epiphytic lichen flora is also very rich, with a range of species characteristic of ancient woodland, such as *Thelotrema lepachinum* and the Nationally Scarce (i.e. a species that is recorded in only 16 to 100 ten km squares in Britain) *Cyphelium sessile*. In the gills, and other wet flushes alder *Alnus glutinosa* is frequent, over lady fern *Athyrium filix femina*, opposite-leaved golden-saxifrage *Chrysosplenium oppositifolium* and the bog-moss *Sphagnum palustre*. The moist mild micro-climate of the gills is suitable for several 'Atlantic' bryophytes that are most frequently found in Western Britain, and are rare in the South-east of England, such as the mosses *Hookeria lucens* and *Hyocomium armoricum*.
- In the flushes and shaded woodland pools there are two Nationally Scarce species of water beetle, *Agabus chalconatus* and *Hydroporus neglectus*, as well as several others that are local in distribution

(Information from the Ashdown Forest SSSI citation, available from:
http://www.sssi.naturalengland.org.uk/special/sssi/sssi_details.cfm?sssi_id=1003507).

Despite the great potential of gills to support a range of rare invertebrate and other species, gill woodlands remain little studied and knowledge of their biodiversity incomplete (Rose and Patmore, 1997; Burnside et al., 2006; Sansum 2013). Nevertheless, it is clear gills are of national – and likely international – importance for biodiversity, and as we discover more about these unusual ecosystems, it seems likely that our appreciation of their importance will only increase.

5.4 Sandstone outcrops

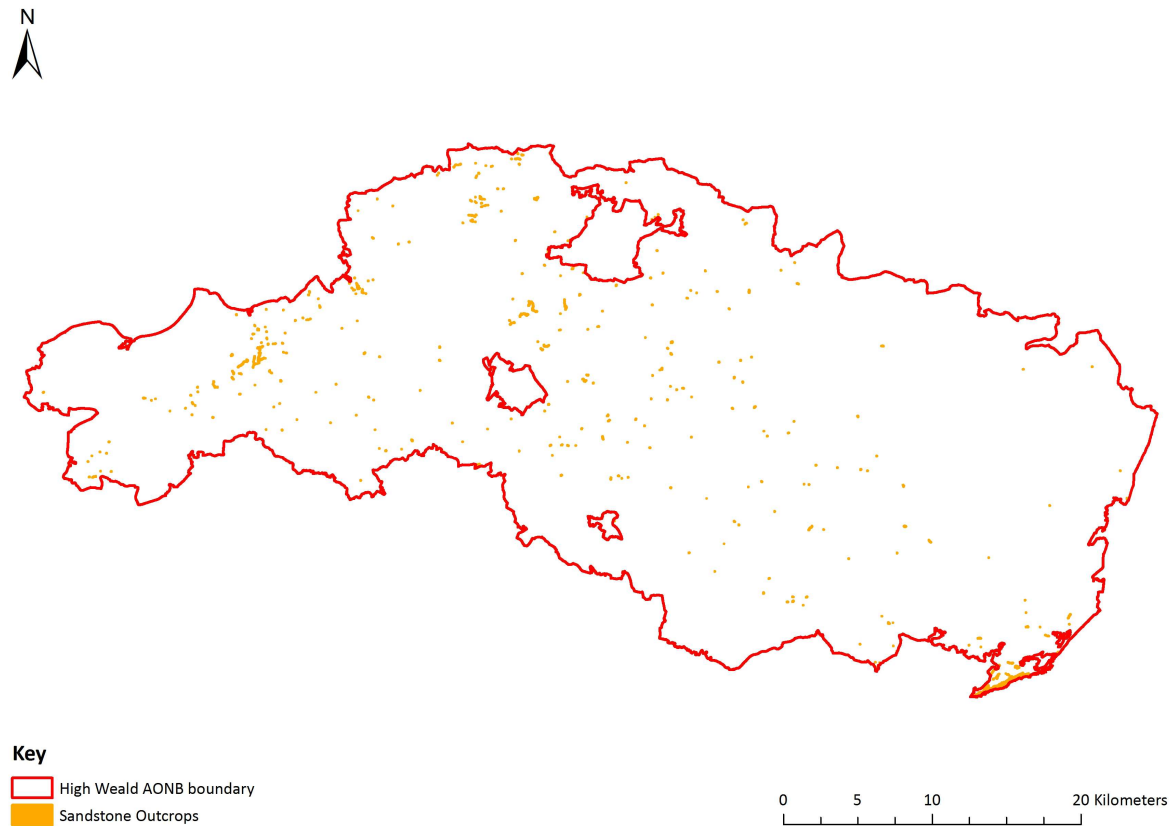
Sandstone outcrops are geological features that occur anywhere in High Weald where Ardingly Sandstone, or occasionally Ashdown Sandstone (both of which are massive, cross-bedded sandstones that are highly porous, poorly cemented and very friable (Williams, 1997; Rich and Rumsey, 2004)), are exposed on the land's surface. Often associated with

Sandstone outcrops are a characteristic geological feature of the High Weald and are considered to be of significant biodiversity value

gills, where their streams have eroded the valley sides exposing the underlying bedrock (although they may also occur along the banks of a road cutting or at an isolated rock exposure), sandstone outcrops are a characteristic geological feature of the High Weald, with 671 such exposures occurring across the AONB. Figure 8, p.26, displays the extent of sandstone outcrops across the High Weald AONB.

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Figure 8. The extent of sandstone outcrops in the High Weald AONB.



Data sources: Sandstone outcrop data (derived by the High Weald AONB Unit from Ordnance Survey basemaps), and Natural England's AONBs (England) boundary data.

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NB: the size of the points representing the sandstone outcrops have been increased in order to make them more easily visible at this scale.

Many of these sandrock outcrops are considered to be of significant value for biodiversity (Childs, 2012). See, for example, Biodiversity Box 4, below, which describes the diversity of plant species that may be encountered at Harrison's Rocks, an outcrop of Tunbridge Wells Sandstone just south of the village of Groombridge.

Biodiversity Box 4

Sandstone outcrop example 1: Harrison's Rocks

Located in the north central part of the High Weald AONB, Harrison's Rocks comprise a west-facing outcrop of Tunbridge Wells Sandstone about 0.5km in length. The exposed faces of this sandstone outcrop are extremely popular with climbers and there are estimated to be as many as 380 routes to explore (The British Mountaineering Council, 2013). The rocks provide a valuable habitat for a range of bryophyte species and the following information provides an overview of the biodiversity that this site supports:

- Despite fairly heavy usage by climbers, the rocks represent a classic site for bryophytes. The abundant clefts and gullies provide a range of habitat niches, ranging from sheltered wet nooks with plenty of water seepage, to drier more exposed faces
- The generally drier, more exposed northern end of the outcrop supports large mounds of great wood-rush *Luzula sylvatica* and patches of pore lichen *Pertusaria amara*, egg-yolk lichen *Candelriella Vitellina* and parelle *Ochrolechia parella*
- The wetter, southern end of the rocks harbour populations of vielwort *Pallavicinia lyellii* (a Nationally Scarce liverwort listed as a UK BAP priority species (Turner and Plantlife International, 2007; JNCC, 2013b)) and the uncommon matchstick flapwort *Odontoschisma denudatum*. It is notable that the High Weald represents vielwort's main stronghold in Britain, with more records for this species coming from East Sussex than any other vice-county, and Harrison's Rocks its most stable population, with the species maintaining a healthy population since it was first recorded there over 150 years ago
- Birch *Betula* sp. and sessile oak *Quercus petraea* shade the majority of the site, and bracken *Pteridium aquilinum* and bramble *Rubus fruticosus* agg. are present along the base of the rocks

Information from Pitt and Hendy (2012 pp.29-35).

The biodiversity value of sandstone outcrops comes primarily from their small-scale structural heterogeneity. Indeed, a single sandstone outcrop usually includes vertical walls, ledges, crevices, caves, cracks, overhangs and gullies – all of which create a multitude of microhabitats due to differences in exposure to light, differences in the amount of shelter that is provided from the wind, the different substrates that are available, and the varying degree of humidity and wetness on different parts of the sandstone exposure (Thiel and Spribille, 2007; Childs, 2012). It is this diversity of ecological niches that enable the High Weald's sandstone outcrops to support a range of specialist species (a fact that is supported by evidence from other countries, such as the sandstone outcrops in the Lower Saxony region of Germany (Thiel and Spribille, 2007) and the rockhouses of the eastern United States (Farrar, 1998)). Indeed, High Wealden sandstone outcrops have been found to support an impressive diversity of non-vascular, including UK BAP priority species like Dumortier's liverwort *Dumortiera hirsuta* and veilwort *Pallavicinia lyellii* (Childs, 2012; Pitt and Hendy, 2012; JNCC, 2013c), as well vascular plants like Tunbridge filmy-fern *Hymenophyllum tunbrigense*, which received its name after being recorded for the first time in 1686 at High Rocks, Tunbridge Wells in the High Weald (Rich and Rumsey, 2004).

Moreover, the fact that High Wealden sandstone outcrops often occur in woodlands, and particularly in gills, means the boundaries between ancient woodland, gill and sandstone outcrop habitats are often blurred, and the species associated with each can occur together, significantly enhancing the species richness of a particular location (see, for example, Biodiversity Box 5, p.29).

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Biodiversity Box 5

Sandstone example 2: Wakehurst and Chiddingly Woods

Located in the western part of the High Weald AONB, Wakehurst and Chiddingly Woods contains extensive exposures of sandstone, a nationally rare habitat, which are of biological and geological importance. This site has the richest sandstone community in the country, supporting a unique flora. It is also the locality of an uncommon cranefly and has a diverse breeding community of woodland birds.

- The wooded gills have been formed by streams cutting through formations of Wadhurst clay and Lower Tunbridge Wells sands, leaving exposed outcrops of sandstone in the valleys. The warm, moist micro-climate allows plants to flourish which are more typically restricted to the west of the country. The streams have been dammed to form a series of ponds with marginal vegetation which contribute to the value of the site for birds
- Much of the woodland is semi-natural, but in some areas conifers and rhododendron have been planted. The sandstone outcrops in Wakehurst and Chiddingly Woods support rich communities of ferns, bryophytes (mosses and liverworts) and lichens. These are a remnant of a Western 'Atlantic' plant community which was once far more widespread in distribution. They include uncommon plants such as the Tunbridge filmy fern *Hymenophyllum tunbrigense*, bryophytes such as *Dicranum scottianum*, *Orthodontium gracile*, *Tetradontium brownianum*, *Scapania gracilis* and *Blepharostoma trichophyllum*, and some lichens of county importance
- Several types of woodland are present. On the higher slopes woodland of oak *Quercus robur* standards and hazel *Corylus avellana* coppice grade into more varied oak wood with birch *Betula* spp., yew *Taxus baccata*, holly *Ilex aquifolium* and some beech *Fagus sylvatica*. Ash *Fraxinus excelsior* is frequent in some areas and alder *Alnus glutinosa* occupies the springlines in the vallebottoms. Bracken *Pteridium aquilinum*, bilberry *Vaccinium myrtillus* and honeysuckle *Lonicera periclymenum* dominate the ground flora on the higher slopes; on the clays bramble *Rubus fruticosus* is prevalent, while flush communities which include opposite-leaved golden-saxifrage *Chrysosplenium oppositifolium* occur with the alder. Several species which are uncommon in Sussex are present here, including hay-scented fern *Dryopteris aemula*, ivy-leaved bellflower *Wahlenbergia hederacea* and green hellebore *Helleborus viridis*
- The woodlands support a diverse community of breeding birds, including all three British species of woodpecker (the green woodpecker *Picus viridis*, the great spotted woodpecker *Dendrocopos major* and the Red List lesser spotted woodpecker *Dendrocopos minor*), the Amber List grey wagtail *Motacilla cinerea* and the Red List tree pipit *Anthus trivialis*. At least fifty species are known to breed in Wakehurst Woods and its associated lakes, among them great crested grebe *Podiceps cristatus* and tufted duck *Aythya fuligula* – classified as an Amber List species under the Birds of Conservation Concern review) (Eaton et al., 2009; RSPB, 2012)
- The rare cranefly *Erioptera nigripalpis* has been recorded at the site, as well as several uncommon beetles. The alder carr supports a diverse snail population, includes *Spermod lamellata*, *Leiostryla anglica* and *Acicula fusca*, all uncommon species with an "Atlantic" distribution
- Chiddingly Wood is also an important geomorphological locality for sandstone weathering features developed on some of the tallest and most impressively sculptured sandstone cliffs in the central Weald. Cambering (deformation) on a large scale has produced a complex system of gulls, (tension cracks) and the cliffs are deeply undercut at their base by rock shelters and small caves. Great-upon-Little is now an isolated 400-500 tonne block standing on a narrow pedestal that has been undercut on all sides. The cliffs are particularly distinguished by a wealth of micro-weathering features, such as honeycombing and polygonal cracking of the surface. No other sandstone cliffs in the central Weald exhibit such a comprehensive suite of weathering features. Deposits of sand and angular blocks of sandstone at the base of the cliffs probably accumulated under periglacial conditions during the Pleistocene and are the best examples of their type in the central Weald. The importance of Chiddingly Wood is further emphasised by the large number of geologists and geomorphologists who have studied the weathering phenomena and morphological characteristics of the cliffs

(Information from the Wakehurst and Chiddingly Woods SSSI citation, available from: http://www.sssi.naturalengland.org.uk/citation/citation_photo/1001409.pdf).

Although, like gills, the biodiversity value of sandstone outcrops remains understudied, it is clear that they make a significant contribution to the biodiversity of the High Weald AONB – particularly in terms of the rarity of the species, and species assemblages, that they support.

5.5 Historic routeways

Identified as one of the five key character components of the High Weald AONB's landscape (High Weald AONB Joint Advisory Committee, 2014), historic, or ancient, routeways (ancient in the sense of Rackham's (1995) definition of "ancient countryside", which describes landscapes and landscape features with their origin before 1700 A.D.) are likely of particular significance for biodiversity in the region.

Firstly, historic routeways provide an important array of habitats. This habitat diversity is particularly apparent where historic routeways are sunken. Thought to have been formed either by traffic – in the form of people, horse-drawn vehicles and livestock – eroding and lowering the routeway's surface relative to the surrounding land (which once begun was likely exacerbated by a range of natural erosive processes, such as rill and gully erosion following rainfall events), and/or by historical embanking along either side of a route (Harris, 2003), these sunken tracks are often lined with trees and shrubs, creating sinuous strips of woodland habitat (Rackham, 1995; Sansum, 2013). Indeed, Deckers et al. (2005) report that, rather than acting as sinks in which woodland plant populations are only maintained through recurrent immigration from larger tracts of woodland, sunken roads in Belgium support long-lived and diverse communities of many of the species usually associated with woodland interiors – a finding that they attribute to the buffered, temperate and generally more woodland-like microclimate that sunken routeways typically possess.

Moreover, by increasing the area and complexity of the landsurface, sunken historic routeways often harbour a mosaic of habitat types (Sansum, 2013). Due to the complex mixture of substrates, aspects, moisture levels, shade and sun exposure, patches of heathland, unimproved grassland and ancient semi-natural woodland may all be found along relatively short stretches of historic routeway (Sansum, 2013). This small-scale habitat diversity can promote rich associated faunas, particularly amongst invertebrates (Patrick Roper, 16th May 2011, pers. comm.).

Patches of heathland and unimproved grassland – in addition to ancient semi-natural woodland vegetation – may all be found along relatively short stretches of routeway

Moreover, sandstone exposures may be present along certain stretches of historic routeway, potentially adding diverse assemblages of specialist flora and fauna (Kubalikova, 2011; Sansum, 2013). Thus, the small-scale habitat heterogeneity associated with historic routeways (particularly those that are sunken) significantly enhances their importance for a wide range of species.

Biodiversity Box 6

Ancient routeways and their importance for biodiversity

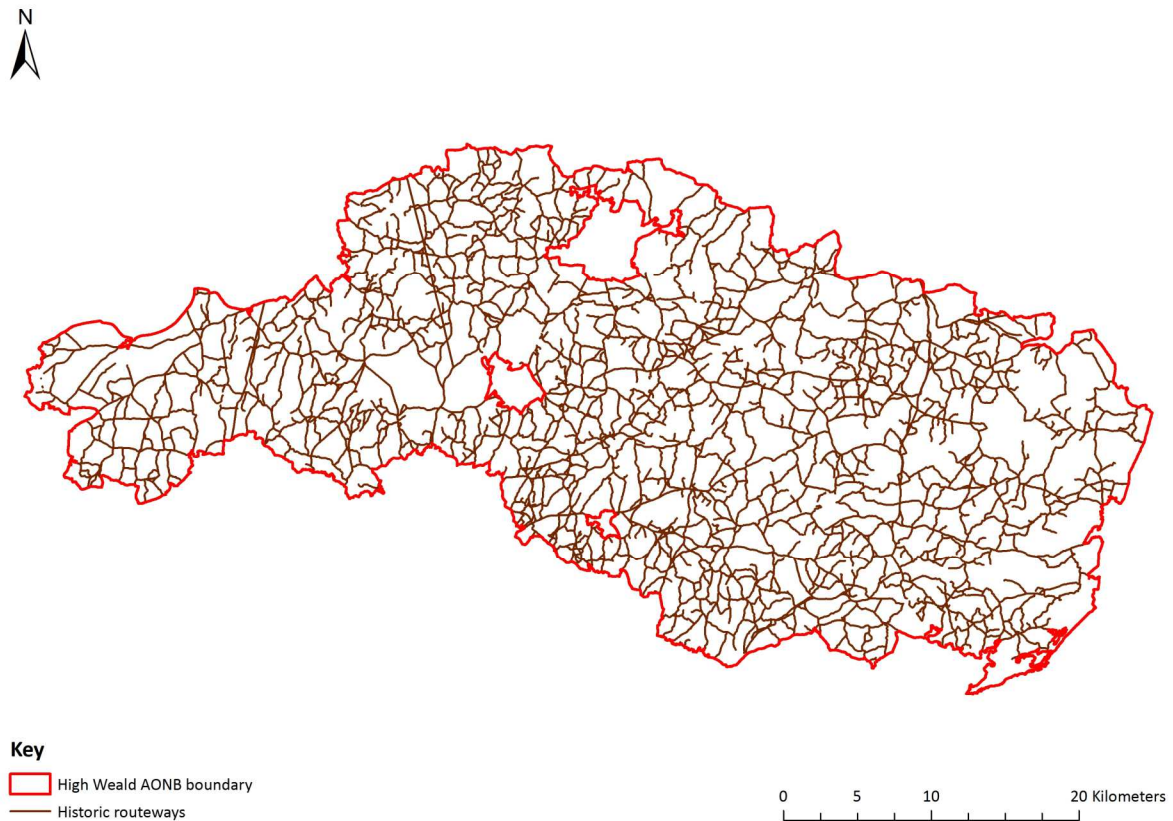
Due to the fact that routeways have not traditionally been considered as natural features in their own right (with the variety of habitats that they support typically being treated as the relevant unit of biological interest), there are no detailed species or habitat surveys of routeways on which to draw. However, due to their density, linear nature and complex composite habitat structure, their biodiversity value is likely to be significant.

- Trees along the banks and boundaries of ancient routeways may include broadleaved species such as: pedunculate/English oak *Quercus robur*, holly *Ilex aquifolium*, hazel *Corylus avellana* birch *Betula* sp. and alder *Alnus glutinosa*
- Ancient woodland indicator species, like bluebell *Hyacinthoides non-scripta*, wood anemone *Anemone nemorosa* and primrose *Primula vulgaris*, and potentially even the rare spiked rampion *Phyteuma spicatum*, may also be present along the edges and banks of ancient routeways. Heathland species, like common heather/ling *Calluna vulgaris*, grasses such as cock's-foot *Dactylis glomerata* and Yorkshire fog *Holcus lanatus*, as well as sandrock-associated plants, like veilwort *Pallavicinia lyellii* and the UK BAP priority Dumortier's liverwort *Dumortiera hirsute*, could also occur along a stretch of routeway given the right conditions
- In terms of the fauna associated with ancient routeways, they will likely reflect the diversity of habitats present. So, for example, a wooded ancient routeway may provide foraging and nesting sites for woodland birds, such as wrens *Troglodytes troglodytes*, robins *Erithacus rubecula* and woodpeckers (green *Picus viridis*, great spotted *Dendrocopos major* and the Red Listed lesser spotted *Dendrocopos minor*), as well as roosting sites for tree dwelling bats, like the UK BAP priority noctule *Nyctalus noctula*
- A hedge-lined routeway may provide shelter for a range of small mammals, such as the UK BAP priority hedgehog *Erinaceus europaeus*, habitat corridors for herpatiles like the UK BAP grass snake *Natrix natrix* and great crested newt *Triturus cristatus*, and breeding and foraging sites for butterflies like the brown hairstreak *Thecla betulae* (a UK BAP priority species), the holly blue *Celastrina argiolus* and the gatekeeper *Pyronia tithonus*.
- A routeway harbouring veteran trees may provide niches for both epiphytic and saproxylic species, such as the UK BAP priority stag beetle *Lucanus cervus* and the orange-fruited elm lichen *Caloplaca luteoalba*
- Routeways with exposed sandrock might potentially support rare non-vascular and vascular plants, including the UK BAP priority Dumortier's liverwort *Dumortiera hirsuta* and the regionally scarce hay-scented buckler fern *Dryopteris aemula*
- Finally, patches of heath and unimproved grassland along the banks of a routeway will likely support a rich array of associated invertebrates, including bumblebees, butterflies, grasshoppers, crickets, moths, spiders, dragonflies and ground beetles.

NB: it is important to note that our understanding of the biodiversity importance of ancient routeways remains relatively incomplete. Their true value – as both repositories of biological diversity and as corridors for species movement – is likely to be much greater than is currently appreciated.

Secondly, historic routeways likely play a critical role as corridors for biodiversity, facilitating foraging and dispersal – among other things – and thus helping to enhance ecological connectivity of the High Weald at a landscape-scale (Deckers et al., 2005; Sansum, 2013). Indeed, as Sansum (2013 p.13) suggests, by linking together many of the High Weald's numerous small-scale woodlands, historic routeways may help to "effectively decrease the degree of isolation of woods by allowing more organisms to use the 'fragmented' woodland resource as though it were a continuous piece of habitat." Indeed, Figure 9, p.32, provides a graphic illustration of how the High Weald's historic routeways stitch together the landscape due to their sheer density and interconnectedness.

Figure 9. The extent of historic routeways within the High Weald AONB.



Data sources: Historic routeways data (derived by the High Weald AONB Unit from Ordnance Survey basemaps), and Natural England's AONBs (England) boundary data.

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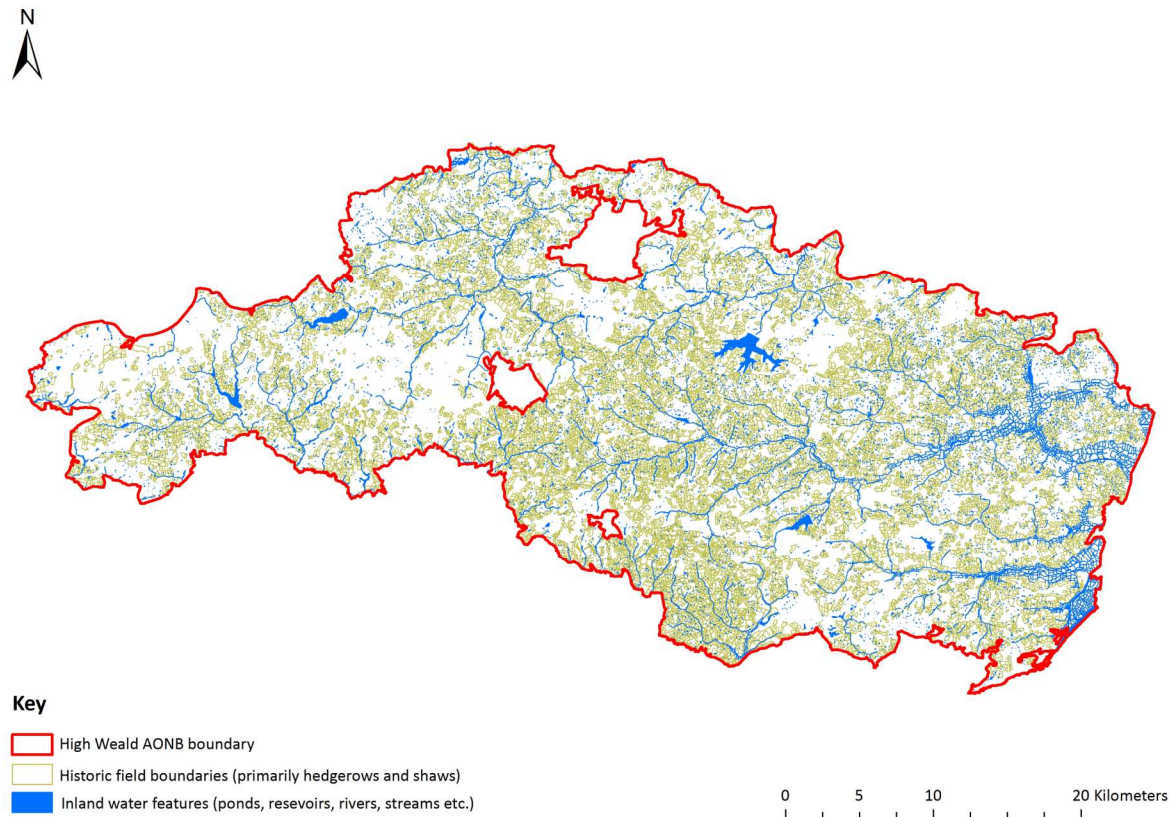
In light of the fact that sunken historic routeways appear to provide suitable environmental conditions for a significant proportion of woodland plants, as well as the uncertainty regarding the ability of other linear woody features, like hedgerows, to act as corridors for woodland biodiversity (see, for example, McCollin et al., 2000 and Barr, n.d.), the historic routeways of the High Weald AONB could prove critical for the overall ecological connectivity and resilience of the landscape, and, consequently, the future persistence of a range of species in the face of future environmental change (Sansum, 2013).

Despite the likely central importance of historic routeways for a range of species in the High Weald, they remain understudied and their true value poorly understood. However, given that they likely play a critical role in enhancing landscape-scale connectivity and thus bolstering the resilience of biodiversity in the High Weald to future environmental change, future research on these intriguing features must be a high priority.

5.6 Hedgerows & shaws

Defined by the UK Biodiversity Action Plan as any boundary line of trees or shrubs over 20m long and less than 5m wide, and where any gaps between the trees or shrubs are less than 20m wide (Bickmore, 2002; Maddock, 2008), hedgerows form an important component of the High Weald AONB's landscape, bounding the region's many small, irregularly-shaped fields and helping to define the its medieval character (Harris, 2003; Rennells, 1998; High Weald AONB Joint Advisory Committee, 2014). Figure 10, p.34, displays the spatial extent of mapped field boundaries (which are primarily composed of a combination of hedgerows and shaws) across the High Weald AONB.

Figure 10. The extent of historic field boundaries (primarily hedgerows and shaws) extant within the present-day landscape of the High Weald AONB.



Data sources: The High Weald AONB Unit's Water Features and Historic Field Boundary data (derived from OS MasterMap), and Natural England's AONBs (England) boundary data.

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NB: The historic field boundaries mapped above constitute those field boundaries present on OS Master Map which could be traced back, via historic map regression, to Ordnance Survey's Epoch 1 County Series (surveyed between c.1843 and 1893). Areas without mapped historic field boundaries do not necessarily lack such features and the data displayed above should be treated as indicative only. It should also be noted that the Water Feature layer has been added to the map in order to help highlight field boundaries comprised of ditches and watercourses, rather than hedges and shaws. Although hedges and shaws constitute the majority of mapped field boundaries, there is a danger of confusion in certain areas – for example, in the south eastern part of the High Weald AONB, where the lower reaches of the Rother, Brede and Tillingham Rivers form part of an artificially drained landscape criss-crossed with drainage ditches. The addition of the Water Feature layer should help with this distinction.

Due to the fact that the landscape of the High Weald AONB is essentially medieval in origin (Harris, 2003), it is likely that many of the region's hedges pre-date the period of hedgerow planting – which usually resulted in the creation of straight, uniform hedges composed only of hawthorn *Crataegus monogyna* – that accompanied the 18th and 19th century parliamentary enclosures (only 1% of the Weald's total area was effected by the Enclosure Acts (Gonner, 1912; Hoskins, 1965; Challis 2008)) (Buglife, 2013a). An important consequence of this is that a significant proportion of the region's hedgerows are likely to be ancient (i.e. have existed since before 1700 and the advent of the "Planned Countryside" brought about by the Enclosure Acts (Rackham, 1995)) and species-rich (i.e. contain five or more native woody species on average in a 30 metre length (UK Biodiversity Steering Group, 1995; Buglife, 2013a)).

A significant proportion of the High Weald's hedgerows are likely to be ancient and species-rich

Indeed, species surveys conducted as part of the Sussex Hedgerow Project suggest that 55% of the High Weald's estimated 4,884km of hedgerow are likely to be species rich, compared to just 46% in England and Wales as a whole (Challis, 2008; Haines-Young et al., 2000). Table 5, below, illustrates the variety of woody shrub and tree species which can be found in the hedges of the High Weald.

Table 5. Woody shrub and tree species associated with hedgerows in the High Weald.

Latin name	Common name	Latin name (cont.)	Common name (cont.)
<i>Acer campestre</i>	Field maple	<i>Ligustrum</i>	Wild privet
<i>Acer pseudoplatanus</i>	Sycamore	<i>Populus alba</i>	White poplar
<i>Alnus glutinosa</i>	Alder	<i>Prunus avium</i>	Wild cherry
<i>Betula pendula</i>	Silver birch	<i>Prunus spinosa</i>	Blackthorn
<i>Betula pubescens</i>	Downy/white birch	<i>Quercus robur</i>	Pedunculate/English oak
<i>Carpinus betulus</i>	Hornbeam	<i>Rosa</i> spp.	Rose
<i>Castanea sativa</i>	Sweet chestnut	<i>Salix</i> spp.	Willow
<i>Corus sanguinea</i>	Dogwood	<i>Sambucus nigra</i>	Elder
<i>Corylus avellana</i>	Hazel	<i>Sorbus aucuparia</i>	Rowan
<i>Crataegus monogyna</i>	Hawthorne	<i>Taxus baccata</i>	Yew
<i>Cytisus scoparius</i>	Broom	<i>Tilia cordata</i>	Small-leaved lime
<i>Eunymus Europaeus</i>	Spindle	<i>Ulex europaeus</i>	Gorse
<i>Fagus sylvatica</i>	Beech	<i>Ulmus</i> spp.	Elm
<i>Fraxinus excelsior</i>	Ash	<i>Viburnum lantana</i>	Wayfaring-tree
<i>Ilex aquifolium</i>	Holly	<i>Viburnum opulus</i>	Guelder-rose

Source: Challis (2008, p.10).

In addition to the plant species that compose the body of the hedge itself, a range of other species are associated with hedgerow habitats. Indeed, as many as 130 hedgerow-associated are listed as priorities on the UK BAP, including 10 threatened lichens, 72 invertebrates, 5 reptiles and amphibians, 20 birds and 11 mammals (Wolton, 2009). For a full list of the UK BAP species identified as being “significantly associated” with hedgerows, see Appendix G, pp.113-117 (Wolton, 2009).

In terms of the biodiversity found at the base of hedgerows, they can support a range of herbaceous plants. These can include: primrose *Primula vulgaris*, ground ivy *Glechoma hederacea*, hemlock *Conium maculatum*, common nettle *Urtica dioica* and bluebell *Hyacinthoides non-scripta*, as well as the grasses cock’s-foot *Dactylis glomerata*, Yorkshire fog *Holcus lanatus*, common bent *Agrostis capillaris* and the fescues *Festuca* spp.

Moreover, hedges also help to support a variety of fauna (Barr et al., n.d.; Wolton, 2009; Hedgelink, 2013). For mammals, like hedgehogs *Erinaceus europaeus* (a UK BAP priority species), shrews (common *Sorex araneus* and pygmy *Sorex minutus*), voles (bank *Clethrionomys glareolus* and the field *Microtus agrestis*) and mice (including wood mice *Apodemus sylvaticus*, yellow-necked mice *Apodemus flavicollis* and harvest mice *Micromys minutus*, a UK BAP priority species), hedges provide valuable food sources, boosting the populations of invertebrates and providing a range of fruits, seeds and vegetation on which they can feed (Packer, n.d.; Hedgelink, 2013). Hedges also provide important breeding habitat and shelter. Indeed, hedgerows may be just as valuable a habitat as woodland for some species, with Bright and MacPherson (2002) finding that hedgerow-dwelling populations the UK BAP priority dormouse *Muscardinus avellanarius* can occur in densities comparable to those found within woodlands. Hedgerows are also used during the day by brown hares *Lepus europaeus* – a UK BAP priority species – for shelter (Packer, n.d.).

Invertebrates, birds and amphibians also benefit from the food and shelter hedges provide (Hedgelink, 2013). Indeed, hedges supply food, shelter and breeding sites for pollinators, such as bees, and for pest predators such as scorpion flies *Panorpa communis*. Stag beetles *Lucanus cervus* may also be found among decaying stumps at the base of a hedge. In addition, more than 20 of the butterfly species found in lowland Britain breed in hedgerows, including the brown hairstreak butterfly *Thecla betulae* (a UK BAP priority species), which lays its eggs on blackthorn, the holly blue *Celastrina argiolus*, whose caterpillars will only be found in hedges containing holly or ivy, and the gatekeeper *Pyronia tithonus* – also known as the hedge brown (Corbett and Mole, n.d.). The UK BAP pearl-bordered fritillary *Boloria euphrasyne* also uses hedgerows for nectar, basking or as transport corridors from other ‘core’ habitats (Hedgelink, 2013). (See Appendix H, pp.118-120, for a more detailed list of “notable invertebrates” associated with ancient and species-rich hedgerows).

Birds such as blue tit *Parus major*, great tit *Parus caeruleus*, wren *Troglodytes troglodytes*, blackbird *Turdus merula*, robin *Erithacus rubecula* and chaffinch *Fringilla coelebs* are common in taller, wider hedges. Birds that favour scrubby or open woodland, such as dunnoek *Prunella modularis*, yellow hammer *Emberiza citrinella* and whitethroat *Sylvia communis*, often use hedgerows as well, and hedge bases are important for ground-nesting species like the grey partridge *Perdix perdix* (Sparks, n.d. a; Hedgelink, 2013). Hedges also seem to be used as corridors by a number of herptiles, including the UK BAP grass snake *Natrix natrix* (which seem to use hedges as corridors between hibernating and breeding areas and for hunting) and the great crested newt *Triturus cristatus* (which can use the shelter of hedges to travel from pond to pond) (Sparks, n.d. b; Hedgelink, 2013).

Clearly, hedgerows can support a wide range of taxa; however, from this diversity, twelve species have been singled out by the UK Hedgerow Habitat Action Plan Group (run by the Hedgelink partnership) as being “flagship” hedgerow species. In order to qualify, flagship hedgerow species should meet at least four of the following criteria:

1. Be widely distributed within the UK, preferably occurring in at least three countries
2. Require the same habitat conditions as a suite of priority species
3. Require hedgerows to be in favourable condition, either at an individual level or at a landscape level, or preferably both.
4. Be sufficiently well understood for effective conservation action to be taken now
5. Have a high public profile, or be sufficiently interesting or appealing to attract public interest

In addition, the flagship species should collectively use each of the main structural components of hedgerows (tree, shrub, bank/base, margin), and include representatives of each of the main taxonomic groups. Table 6, p.38, lists these twelve species, along with information on their conservation status, hedgerow use and ecological requirements.

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Table 6. The twelve flagship hedgerow species identified by the UK Hedgerow Habitat Action Plan Group.

Species	High level taxa	Status	Main hedgerow parts used	Ecological requirements
Purple rampion fumitory <i>Fumaria purpurea</i>	Vascular plant	Nationally scarce, endemic	Base (including bank)	Herbaceous flora in favourable condition
Orange-fruited elm-lichen <i>Caloplaca luteoalba</i>	Lichen	Nationally scarce, schedule 8, declining	Tree	Viable tree population structure, including veteran trees
Large (Moss) Carder bee <i>Bombus muscorum</i> *	Invert	Nationally scarce, rapidly declining	Margin	Pollen and nectar-rich herbaceous margins
Brown hairstreak butterfly <i>Thecla betulae</i>	Invert	Widespread, rapidly declining	Shrubby part	Favourable hedgerow dimensions, structure and cutting frequency
Goat moth <i>Cossus cossus</i>	Invert	Widespread, declining, nationally scarce	Tree	Viable hedgerow tree population
Common lizard <i>Zootoca vivipara</i>	Reptile	Widespread	Base and margin	Hedgerow bases and margins which provide good cover and plentiful invertebrate food
Bullfinch <i>Pyrrhula pyrrhula</i>	Bird	Widespread, declining, Red listed, Woodland Bird Indicator Species	Shrubby part	Favourable hedgerow dimensions, structure and cutting frequency
Tree sparrow <i>Passer montanus</i>	Bird	Widespread, declining, Red listed, Farmland Bird Indicator Species	Tree	Viable tree population structure, including veteran trees
Yellowhammer <i>Emberiza citrinella</i>	Bird	Widespread, declining, Red listed, Farmland Bird Indicator Species	Base and margin	Presence of undisturbed ground and favourable herbaceous flora
Soprano pipistrelle <i>Pipistrellus pygmaeus</i>	Mammal	Widespread, declining, UK BAP priority species, European Protected Species	Entire hedge	Continuity of hedgerows at individual and landscape levels
Hedgehog <i>Erinaceus europaeus</i>	Mammal	Widespread, declining	Base and margin	Presence of undisturbed ground and favourable herbaceous flora, and landscape continuity
Dormouse <i>Muscardinus avellanarius</i>	Mammal	Nationally scarce, declining, European Protected Species	Shrubby part	Favourable hedgerow dimensions, structure and cutting frequency

Source: Wolton (2009, p.12-13).

*No records of this species within the High Weald AONB according to the National Biodiversity Network (2013).

Finally, hedgerows are important for ecological connectivity, allowing species to more easily navigate and move through the landscape (Packer, n.d.). For bats (including the pipistrelle *Pipistrellus pipistrellus*, the serotine *Eptesicus serotinus* and the brown long-eared *Plecotus auritus*, a UK BAP species), for example, hedgerows, often form important commuting routes between

roosting sites and feeding areas (Jones et al. 1995; Entwistle et al. 1996), aiding navigation and providing shelter from wind during flight. Hedgerow trees may also provide roosting opportunities for bats throughout the year, particularly for tree roosting species like the UK BAP priority noctule *Nyctalus noctula* (Packer, n.d.).

In places where hedges are particularly broad (i.e. more than 5m wide) and resemble small strips of woodland more than hedges, they form what are locally known as shaws (Harris, 2003; Rennells, 1998; High Weald AONB Joint Advisory Committee, 2014). Thought to be remnants of larger areas of woodland that were left to act as field boundaries following the clearance of land for cultivation (a process known as “assarting” (Harris, 2003)), these sinuous strips of woodland usually support many of the aforementioned hedgerow-associated species; although they tend to be more like woodlands in character and therefore also in terms of the biodiversity that they support.

Although it is often assumed shaws support less biodiversity than larger woodlands, Rackham (2003) questions this assumption. Indeed, he found that many of the plants characteristic of ancient woodland (see the section specifically on ancient woodland, pp.14-17) may also be found in smaller woods, with some even preferring small woods (although some species also seem to prefer larger woodlands) (Rackham, 2003). Furthermore, small woods in the High Weald AONB have often suffered less from replanting and intensive management than their larger counterparts, and are therefore more likely to retained a more historically representative selection of species – something which Sansum (2013) points out is likely to particularly true of woody species, but less so of disturbance-sensitive ground flora, which are prone to extinction due to small population sizes.

The biodiversity value of shaws may also be enhanced by their high edge-to-core ratio, providing greater proportions of woodland/grassland transitional habitat that may be exploited by species associated with transitional habitats like woodland edges (such as the grizzled skipper butterfly *Pyrgus malvae*, betony *Betonica officinalis* and devilsbit scabious *Succisa pratensis* (Rother Woods Project, 2010; Sansum, 2013). Although intensive land use adjacent to shaws may reduce these edge habitats, and potentially threaten the species found towards the interior (for example, through herbicide spray drift directly killing them off, or artificial fertiliser seepage causing eutrophication (Gove et al., 2007)), there’s little doubt that shaws make a valuable contribution to both edge habitat biodiversity, and to overall woodland biodiversity (Sansum, 2013).

5.7 Wood-pasture, parkland & veteran trees

Wood-pasture and parklands may be defined as mosaic habitats that support a combination of mature – veteran and/or ancient¹ – trees and a ground flora composed of either grassland, which may be unimproved (see the section specifically on unimproved grassland, pp.55-59), or heathland (see the section specifically on lowland heath, pp.48-54). In addition to the presence of mature trees, wood-pastures and parklands are defined by their dependence on a regime of grazing for their maintenance (Rackham, 1995; Maddock, 2008). In the absence of such grazing pressure, scrub would encroach and younger trees would establish themselves, eventually resulting in the development of a more densely wooded habitat, rather than the more open, mosaic structure –

¹ “The term 'veteran' tree encompasses a wide range of trees which display attributes associated with late maturity such as large trunk girth and truck hollowing. The term 'ancient' refers specifically to the age class of a tree, describing the stage of development in the ageing process beyond full maturity. Whilst all veteran trees are potentially of cultural and ecological value, ancient individuals are a key indication that there is likely to have been a continuity of veteran tree/deadwood habitat and management at a site” (Maddock, 2008 p.95).

dominated by scattered, mature trees – that characterises wood-pasture and parkland (Sansum, 2013).

In the context of the High Weald AONB, wood-pasture and parkland predominantly occur in either historic deer parks or wood-heath environments. The former are traditionally managed by pollarding, whilst the latter are more natural systems where a mosaic of open land and trees co-exist, with phases of regeneration creating stands of trees in various stages of growth and decline (Sansum, 2013). Both types are important features of the landscape and reflect its essentially medieval character (Harris, 2003; Sansum, 2013). Indeed, according to Brandon (1969) wood-pasture/parkland likely formed a very extensive part of the medieval landscape of the Weald. As Sansum (2013 p.11) writes: “It has been suggested (Gulley, 1960) that there were over 200 square miles of parkland in the Weald by the mid 14th century, that 10% of the Weald must have been taken up by parks in 1600 and that many of the larger expanses of woodland in the Weald surviving at that time were within parks.”

Crucially, wood-pastures and parklands are of considerable value for the biodiversity that they support. This biodiversity is most obviously manifested in the veteran trees themselves (see Table 7, below, for a list of ancient tree species that may be found in the High Weald AONB).

Table 7. Ancient tree species and their abundance in Wealden District. The girth and form of the largest example of each species is also recorded.

Latin name	Common name	No. recorded	Girth of largest tree (m)	Form of largest tree
<i>Quercus robur</i> & <i>Quercus petraea</i>	Pendunculate oak & sessile oak	236	8.06	Pollard
<i>Fagus sylvatica</i>	Beech	233	8.4	Pollard
<i>Castanea sativa</i>	Sweet chestnut	88	7.2	Pollard
<i>Fraxinus excelsior</i>	Ash	58	6.5	Pollard
<i>Carpinus betulus</i>	Hornbeam	43	2.92	Maiden
<i>Taxus baccata</i>	Yew	43	8.5	Maiden split
<i>Tilia x europaea</i>	Common Lime	20	6.38	Pollard
<i>Betula pendula</i>	Silver Birch	19	2.58	Maiden
<i>Salix alba</i>	White willow	17	5.85	Pollard
<i>Alder glutinosa</i>	Alder	15	4.04	Coppice
<i>Pinus sylvestris</i>	Scots pine	15	4.7	Maiden
<i>Acer campestre</i>	Field maple	14	4.2	Maiden
<i>Betula pubescens</i>	Downy birch	11	3.9	Maiden
<i>Prunus Avium</i>	Wild cherry	11	3.17	Maiden
<i>Ulmus procera</i>	English elm	10	3.7	Pollard
<i>Populus nigra</i> ssp. <i>betulifolia</i>	Wild black poplar	9	4.27	Maiden
<i>Sequoiadendron giganteum</i>	Giant sequoia	8	8.86	Maiden
<i>Ilex aquifolium</i>	Holly	8	1.95	Maiden

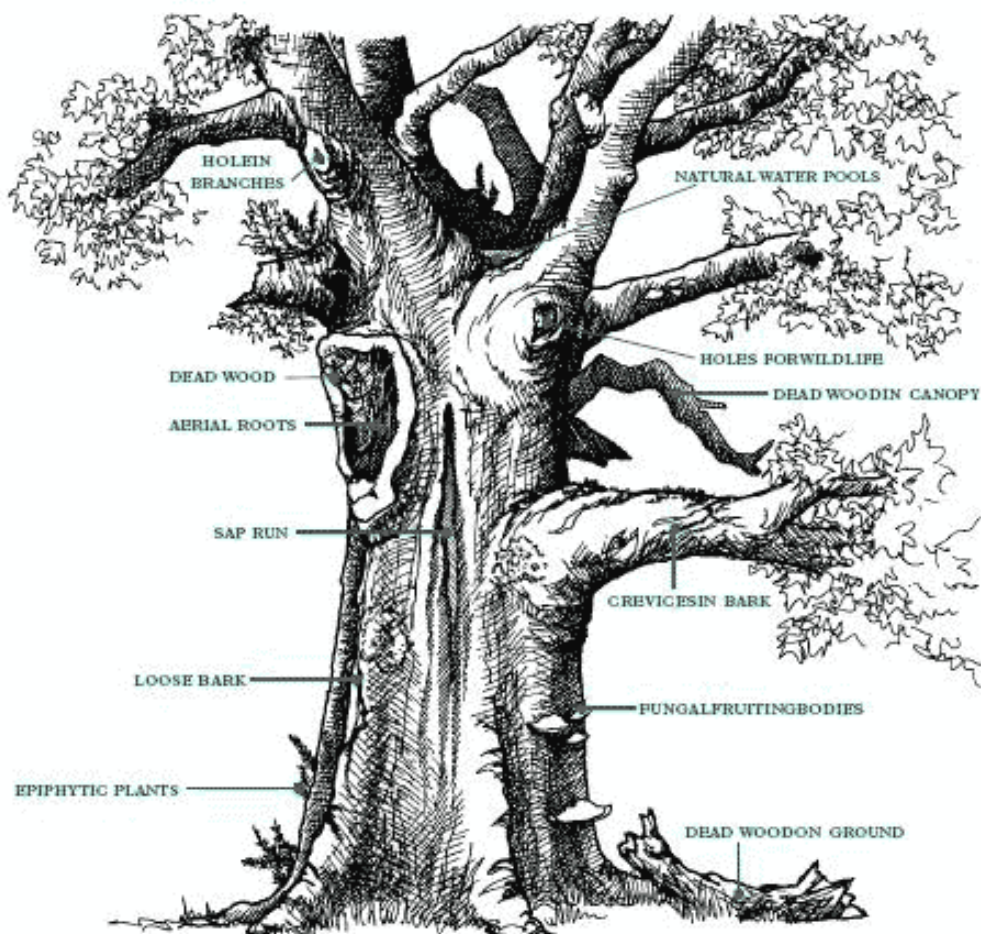
<i>Pinus radiata</i>	Monterey pine	8	5.65	Maiden
<i>Aesculus hippocastanum</i>	Horse chestnut	5	5.07	Maiden
<i>Cedrus libani</i>	Cedar of Lebanon	4	6.5	Maiden
<i>Malus sylvestris</i>	Crab apple	4	2.26	Maiden
<i>Salix caprea</i>	Goat willow	4	2.8	Pollard
<i>Crataegus monogyna</i>	Hawthorn	4	2.77	Multi-stem
<i>Populus x canadensis</i>	Hybrid black poplar	4	4.95	Maiden
<i>Acer pseudoplatanus</i>	Sycamore	4	5.02	Maiden
<i>Ulmus glabra</i>	Wych elm	4	3.15	Maiden
<i>Sorbus aucuparia</i>	Rowan	3	1.8	Maiden
<i>Quercus cerris</i>	Turkey oak	3	6.22	Maiden
<i>Populus canescens</i>	Grey poplar	2	5.22	Maiden
<i>Cupressus sempervirens</i>	Italian Cyprus	2	3.4	Maiden
<i>Juglans regia</i>	Walnut		3.74	Maiden
<i>Pyrus communis</i>	Wild pear	2	2.17	Maiden
<i>Buxus sempervirens</i>	Box	1	0.5	Multi-stem
<i>Acer cappadocicum</i>	Cappadocian maple	1	2.95	Maiden
<i>Sequoia sempervirens</i>	Coast redwood	1	4.5	Maiden
<i>Ulmus minor subsp. angustifolia</i>	Cornish elm	1	3.25	Maiden
<i>Pinus nigra var. maritime</i>	Corsican pine	1	3.2	Maiden
<i>Larix decidua</i>	European larch	1	2.94	Maiden
<i>Abies cephalonica</i>	Grecian fir	1	4.6	Maiden
<i>Corylus avellana</i>	Hazel	1	2.7	Multi-stem
<i>Quercus ilex</i>	Holm oak	1	4.5	Pollard
<i>Quercus frainetto</i>	Hungarian oak	1	5.9	Maiden
<i>Ulmus x hollandica 'Vegeta'</i>	Huntingdon elm	1	4.87	Maiden
<i>Tilia platyphyllos</i>	Large-leaved lime	1	6.85	Pollard
<i>Quercus x hispanica 'Lucombeana'</i>	Lucombe oak	1	4.4	Maiden
<i>Acer campestre</i>	Maple	1	3.74	Pollard
<i>Cupressus macrocarpa</i>	Monterey cypress	1	3.75	Maiden
<i>Abies procera</i>	Noble fir	1	3.85	Maiden
<i>Acer platanoides</i>	Norway maple	1	3.9	Unknown
<i>Quercus rubra</i>	Red oak	1	3.45	Maiden
<i>Metasequoia glyptostroboides</i>	Redwood	1	4.2	Maiden
<i>Ulmus minor var. minor</i>	Smooth-leaved elm	1	2.9	Maiden

<i>Taxodium distichum</i>	Swamp cypress	1	3.4	Maiden
<i>Liriodendron tulipifera</i>	Tulip tree	1	4	Maiden
<i>Tsuga heterophylla</i>	Western hemlock	1	3.78	Maiden
<i>Thuja plicata</i>	Western red cedar	1	4.6	Maiden
<i>Ulmus minor subsp. sarniensis</i>	Wheatley elm	1	3.65	Maiden
<i>Populus alba</i>	White poplar	1	4.35	Maiden

Source: Wealden Ancient Tree Project Report (p.35).

However, the vast majority of biodiversity associated with wood-pasture and parkland is comprised of species that inhabit the veteran and/or ancient trees themselves. Indeed, due in large part to their wide variety of ecological niches and microhabitats (see Figure 11, below), these long-lived trees support a staggering abundance and diversity of species (Wright, 2008; Sussex Biodiversity Record Centre, 2013; Woodland Trust, 2013c).

Figure 11. Features (habitats and species) associated with ancient/veteran trees.



Source: Wealden Ancient Tree Project (available from: <http://sxbr.org.uk/projects/ancient-tree-project/>).

Species that are particularly associated with veteran and/or ancient trees are those that are epiphytic – i.e. grow on the surface of other plants but are not parasitic – or saproxylic – i.e. dependent on a habitat composed of dead or decaying wood (Sansum, 2013). Examples of epiphytic species which may be found in the High Weald AONB include: *Bacidia incompta*, *Enterographa sorediata* and orange-fruited elm lichen *Caloplaca luteoalba*, all of which are lichens generally associated with old trees (Wright, 2008). Saproxylic species include invertebrates such as: the black-headed cardinal beetle *Pyrochroa coccinea*, the oak longhorn beetle *Rhagium mordax* (recorded in Ashburnham Park, a former medieval deer park in the south east of the AONB (National Biodiversity Network, 2013)) and the stag beetle *Lucanus cervus* (classified as a UK BAP priority species and the subject of a Sussex Species Action Plan) (Wright, 2008). Indeed, it is difficult to underestimate the importance of veteran and/or ancient trees to invertebrate life – approximately 1,700 (6%) of invertebrates in the British Isles are dependent upon dead and decaying wood in order to complete their lifecycles (Woodland Trust, 2013c). Notably, a number of fungi play an important role in the creation of the dead-wood habitat upon which these saproxylic invertebrates depend. For example, both sulphur polypore *Laetiporus sulphureus* and tinder fungus *Fomes fomentarius* attach themselves to the sides of trees and, through weaknesses in the bark, cause internal rotting (Wright, 2008).

In addition to these specialists lichens, invertebrates and fungi, a range of other species make use of old trees at various stages of their lifecycles. For example, birds species such as the treecreeper *Certhia familiaris*, kestrel *Falco tinnunculus* (classified as an Amber List species under the Birds of Conservation Concern review), barn owl *Tyto alba* (classified as an Amber List species under the Birds of Conservation Concern review) and marsh tit *Poecile palustris* (classified as an Amber List species under the Birds of Conservation Concern review and as a priority species under the UK BAP) (Eaton et al., 2009; JNCC, 2013c; RSPB, 2013), may all make use of the cavities often found in mature trees for nesting sites (Wright, 2008; Woodland Trust, 2013c). Other birds, such as the three species of woodpecker – green *Picus viridis*, great spotted *Dendrocopos major* and lesser spotted *Dendrocopos minor* (RSPB, 2013) – may not only nest in existing cavities, but actively modify them, as well as exploiting the abundant food sources that mature trees provide in the form of invertebrates (Wright, 2008).

Finally, holes near the base of veteran and ancient trees may provide shelter for herptile species like grass snake *Natrix natrix* and common lizard *Zootoca vivipara* (both classified as a UK BAP priority species), whilst frogs and newts can exploit any crevices that collect small pools of water (Wright, 2008; JNCC, 2013c). In terms of mammals, veteran and ancient trees certainly form part of the habitat matrix exploited by a variety of species, but are particularly important for bats (Bat Conservation Trust, 2013; Woodland Trust 2013c). Indeed, of the 17 species of bat found in the UK, all frequent woods, with invertebrates associated with trees being particularly important food source (Bat Conservation Trust, 2013). However, a number of bats utilise veteran and ancient trees for their roost sites – especially since they tend to provide an abundance of hollows, woodpecker holes, loose bark, cracks, splits, thick ivy and root cavities (Forestry Commission, 2005). These include: bechstein's bat *Myotis bechsteinii*, brown long-eared bat *Plecotus auritus* and noctule bat *Nyctalus noctula*, all of which are classified as UK BAP priority species (Forestry Commission, 2005; JNCC, 2013c).

Biodiversity Box 7

Wood-pasture, parkland and veteran tree example: Eridge Park

Located in the central part of the High Weald AONB, this site comprises parkland and adjacent ancient woodland on the lower Tunbridge Wells Sandstone and underlying Wadhurst Clay. It has one of the richest epiphytic lichen floras of any single park in Britain and the variety of habitats present also support diverse insect and bird communities.

- The woodlands of Saxonbury Hill and Nap Wood lie on Tunbridge Wells Sandstone and contain a mixture of stand types. Sessile oak *Quercus petraea*, and pedunculate/English oak *Quercus robur* are frequently associated with beech *Fagus sylvatica* to form a high forest with bracken *Pteridium aquilinum* dominating the ground flora. Many local variations occur with hazel *Corylus avellana*, ash *Fraxinus excelsior* or birch *Betula spp.* as co-dominants. In Rocks Wood there is an area of coppiced sweet chestnut *Castanea sativa* and small plantations of beech or conifers are also present
- Further north is the open woodland of Eridge Old Park on steep south facing slopes. Many of the ancient oaks, beeches, birches, ashes and field *maples* *Acer campestre* have a notable lichen flora. The ground layer is predominantly bracken and bramble *Rubus fruticosus agg.*, although acidic marshy grassland with purple moor-grass *Molinia caerulea* is found along the seepage zone where the sandstone overlies clay.
- On the plateau above there are remnants of a dry heath community with heather *Calluna vulgaris*, bell heather *Erica cinerea*, bilberry *Vaccinium myrtillus* and gorse *Ulex spp.* Streams dissect the site exposing the Wadhurst Clay, and in places they have been dammed to form a series of ornamental ponds. Alder *Alnus glutinosa* woods with hazel, ash and alder buckthorn *Frangula alnus* occupy the valley bottoms and wetter flushes above. Here the ground flora reflects the damper base-rich conditions and contains wood avens *Geum urbanum*, marsh woundwort *Stachys palustris*, opposite-leaved golden saxifrage *Chrysosplenium oppositifolium* and a range of sedges and rushes
- The site as a whole, woodland and parkland, is of national importance for its lichens, with 167 recorded species, many of which are characteristic of old forests, including *Parmeliella plumbea* and *Nephroma laevigatum*. The epiphytic bryophytes *Frullania fragilifolia* and *Orthotrichum stramineum* are also present here at their only known south-eastern locality
- This wide range of habitats also supports a rich fauna particularly invertebrates and birds. The site is considered nationally important for dragonflies with 22 species recorded including the notable brilliant emerald *Somatochlora metallica*. It contains the only remaining East Sussex colony of the high brown fritillary *Argynnis adippe*, as well as the white letter hairstreak *Strymonidia w-album*. The bog bush cricket *Metrioptera brachyptera* is present in large numbers and there are a great variety of water beetles
- The breeding bird community is also important; 60 species are known to breed here including hobby, redstart, water rail and all three British woodpecker species. The site also contains a heronry

(Information from the Eridge Park SSSI citation, available from:

http://www.sssi.naturalengland.org.uk/Special/sssi/sssi_details.cfm?sssi_id=1003196).

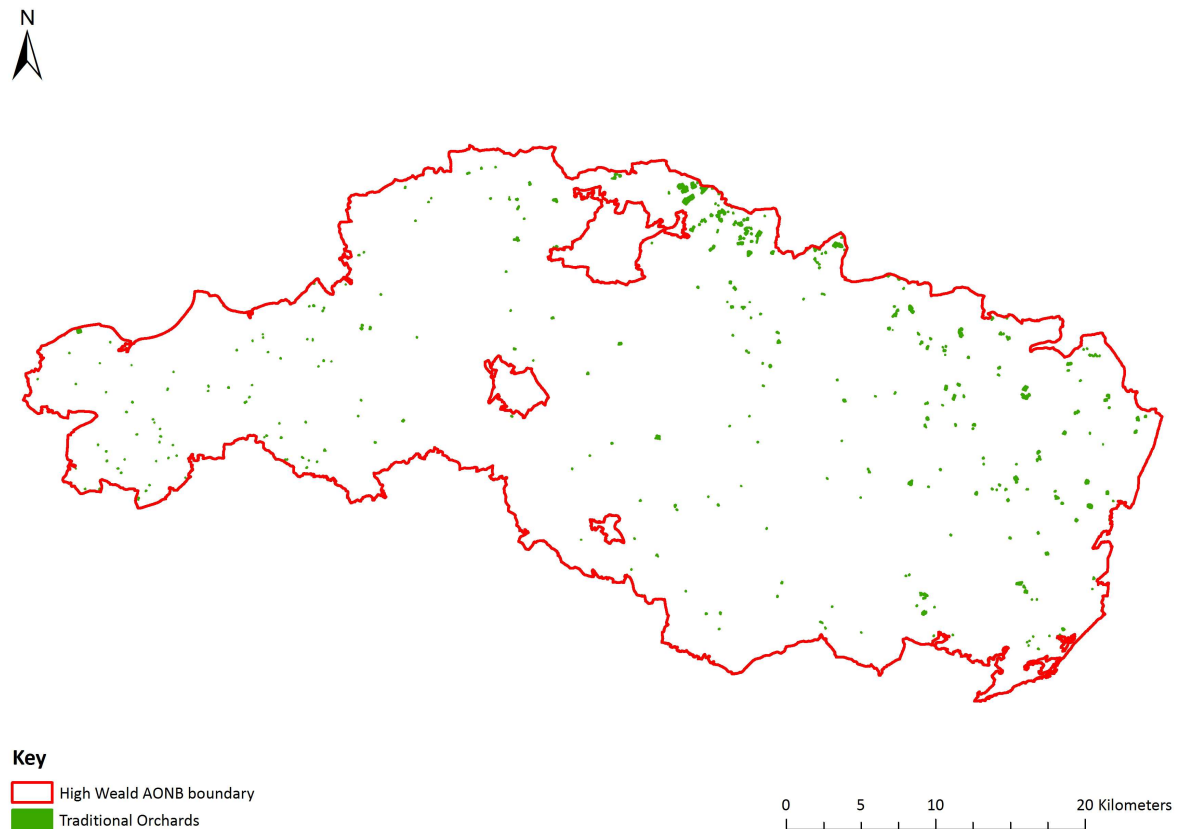
Clearly, then, the veteran and ancient trees of wood-pasture and parkland are of enormous value for biodiversity. Indeed, when this biological value is considered alongside their historical and cultural significance, it is no surprise that Rackham (1995 p.152) commented: “Ten thousand oaks of 100 years old are not a substitute for one 500 year-old oak.”

5.8 Traditional orchards

Defined by the UK Biodiversity Action Plan as “groups of fruit and nut trees planted on vigorous rootstocks at low densities in permanent grassland, and managed in a low intensity way” (Maddock, 2008), traditional orchards are important repositories of biodiversity (The Wildlife Trusts, 2013f). Moreover, traditional orchards are a characteristic feature of the High Weald, particularly in the Kent portion of the AONB, with Natural England (2013c) noting that, not only is 2% of England’s total traditional orchard priority habitat in located in the region, but that the High Weald AONB has the third largest area of traditional orchard of all of all the 34 English AONBs (see Figure 12, p.46, for a map displayin the extent of traditional orchards in the High Weald AONB).

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Figure 12. The extent of traditional orchards within the High Weald AONB.



Data sources: Natural England's Priority Habitats Inventory, Sussex Biodiversity Records Centre's UK BAP priority habitats data, Kent & Medway Biological Records Office's UK BAP priority habitats data, and Natural England's AONBs (England) boundary data.

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NB: the size of the points representing the sandstone outcrops have been increased in order to make them more easily visible at this scale.

Like wood-pasture and parkland (see pp.39-44), much of this biodiversity value is directly associated with the fruit trees themselves, many of which will be old and composed, in part, of dead and decaying wood. Consequently, a range of epiphytic lichens, mosses and liverworts, as well as fungi and invertebrates (especially saproxylic, or dead and decaying wood, invertebrates), thrive on the fruit trees found in traditional orchards (Wedge and Robertson, 2007; Lush et al., 2009a; Lush et al., 2009b; Bicker and Billings, 2011; The Wildlife Trusts, 2013f). Indeed, in a survey of six traditional orchards in England (including one in Kent), Lush et al. (2009a) found a total of 131 epiphytic lichens, 50 epiphytic bryophytes, 175 fungi and 522 invertebrate species. Among the epiphytic lichens, 16 Nationally Rare or Scarce species were found (e.g. *Bacidia brandii* and *Bacidia neosquamulosa*), including one species (*Parmelinopsis minarum*) on Schedule 8 of the Wildlife and Countryside Act 1981. In addition, thirteen provisional Red Data List or Nationally Rare fungi species were found (e.g. *Schizophyllum amplum* and *Entoloma saepium*), and a total of 45 Nationally Rare or Scarce invertebrates – primarily from the saproxylic (dead and decaying wood) assemblage – were recorded (e.g. stag beetle *Lucanus cervus*, larger shothole borer *Scolytus mali*, *Tomoxia bucephala* and *Nitela borealis*) (Lush et al., 2009a; Lush et al., 2009b).

In addition to dead and decaying wood, a single traditional orchard may contain a mosaic of other types of habitats, including scrub, hedgerows, unimproved grassland and ponds. Much orchard wildlife depends on this mosaic. For instance many

In addition to dead and decaying wood, a single orchard may contain a mosaic of other habitats, including scrub, hedgerows, unimproved grassland and ponds

bumblebee species, which help pollinate the fruit trees, need tussocky grassland for nesting and hedgerows or scrub to hibernate under through the winter, and beetles which live as larvae in the wood of the trees feed as adults on the flowers of tall herbs, such as hogweed *Heracleum sphondylium* and wild angelica *Angelica sylvestris*, as well as hawthorn *Crataegus monogyna* and other shrubs (Wedge and Robertson, 2007). A variety of bats forage over traditional orchards, including the pipistrelle *Pipistrellus pipistrellus* (protected in the UK under the Wildlife and Countryside Act, 1981 (The Wildlife Trusts, 2013e)) and the greater horseshoe bat *Rhinolophus ferrumequinum* (classified as a UK BAP priority species) (Wedge and Robertson, 2007; Lush et al., 2009a). Moreover, dormice *Muscardinus avellanarius* have been found foraging in cobnut plots and hedges around orchards, and the great crested newt *Triturus cristatus* may be found in orchards which have ponds for breeding, rough grassland for foraging and hedgerows and fallen logs for shelter (both are classified as a UK BAP priority species). Finally, foxes *Vulpes vulpes* visit orchards whilst hunting for rabbits and other small mammals and, along with badgers *Meles meles*, they will also eat fallen fruit and have been seen reaching up to pick fruit from low branches (Wedge and Robertson, 2007).

Orchards are also the preferred habitat for the UK's only species of mistletoe: *Viscum album* (Bicker and Billings, 2011). In addition to the biodiversity and cultural value of the plant itself, mistletoe also supports a surprising range of species. Indeed, no less than six invertebrates that depend on mistletoe for their lifecycle, including: three sap-sucking bugs (*Cacopsylla visci*, *Pinalitus viscicola* and *Hypseloecus visci*), one predatory bug (*Anthocoris viscid*, which feeds on the other bugs), one beetle (the mistletoe weevil *Ixapion variegatum*) and one moth (the mistletoe marble moth *Celypha woodiana*, classified as a UK BAP priority species and a Species of Principal Importance in England under the Natural Environment and Rural Communities (NERC) Act 2006) (Briggs, 2011a; Briggs, 2011b; Mistletoe Matters, 2012). A number of bird species also use mistletoe as a source of winter berries, including the mistle thrush *Turdus viscivorus*, the blackcap *Sylvia atricapilla* and the fieldfare *Turdus pilaris* (classified as an Amber List species under the Birds of Conservation Concern review (Eaton et al., 2009; RSPB, 2013)) (Briggs, 2011b; Mistletoe Matters, 2012).

Finally, traditional orchards contribute to the biodiversity of the High Weald AONB in the form of the genetic diversity contained within traditional fruit varieties. Indeed, there are over 2,000 varieties of cooking and eating apple in Britain and hundreds more varieties of cider-making apples, including traditional varieties like Peasgood's Nonesuch, Sheep's Snout, Bastard Rough Coat and Slack my Girdle (Natural England, 2011). A selection of the traditional apple varieties that one may have found growing in 19th and early 20th century orchards in the High Weald may be seen in Table 8, below.

Table. 8 A selection of apple varieties that may have been found in traditional High Weald orchards.

Eating apple variety	Cooking apple variety
Sussex Mother	Beauty of Kent
Sussex Wealden	Kentish Fillbasket
Laxton's Subperb	Alfriston
Crawley Beauty	Forge
Gladstone	Early Victoria
Lady Sudeley	Keswick Codlin
Beauty of Bath	Grenadier
Miller's Seedling	King of the Pippins
Worcester Pearmain	Golden Noble
James Grieve	Reverend Wilks
Lord Lambourne	Peasgood's Nonsuch
Gascoigne's Scarlet	Lord Derby
Merton Worcester	Bramley's Seedling
Allington Pippin	Newton Wonder
Blenheim Orange	Annie Elizabeth
Cox's Orange Pippin	Lane's Prince Albert
Riston Pippin	Warner's King

Source: Joan Morgan (2013 personal communication) and Bernwode Fruit Trees (2013).

Although the importance of agricultural genetic diversity is often underappreciated, it will undoubtedly be of critical importance in meeting the challenge of feeding a growing population in the face of climatic change and the ever-present threat of new pests, parasites and disease (Convention on Biological Diversity, 2013).

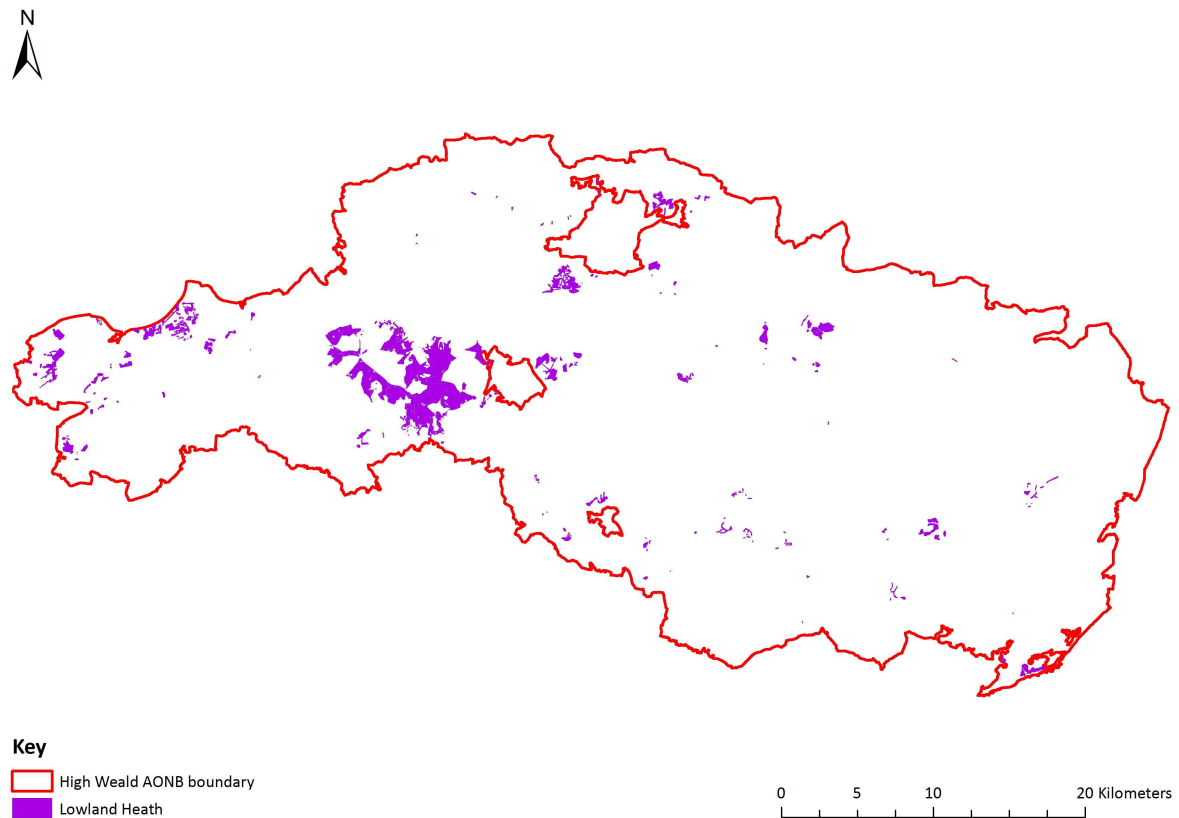
5.9 Lowland heath

In terms of non-woodland habitat, lowland heath is particularly important for biodiversity in the High Weald. Predominantly concentrated in the Ashdown Forest area (65.5% of the High Weald's heathland is located within the Ashdown Forest SSSI), with the rest scattered along the sandy ridges of the High Weald, the region's lowland heath is the largest concentration of this habitat in South

East England (Greenaway et al., 2004; Allum and FitzGerald, 2005; High Weald AONB Joint Advisory Committee, 2014). Indeed, according to Natural England there is a total 2,344.88ha of UK BAP lowland heath priority habitat within the High Weald AONB (see Figure 13, p.50).

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Figure 13. The extent of lowland heath within the High Weald AONB.



Data sources: Natural England's Priority Habitats Inventory, the High Weald AONB Unit's heathland data, and Natural England's AONBs (England) boundary data.

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There are a number of distinct types of plant communities, and sub-communities, which comprise the High Weald's heathland. These are listed in Table 9, below, according to the British National Vegetation Classification (NVC) scheme.

Table 9. NVC plant communities (and sub-communities) comprising the High Weald's heathlands.

NVC plant community code	Characteristic species
H2	<i>Calluna vulgaris</i> - <i>Ulex minor</i> heath (sub-communities <i>Vaccinium myrtillus</i> and <i>Molinia caerulea</i>)
M16	<i>Erica tetralix</i> - <i>Sphagnum compactum</i> wet heath
M25	<i>Molinia caerulea</i> - <i>Potentilla erecta</i> mire
U1	<i>Festuca ovina</i> - <i>Agrostis capillaries</i> - <i>Rumex acetosella</i> acid grassland
U20	<i>Pteridium aquilinum</i> - <i>Gallium saxatile</i> community
W10	<i>Quercus robur</i> - <i>Pteridium aquilinum</i> - <i>Rubus fruticosus</i> woodland
W15	<i>Fagus sylvatica</i> - <i>Deschampsia flexuosa</i> woodland
W16	<i>Quercus</i> spp.- <i>Betula</i> spp.- <i>Deschampsia flexuosa</i> woodland

Source: adapted from Allum and Fitzgerald (2005 p.7).

This complex mosaic of plant communities – which range from dense heather and lichen heath to acid grassland, and include plants like marsh gentian *Genetiana pneumonanthe* and marsh clubmoss *Lycopodiella inundata* (classified as a UK BAP priority species) (Allum and Fitzgerald, 2005; JNCC, 2013c) – support an extraordinarily rich variety of wildlife, including as many as 5,000 species of invertebrates (The Wildlife Trusts, 2013b). Indeed, the High Weald AONB's lowland heaths provide much needed habitat for UK BAP priority invertebrates such as the narrow-bordered bee hawk-moth *Hemaris tityus* and the silver-studded blue butterfly *Plebejus argus* (Conservators of Ashdown Forest, 2011; JNCC, 2013c), as well as species like the beautiful yellow underwing moth *Anarta myrtille*, which requires heather – both ling *Calluna vulgaris* and bell heather *Erica cinerea* – as a foodplant for its larvae (Greenaway et al., 2004; Butterfly Conservation, 2013; Kimber, 2013).

Moreover, over half of all the UK's dragonfly species can be found in this habitat type (The Wildlife Trusts, 2013b), with species like the golden-ringed *Cordulegaster boltonii* and the Nationally Scarce (i.e. a species that is recorded in only 16 to 100 ten km squares in Britain) downy emerald *Cordulia aenea* both present at Ashdown Forest (Marrable, 1999; British Dragonfly Society, 2004; Reed and Reed, 2007). Other species of note include the Nationally Scarce small red damselfly *Ceragrion tenellum* (Marrable, 1999; Reed and Reed, 2007; British Dragonfly Society, 2013).

The High Weald AONB's heathland is also of great importance for a number of bird species. Indeed, Ashdown Forest was classified as an SPA for birds under the European Birds Directive in 1996 due to the fact that it supports internationally important populations of three European Bird Directive Annex 1 species – nightjar *Caprimulgus europaeus*, Dartford warbler *Sylvia undata* and woodlark *Lullula arborea* (Allum and Fitzgerald, 2005). Other birds, like the song thrush *Turdus philomelos* and the nightjar *Numenius arquata*, are also associated with the High Weald's heathland, and are both

classified as Red List species under the Birds of Conservation Concern review and as a priority species under the UK BAP (Eaton et al., 2009; JNCC, 2013c; RSPB, 2013).

A number of other animals of conservation interest also exploit the region's heathland resource, including UK BAP priority mammals, like the dormouse *Muscardinus avellanarius* and the noctule bat *Nyctalus noctula*, as well as UK BAP priority herptiles, such as the great crested newt *Triturus cristatus* and the adder *Vipera berus* (Conservators of Ashdown Forest, 2011; JNCC, 2013c).

Interestingly, the particular fauna present in a given area of heathland may vary significantly over relatively small distances, with scrubby areas of heath found to support a different collection of species to those present along heath verges, or along the hedges of enclosed fields (Mike Edwards, 15th May 2011, pers. comm.). Moreover, management has also been shown to have a significant impact on how species are distributed across the High Weald's heathland, with grazing pattern being a particularly important factor (Mike Edwards, 15th May 2011, pers. comm.).

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Biodiversity Box 8

Lowland heath example: Ashdown Forest

Located towards the west of the High Weald AONB, Ashdown Forest comprises an extensive area of common land lying between East Grinstead and Crowborough. Overlying soils that are derived from the predominantly sandy Hastings Beds, it is one of the largest single continuous blocks of heath, semi-natural woodland and valley bog in south-east England, and it supports several uncommon plants, a rich invertebrate fauna, and important populations of heath and woodland birds. The following species information provides an overview of the area's significant biodiversity value:

- Ashdown Forest supports extensive areas of dry heath dominated by ling *Calluna vulgaris*, mixed with bell heather *Erica cinerea* and dwarf gorse *Ulex minor*. Important lichen communities are also present, including species such as *Pycnothelia papillaria*
- On the damper heath, cross-leaved heath *Erica tetralix* becomes dominant with deer-grass *Trichophorum cespitosum*. The heath and bracken communities form a mosaic with acid grassland dominated by purple moor-grass *Molinia caerulea* with species such as the local petty whin *Genista anglica*. Wet areas provide suitable conditions for several species of sphagnum moss, together with which are found bog asphodel *Narthecium ossifragum*, common cotton-grass *Eriophorum angustifolium* and specialities such as marsh gentian *Gentiana pneumonanthe*, ivy-leaved bell flower *Wahlenbergia hederacea*, white-beaked sedge *Rhynchospora alba* and the marsh clubmoss *Lycopodiella inundata*
- Gorse *Ulex europaeus*, silver birch *Betula pendula*, pedunculate/English oak *Quercus robur* and Scots pine *Pinus sylvestris* are scattered across the heath, and in some areas form extensive secondary woodland and scrub. The older woodlands consist of beech *Fagus sylvatica* and sweet chestnut *Castanea sativa*. These contain bluebell *Hyacinthoides non-scripta*, bilberry *Vaccinium myrtillus*, the hard fern *Blechnum spicant*, and honeysuckle *Lonicera periclymenum* with birds-nest orchid *Neottia nidus-avis* and violet helleborine *Epipactis purpurata* found particularly under beech
- Forest streams are often lined by alders *Alnus glutinosa* with grey willow *Salix cinerea*, birch and oak. These streams cut through the soft sandstone in places, forming steep sided valleys (gills) which are sheltered from winter frosts and remain humid in summer. Uncommon bryophytes, such as the liverwort *Nardia compressa*, and a range of ferns, including the mountain fern *Oreopteris limbosperma* and the hay-scented buckler fern *Dryopteris aemula*, thrive in this 'Atlantic' microclimate
- The damming of streams, digging for marl and quarrying have produced several large ponds in a number of areas of the forest. Although often largely free of aquatic vegetation, there may be localised rafts of broadleaved pondweed *Potamogeton natans*, beds of reedmace *Typha latifolia* and water horsetail *Equisetum fluviatile*. The aquatic habitats support a diverse fauna, including a range of water beetles (Coleoptera) a rare midge *Dixella filiformis*, a diversity of dragonfly and damselfly species (Odonata) and the locally uncommon snail *Vertigo substriata*. Some of the ponds also have large amphibian populations, including the great-crested newt *Triturus cristatus*
- The heathlands and woods support many uncommon beetles, moths and butterflies. There are still several populations of the rare silver-studded blue *Plebejus argus* on the open heath and the bog bush cricket *Metrioptera brachyptera* is particularly abundant in the forest. Large populations of reptiles, including the viviparous lizard *Lacerta vivipara* and the adder *Vipera berus*, occur on the open habitats. Notable heath nesting birds include curlew *Numenius arquata*, nightjar and hobby. Scrub, woodlands and coppice together support a wide range of breeding woodland birds, and a refuge for the dormouse *Muscardinus avellanarius*, which has become scarce over large areas of the country in recent years

(Information from the Ashdown Forest SSSI citation (available from: http://www.sssi.naturalengland.org.uk/special/sssi/sssi_details.cfm?sssi_id=1007128) and Sherwin (2000)).

Finally, the High Weald supports an often unrecognised, sub-type of heathland habitat: wooded heath (Greenaway et al., 2004). This dynamic habitat, with a fluid proportion of tree cover vs. open space, is qualitatively different from woodland found on acid soil, primarily because its ground flora is dominated by species generally associated with heathland rather than woodland (Greenaway et al., 2004). The formation of wooded heath in a given place generally occurs as a result of past management activity, with wooded heath typically occurring in areas formerly managed as wood-pasture through a combination of grazing and pollarding.

Although wooded heath is a largely unrecognised habitat type (due mainly to the fact that it combines the characteristics of both woodland and heathland, and thus tends to be categorised as either one or the other), it is of considerable value for biodiversity. This is largely due to the fact that wooded heath exhibits high structural diversity and a high proportion of edge habitat – features which result in a correspondingly wide range of ecological niches for species to exploit (Greenaway et al., 2004). Table 10, below, lists just some of the species that are characteristic of wooded heath habitats, illustrating their significant value for the biodiversity of the High Weald.

Table 10. Wooded heath indicator species.

Vascular plants	Bryophytes (common names are included where available)	Fauna
Alder buckthorn (<i>Frangula alnus</i>)	Paradox campylopus moss (<i>Campylopus paradoxus</i>)	Heath fritillary (<i>Melitaea athalia</i>)
Allseed (<i>Radiola linoides</i>)	Dicranella Moss (<i>Dicranella heteromalla</i>)	Green hairstreak (<i>Callophrys rubi</i>)
Bilberry (<i>Vaccinium myrtillus</i>)	Dicranum Moss (<i>Dicranum majus</i>)	Dingy skipper (<i>Erynnis tages</i>)
Climbing corydalis (<i>Ceratocarpus calviculata</i>)	<i>Hookeria lucens</i>	Grizzled skipper (<i>Pyrgus malvae</i>)
Common cow-wheat (<i>Melampyrum pratense</i>)	<i>Isopterygium elegans</i>	Grayling (<i>Hipparchia semele</i>)
Devil's-bit scabious (<i>Succisa pratensis</i>)	Leucobryum Moss (<i>Leucobryum glaucum</i>)	Pearl-bordered fritillary (<i>Boloria euphrosyne</i>)
Goldenrod (<i>Solidago virgaurea</i>)	<i>Leucobryum juniperoideum</i>	Small pearl-bordered fritillary (<i>Boloria selene</i>)
Great woodrush (<i>Luzula sylvatica</i>)	<i>Lophocolea bidentata</i>	Tiger beetles (<i>Cicindela</i> sp)
Heath bedstraw (<i>Galium saxatile</i>)	Undulate Plagiothecium Moss (<i>Plagiothecium undulatum</i>)	Nightjar (<i>Caprimulgus europaeus</i>)
Heath milkwort (<i>Polygala serpyllifolia</i>)	Schreber's Big Red Stem Moss (<i>Pleurozium schreberi</i>)	Meadow pipit (<i>Anthus pratensis</i>)
Ivy-leaved bellflower (<i>Wahlenbergia hederacea</i>)	Pohlia Moss (<i>Pohlia nutans</i>)	Stonechat (<i>Saxicola torquata</i>)
Ling (<i>Calluna vulgaris</i>)	Polytrichum Moss (<i>Polytrichum formosum</i>)	Tree pipit (<i>Anthus trivialis</i>)
Lousewort (<i>Pedicularis sylvatica</i>)	Sphagnum (<i>Sphagnum fimbriatum</i>)	Woodlark (<i>Lullula arborea</i>)
Wavy hair-grass (<i>Deschampsia flexusa</i>)	Sphagnum (<i>Sphagnum squarrosum</i>)	Hobby (<i>Falco subbutea</i>)
Wood sage (<i>Teucrium scorodonia</i>)	<i>Zygodon baumgartneri</i>	Adder (<i>Vipera berus</i>)

Source: adapted from Greenaway et al. (2004 pp.52-53).

5.10 Lowland meadows, lowland dry acid grassland, and semi-improved grassland

Grassland covers around 44% (almost 65,000ha) of the High Weald AONB, but the majority of this habitat is relatively species-poor, largely as a result of the ploughing, re-seeding and fertilisation that took place during post-war agricultural improvement (Ryland, 2007; JNCC, 2013d). Today, only 777.16ha (c.1.2%) of the region's total grassland resource is composed of UK BAP priority species-rich, lowland meadows, also sometimes referred to as "unimproved neutral grassland" (i.e. grassland that has never been ploughed, re-seeded, or received inorganic fertiliser, and that supports a high number of native grasses and flowering plants) (Ryland, 2007; The Wildlife Trusts, 2013c). Moreover, most of this UK BAP priority lowland meadow habitat is composed of small and isolated fragments that are vulnerable to neglect and inappropriate management (Ryland, 2007 and 2013).

However, due to the overall scarcity of this habitat type, the High Weald's lowland meadow resource is of national importance. Indeed, the High Weald AONB has over 2% of the entire national lowland meadow resource, and the second largest total area of lowland meadow habitat of all the 34 English AONBs – a category in which it is second by only 10ha to Dorset AONB (Natural England, 2013c).

Even small patches of lowland meadow are capable of supporting an incredibly rich variety of flora and fauna (Ryland 2013). Lowland meadows in the High Weald have been found to support up to 30 species of grasses and wildflowers per square metre (Ryland, 2007). Species may include: crested dog's-tail *Cynosurus cristatus*, sweet vernal grass *Anthoxanthum odoratum*, red fescue *Festuca rubra*, ox-eye daisy *Leucanthemum vulgare*, devil's-bit scabious *Succisa pratensis*, betony *Betonica officinalis* and adder's-tongue fern *Ophioglossum vulgatum* (Ryland, 2007; Brickwood, 2007; The Wildlife Trusts, 2013c).

Moreover, where an area of lowland meadow exists alongside a variety of other habitats and landscape features (such as ancient woodland, heathland and wetland), the invertebrate fauna has the potential to be particularly rich; although, due to the aforementioned scarcity and isolation of unimproved grassland, such populations are often vulnerable and extremely susceptible to threats like inappropriate management (Patrick Roper, 16th May 2011, pers. comm.).

For a more detailed insight into the diversity of plant species which may be found in a lowland meadow in the High Weald, see Biodiversity Box 9, p.56.

Biodiversity Box 9

Unimproved meadow example: Cowden Pound Pastures

Located in the north west of the High Weald AONB, Cowden Pound Pastures represents one of the region's few surviving fragments of agriculturally unimproved lowland grassland – a Nationally Rare habitat type. The site, situated on one side of a valley, consists of a meadow divided into three sections by scrub and is maintained in its present state by a traditional grazing regime. As is characteristic of unimproved lowland meadows, this site supports a rich variety of species that thrive in more open types of habitat. A selection of the species found at Cowden Pound Pastures is presented below:

- The meadow's species-rich sward is characterised by crested dog's-tail *Cynosurus cristatus* and common knapweed *Centaurea nigra*, but also supports common bent *Agrostis capillaries*, creeping bent *A. stolonifera*, sweet vernal grass *Anthoxanthum odoratum*, red fescue *Festuca rubra*, and Yorkshire fog *Holcus lanatus*
- Other plants present include: yarrow *Achillea millefolium*, bird's-foot-trefoil *Lotus corniculatus*, field wood-rush *Luzula campestris*, ribwort plantain *Plantago lanceolata*, tormentil *Potentilla erecta*, devil's-bit scabious *Succisa pratensis*, betony *Betonica officinalis* (characteristic of the High Weald), brown sedge *Carex disticha* and heath-grass *Danthonia decumbens* (both scarce in Kent), and heath dog-violet *Viola canina* (rare in Kent)
- Finally, bordering the stream that runs along the edge of the meadow is an area of wet grassland. The damp soil of this area supports typical fen meadow species such as jointed rush *Juncus articulatus*, soft rush *J. effusus*, marsh thistle *Cirsium palustre*, greater bird's-foot-trefoil *Lotus uliginosus* and water mint *Mentha aquatica*

(Information from the Cowden Pound Pastures SSSI citation, available from:
http://www.sssi.naturalengland.org.uk/special/sssi/sssi_details.cfm?sssi_id=1007128)

This diversity of plant species supports a wide array of associated fauna. Invertebrates, in particular, benefit from the floral diversity of unimproved lowland meadows. Many species of bumblebee, butterfly, grasshopper, cricket, moth, spider, dragonfly and ground beetle spend some or all of their lifecycle in species-rich grassland, exploiting the habitat and food sources that they provide (Ryland, 2007). In turn, these invertebrates provide food for a variety of small mammals, such as voles, shrews, moles, hedgehogs and bats, as well as birds like the skylark *Alauda arvensis* (protected under the Wildlife and Countryside Act, 1981, classified as a Red List species under the Birds of Conservation Concern review and listed as a UK BAP priority species) (Eaton et al., 2009; RSPB, 2013; JNCC, 2013c; JNCC, 2013d; The Wildlife Trusts, 2013a). Moreover, this abundance of small mammals provides a critical source of prey for larger species, such as foxes, hawks and owls – notably the barn owl *Tyto alba* (classified as an Amber List species under the Birds of Conservation Concern review) (Eaton et al., 2009; RSPB, 2013; The Wildlife Trusts, 2013a).

In addition to unimproved lowland meadows, the High Weald AONB also supports two other types of grassland notable for their scarcity and species richness: lowland dry acid grassland and semi-improved grassland.

There are 142.12ha of UK BAP priority lowland dry acid grassland within the AONB – an area which represents about 1% of the total area of this habitat type in England (Natural England, 2013c). This type of grassland is characterised by plant species like heath bedstraw *Galium saxatile*, sheep's-fescue *Festuca ovina*, common bent *Agrostis capillaris*, sheep's sorrel *Rumex acetosella*, wavy hair-grass *Deschampsia flexuosa*, bristle bent *Agrostis curtisii* and tormentil *Potentilla erecta*, with

presence and abundance depending on community type and locality (Maddock, 2008). Dwarf shrubs, such as heather *Calluna vulgaris* and bilberry *Vaccinium myrtillus*, can also occur at low abundance, with lowland acid grassland often forming a mosaic with lowland heath. Moreover, acid grasslands can have a high cover of bryophytes and parched acid grassland can be rich in lichens. Overall, acid grassland is very variable in terms of plant species richness, with stands ranging from relatively species-poor (less than 5 species per 4m²) to species-rich (in excess of 25 species per 4m²) (Maddock, 2008).

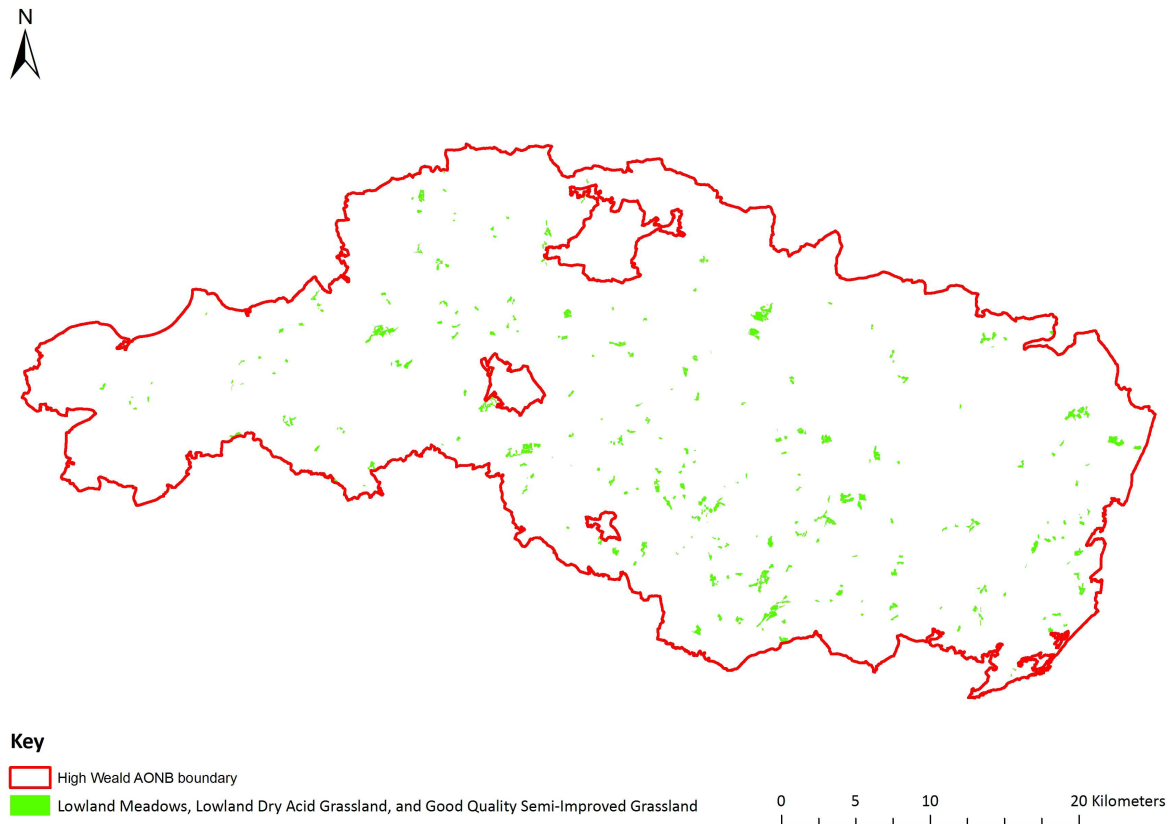
A diverse fauna is also associated with this type of grassland (JNCC, 2013d). Bird species of conservation concern which utilise acid grassland for breeding or wintering include woodlark *Lullula arborea*, green woodpecker *Picus viridis*, nightjar *Caprimulgus europaeus*, lapwing *Vanellus vanellus*, skylark *Alauda arvensis*, and hen harrier *Circus cyaneus* (the latter four of which are classified as Red List species under the Birds of Conservation Concern review (Eaton et al., 2009; RSPB, 2013)) (Maddock, 2008). Moreover, acid grassland often supports a range of invertebrates, many of which are specialists that do not occur in other types of grassland. Indeed, a considerable number of ground-dwelling and burrowing invertebrates, such as solitary bees and wasps, may be found amongst open parched acid grasslands on sandy soils. In addition, a number of rare and scarce species are associated with lowland dry acid grassland, including the UK BAP priority field-cricket *Gryllus campestris* (Maddock, 2008; JNCC, 2013c).

The third and final component of the High Weald AONB's grassland resource with notable biodiversity value is semi-improved grassland. Despite not being listed as a UK BAP priority habitat, "good quality semi-improved grassland" has now been included in Natural England's new Priority Habitat data. Although, due to disturbance from past improvement activities like fertilisation, ploughing and reseeded, semi-improved grassland has generally lost many of the grasses and wildflowers associated with unimproved grassland (i.e. lowland meadows), it may still support a significant number of species. For example, semi-improved grasslands may retain wildflowers such as red clover *Trifolium pratense*, bird's-foot trefoil *Lotus corniculatus*, ox-eye daisy *Leucanthemum vulgare* and knapweed *Centaurea nigra* – all of which are important for bumblebees (genus *Bombus*) and many other insects (The Wildlife Trusts, 2013h; High Weald AONB Unit, n.d.).

Furthermore, with appropriate management, certain semi-improved grasslands have the potential to support many more species, and may even be suitable for restoration to species-rich unimproved grassland (see the section on unknown potential biodiversity, pp.80-81). Consequently, the 974.95ha of good quality semi-improved grassland present within the High Weald AONB is of considerable value for biodiversity conservation.

The total extent of all the aforementioned types of grassland present in the High Weald AONB is displayed in Figure 14, p.58.

Figure 14. The extent of unimproved, semi-improved and dry acid grassland within the High Weald AONB.



Data sources: Natural England's Priority Habitats Inventory, and Natural England's AONBs (England) boundary data.

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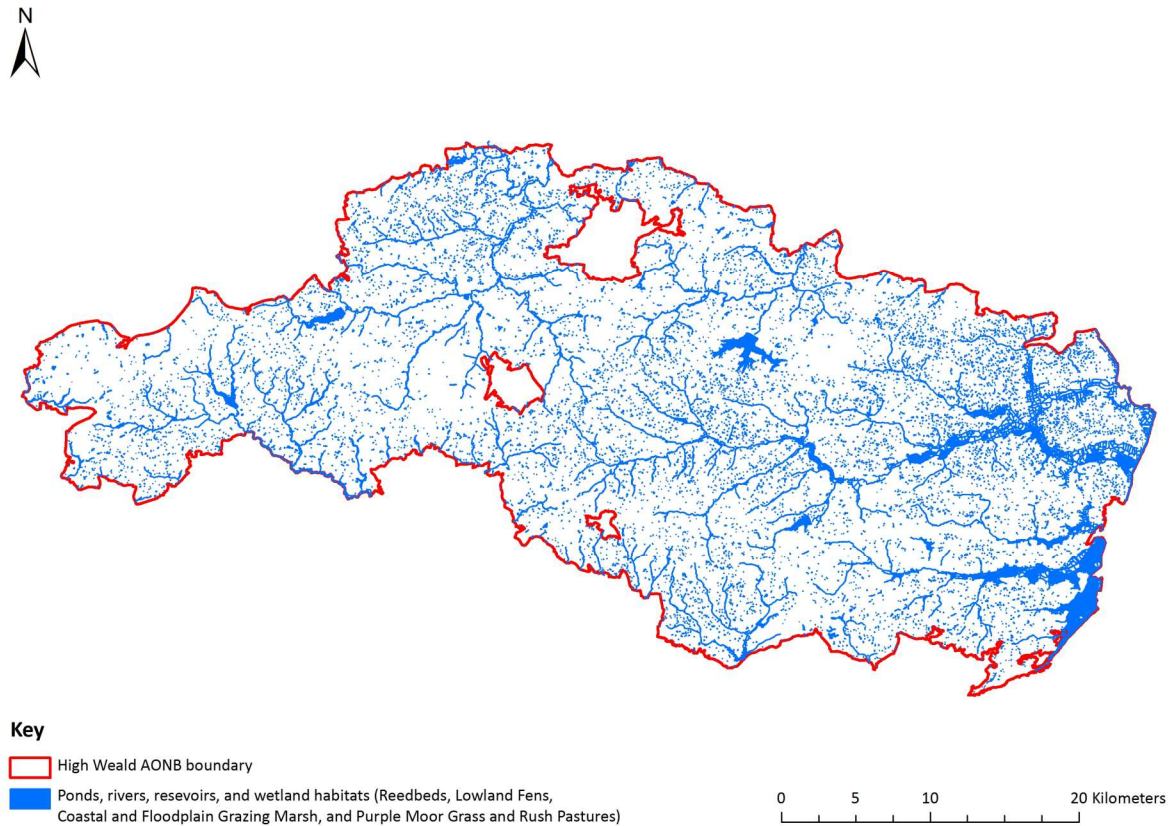
Collectively, the ecological significance of the High Weald's grasslands is much greater than this relatively small and scattered habitat resource would suggest (Ryland, 2007). Indeed, with sites scattered across the entire AONB (Ryland, 2007 and 2013), much of the value of unimproved lowland meadows lies in the way they enhance the AONB's ecological resilience and connectivity at a landscape-scale, sustaining source populations of species that can move through the region's heterogeneous and relatively permeable medieval landscape, characterised as it is by an abundance of small-scale and linear features, like ancient woodlands, gills, shaws, hedgerows and sunken routeways. Such flexibility will be critical for the persistence of species in the face of climatic and wider environmental change (Ryland, 2007).

Thus, whilst the biodiversity of the High Weald AONB's unimproved meadows is undoubtedly highly significant, insofar as they form a network, their overall ecological value is far greater than is suggested by species counts alone.

5.11 Rivers

There are a range of aquatic environments within the High Weald AONB, including rivers, ponds and wetlands. These environments play home to a wide variety of flora and fauna, as well as helping to support a number of species of conservation importance. Together, they represent a significant habitat resource – in total there are 863.82km of main river channel, 1991ha of wetland (i.e. Reedbeds, Lowland Fens, Coastal and Floodplain Grazing Marsh, and Purple Moor Grass and Rush Pastures), 13,408 ponds, and five reservoirs (Ardingly, Bewl Water, Darwell, Powdermill and Wier Wood). For an illustration of the extent of aquatic habitats in the High Weald AONB, see Figure 15, p.60.

Figure 15. The extent of aquatic habitats within the High Weald AONB.



Data sources: The High Weald AONB Unit and the Pond Conservation Trust's pond data, the High Weald AONB Unit's Water Features data (derived from Ordnance Survey MasterMap), Natural England's Priority Habitats Inventory, and Natural England's AONBs (England) boundary data.

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For example, the High Weald's rivers are known to support a number of aquatic taxa that are nationally rare. These include otter *Lutra lutra*, water vole *Arvicola terrestris*, white-clawed freshwater crayfish

The High Weald's rivers are known to support a number of aquatic taxa that are nationally rare

Austropotamobius pallipes (all of which are listed as UK BAP priority species) and black poplar *Populus nigra ssp. betulifolia* (the most uncommon timber tree in Britain and listed as Rare under section 13 of the Wildlife and Countryside Act, 1981) (Land Use Consultants and The River Restoration Centre, 2003; JNCC, 2013c; The Sussex Otters and Rivers Partnership, 2013; The Wildlife Trusts, 2013d).

In terms of fish species, the rivers of the High Weald support both coarse and salmonid fisheries. Coarse fish species include bullhead *Cottus gobio*, stoneloach, dace *Leuciscus leuciscus*, chub *Leuciscus cephalus*, tench *Tinca tinca*, bream *Abramis brama*, roach *Rutilus rutilus*, pike *Esox lucius*, perch *Perca fluviatilis*, gudgeon *Gobio gobio*, bleak *Alburnus alburnus*, carp *Cyprinus carpio*, barbell *Barbus barbus* and eel *Anguilla anguilla*, whilst salmonid species are limited to artificially stocked rainbow trout *Onchorynchus mykiss*, and wild brown trout *Salmo trutta* and their sea trout variant (Land Use Consultants and The River Restoration Centre, 2003; Environment Agency, 2012; Ouse & Adur Rivers Trust, 2013a; The Wild Trout Trust, 2013). The distribution of these salmonid species is generally limited by the stringent water quality requirements of their member species, the presence of water control structures and other barriers, and the need for well-oxygenated and contain silt-free gravel beds in which to spawn (Land Use Consultants and The River Restoration Centre, 2003; The Wild Trout Trust, 2013).

In addition, a range of invertebrates – including mayflies, caddis flies, dragonflies, shrimps, snails, beetles, leeches and worms – are associated with the region's rivers (Ouse & Adur Rivers Trust, 2013b). Taking the upper reaches of the River Uck as an example, Table 10, p.62, illustrates just how extensive this variety can be.

Table 10. River Uck invertebrate survey.

Invertebrate type	Family	Species (including common name, if available, and number found)	Abundance
Mayfly nymphs	Ephemeraidae	<i>E. danica</i> (Greendrake) (4), <i>E. vulgata</i> (drake mackerel)	30+
Mayfly nymphs	Heptageniidae	<i>Rhithrogena semicolorata</i> (olive upright) (5), <i>Ecdyonurus</i> sp.(14)	19
Stonefly nymphs	Perlodidae	<i>Isoperla grammatica</i>	20+
Cased caddis	Sericostomatidae	<i>S. personatum</i> (Welshman's button)	30+
Cased caddis	Lepidostomatidae	<i>L. hirtum</i> (Small silver sedge)	12
Cased caddis	Leptoceridae	<i>Mystacides azurea</i> (4), <i>Mystacides nigra</i> (3) (Black silverhorns)	7
Cased caddis	Goeridae	<i>Silo pallipes</i> (black sedge)	8
Damselfly nymphs	Calopterygidae	<i>C. splendens</i> (banded demoiselle)	2
Cased caddis	Glossosomatidae	<i>Agapetus</i> sp. (tiny grey sedge)	3
Mayfly nymphs	Caenidae (Angler's curse)	Unknown	8
Stonefly nymphs	Nemouridae	<i>N. erratica</i>	5
Cased caddis	Limnephilidae	<i>Chaeopteryx villosa</i> (2), <i>Micropterna sequax</i> (4), <i>Potamophylax cingulatus</i> (4), <i>Potamophylax latipennis</i> (large cinnamon sedge) (13), <i>Hydatophylax infumatus</i> (14), <i>Halesus</i> sp (Caperer) (5)	42
Cased caddis	Hydroptilidae	<i>Hydroptila</i> sp.	1
Shrimps	Gammaridae	<i>G. pulex</i>	10
Water cricket	Vellidae	<i>V. caprai</i>	1
Riffle beetles	Elmidae	<i>E. aenea</i> (3) <i>Oulimnius tuberculatus</i> (5)	8
Blackfly larvae	Simuliidae	Unkown	2
Flatworms	Planariidae	<i>Polycelis</i> sp.	2
Caseless caddis	Hydropsychidae	<i>H. angustipennis</i> (brown flag)	3
Crane fly larvae	Tipulidae	Unkown	3
Fish leech	Piscicolidae	<i>P. geometra</i>	1
Alder fly larvae	Sialidae	<i>S. lutaria</i>	3
Mayfly larvae	Baetidae	<i>B. rhodani</i>	8
Hog louse	Asellidae	Unknown	1
Midge larvae	Chironomidae	<i>A. aquaticus</i>	20+
Location:		River Uck – Huggets Furnace Farm	
Date:		3.4.12	
Grid Reference:		TQ 52325 : 25694	
Local Conditions:		Low flow of clear water, riffle/glide, over fine gravel/clay substrate. Part shaded.	
Water Velocity:		0.10 m/sec	
Discharge Volume:		0.03 m ³ /s	
Also Netted:		2 Bullheads (<i>Cottus gobio</i>) water mites, Diptera larvae, 1 empty river limpet shell.	
Biological Quality Rating:		Very good	
Water Quality Rating:		Very good	
Comments:		This site on the upper reaches of the River Uck has excellent invertebrate biodiversity. Unfortunately the quality deteriorates downstream. All parts of the Ouse catchment would produce scores like this if it were not for pollutants.	

Source: all information has been taken from a survey that was undertaken as part of the The Ouse & Adur Rivers Trust's biological monitoring programme.

It should also be noted that a number of bird species are associated with the region's rivers. These include water rail, reed and sedge warblers, grey wagtails and kingfishers (the latter two of which are classified as Amber List species under the Birds of Conservation Concern review (Eaton et al., 2009; RSPB, 2013)), as well as moorhens *Gallinula chloropus*, coots *Fulica atra* and a range of geese, ducks and swans.

The biodiversity value of the High Weald's rivers is also significantly enhanced by the regionally – and potentially internationally – significant assemblages of lower plant species that are found in the many gills stream tributaries of their upper reaches (for more information, see the section on gills, pp.20-24) (Rose and Patmore, 1997; Land Use Consultants and The River Restoration Centre, 2003; Burnside et al., 2006).

Finally, it is worth noting that there are also a range of invasive alien species found within the High Weald's rivers, including the plants Japanese knotweed *Fallopia japonica*, Himalayan balsam *Impatiens glandulifera* and giant hogweed *Heracleum mantegazzianum*, and the animals American mink *Neovision vison*, Chinese mitten crab *Eriocheir sinensis* and signal crayfish *Pacifastacus leniusculus* (Land Use Consultants and The River Restoration Centre, 2003; Natural History Museum, 2013). Although, superficially, they add to the biodiversity of the High Weald's rivers (particularly at a smaller scale), they also have the potential to reduce overall biodiversity by crowding out native species and contributing to "biotic homogenisation" – a process by which disparate places become more similar in terms of the species they support, due to the increasing prevalence of the same aggressive species (Olden et al., 2011).

5.12 Ponds

In addition to the biodiversity associated with the region's rivers, the ponds of the High Weald AONB are also critical for a wide array of species.

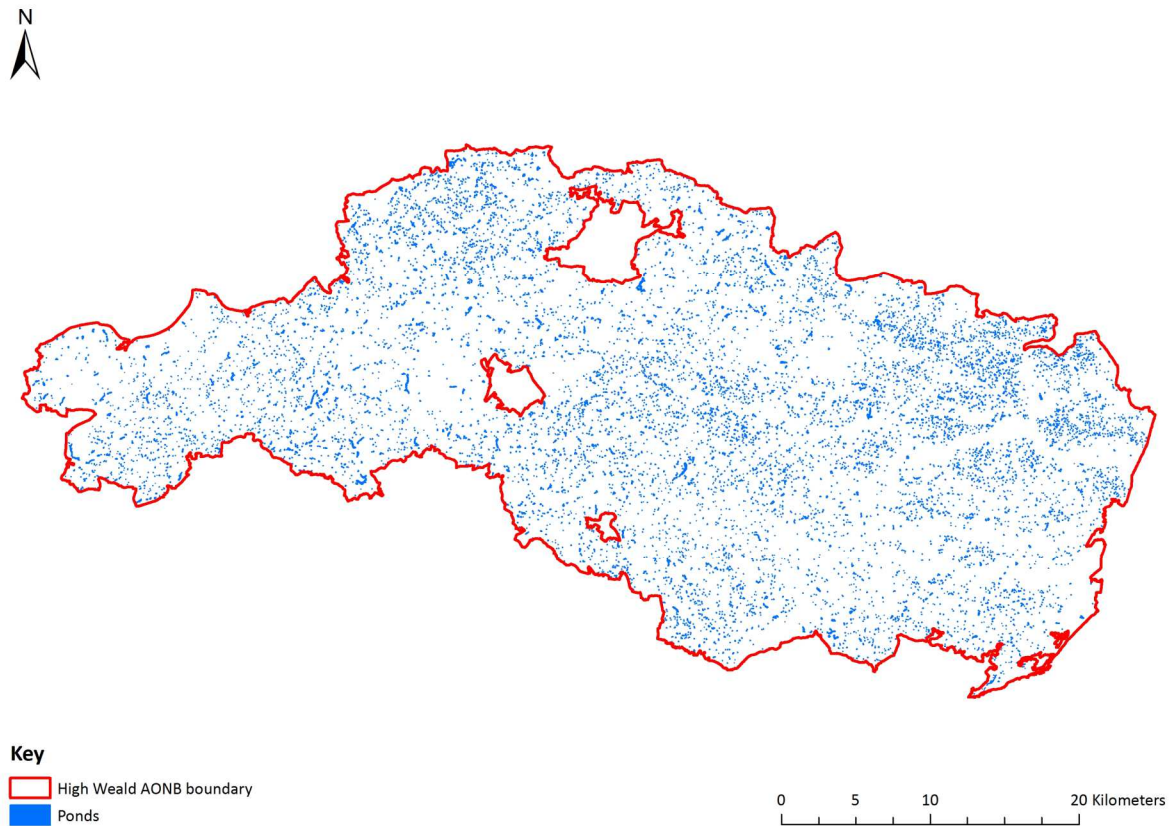
Research has shown that, on a regional scale, ponds generally support more species – as well as more uncommon species – than rivers, streams or ditches (Williams et al., 2004; Davies et al., 2008; Webb, 2008a), and as much as twice as many species as lakes (Webb, 2008b). Generally, this

The density of ponds in the High Weald is 9 per km² – five times greater than the national average of 1.8 ponds per km²

biodiversity value stems from the fact that ponds are so varied in terms of their physical and chemical characteristics (Williams et al., 2010; Pond Conservation, 2012). Determined by factors like soil type, age and land use, this variation can occur on a micro-scale, with ponds immediately adjacent to one another often supporting distinct plant and animal assemblages. In contrast the mixing action of streams and rivers generally prevents such sharp spatial variation. This inter-pond diversity helps explain why around 70% of all freshwater species in the landscape use pond habitat and why 10% (105) UK BAP species live in, or are associated with, ponds (Pond Conservation Trust, 2012). Consequently, it is likely that ponds represent one of the most important habitat resources in the entire AONB (Williams et al., 2010; Pond Conservation, 2012).

This is likely to be particularly true given the fact that the High Weald supports an unusually high density of ponds (9 ponds per km² (0.09 per ha), five times greater than the national average of 1.8 ponds per km² (0.018 per ha)), many of which occupy human-made features created by interactions between people and the landscape – such as like marl pits, moats and hammer ponds (see Figure 16, p.64, for a map of the ponds in the High Weald AONB).

Figure 16. The extent of ponds within the High Weald AONB.



Data sources: the High Weald AONB Unit and the Pond Conservation Trust's pond data, and Natural England's AONBs (England) boundary data.

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Moreover, five of The Pond Conservation Trust's Important Areas for Ponds (IAPs) fall within, or at least partly within, the boundary of the High Weald AONB. These IAPs are significant, demarcate clusters of ponds that support freshwater species, or species assemblages, of national, and/or of international, biodiversity importance (Keeble et al., 2009). Notably, one of these IAPs – “the Great Crested Newt IAP” – covers the entire High Weald AONB, and is specifically designated for its high concentrations of great crested newts *Triturus cristatus*. Highlighting the particular importance of the High Weald AONB for this UK BAP species (Keeble et al., 2009; JNCC, 2013c).

One IAP particularly rich in biodiversity is the Ashdown Forest IAP. Encompassing over 100 ponds (the majority of which are human-made), Ashdown Forest IAP is of national importance, with ponds and pools supporting a range of BAP species. For example, there are (unconfirmed) records of yellow centaury *Cicendia filiformis* and water germander *Teucrium scordium*, and common toad *Bufo bufo* and grass snake *Natrix natrix* are both known from ponds in the area (all of which are classified as BAP species in England) (Keeble et al., 2009). Records of great crested newt *Triturus cristatus* (a UK BAP priority species) are also scattered across the IAP. Ponds in the Colemans Hatch area of Ashdown Forest are particularly important for their diverse plant and invertebrate assemblages, which include a range of Nationally Scarce (i.e. a species that is recorded in only 16 to 100 ten km squares in Britain) water beetles, including: *Cercyon sternalis*, *Helochares punctatus*, *Hydaticus seminiger*, *Hydraena testacea* and *Hydrochus angustatus* (Keeble et al., 2009).

The ponds of Ashdown Forest also support a range of Odonata – the order that encompasses dragonflies and damselflies. These include: the brilliant emerald *Somatochlora metallica* (classified as “Vulnerable” in the The Odonata Red Data List for Great Britain (Daguet et al., 2008)), the hairy dragonfly *Brachytron pratense*, small red damselfly *Ceriagrion tenellum* and the downy emerald *Cordulia aenea* (the latter three of which are classified as Nationally Scarce) (Reed and Reed, 2007; Keeble et al., 2009).

Biodiversity Box 10

Pond example: Buchan Hill Ponds

Buchan Hill Ponds, located in the far northwest corner of the High Weald AONB, is composed of three individual ponds which, together, represent the best example in West Sussex of Wealden hammer ponds on acid Tunbridge Wells sands. Created by damming two streams in order to power a former iron works, the ponds now support an array of biodiversity:

- The ponds are fringed by marginal fen communities which grade into the nationally uncommon, woodland type, base-poor springline alder. This wet woodland type occupies the broad stream valleys and the boggy depressions which surround the ponds. The upper valley sides and plateau areas support drier woodlands
- The wet woodlands are dominated by alder *Alnus glutinosa* above a rich ground flora which includes *Sphagnum* moss, marsh violet *Viola palustris*, yellow sedge *Carex demissa*, opposite leaved golden saxifrage *Chrysosplenium oppositifolium*, wood avens *Geum urbanum*, water mint and rushes. The drier woodland consists of pedunculate/English oak *Quercus robur*, downy birch *Betula pubescens*, beech *Fagus sylvatica*, hazel *Corylus avellana*, rowan *Sorbus aucuparia* and ash *Fraxinus excelsior* above wood sage *Teucrium scorodonia*, bluebell *Hyacinthoides non-scripta* and ling *Calluna vulgaris*
- The ponds and surrounding vegetation carry seventeen species of dragonfly which represents a nationally significant population. One of the dragonfly species which breeds at the site – the brilliant emerald *Somatochlora metallica* – is classified as “Vulnerable” in the The Odonata Red Data List for Great Britain (Daguet et al., 2008), whilst another two – the hairy dragonfly *Brachytron pratense* and the downy emerald *Cordulia aenea* – are nationally uncommon. This site is also the county stronghold for the brilliant emerald *Somatochlora metallica* and the hairy dragonfly *Brachytron pratense*

(Information from the Buchan Hill Ponds SSSI citation, available from:

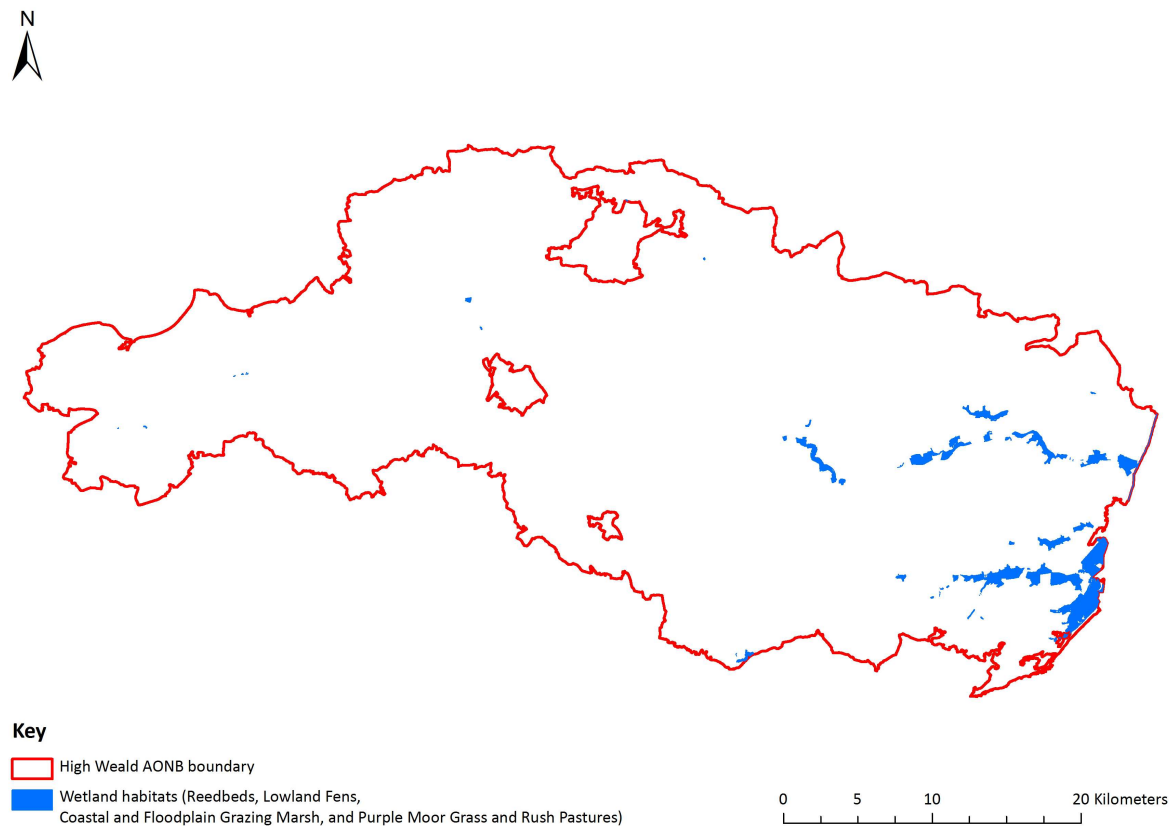
http://www.sssi.naturalengland.org.uk/special/sssi/sssi_details.cfm?sssi_id=1004098).

Crucially, as well as representing hotspots of biodiversity and acting as refugia for a range of aquatic and terrestrial organisms – including species which are rare and threatened – ponds help increase landscape-scale connectivity by providing stepping stones of habitat in what may be an otherwise hostile agricultural matrix (a feature of ponds recognised by Article 10 of Council Directive 92/43/EEC, otherwise known as the Habitats Directive) (Ponds Conservation Trust, 2012).

5.13 Wetlands

Finally, in addition to the aquatic biodiversity associated with the region’s rivers and ponds, the High Weald AONB contains patches of more unusual wetland habitats, such as lowland fen and reedbeds (see Figure 17, below, for a map illustrating their location and distribution).

Figure 17. The extent of wetland habitats within the High Weald AONB.



Data sources: Natural England's Priority Habitats Inventory and Natural England's AONBs (England) boundary data.

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Several of these wetland habitats may be found in the Brede Valley, which is located in western part of the High Weald AONB and is designated as a Site of Nature Conservation Interest (i.e. a type of Local Wildlife Site), due to its nationally significant species richness (Friends of the Brede Valley, 2013a; Friends of the Brede Valley, 2013c). Indeed, the lower reaches of the Brede River, which were originally inundated by sea water before being reclaimed for farm land during the 12th century, support a mosaic of freshwater grazing marsh, reedbeds and drainage channels (Friends of the Brede Valley, 2013b; Friends of the Brede Valley, 2013c). It is this collection of wetland habitats – particularly in the lower part of the Brede Valley less than 5m above sea level, known as the Brede Levels – that enable such a diversity of flora and fauna to flourish.

For example, plant species like frogbit, purple loosestrife *Lythrum salicaria*, meadowsweet *Filipendula ulmaria*, yellow water lilies *Nuphar lutea*, southern marsh orchid *Dactylorhiza praetermissa*, rootless duckweed *Wolffia arrhiza* (Britain's smallest flowering plant) and marsh mallow plant *Althaea officinalis* (classified as Nationally Scarce – i.e. recorded in only 16 to 100 ten km squares in Britain) may all be found along the river banks, drainage ditches and other wet areas within the Brede Valley (Friends of the Brede Valley, 2013c; Friends of the Brede Valley, 2013d).

In addition, the valley supports a rich array of birds. These include wetland-associated birds like reed warbler *Acrocephalus scirpaceus*, grey heron *Ardea cinerea*, cormorant *Phalacrocorax carbo*, green sandpiper *Tringa ochropus* (amber), teal *Anas crecca* (amber), wigeon *Anas Penelope* (amber), pintail *Anas acuta* (amber), little egret *Egretta garzetta* (amber), kingfisher *Alcedo atthis* (amber), marsh harrier *Circus aeruginosus* (the last seven of which are classified as an Amber List species under the Birds of Conservation Concern review) and hen harrier *Circus cyaneus* (classified as Red List species under the Birds of Conservation Concern review and as a priority species under the UK BAP) (Eaton et al., 2009; Friends of the Brede Valley, 2013c; Friends of Brede Valley, 2013e; JNCC, 2013c; RSPB, 2013).

A range of mammals and herptiles also exploit the wetland habitat of the Brede Valley. For example, the UK BAP priority otter *Lutra lutra* and water vole *Arvicola terrestris* are both present in the Valley, as are amphibians like the marsh frog, palmate newt and smooth newt, and three of Great Britain's six reptiles – the UK BAP priority grass snake *Natrix natrix*, the common lizard *Zootoca vivipara* and the slow worm *Anguis fragilis* (Friends of the Brede Valley, 2013c; Friends of the Brede Valley, 2013f; Friends of the Brede Valley, 2013g; JNCC, 2013c). Another species worth of note that may be found in the waterways of the Brede Valley is the sea trout *Salmo trutta morpha trutt* (Friends of the Brede Valley, 2013c).

Finally, the Brede Valley also supports a variety of invertebrates (Friends of the Brede Valley, 2013h). These include the rare weevil *Ceuthorrhynchus viduatus*, which can be found on marsh woundwort *Stachys palustris*, and

Nephanes marmoratus, another species of weevil which uses purple loosestrife *Lythrum salicaria* as its host plant (Friends of Brede Valley, 2013i). In addition, the valley is particularly important for the abundance of dragon and damselflies – i.e. *Odonata* – that it supports: “the wetland of the Brede Valley is superb for dragonflies and damselflies” (Friends of the Brede Valley, 2013j). Table 10, p.69, presents a selection of the species of *Odonata* which may be found there.

*“The wetland of the Brede Valley is superb for dragonflies and damselflies”
– Friends of Brede Valley (2013j)*

Table 10. Species of *Odonata* which may be found in the Brede Valley.

Dragonflies		Damselflies	
Latin name	Common name	Latin name	Common name
<i>Corduligaster boltonii</i>	Golden-ringed dragonfly	<i>Calopteryx virgo</i>	Beautiful demoiselle
<i>Brachytron pratense</i>	Hairy dragonfly	<i>Calopteryx splendens</i>	Banded demoiselle
<i>Aeshna cyanea</i>	Southern hawker	<i>Lestes sponsa</i>	Emerald damselfly
<i>Aeshna mixta</i>	Migrant hawker	<i>Erythromma najas</i>	Large red-eyed damselfly
<i>Anax imperator</i>	Emperor dragonfly		
<i>Aeshna grandis</i>	Brown hawker		
<i>Cordulia aenea</i>	Downy emerald		
<i>Libellula quadrimaculata</i>	Four-spotted chaser		
<i>Libellula depressa</i>	Broad-bodied chaser		
<i>Orthetrum cancellatum</i>	Black-tailed skimmer		
<i>Sympetrum striolatum</i>	Common darter		
<i>Sympetrum sanguineum</i>	Ruddy darter		

Source: Friends of the Brede Valley, 2013j.

However, possibly the single most significant wetland environment within the High Weald AONB in terms of biodiversity, is Pett Level. Designated as a SSSI and SPA (and in the process of being designated as a Ramsar site) (Natural England, 2013d), Pett Level supports an extensive system of ditches and dykes which, together, represent important examples of lowland, slow-moving and eutrophic – i.e. nutrient-rich – water systems.

Biodiversity Box 11

Wetland example: Pett Levels

Located in the far south west of the High Weald AONB, Pett Levels are nationally recognised for the important habitat and species that they support. The following information provides an overview of these habitats and the biodiversity that they support:

- There is a brackish influence near the sea and also inland in the large ditches or where peat deposits, which leach salt, lie close to the surface. The majority of the ditches have high plant species richness. Indeed, recently cleared ditches rapidly become invaded by aquatic plants, such as fennel pondweed *Stuckenia pectinata*, soft hornwort *Ceratophyllum submersum* and bladderwort *Utricularia australis* in the brackish ditches, and rigid hornwort *Ceratophyllum demersum*, broad-leaved pondweed *Potamogeton natans* and hairlike pondweed *P. trichoides* in those with a freshwater influence. The brackish ditches eventually become invaded by emergent species such as sea club-rush and grey club-rush *Schoenoplectus tabernaemontani*, whilst arrowhead, lesser bulrush *Typha angustifolia*, greater pond-sedge *Carex riparia*, and water dock *Rumex hydrolapathum* are more common in the freshwater ditches. Eventually, the late succession ditches become dominated by common reed *Phragmites australis*
- Shallow open water and emergent vegetation, largely comprising common reed *Phragmites australis* and bulrush *Typha latifolia*, supports a rich water beetle assemblage including four species of *Dytiscus* and the great silver diving beetle *Hydrophilus piceus*. It also supports a substantial dragonfly assemblage
- Other noteworthy aspects of the invertebrate assemblage include a suite of reed beetles *Donacia* spp., snail-killing flies (*Sciomyzidae*) and soldier-flies (*Stratiomyidae*) that are typical of coastal marshes. Much of this assemblage is to be found within the ditch systems of Walland Marsh, Pett Level, Rye Harbour and Denge Marsh. The range of shallow, well-vegetated waterbodies provide ideal conditions for a nationally important metapopulation of medicinal leeches *Hirudo medicinalis*, a species listed in Schedule 5 of the Wildlife and Countryside Act 1981 (as amended)
- The area is regularly used by an assemblage of at least 40 breeding bird species typical of shingle beaches and saltmarshes, lowland damp grasslands, lowland open waters and their margins, and scrub. This assemblage regularly includes nationally important breeding numbers (exceeding 1% of the Great Britain breeding populations) of gadwall *Anas strepera*, garganey *A. querquedula*, shoveler *A. clypeata*, pochard *Aythya ferina*, tufted duck *A. fuligula*, little grebe *Tachybaptus ruficollis*, water rail *Rallus aquaticus*, avocet *Recurvirostra avosetta*, black-headed gull *Larus ridibundus*, sandwich tern *Sterna sandvicensis*, common tern *S. hirundo*, little tern *S. albigularis*, Cetti's warbler *Cettia cetti* and bearded tit *Panurus biarmicus*
- Water voles also occur in large numbers. The area is particularly favourable for water voles because many of the ditches hold water in the summer, stretches of ungrazed ditch bank provide vegetation cover, and predatory mink *Mustela vison* occur at a low density

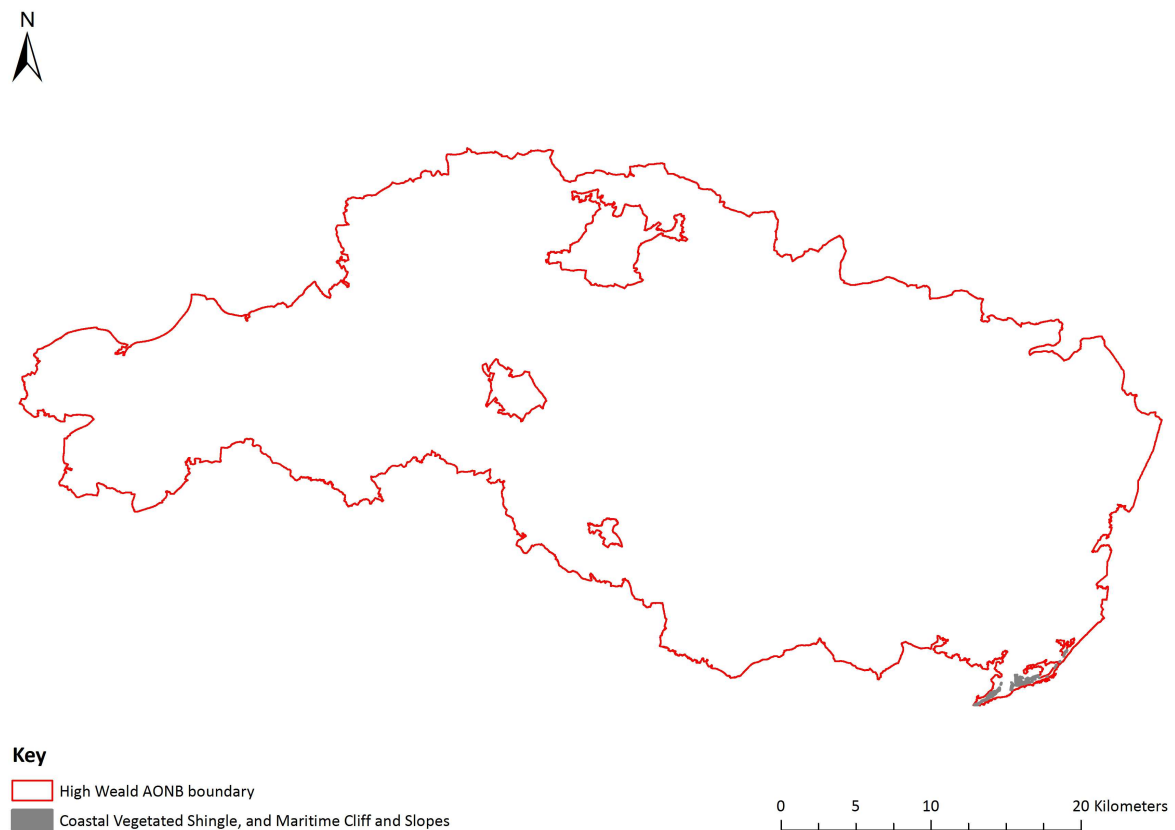
(Information from the Pett Levels SSSI citation, available from:

http://www.sssi.naturalengland.org.uk/special/sssi/sssi_details.cfm?sssi_id=2000533).

5.14 Coastal vegetated shingle and maritime cliff and slopes

Although there is only a relatively small stretch of coastal vegetated shingle and maritime cliff and slope habitats within the High Weald AONB (see Figure 18, p.70), they nevertheless makes a noteworthy contribution to the region's biodiversity interest.

Figure 18. The extent of coastal vegetated shingle and maritime cliff and slope habitats within the High Weald AONB.



Data sources: Natural England's Priority Habitats Inventory and Natural England's AONBs (England) boundary data.

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Indeed, the entire length of shingle and cliff that does fall within the AONB boundary is designated as a SSSI on account of its biological – and geological – importance. For an overview of the some of the species associated with these habitats, see Biodiversity Box 12, below.

Biodiversity Box 12

Coastal cliff & shingle example: Hastings Cliffs to Pett Beach

Located in the far south west of the High Weald AONB, the stretch of coastline that forms the Hastings Cliffs to Pett Beach SSSI supports a number of species associated with coastal cliff and shingle habitats. The following information provides an overview of these habitats and the biodiversity that they support:

- Near the coast, the trees of the gill woodlands above become progressively more affected by salt spray from the sea and at Covehurst Wood there are extremely stunted trees growing on acidic sandstone boulders. Here there is an important bryophyte flora including the liverwort *Lophocolea fragans* at its only locality in south east England
- The woodlands grade into a coastal scrub along the cliff edges, consisting of wind-pruned thickets of privet *Ligustrum vulgare* and blackthorn *Prunus spinosa*. Within the scrubby areas there are patches of grassland dominated by yellow oat-grass *Trisetum flavescens* and red fescue *Festuca rubra*, common centaury *Centaureum erythraea* and scarlet pimpernel *Anagallis arvensis*. Thrift *Armeria maritime* is common along the cliff edge with the scarce loose silky-bent *Aspera spica-venti*
- At Firehills there is an area of coastal heathland which is now invaded by bracken *Pteridium aquilinum* and gorse *Ulex europaeus*, but which still has areas of ling *Calluna vulgaris* with bell heather *Erica cinerea*, and local rarities such as pale dog violet *Viola lactea*, fenugreek *Trifolium ornithopodioides* and bog pimpernel *Anagallis tenella*
- The shingle beach supports a range of coastal plants such as sea kale *Crambe maritima*, bittersweet *Solanum dulcamara* and sea beet *Beta vulgaris*, with nationally rare plants such as the sea pea *Lathyrus japonicus* and yellow vetch *Vicia lutea*. The rocky intertidal areas with their characteristic fauna and flora have a long history of marine biological study. They are particularly interesting because of their isolated position on a predominantly shingle and soft sediment coast

(Information from the Hastings Cliffs to Pett Beach SSSI citation, available from: http://www.sssi.naturalengland.org.uk/Special/sssi/sssi_details.cfm?sssi_id=1002885).

6. What's special about the High Weald AONB in particular?

Although the High Weald AONB is by no means a global biodiversity hotspot (defined as a biogeographic unit/area featuring exceptional concentrations of endemic species and experiencing exceptional loss of habitat – see Myers et al. (2000)), as the preceding sections have illustrated, it is nevertheless of considerable value for a range of species and habitats. In the following sections, some of the special features that further enhance the biodiversity value of the High Weald AONB's landscape are highlighted.

6.1 Uniqueness and rarity

The High Weald AONB contains a number of Nationally Rare species and internationally important species assemblages. This is particularly true for non-vascular plants. Principally associated with the region's steeply incised gills and sandstone outcrops, these plant species (which include the UK BAP

priority species like Dumortier's liverwort *Dumortiera hirsute* and the regionally scarce hay-scented buckler fern *Dryopteris aemula*) are usually only found on certain parts of the Atlantic coast of Ireland, Scotland and south west England, where the climate is sufficiently wet and humid to support them (Rose and Patmore, 1997; Childs, 2012). Consequently, their occurrence in the relatively dry south east, and, even more significantly, in a combination which has not been documented anywhere else in the world (Rose and Patmore, 1997), means they make a particularly significant contribution to the interest and value of the of the High Weald AONB's biodiversity.

The uniqueness and rarity of non-vascular plant communities found in gills may also be mirrored by a rich and potentially rare associated fauna. Indeed, it has been suggested that due to the considerable age of gill woodlands and the regionally unique and stable micro-environmental conditions that they create and sustain, gills may harbour a variety of animals of conservation concern – particularly in terms of invertebrate species (Rose and Patmore, 1997; Burnside et al., 2006). Tantalising clues to a rich gill invertebrate fauna are provided by evidence like the presence of the rare beetle *Hydraena pygmaea* in a gill stream at Fairlight Glen, and the discovery in Wealden gills of a mollusc fauna (including the English chrysalis snail *Leiostyla anglica*) indicative of an oceanic, or Atlantic, climate (Rose and Patmore, 1997). Clearly, the biodiversity supported by gills and sandstone outcrops could be even more significant than is currently appreciated.

Interestingly, recent research has provided further evidence for the presence of internationally rare – and potentially nationally unique – species within the High Weald AONB. Undertaking survey work for the RSPB in early 2013, Rosie Earwaker discovered a Finge Horned Mason Bee *Osmia pilicornis* nectaring on Common Dog-violet *Viola riviniana* at a site for which there are no previous record of this species. This find highlights the paucity of biological data even in the relatively well-surveyed South East, and the danger of failing to appreciate the full diversity of species that the High Weald's landscape supports simply because of a lack of knowledge (see the section 7, p.???, on “Unkown and potential biodiversity”).

Osmia pilicornis has previously only been recorded at four sites in Britain since 2005, one of which was also in the High Weald AONB (*Osmia pilicornis* is currently listed as a Nationally Notable species in Britain, indicating that it has been found in 30 or fewer 10 kilometre squares of the National Grid – a classification derived from survey work dating back to 1991, and which therefore likely underestimates the present rarity of this species (Falk, 1991)) (Earwaker, 2013). Moreover, *Osmia pilicornis* is not only rare in the context of the British Isles; research also suggests it is rare –and in many cases rapidly declining – across the rest of its European range (Earwaker, 2012). Indeed, the only country for which there are relatively recent records is Sweden, and even there it is listed on the Regional Red List. The situation is similar in Germany, where *Osmia pilicornis* is on the Red List due to declines and possible extinctions in many regions, as well as in Austria, where a number of regional extinctions of this species have already been declared (Earwaker, 2012).

In light of the threatened status of *Osmia pilicornis*, both within Britain and beyond, its conservation in the High Weald becomes even more critical. Success will ultimately depend upon the creation and maintenance of the open-structure woodland habitat that, largely as a result of traditional management practices like coppicing, was for many centuries a characteristic feature of this landscape (Earwaker, 2012). The revival and maintenance of coppicing would not only benefit rarities like *Osmia pilicornis*. By creating spatial and temporal variation in the structure of woodland habitat (i.e. successional stages ranging from open areas that have been freshly coppiced, to more mature, close-canopy environments), traditional management would also provide ecological niches for a huge diversity of species (Welch, 1978; Fuller and Moreton, 1987; Fuller et al., 1989; Thomas, 1991; Warren and Thomas, 1992; Fuller and Warren, 1993; Natural History Museum, 2011).

Thus, the value of rare species is not limited to their distinctiveness or uniqueness, or the contribution they make to the overall biodiversity of the High Weald. Rather, insofar as rarities, like *Osmia pilicornis*, become flagship species that motivate habitat creation and management, they have the potential to stimulate conservation action benefiting a much broader suite of flora and fauna.

6.2 Difference

The aforementioned uniqueness and rarity of species and species assemblages highlights another special quality of the High Weald AONB's biodiversity – its distinctiveness, or difference. In biodiversity science, an important aspect of the biodiversity of an area is its beta diversity. Rather than simply measuring the number of species found in a given area (technically known as alpha diversity), beta diversity measures the differences in species between areas (Ladle and Whittaker, 2011). Thus the presence of regionally – and potentially internationally – unique collections of lower plants associated with the gills and sandstone outcrops of the High Weald, significantly enhances the region's biological distinctiveness and therefore its beta diversity.

This difference is further enhanced by the occurrence of species usually found further north, such as the click beetles *Hypnoidus riparius* and *Aplotarsus incanus*. These species, which are associated with a variety of wetland habitats, including gill streams, are much more typical of northern locations and are therefore somewhat unusual in the South East. Interestingly, their occurrence may be representative of a more general feature of the region's invertebrate fauna. Indeed, Peter Hodge (15th May 2011, pers. comm.) notes that, due to a variety of factors (such as the wet clay soils, the moderately high altitude and the microclimatic conditions sustained in the region's gills), the High Weald tends to support invertebrates more commonly found further north, as opposed to continental species close to their northern limit. Not only does this mean the High Weald might prove particularly important in the future for species seeking refuge from the effects of climate change, but, crucially, it marks out the High Weald's biological distinctiveness compared to neighbouring regions.

Moreover, the High Weald's beta diversity may also be thought of on a sub-regional scale. Indeed, due to the small-scale and heterogeneous nature of the High Weald's landscape, its sub-regional beta diversity – e.g. the degree of difference between the species found in ancient woodland vs. lowland heath, or unimproved meadow vs. a sandstone outcrop – is likely to be particularly high.

Although this aspect of biodiversity is often not explicitly acknowledged in discussions of biodiversity, it is clear that it is of significant importance. Indeed, the value that is attached to beta diversity can be clearly seen in the way people take great pride in locally rare, or endemic, species (for example, the saguaro cactus in Tucson, Arizona, features in many local business names and on car bumper stickers) (Wright, 2011). Moreover, the “anthropogenic blender” thought experiment – in which one imagines a completely biologically homogenised world where any differences in biodiversity between regions have been eliminated by the repeated introduction of non-native species by humans – quickly makes us realise the enormous value we attach to regional differences in biodiversity and the horror that is elicited by the prospect of a coming “homogocene” (Wright, 2011).

Furthermore, beta diversity is an important part of what defines a healthy ecosystem, and what helps sustain and create alpha diversity, or species richness. Indeed, the production of beta diversity, through both evolution (which results in the gradual accumulation, or “packing”, of species through time as they become increasingly specialised by gradually undergoing the adaptations

necessary to exploit particular environmental niches) and colonisation (through which waves of different species come to occupy an area following an environmental disturbance, thus creating biological heterogeneity in time and space), is inextricably linked – and critical to – the production and maintenance of general species richness, or alpha diversity (Wright, 2011).

Moreover, the beta diversity which results from these processes is critical to ecosystem resilience. This is because places with high beta diversity are better able to recover following ecological disturbances, such as fire or windthrow (Warren and Key, 1991). Indeed, due to the fact a heterogeneous environment with high beta diversity is likely to harbour both colonisers (essential for recovery following disturbance), and climax species (those most vulnerable to disturbance and which often rely on pioneer species to create suitable conditions for their re-colonisation), the chances of the ecosystem making a recovery to pre-disturbance conditions, without local extinctions, is greatly improved (Wright, 2011).

Clearly, then, beta diversity is an important and special component of the High Weald AONB's biodiversity. However, in addition to all the aforementioned reasons, there is another more fundamental reason why the beta diversity of the High Weald should be recognised as being of particular value: its contribution to variety. To explain why variety should be thought of as valuable in itself, we first need to understand contributory value.

In addition to instrumental value (the use-value of a thing) and intrinsic value (the value of a thing in itself), contributory value may be defined as the additional value that a thing adds to the world, or the whole, less its instrumental and intrinsic value (Bradley, 2001). The additional value added to the world in this case is variety. But why does variety add value? The answer lies in Leibniz and Brentano's principle of *bonum variationis* (Wright, 2011). This principle holds that, all things being equal, it is better to combine two dissimilar goods than to combine to similar goods – a principle which may be applied to objects of aesthetic appreciation and, in this case, the natural world. Thus, the value of a landscape's biodiversity is a combination of the number of species it supports, and the extent to which it supports more regionally different/unique types of species (Wright, 2011).

Consequently, the value of the High Weald AONB'S biodiversity should not only be located in the total number of species it supports, or has the potential to support, but also in the degree to which it differs from both surrounding regions, and internally between the various landscape features and habitat types found within its boundaries.

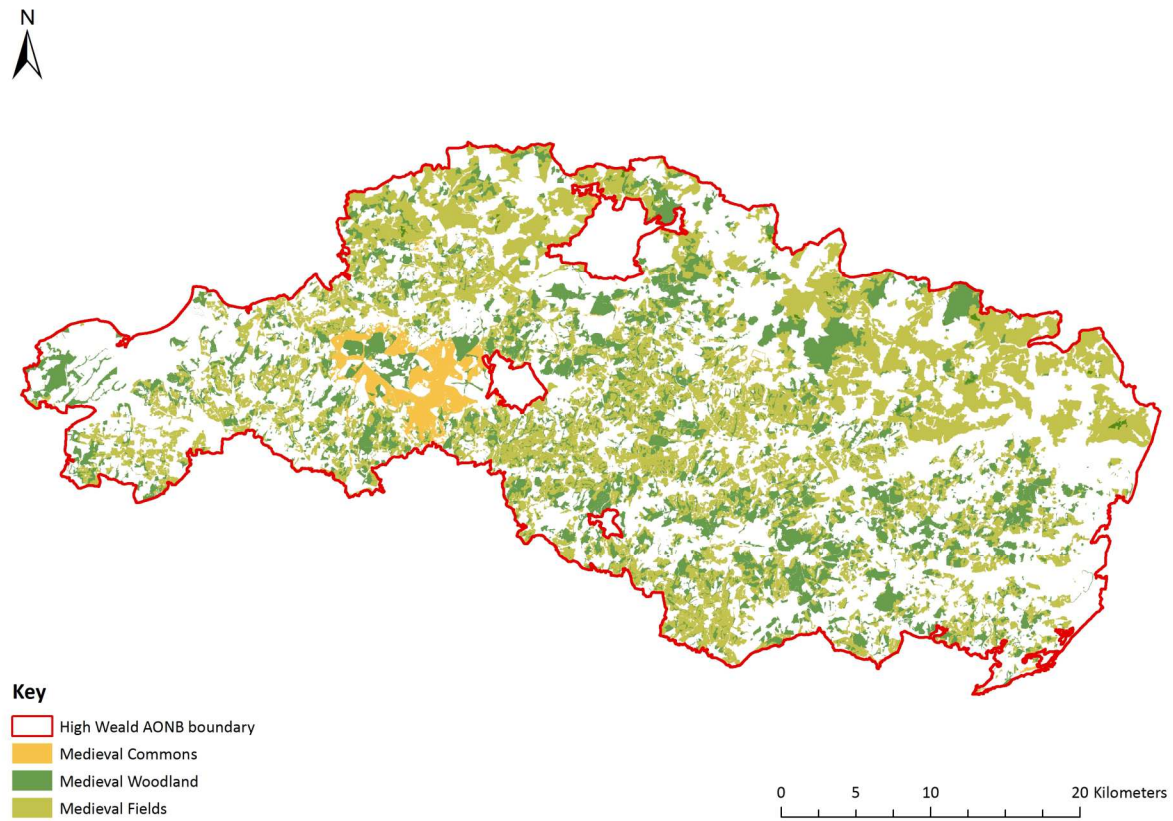
6.3 Ancientness

The High Weald is an essentially medieval landscape (considered to be one of the most coherent and best surviving medieval landscapes in Northern Europe), with many of the region's characteristic features originating before the 14th

The High Weald is an essentially medieval landscape, with many of the region's characteristic features originating before the 14th century

century (Harris, 2003; High Weald AONB Joint Advisory Committee, 2014). Due in large part to an underlying geology that resulted in relatively unproductive soils and a dissected topography unsuitable for intensive cultivation, the region was largely unaffected by post-medieval agricultural improvements (Harris, 2003). Consequently many of the habitats found in the region – and therefore the species that they support – have been afforded an unusual degree of ecological continuity (see Figure 19, p.76, for a map displaying the extent of medieval landscape features which have been mapped and are still present in the landscape of the High Weald AONB today).

Figure 19. The extent of medieval landscape features extant within the present-day landscape of the High Weald AONB.



Data sources: English Heritage's Historic Landscape Characterisation data for Sussex, Kent and Surrey, and Natural England's AONBs (England) boundary data.

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NB: Areas without mapped medieval features do not necessarily lack such features. Indeed, in some cases gaps may reflect methodological limitations/constraints rather actual absences. Consequently, the Historic Landscape Characterisation data displayed above should be treated as indicative only. It is also worth noting that the Historic Landscape Characterisation data for Kent is relatively coarse in scale compared to Sussex and Surrey. Therefore, the mapped medieval features for the Kent portion of the High Weald AONB are much less precise and only provide a broad-scale overview.

This ecological continuity is most clearly evident in the High Weald's abundant ancient woodlands, where long-established woodland cover has allowed for the accumulation and persistence of a rich variety of species, particularly plants. Indeed, characteristic ancient woodland flora – often composed of plants with relatively poor dispersal and colonisation abilities, such as wood anemone *Anemone nemorosa*, coralroot *Cardamine bulbifera*, thin spiked wood-sedge *Carex strigosa* and butcher's broom *Ruscus aculeatus* (Rose, 1999; Sansum, 2013 personal communication) – represents a vital and characteristic component of the High Weald's biodiversity.

However, perhaps the most striking example of the value of “ancientness” (i.e. ecological continuity) for biodiversity in the High Weald is provided by gills. Due to the cool and humid microclimates that gills tend to create and sustain, they are able to support unique assemblages of rare species (particularly non-vascular plants) even in locations with generally unsuitable wider climatic conditions. Indeed, the presence of species indicative of an “oceanic”, or “Atlantic”, climate (a climate type that is now restricted to the wetter, western parts of the British Isles) (Rose and Patmore, 1997), suggests that gills have allowed for the persistence of climatic conditions – and, consequently, an assemblage of species – not prevalent in the south east of Britain since the Atlantic period of the mid-Holocene, 7,500 to 5,000 years ago.

It has also been suggested that these steeply incised wooded valleys may harbour pockets of primary woodland, or what Rackham (2003) refers to as “wildwood” – i.e. remains of the woodland that colonised Britain in the mid-Holocene, after the end of the last glacial period (Rose and Patmore, 1997; Burnside et al., 2006; Sansum, 2013). This possibility is supported by the presence of now regionally scarce species, such as small-leaved lime (*Tilia cordata*), (Sansum and Ryland, 2013), that were once common in woodlands of the region.

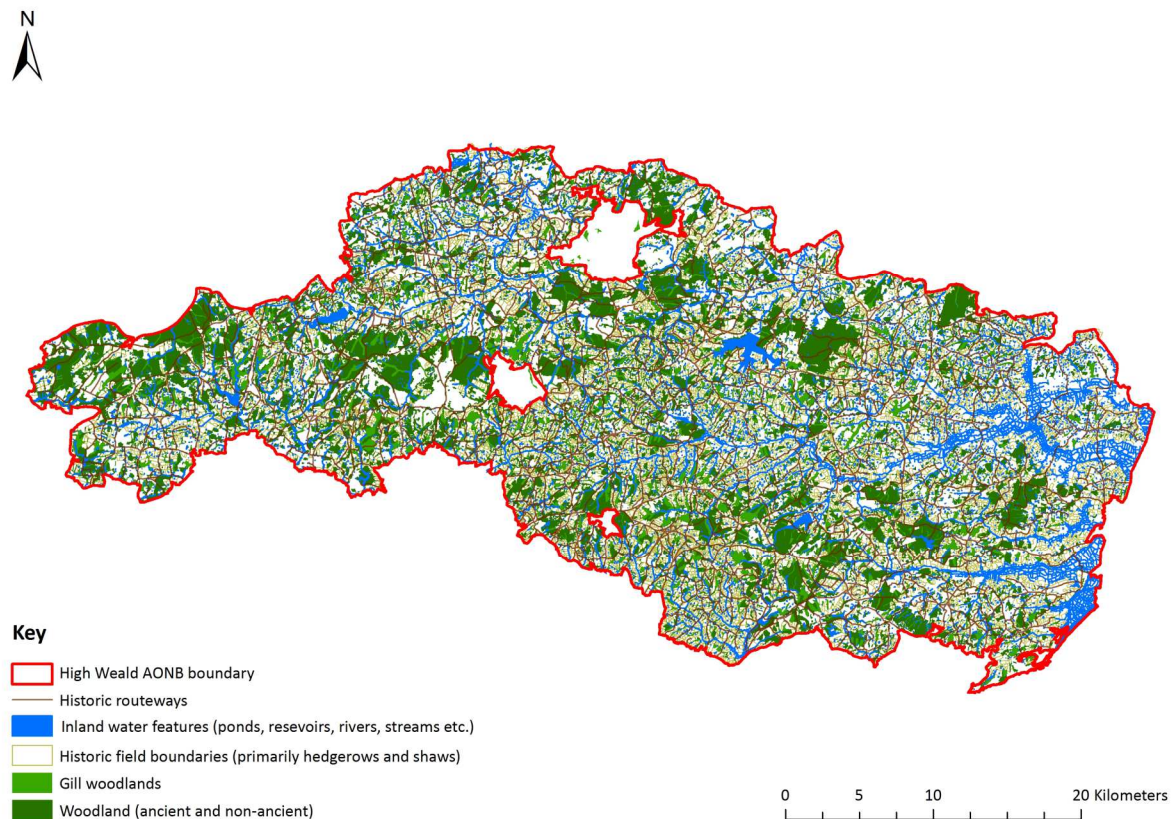
Finally, the importance of “ancientness” is also evident in the sunken, historic routeways of the High Weald. Like gills, sunken routeways seem to create microclimatic conditions, and a diversity of ecological niches, that enable them to act as repositories of biodiversity (Deckers et al., 2005; Sansum, 2013). Indeed, it is possible that some particularly old sunken routeways have provided a degree of continuity and stability in environmental conditions not found in most woodlands, many of which has been subjected to relatively intense management at various points in history. As a result, sunken routeways may support populations of species (such as the ancient woodland indicator species sweet woodruff (*Galium odoratum*)) not commonly found in the kinds of habitats one might expect – i.e. woodland interiors (Rose, 1999; Roper, 2011; Sansum, 2013).

Clearly, then, the great age – or “ancientness” – of many of the High Weald's landscape features and habitats makes an important contribution to the richness and rarity of the region's biodiversity.

6.4 Connectivity and resilience

There are a number of features in the High Weald AONB that, together, act to enhance the region's ecological connectivity – and consequently resilience – on a landscape-scale (for an illustration of this, see Figure 20, p.78).

Figure20. Landscape features that enhance the connectivity of the High Weald AONB’s landscape.



Data sources: The High Weald AONB Unit’s Water Features and Historic Field Boundary data (derived from OS MasterMap), Natural England’s Ancient Woodland Inventory, The Forestry Commission’s National Forest Inventory, The Weald & Downs Ancient Woodland Survey data, Dr Francis Rose’s gill woodland data (digitised by Sussex Biodiversity Records Centre), and Natural England’s AONBs (England) boundary data. © Crown copyright. All rights reserved. 100019601, 100019238, 100018485, 100019613 (2013).

NB: The historic field boundaries mapped above constitute those field boundaries present on OS Master Map which could be traced back, via historic map regression, to Ordnance Survey’s Epoch 1 County Series (surveyed between c.1843 and 1893).

Firstly, in addition to the unusually large amount of woodland in the AONB (which contains nearly three times the national average woodland cover and almost seven times the national average for ancient woodland), it is the sheer density of woodland habitat patches that is outstanding. As Sansum (2013, p.13) puts

“The unusually high density of woodland... confer ecological values on the habitats beyond what can be indicated by the mapping and calculation of area extent”
– Sansum (2013 p.13)

it: “The unusually high density of woodland and the environmental conditions of the High Weald confer ecological values on the habitats beyond what can be indicated by the mapping and calculation of area extent.” Thus, although the High Weald’s woodland resource may appear highly fragmented (composed, as it is, of a large number of small woodlands), the great density and consequent spatial proximity of these woodlands – to a much larger degree than most of the rest of lowland England – has the effect of significantly reducing ecological isolation and enhancing connectivity (Sansum, 2013).

Furthermore, these patches of woodland tend to be well connected via a range of linear features (Sansum, 2013). Indeed, the abundance of hedgerows, shaws, gills, and routeways provide a variety of corridors which species – of both flora and fauna – can use to move through the landscape.

Routeways, and particularly sunken routeways, may play an especially significant role in enhancing connectivity. Indeed, as illustrated by research on sunken lanes in central Belgium (Deckers et al., 2005), not only are routeways capable of providing conduits through which woodland species can move and disperse, but they also seem to provide conditions suitable for the formation of self-sustaining floras more commonly associated with woodland interiors (Deckers et al., 2005; Sansum, 2013). Due in part to small-scale variations in soil conditions, moisture levels, slope, aspect and the availability of light, as well as the cooler more humid microclimatic conditions they tend to provide, the banks of sunken routeways offer a range of ecological niches and conditions that are more usually associated with larger woodlands. What’s more, it is possible that some particularly old sunken routeways have provided a greater degree of environmental continuity and stability than many woodlands, a significant proportion of which have been subjected to relatively intense management at various points in their history. Consequently, routeways may support populations of woodland species, such as the ancient woodland indicator species sweet woodruff *Galium odoratum* (Rose, 1999), that are not even found in most woods (Roper, 2011; Sansum, 2013).

Due largely to the aforementioned landscape features, the problems commonly associated with habitat fragmentation – i.e. ecological isolation, leading to reduced species movement and ultimately reduced ecological resilience (see, for example, van der Ree et al. (2003)) – appear likely to be less of

“The functioning of sunken roads as a sustainable habitat for forest species enhances the metapopulation viability of forest plants in agricultural landscapes”
– Deckers et al. (2005 p.99)

an issue for biodiversity in the High Weald. Abundant woodlands, shaws, hedges, gills and routeways combine to create a degree of ecological connectivity uncommon – and perhaps unparalleled – in lowland England (Sansum, 2013). It is this enhanced connectivity, making the High Weald more permeable on a landscape-scale, which will be critical in ensuring the region’s biodiversity is resilient to future environmental change. Although the way in which different species and habitats respond to future environmental change will likely vary significantly (see, for example, Bergamini et al., 2009), there is no doubt that, by enabling species populations to behave more like interconnected meta-populations and less like individual, isolated communities (Bennett and

Saunders, 2010), the nature of the High Weald AONB's landscape – with its generally high levels of ecological connectivity – will likely prove invaluable for helping to ensure the persistence of a range of species (Ouborg, 1993; Hanski, 1998).

7. Unknown and potential biodiversity

Finally, much remains to be discovered about the nature and functioning of the High Weald AONB's ecosystems and the diversity, distribution and abundance of its species. Indeed, our lack of knowledge about the full extent of the region's biodiversity is put into sharp focus by the fact that even a cursory moth survey of what might be described as "fairly standard" deciduous woodland in the High Weald revealed in excess of 180 species, including brindled beauty *Lycia hiraria*, white ermine *Spilosoma lubricipeda* and shoulder-striped waistcoat *Mythimna comma* – all of which are classified as UK BAP priority species (JNCC, 2013c; Sansum 2013a, personal communication). This paucity of knowledge about biodiversity is, however, not unique to the High Weald; gaps in our knowledge regarding the number location and kinds of species that exist – commonly referred to as the Linnean and Wallacean shortfalls (Whittaker et al., 2005; Riddle et al., 2011) – remains an enormous problem the world over, hampering the effectiveness of practical conservation measures at a time when action to stem ecosystem degradation and species loss can little afford delay.

Consequently, the future collection of biological data – for a broad range of species and on an AONB-wide scale, rather than simply on a county-by-county basis – will be critical in ensuring the High Weald's biodiversity resource is effectively conserved. Thus the collection of biological records throughout the AONB should certainly be a priority for the future. However, it is important to recognise that with constantly shifting environmental conditions, driven both by direct human-impact and more diffuse factors, like climate change, and practical limitations in terms of recording resources, our knowledge of the region's biodiversity will always remain imperfect. Thus where information on the region's biodiversity is sparse, the absence of evidence should never be assumed to mean the evidence of absence.

In addition to this problem of unknown biodiversity, it is important to recognise the great potential of the High Weald AONB to support even more species than it does currently – what may be termed its biodiversity potential. Indeed, there are a number of species that one might expect to be associated with a lowland English landscape dominated by traditional small-scale mixed farming and abundant small woodlands – what may be termed representative species (Tubbs, 1996; Sansum, 2013). These include, for example, birds like barn owl *Tyto alba*, woodcock *Scolopax rusticola*, green woodpecker *Picus viridis*, sparrowhawk *Accipiter nisus*, spotted flycatcher *Muscicapa striata*, skylark *Alauda arvensis* and meadow pipit *Anthus pratensis*; mammals like badgers *Meles meles*, red foxes *Vulpes vulpes*, common shrews *Sorex araneus*, field voles *Microtus agrestis*, hedgehogs *Erinaceus europaeus*, dormice *Muscardinus avellanarius* and harvest mice *Micromys minutus*; invertebrates like the woodland-dwelling silver-washed fritillary *Argynnis paphia*, white admiral *Limenitis camilla*, pearl-bordered fritillary *Boloria euphrosyne* and small pearl-bordered fritillary *Boloria selene*, and the more open habitat-dwelling dingy skipper *Erinnes tages*, grizzled skipper *Pyrgus malvae*, common blue *Polyommatus icarus* and meadow brown *Maniola jurtina*; and meadow plants like crested dog's-tail *Cynosurus cristatus*, sweet vernal grass *Anthoxanthum odoratum*, red fescue *Festuca rubra*, ox-eye daisy *Leucanthemum vulgare*, devil's-bit scabious *Succisa pratensis*, betony *Betonica officinalis* and adder's-tongue fern *Ophioglossum vulgatum* (it should be stressed that this list of representative species is inevitably partial and thus subject to revision) (Ryland, 2007; Brickwood, 2007; Butterfly Conservation, 2013a; JNCC, 2013c; RSPB, 2013; The Wildlife Trusts, 2013a; The Wildlife Trusts, 2013c; The Wildlife Trusts, 2013e).

Although these representative species may all currently be found within the AONB, their distribution is often patchy and confined to certain isolated sites. However, the High Weald undoubtedly has the potential to support a much broader distribution of such plants and animals if appropriate management regimes are encouraged and supported (Patrick Roper, 16th May 2011, pers. comm.). An increase in the abundance of certain species within the AONB – particularly those that are currently rare and spatially restricted – would not only increase species richness in certain parts of the region, but also boost species abundance and thus biomass (i.e. the total quantity or weight of organisms in a given area (Oxford Dictionaries, 2013)). Such changes would be particularly welcome for a number of groups, including, for example, the nonbiting midges (*Chironomidae*), which, according to data gathered in the late 1950s and early 1960s, have since experienced an alarming decline in both species richness and biomass (Patrick Roper, 16th May 2011, pers. comm.). Not only is this an opportunity to help reverse the declines experienced by many species over the last several decades, both within the High Weald and nationally, but also to contribute to an overall improvement in ecosystem health.

8. Conclusion

The High Weald AONB is of national and, in some cases, international significance in terms of the biodiversity it supports. However, this significance is not only a function of the number of species or habitats the found in the High Weald, nor, indeed, their rarity. Rather, it is also a result of the landscape-scale connectivity and permeability provided by the dense patchwork of small-scale habitats – particularly ancient woodlands – that are linked together by a range of linear landscape features, such as hedgerows, shaws, routeways and gills. These characteristic features enable species to move more freely between suitable areas and thus help ensure their persistence, providing one of the most important elements of successful biodiversity conservation: a coherent and resilient ecological network (Lawton, 2010; Defra, 2011a; Defra, 2011b). Clearly, then, the value of the High Weald AONB's character components is not merely cultural, historical or aesthetic, but also ecological. Consequently, these components merit careful conservation and, where appropriate, enhancement – something that will be of critical importance for the region's biodiversity in the face of future climatic and environmental change.

References

- ALLUM, R. and FITZGERALD, C., 2005. Weald Heathland Initiative: Ecological Monitoring Paper. Internal publication available on request from the High Weald AONB Unit's document library.
- BARR, C. J., n.d. Plants and Hedgerows. C. J. BARR, C. P. BRIT, T. H. SPARKS and J. M. Churchward eds. *Hedgerow Management and Wildlife: A review of research on the effects of hedgerow management and adjacent land on biodiversity*. Defra, pp.19-34. Available from: <http://www.hedgelink.org.uk/files/hedgerow%20management%20and%20wildlife.pdf> [Accessed 24th June 2013].
- BARR, C. J., BRIT, C. P., SPARKS, T. H. and Churchward J. M., (eds), n.d. *Hedgerow Management and Wildlife: A review of research on the effects of hedgerow management and adjacent land on biodiversity*. Available from: <http://www.hedgelink.org.uk/files/hedgerow%20management%20and%20wildlife.pdf> [Accessed 25th June 2013].
- Bat Conservation Trust, 2013. Bat Roosts. Available from: http://www.bats.org.uk/pages/bat_roosts.html#TreeRoosts [Accessed 2nd July 2013].
- BENNETT, A. F. and SAUNDERS, B. A., 2010. Habitat fragmentation and landscape change. In: N. S. SODHI and P. R. ELRICH eds. *Conservation Biology for All*. Oxford: Oxford University Press, 2010, pp.88-106.
- BERGAMINI, A., UNGRICHT, S. and HOFMANN, H., 2009. An elevational shift of cryophilous bryophytes in the last century – an effect of climate warming? *Diversity and Distributions*, 15 (5), pp.871-879.
- Bernwode Fruit Trees, 2013. Available from: <http://www.bernwodefruittrees.co.uk/applelist.htm> [Accessed 17th July 2013].
- BICKER, R. and BILLINGS, P., 2011. The Condition of Traditional Orchards in the West Weald Landscape Area. West Weald Landscape Partnership.
- BICKMORE, C. J., 2002. Hedgerow survey handbook: a standard procedure for local surveys in the UK. London: DEFRA.
- BRADLEY, B., 2001. The Value of Endangered Species. *The Journal of Value Enquiry*, 35, pp.43-58.
- BRENNAN, A., 2012. Kent Habitat Survey 2012. Available from: <http://archnature.eu/> [Accessed 1st July 2013].
- BRICKWOOD, D., 2007. Weald Meadows Initiative site survey: Fosters Site of Nature Conservation Interest (SNCI) – Rushlake Green. Internal publication available on request from the High Weald AONB Unit's document library.
- BRIGHT, P. and MACPHERSON, D., 2002. Hedgerow Management, Dormice and Biodiversity. English Nature Research Report No. 454.

BRIGGS, J., 2011a. Mistletoe – a review of its distribution, conservation and insect associates. *British Wildlife*, 23, pp.23-31.

BRIGGS, J., 2011b. Mistletoe (*Viscum album*); a brief review of its local status with recent observations on its insect associations and conservation problems. *Proceedings of the Cotteswold Naturalists' Field Club*, XLV (II), pp.181-193.

British Dragonfly Society, 2004. Draft Management Fact File: The Downy Emerald *Cordulia aenea* (L.). Available from: <http://www.british-dragonflies.org.uk/sites/british-dragonflies.org.uk/files/cordulia%20aenea.pdf> [Accessed 4th July 2013].

British Dragonfly Society, 2013. Key Sites. Available from: <http://www.british-dragonflies.org.uk/content/key-sites> [Accessed 4th July 2013].

Buglife, 2013a. Ancient and Species-rich hedgerows. Available from: <http://www.buglife.org.uk/conservation/adviceonmanagingbaphabitats/sancientandspeciesrichhedgerows> [Accessed 24th June 2013].

Buglife, 2013b. Lowland calcareous grassland. Available from: <http://www.buglife.org.uk/advice-and-publications/advice-on-managing-bap-habitats/lowland-calcareous-grassland> [Accessed 13th December 2013].

BURNSIDE, N. G., METCALFE, D. J., SMITH, R. F. and WAITE, S., 2006. Ghyll woodlands of the Weald: characterisation and conservation. *Biodiversity and Conservation*, 15, pp.1319-1338.

Butterfly Conservation, 2013. Beautiful Yellow Underwing. Available from: <http://butterfly-conservation.org/51-1093/beautiful-yellow-underwing.html> [Accessed 4th July 2013].

Butterfly Conservation, 2013a. A – Z of Butterflies. Available from: <http://butterfly-conservation.org/679/a-z-of-butterflies.html> [Accessed 16th July 2013].

CHALLIS, P., 2008. Sussex Hedgerow Inventory Project. (Funded during 2007 by Defra and West Sussex County Council). Available upon request from the Sussex Biodiversity Records Centre.

CHEFFINGS, C. and FARRELL, L. (eds.), 2005. The Vascular Plant Red Data List for Great Britain, ISSN 1473-0154. Available from: <http://jncc.defra.gov.uk/page-3354> [Accessed 28th November 2013].

CHILDS, R., 2012. *The High Weald Sandstone Project*. Available from: <http://www.highweald.org/home/news/2017-discovering-sandstone.html> [Accessed 30th May 2013].

Convention on Biological Diversity, 2013. Agricultural Biodiversity: Why is it Important? Available from: <http://www.cbd.int/agro/importance.shtml> [Accessed 20th June 2013].

COOK, D., GREENAWAY, T., BROCKLEBANK, H. and SOUTHGATE, F., 2004. Sussex Floodplain Forest Concept Study. Available upon request from the Sussex Biodiversity Records Centre.

COOK, D., GREENAWAY, T., BROCKLEBANK, H. and SOUTHGATE, F., 2005. Sussex Floodplain Forest Concept Study: Summary. Available upon request from the Sussex Biodiversity Records Centre.

CORBETT, S. and MOLE, A., n.d. Invertebrates and Hedgerows. C. J. BARR, C. P. BRIT, T. H. SPARKS and J. M. Churchward eds. *Hedgerow Management and Wildlife: A review of research on the effects of hedgerow management and adjacent land on biodiversity*. Defra, pp.35-46. Available from: <http://www.hedgelink.org.uk/files/hedgerow%20management%20and%20wildlife.pdf> [Accessed 24th June 2013].

DAGUET, C., FRENCH, G. and TAYLOR, P., 2008. The Odonata Red Data List for Great Britain. *Species Status*, 11, pp.1-34. Peterborough: Joint Nature Conservation Committee. Available from: <http://jncc.defra.gov.uk/page-4517> [Accessed 18th June 2013].

DAVIES, B., BIGGS, J., WILLIAMS, P., WHITFIELD, M., NICOLET, P., SEAR, D., BRAY, S. and MAUD, S., 2008. Comparative biodiversity of aquatic habitats in the European agricultural landscape. *Agriculture Ecosystems & Environment*, 125, pp.1-8.

DECKERS, B., BECKER, P. D., HONNAY, O., HERMY, M. and MUYS, B., 2005. Sunken roads as habitats for forest plan species in a dynamic agricultural landscape: effects of age and isolation. *Journal of Biogeography*, 32, pp.99-109.

Defra, 2007. Guidance for Local Authorities on Implementing the Biodiversity Duty. Available from: <http://www.naturalengland.org.uk/ourwork/conservation/biodiversity/protectandmanage/duty.aspx> [Accessed 15th July 2013].

Defra, 2011a. Biodiversity 2020: A strategy for England's wildlife and ecosystem services. Available from: <https://www.gov.uk/government/publications/biodiversity-2020-a-strategy-for-england-s-wildlife-and-ecosystem-services> [Accessed 4th June 2013].

Defra, 2011b. The Natural Choice: securing the value of nature. Available from: <http://sd.defra.gov.uk/2011/06/the-natural-choice-securing-the-value-of-nature/> [Accessed 4th June 2013].

EARWAKER, R., 2012. Habitat assessment for the conservation of *Osmia pilicornis* Smith. Unpublished report to the RSPB.

EARWAKER, R., 2013. *Osmia pilicornis* surveys in South-east England, 2013. Unpublished report to the RSPB.

EATON, M. A., BROWN, A. F., NOBLE, D. G., MUSGROVE, A. J., HEARN, R. D., AEBISCHER, N. J., GIBBONS, D. W., EVANS A. and GREGORY, R. D., 2009. Birds of Conservation Concern 3: The population status of birds in the United Kingdom, Channel Islands and Isle of Man. *British Birds*, 102, pp.296-341.

EDWARDS, M., (ammophila@macace.net) 2011. Inverts in the High Weald. 15th May. Email to: Sally Marsh (s.marsh@highweald.org).

ENTWISTLE, A.C., RACEY, P.A. and SPEAKMAN, J.R., 1996. Habitat exploitation by a gleaning bat, *Plecotus auritus*. *Philosophical Transactions of the Royal Society of London B Biological Sciences*, 351, pp.921-931.

Environment Agency, 2012. *Coarse Fish Biology and Management*. Available from: http://www.oart.org.uk/resources/docs/Coarse_fish_advisory_booklet.pdf [Accessed 13th June 2013].

FALK, S., 1991. *A review of the scarce and threatened bees, wasps and ants of Great Britain*. Joint Nature Conservation Committee, Peterborough, UK.

FARRAR, D. R., 1998. The tropical flora of rockhouse cliff formations in the eastern United States. *Journal of the Torrey Botanical Society*, 125 (2), pp.91-108.

FOREST, F., GRENYER, R., ROUGET, M., DAVIES, T. J., COWLING, R. M., FAITH, D. P., BALMFORD, A., MANNING J. C., PROCHES, S., VAN DER BANK, M., REEVES, G., HEDDERSON, T. A. J. and SAVOLAINEN, V., 2007. Preserving the evolutionary potential of floras in biodiversity hotspots. *Nature*, 445, pp.757-760.

Forestry Commission, 2005. Woodland management for bats. Available from: http://www.bats.org.uk/pages/bat_roosts.html#TreeRoosts [Accessed 2nd July 2013].

Forestry Commission, 2013. Ancient Woodlands. Available from: <http://www.forestry.gov.uk/forestry/INFD-8UMCRQ> [Accessed 12th June 2013].

Friends of the Brede Valley, 2013a. Biodiversity. Available from: <http://www.bredevalley.info/wildlife/biodiversity.php> [Accessed 17th July 2013].

Friends of the Brede Valley, 2013b. History. Available from: http://www.bredevalley.info/the_brede_valley/history.php [Accessed 17th July 2013].

Friends of the Brede Valley, 2013c. The Brede Valley. Available from: http://www.bredevalley.info/the_brede_valley/BredeValleyBrochure.pdf [Accessed 17th July 2013].

Friends of the Brede Valley, 2013d. Plants. Available from: <http://www.bredevalley.info/wildlife/plants.php> [Accessed 17th July 2013].

Friends of Brede Valley, 2013e. Birds. Available from: <http://www.bredevalley.info/wildlife/birds.php> [Accessed 17th July 2013].

Friends of the Brede Valley, 2013f. Mammals. Available from: <http://www.bredevalley.info/wildlife/mammals.php> [Accessed 17th July 2013].

Friends of the Brede Valley, 2013g. Amphibians and Reptiles. Available from: <http://www.bredevalley.info/wildlife/amphibians-reptiles.php> [Accessed 17th July 2013].

Friends of the Brede Valley, 2013h. Invertebrates. Available from: <http://www.bredevalley.info/wildlife/invertebrates.php> [Accessed 17th July 2013].

Friends of Brede Valley, 2013i. Beetles. Available from: <http://www.bredevalley.info/wildlife/beetles.php> [Accessed 22nd July 2013].

Friends of Brede Valley, 2013j. Available from: <http://www.bredevalley.info/wildlife/dragonflies.php> [Accessed 22nd July 2013].

FULLER, R. J. et al., 1989. The distribution of breeding songbirds within mixed coppiced woodland in Kent, England, in relation to vegetation age and structure. *Annales Zoologici Fennici*, 26, pp.265-275.

FULLER, R. J. and MORETON, B. D., 1987. Breeding Bird Populations of Kentish Sweet Chestnut (*Castanea sativa*) Coppice in Relation to Age and Structure of the Coppice. *Journal of Applied Ecology*, 24, pp.13-27.

FULLER, R. J. and WARREN, M. S., 1993. *Coppiced woodlands: their management for wildlife*. 2nd ed. Out of Print, 34 pages A5 softback, ISBN 1 873701 32 2.

GOVE, B., POWER, S., BUCKLEY, G. and GHAZOUL, J., 2007. Effects of herbicide spray drift and fertilizer overspread on selected species of woodland ground flora: comparison between short-term and long-term impact assessments and field surveys. *Journal of Applied Ecology*, 44, pp.374-384.

GREENAWAY, T., ROPER, P. and RYLAND, K., 2004. Wooded Heaths in the High Weald: A research project to further the understanding of the ecology and management of the woodland / heathland mosaic. Internal publication available on request from the High Weald AONB Unit's document library.

GULLEY, J. L. M., 1960. The Wealden landscape in the early seventeenth century and its antecedents. University of London: Doctoral thesis.

HAINES-YOUNG, R. H., BARR, C. J., BLACK, H. I. J., BRIGGS, D. J., BUNCE, R. G. H., CLARKE, R. T., COOPER, A., DAWSON, F. H., FIRBANK, L. G., FULLER, R. M., FURSE, M. T., GILLESPIE, M. K. HILL, R., HORNUNG, M., HOWARD, D. C., McCANN, T., MORECROFT, M. D., PETIT, S., SIER, A. R. J., SMART, S. M., SMITH, G. M., STOTT, A. P., STUART, R. C. and WATKINS, J. W., 2000. *Accounting for nature: assessing habitats in the UK countryside*. London: DETR.

HALL, J., 1997. An Analysis of National Vegetation Classification Survey Data. JNCC Report No.272. Peterborough: Joint Nature Conservation Committee.

HANSKI, I., 1998. Metapopulation dynamics. *Nature*, 396, pp.41-49.

HARRIS, R. B., 2003. The Making of the High Weald. High Weald Joint Advisory Committee. Available from: http://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0CCEQFjAA&url=http%3A%2F%2Fwww.highweald.org%2Fresearch%2Fdoc_download%2F589-making-of-the-high-weald-full-report.html&ei=xGIXULbxCoaJOAXNioDICw&usg=AFQjCNG7v7cg-m8IUv9wxVV3CfBO-MphaQ [Accessed 4th June 2013].

Hedgelink, 2013. Wildlife and hedgerows. Available from: http://www.hedgelink.org.uk/wildlife-and-hedgerows.htm#Hedgerow_Features_Important_to_Wildlife_1 [Accessed 24th June 2013].

High Weald AONB Joint Advisory Committee, 2014. The High Weald Area of Outstanding Natural Beauty Management Plan 2014-2019. 3rd ed., adopted March 2009. Available from: <http://www.highweald.org/high-weald-aonb-management-plan.html> [Accessed 19th December 2013].

High Weald AONB Unit, n.d. Semi-improved grassland. Available from: <http://www.highweald.org/look-after/land-management/grassland/semi-improved-grassland.html> [Accessed 13th December 2013].

HODGE, P., (peter.hodge@mypostoffice.co.uk) 2011. Inverts in the High Weald. 15th May. Email to: Sally Marsh (s.marsh@highweald.org).

- JNCC and Defra (on behalf of the Four Countries' Biodiversity Group), 2012. UK Post-2010 Biodiversity Framework. Available from: <http://jncc.defra.gov.uk/page-6189> [Accessed 15th July 2013].
- JNCC, 2013. Protected sites designations directory Available from: <http://jncc.defra.gov.uk/page-1527> [Accessed 11th July 2013].
- JNCC, 2013a. UK BAP priority species and habitats. Available from: <http://jncc.defra.gov.uk/page-5705> [Accessed 4th June 2013].
- JNCC, 2013b. The National Vegetation Classification (NVC). Available from: <http://jncc.defra.gov.uk/page-4259> [Accessed 2nd July 2013].
- JNCC, 2013c. UK BAP priority species. Available from: <http://jncc.defra.gov.uk/page-5717> [Accessed 30th May 2013].
- JNCC, 2013d. UK BAP list of priority habitats. Available from: <http://jncc.defra.gov.uk/page-5706> [Accessed 30th May 2013].
- JNCC, 2013e. Calcareous grasslands – lowland. Available from: <http://jncc.defra.gov.uk/page-3562> [Accessed 13th December 2013].
- JONES, G., DUVERGÉ, L.P. and RANSOME, R.D., 1995. Conservation biology of an endangered species: field studies on greater horseshoe bats. *Symposia of the Zoological Society of London*, 67, pp.309-324.
- KEEBLE, H., WILLIAMS, P., BIGGS, J. and ATHANSON, M., 2009. Important Areas for Ponds (IAPs) in the Environment Agency Southern Region.
- KIMBER, I., 2013. 2142 Beautiful Yellow Underwing *Anarta myrtilli* (Linnaeus, 1761). Available from: <http://ukmoths.org.uk/show.php?bf=2142> [Accessed 4th July 2013].
- KUBALIKOVA, L., 2011. *The High Weald's Geodiversity and Geological Heritage*. Internal publication available on request from the High Weald AONB Unit's document library.
- LADLE, R. J. and WHITTAKER, R. J., (eds.) 2011. *Conservation Biogeography*. Oxford: Blackwell Publishing Ltd.
- Land Use Consultants and The River Restoration Centre, 2003. *HIGH WEALD AONB INTEGRATED CATCHMENT MANAGEMENT & RIVER RESTORATION STUDY*. Internal publication available on request from the High Weald AONB Unit's document library.
- LAWTON, J., 2010. Making Space for Nature: A review of England's Wildlife Sites and Ecological Network. Available from: <https://www.gov.uk/government/news/making-space-for-nature-a-review-of-englands-wildlife-sites-published-today> [Accessed 4th June 2013].
- LUSH, M., ROBERTSON, H. J., ALEXANDER, K. N. A., GIAVARINI, V., HEWINS, E., MELLINGS, J., STEVENSON, C. R., STOREY, M. & WHITEHEAD, P.F., 2009a. Biodiversity studies of six traditional orchards in England. Natural England Research Reports, Number NERR025.

LUSH, M., ROBERTSON, H. J., ALEXANDER, K. N. A., GIAVARINI, V., HEWINS, E., MELLINGS, J., STEVENSON, C. R., STOREY, M. & WHITEHEAD, P.F., 2009b. Biodiversity studies of six traditional orchards in England. Natural England Research Reports, Number RIN025.

MADDOCK, A. (ed.), 2008. UK Biodiversity Action Plan; Priority Habitat Descriptions. Peterborough: Joint Nature Conservation Committee. Available from: http://jncc.defra.gov.uk/PDF/UKBAP_PriorityHabitatDesc-Rev2011.pdf [Accessed 19th June 2013].

MARRABLE, C. J., 1999. A Survey of Sites Suitable for Damselflies and Dragonflies on Ashdown Forest. Available upon request from the Board of Conservators of Ashdown Forest.

MCCOLLIN, D., JACKSON, J. I., BUNCE, R. G. H., BARR, C. J. and STUART, R., 2000. Hedgerows as habitats for woodland plants. *Journal of Environmental Management*, 60, pp.77-90.

Mistletoe Matters, 2012. Mistletoe Information Sheet No. 6: Biodiversity value. Available from: http://mistletoe.org.uk/homewp/wp-content/uploads/2012/07/Mistletoeinfosheet_6_biodiversityvalue.pdf [Accessed 20th June 2013].

MORGAN, J., 2013 (j.m@robsacks.demon.co.uk) 2012. Keepers Nursery website enquiry. 3rd July. Via email.

MYERS, N., MITTERMEIER, R. A., MITTERMEIER, C. G., da FONSECA, G. A. B. and KENT, J., 2000. Biodiversity hotspots for conservation priorities. *Nature*, 403, pp.853-858.

National Biodiversity Network, 2013. Interactive Map (records obtained by searching for the relevant species). Available from: <http://data.nbn.org.uk/imt/> [Accessed 2nd July 2013].

Natural England, 2011. First ever survey of England's traditional orchards from the air. Available from: <http://www.naturalengland.org.uk/ourwork/conservation/biodiversity/050511.aspx> [Accessed 20th June 2013].

Natural England, 2012. Standing Advice for ancient woodland. Available from: http://www.naturalengland.org.uk/Images/standing-advice-ancient-woodland_tcm6-32633.pdf [Accessed 16th December 2013].

Natural England, 2013. Why declare Local Nature Reserves. Available from: <http://www.naturalengland.org.uk/ourwork/conservation/designations/lmr/whydeclarelmr.aspx> [Accessed 11th July 2013].

Natural England, 2013a. Funding for land management. Available from: <http://www.naturalengland.org.uk/ourwork/farming/funding/> [Accessed 11th July 2013].

Natural England, 2013b. Environmental designations and features. Available from: http://www.naturalengland.gov.uk/ourwork/farming/funding/ecs/sitings/final_designations.aspx [Accessed 24th May 2013].

Natural England, 2013c. Data spreadsheet titled "Priority Habitat Inventory AONB_PHI_data(1)(1)". Data provided by Gavin Measures of Natural England via email on 20th November 2013.

Natural England, 2013d. Dungeness, Romney Marsh and Rye Bay SPA and Ramsar consultation. Available from:

http://www.naturalengland.org.uk/regions/south_east/ourwork/dungenessconsultation/ [Accessed 13th June 2013].

NORTON, B., 2006. Toward a Policy-Relevant Definition of Biodiversity. *In*: edited by J. M. SCOTT, D. D. GOBLE and F. W. DAVIS eds. *The Endangered Species Act at Thirty: Conserving Biodiversity in Human-Dominated Landscapes*. Washington: DC: Island press, 2006, pp.49–58.

Natural History Museum, 2011. Woodland. Available from: <http://www.nhm.ac.uk/nature-online/british-natural-history/british-habitats/oakwoodland/index.html> [Accessed 28th November 2013].

OLDEN, J. D., LOCKWOOD, J. L. and PARR, C. J., 2011. Chapter 9: Biological Invasions and the Homogenization of Faunas and Floras. *In*: R. J. LADLE and R. J. WHITTAKER, eds. *Conservation Biogeography*. Oxford: Blackwell Publishing Ltd, 2011 p.224-243.

OUBORG, N. J., 1993. Isolation, population size and extinction: the classical and metapopulation approaches applied to vascular plants along the Dutch Rhine-system. *Oikos*, 66, pp.298-308.

Ouse & Adur Rivers Trust, 2013a. The Sussex River Ouse Corridor. Available from: <http://www.oart.org.uk/rivers/ouse.htm> [Accessed 13th June 2013].

Ouse & Adur Rivers Trust, 2013a. Biological Monitoring. Available from: <http://www.oart.org.uk/biological/index.htm> [Accessed 13th June 2013].

Oxford Dictionaries, 2013. Biomass. Available from: <http://oxforddictionaries.com/definition/english/biomass> [Accessed 16th July 2013].

PACKER, J. J., n.d. Mammals and Hedgerows. C. J. BARR, C. P. BRIT, T. H. SPARKS and J. M. Churchward eds. *Hedgerow Management and Wildlife: A review of research on the effects of hedgerow management and adjacent land on biodiversity*. Available from: <http://www.hedgeline.org.uk/files/hedgerow%20management%20and%20wildlife.pdf> [Accessed 24th June 2013].

PITT, J. and HENDY, J., 2012. *High Weald Sandstone Project: Bryophyte Survey*. Maidstone: Kent Wildlife Trust.

Plantlife, n.d. Briefing Sheet: Spiked Rampion *Phyteum spicatum*. Available from: http://www.plantlife.org.uk/wild_plants/plant_species/spiked_rampion [Accessed 28th November 2013].

Pond Conservation, 2012. *The national context for the conservation of ponds in the High Weald AONB, with particular focus on the Brede River Catchment*. Internal publication available on request from the High Weald AONB Unit's document library.

RACKHAM, O., 1995. The History of the Countryside: The classic history of Britain's landscape, flora and fauna. London: Weidenfield & Nicolson.

RACKHAM, O., 2003. Ancient Woodland: its history, vegetation and uses in England. 2nd ed. Dalbeattie: Castlepoint.

REED, M. and REED, J., 2007. Survey Report on Water Bodies and Odonata on the Ashdown Forest. Internal publication available on request from the High Weald AONB Unit's document library.

RENNELS, K., LAVENDER, J., ROBSON, J. and SHERWIN, G., 1998. Hedges in the Weald of Kent, Sussex and Surrey: A practical guide to the care of an outstanding feature and its unique wildlife. Internal publication available on request from the High Weald AONB Unit's document library.

Rich, T. C. G. & Rumsey, F. J. (2004). 490. *Hymenophyllum tunbrigense*. *Curtis's Botanical Magazine*, 21, pp.70-76.

RIDDLE, B. R., LADLE, R. J., LOURIE, S. A. and WHITTAKER, R. J., 2011. Chapter 4: Basic Biogeography: Estimating Biodiversity and Mapping Nature. In: R. J. LADLE and R. J. WHITTAKER, eds. *Conservation Biogeography*. Oxford: Blackwell Publishing Ltd, 2011 p.47.

ROPER, P., 2011. The flora and fauna of archaeological sites in woodlands. Transcript of paper from Archaeology of Wooded Landscapes conference, February 2011. Available from: http://www.highweald.org/look-after/archaeology/conference-proceedings/doc_download/1528-dr-patrick-roper-the-flora-and-fauna-of-archaeological-sites-in-woodlands.html [Accessed 5th June 2013].

ROPER, P., (patrick@prassociates.co.uk) 2011. Inverts in the High Weald. 16th May. Email to: Sally Marsh (s.marsh@highweald.org).

ROSE, F. and PATMORE, J. M., 1997. *Gill Woodlands in the Weald*. Peterborough: English Nature.

ROSE, F., 1999. Indicators of ancient woodland: The use of vascular plants in evaluating ancient woods for nature conservation. *British Wildlife*, April 1999.

Rother Woods Project, 2010. 2007-2010 Summary. Produced as part of the Rother Woods Project and available upon request (see: <http://www.sussex-butterflies.org.uk/rother/index.php>).

RSPB, 2013. Bird guide: Birds by name. Available from: <http://www.rspb.org.uk/wildlife/birdguide/name/a/> [Accessed 12th June 2013].

RUMSEY, A., PRICE, D. and LUCAS, K., 2011. Dossier: *Phyteuma spicatum* L. Available from: http://www.plantlife.org.uk/wild_plants/plant_species/spiked_rampion [Accessed 28th November 2013].

RYLAND, K., 2007. *Strategy for the Conservation of Wealden Species-rich, Neutral Grasslands*. Internal publication available on request from the High Weald AONB Unit's document library.

RYLAND, K., 2013. *High Weald Grassland SNCI Landowner Liaison Project: A review of current biodiversity status, management regimes and management issues for High Weald unimproved grassland sites with SNCI/LWS status*. Internal publication available on request from the High Weald AONB Unit's document library.

SANSUM, P., 2013. *A preliminary analysis of woodland data help by the High Weald AONB Unit and further information on some key features of the High Weald woodland resource in support of High Weald AONB Management Plan 2014-2019*. Internal publication available on request from the High Weald AONB Unit's document library.

SANSUM, P., (philip.sansum@googlemail.com) 2013a. Moth surveys. 22nd July. Via email.

SANSUM, P., (philip.sansum@googlemail.com) 2013. AWI species dispersal &c. 24th July. Via email.

SANSUM, P. and RYLAND, K., 2013. *Tilia cordata* (Small-leaved Lime) in gill woodland in the Weald of Kent. *The New Journal of Botany*, 2013.

SHERWIN, G., 2000. *Conserving the Weald's Heathland Heart: A bid to the Heritage Lottery Fund under the Tomorrow's Heathland Heritage Programme*. Internal publication available on request from the High Weald AONB Unit's document library.

SPARKS, T., n.d. a. Plants and Hedgerows. C. J. BARR, C. P. BRIT, T. H. SPARKS and J. M. Churchward eds. *Hedgerow Management and Wildlife: A review of research on the effects of hedgerow management and adjacent land on biodiversity*. Defra, pp.49-53. Available from: <http://www.hedgelink.org.uk/files/hedgerow%20management%20and%20wildlife.pdf> [Accessed 24th June 2013].

SPARKS, T., n.d. b. Amphibians, Reptiles and Hedgerows. C. J. BARR, C. P. BRIT, T. H. SPARKS and J. M. Churchward eds. *Hedgerow Management and Wildlife: A review of research on the effects of hedgerow management and adjacent land on biodiversity*. Defra, pp.49-53. Available from: <http://www.hedgelink.org.uk/files/hedgerow%20management%20and%20wildlife.pdf> [Accessed 24th June 2013].

Sussex Biodiversity Record Centre, 2013. Wealden Ancient Tree Project. Available from: <http://sxbrc.org.uk/projects/ancient-tree-project/> [Accessed 1st July 2013].

Sussex Otters and Rivers Project, 2010. Celebrating 10 Years of Working with Wetlands: March 2000 – March 2010. Available upon request from the Sussex Biodiversity Records Centre.

Sussex Rare Species Inventory, 2013. Data available upon request from the Sussex Biodiversity Records Centre.

The British Mountaineering Council, 2013. Regional Access Database: Harrison's Rocks. Available from: <https://www.thebmc.co.uk/modules/RAD/viewcrag.aspx?id=119> [Accessed 11th June 2013].

The Sussex Otters and Rivers Partnership, 2013. Black Poplar Trees. Available from: <http://www.sussexotters.org/wildlife/blackpoplar.htm> [Accessed 13th June 2013].

The Wildlife Trusts, 2012. Protecting Wildlife for the Future Status of English Local Wildlife Site Systems 2011. Available from: <http://www.wildlifetrusts.org/localwildlifesites#What%20are%20Local%20Wildlife%20Sites> [Accessed 10th July 2013].

The Wildlife Trusts, 2013a. Species explorer: Birds. Available from: <http://www.wildlifetrusts.org/wildlife/species-explorer/birds> [Accessed 12th June 2013].

The Wildlife Trusts, 2013b. Habitat explorer: Lowland Heathland. Available from: <http://www.wildlifetrusts.org/wildlife/habitats/lowland-heathland> [Accessed 6th June 2013].

The Wildlife Trusts, 2013c. Habitat explorer: Lowland Meadows. Available from: <http://www.wildlifetrusts.org/wildlife/habitats/lowland-meadows> [Accessed 12th June 2013].

The Wildlife Trusts, 2013d. Species explorer: Trees and Shrubs. Available from: <http://www.wildlifetrusts.org/wildlife/species-explorer/plants-and-fungi/trees-and-shrubs> [Accessed 12th June 2013].

The Wildlife Trusts, 2013e. Species explorer: Mammals. Available from: <http://www.wildlifetrusts.org/wildlife/species-explorer/animal/mammals> [Accessed 19th June 2013].

The Wildlife Trusts, 2013f. Habitat explorer: Traditional Orchard. Available from: <http://www.wildlifetrusts.org/wildlife/habitats/traditional-orchard> [Accessed 24th June 2013].

The Wildlife Trusts, 2013g. Habitat explorer: Lowland Calcareous Grassland. Available from: <http://www.wildlifetrusts.org/wildlife/habitats/lowland-calcareous-grassland> [Accessed 13th December 2013].

The Wildlife Trusts, 2013h. Species explorer: Wildflowers. Available from: <http://www.wildlifetrusts.org/wildlife/species-explorer/plants-and-fungi/wildflowers> [Accessed 13th December 2013].

The Wild Trout Trust, 2013. About Trout: Challenges. Available from: <http://www.wildtrout.org/content/about-trout-challenges> [Accessed 13th June 2013].

THIEL, H. and SPRIBILLE, T., 2007. Lichens and bryophytes on shaded sandstone outcrops used for rock climbing in the vicinity of Gottingen (southern Lower Saxony, Germany). *Herzogia*, 20, pp159-177.

THOMAS, J. A., 1991. Rare Species Conservation: Case Studies of European Butterflies. In: I. F. SPELLERBERG, F. B. GOLDSMITH and M. G. MORRIS, eds. *The Scientific Management of Temperate Communities for Conservation: The 31st Symposium of the British Ecological Society*. Oxford: Blackwell Scientific Publications.

THOMPSON, R., HUMPHREY, J., HARMER, R. and FERRIS, R., 2003. Restoration of Native Woodland on Ancient Woodland Sites: Practice Guide. 1st ed. Edinburgh: Forestry Commission.

TURNER, J. and Plantlife International, 2007. *Pallavicinia lyellii*. Available from: http://www.plantlife.org.uk/uploads/documents/Pallavicinia_lyellii_dossier1.pdf [Accessed 11th June 2013].

UK Biodiversity Steering Group, 1995. Biodiversity: The UK Steering Group Report Volume 2: Action Plans. London: HM SO.

van der REE, R., BENNET, A. F. and GILMORE, D. C., 2004. Gap-crossing by gliding marsupials: thresholds for use of isolated woodland patches in an agricultural landscape. *Biological Conservation*, 115 (2), pp.241-249.

WARREN, M. S. and KEY, R. S., 1991. Woodlands: Past, Present and Potential for Insects. In: N. M. COLLINS and J. A. THOMAS, eds. *The Conservation of Insects and their Habitats: 15th Symposium of the Royal Entomological Society of London*. London: Academic Press Limited, 1991, pp.155-211.

WARREN, M. S. and THOMAS, J. A., 1992. Butterfly responses to coppicing. In: G. P. BUCKLEY, ed. *Ecology and Management of Coppice Woodland*. London: Chapman & Hall.

WEBB, J., 2008a. *Rivers BIG species integration report*. Draft 18th November 2008. Peterborough: Natural England.

WEBB, J., 2008b. *Lakes and ponds BIG species integration report*. Draft 18th November 2008. Peterborough: Natural England.

WEDGE, C. and ROBERTSON, H., 2007. Traditional orchards: orchards and wildlife. Natural England Technical Information Note TIN020.

WELCH, R. C., 1978. Changes in the Distribution of the Nests of *Formica rufa* L. (Hymenoptera: Formicidae) at Blean Woods National Nature Reserve, Kent, During the Decade Following Coppicing. *Insectes Sociaux, Paris*, 25 (2), pp.173-186.

WHITTAKER, R. J., ARAUJO, M. B., JEPSON, P., LADLE, R. J., WATSON, J. E. M. and WILLIS, K. J., 2005. Conservation Biogeography: assessment and prospect. *Diversity and Distributions*, 11, pp.3-23.

WILLIAMS, R. B. G., 1997. Geomorphological and pictorial evidence of environmental change at Wealden sandstone sites. In: A. JACKSON and M. FLANAGAN eds. *Conservation of cryptogams in the Weald*. Royal Botanic Gardens, Kew, 1997. pp.32-54.

WILLIAMS, P., WHITFIELD, M., BIGGS, J., BRAY, S., FOX, G., NICOLET, P. and SEAR, D., 2004. Comparative biodiversity of rivers streams, ditches and ponds in an agricultural landscape in Southern England. *Biological Conservation*, 115, pp.329-341.

WILLIAMS, P., BIGGS, J., CROWE, A., MURPHY J., NICOLET, P., WEATHERBY, A. and DUNBAR, M., 2010. *Countryside Survey: Ponds Report from 2007*. Technical Report No. 7/07. Available from: http://www.countryside-survey.org.uk/sites/default/files/pdfs/reports2007/CS_UK_2007_TR7.pdf [Accessed 17th June 2013].

WOLTON, R., 2009. UK Biodiversity Action Plan: Priority species linked to hedgerows – A report to Hedgelink. Available from: http://www.hedgelink.org.uk/wildlife-and-hedgerows.htm#Hedgerow_Features_Important_to_Wildlife_1 [Accessed 24th June 2013].

Woodland Trust, 2000. *Woodland Biodiversity: Expanding our Horizons*. Grantham Lincolnshire: Woodland Trust.

Woodland Trust, 2013a. Ancient semi-natural woodland. Available from: <http://www.woodlandtrust.org.uk/en/why-woods-matter/what-are-they/types/ancient-woodland/planted-ancient-woodland-sites/Pages/semi-natural.aspx#UbillNiFvYV> [Accessed 12th June 2013].

Woodland Trust, 2013b. Wildlife species: Plants and animals found in woods. Available from: <http://www.woodlandtrust.org.uk/en/why-woods-matter/wildlife/wildlife-species/Pages/wildlife-species.aspx#UbiZk9iFvYV> [Accessed 12th June 2013].

Woodland Trust, 2013c. Ancient Tree Ecology. Available from: <http://www.ancient-tree-hunt.org.uk/ancienttrees/treeecology> [Accessed 1st July 2013].

WRIGHT, A., 2008. Wealden Ancient Tree Project, 2007-2008. Available, upon request, from the Sussex Biodiversity Record Centre or the Sussex Wildlife Trust.

WRIGHT, S., 2011. Invasive Species and the Loss of Beta Diversity. *Ethics & the Environment*, 16 (1), pp.75-97.

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Appendix A: Species conservation status definitions

Conservation status	Definition
UK Biodiversity Action Plan (UK BAP)	Species identified as a priority for conservation action under the UK Biodiversity Action Plan
Nationally Scarce, also sometimes called Nationally Notable (N or NS)	A species that is recorded in only 16 to 100 10km squares (hectads) in Britain
Nationally Scarce A, also sometimes called Nationally Notable A (Na)	A species that is recorded in 16-30 10km squares (hectads) in Britain
Nationally Scarce B, also sometimes called "Nationally Notable B (Nb)	A species that is found in 31-100 10km squares (hectads) in Britain
Nationally Rare (NR)	A species recorded from 15 or less 10km squares (hectads) in Britain
Bird population status: Amber List	Amber List species are those with an unfavourable conservation status in Europe; those whose population or range has declined moderately in recent years; those whose population has declined historically but made a substantial recent recovery; rare breeders; and those with internationally important or localised populations
Bird population status: Red List	Red List species are those that are Globally Threatened according to IUCN criteria; those whose population or range has declined rapidly in recent years; and those that have declined historically and not shown a substantial recent recovery
Red Data Book 1 (RDB 1)	A species that appears in the Red Data Book and is categorised as endangered
Red Data Book 2 (RDB 2)	A species that appears in the Red Data Book and is categorised as vulnerable
Red Data Book 3 (RDB 3)	A species that appears in the Red Data Book and is categorised as rare
Red Data Book K (RDB K)	A species that appears in the Red Data Book but its status is unknown, although it is thought to be rare
Probable Red Data Book 1 endangered (pRDB 1)	A species that is likely to appear in the Red Data Book and be categorised as endangered
Probable Red Data Book 2 vulnerable (pRDB 2)	A species that is likely to appear in the Red Data Book and be categorised as vulnerable
Probable Red Data Book 3 rare (pRDB 3)	A species that is likely to appear in the Red Data Book and be categorised as rare
Data Deficient (DD)	Assessed as Data Deficient in the Red Data Book
European Protected Species	European Protected Species are animals and plants that receive protection under the Conservation of Habitats and Species Regulations 2010, in addition to the Wildlife and Countryside Act 1981 (as amended).

Source: conservation status information was derived from the following websites:

<http://jncc.defra.gov.uk/page-3425>, <http://www.norfolkmoths.co.uk/status.php>,
http://wessexlichengroup.org/conservation_ecology/fallen_beech/index.html,
<http://www.bto.org/science/monitoring/psob>,
http://www.rspb.org.uk/wildlife/birdguide/status_explained.aspx

Appendix B:

UK Biodiversity Action Plan species that have been recorded in the High Weald AONB (currently only includes records for the parts of Sussex and Kent portions of the High Weald AONB, excluding Surrey)

Latin Name	Common Name
<i>Acronicta psi</i>	Grey Dagger
<i>Acronicta rumicis</i>	Knot Grass
<i>Adscita statice</i>	Forester
<i>Agonum scitulum</i>	Agonum scitulum
<i>Agrochola helvola</i>	Flounced Chestnut
<i>Agrochola litura</i>	Brown-spot Pinion
<i>Agrochola lychnidis</i>	Beaded Chestnut
<i>Agrotera nemoralis</i>	Beautiful Pearl
<i>Allophyes oxyacanthae</i>	Green-brindled Crescent
<i>Amara famelica</i>	Ground beetle
<i>Amphipoea oculaea</i>	Ear Moth
<i>Amphipyra tragopoginis</i>	Mouse Moth
<i>Anania funebris</i>	White-spotted Sable
<i>Anaptychia ciliaris subsp. ciliaris</i>	Anaptychia ciliaris subsp. ciliaris
<i>Andrena (Hoplodreana) ferox</i>	Oak Mining Bee
<i>Andrena (Poliandrena) tarsata</i>	Tormentil Mining Bee
<i>Andrena tarsata</i>	Andrena tarsata
<i>Anguilla anguilla</i>	European Eel
<i>Anguis fragilis</i>	Slow-worm
<i>Anisodactylus nemorivagus</i>	Ground beetle
<i>Anisus (Disculifer) vorticulus</i>	Little Whirlpool Ram's-horn Snail
<i>Anthophora (Pyganthophora) retusa</i>	Anthophora (Pyganthophora) retusa
<i>Anthophora (Pyganthophora) retusa</i>	Potter Flower Bee
<i>Apamea anceps</i>	Large Nutmeg
<i>Apamea remissa</i>	Dusky Brocade
<i>Aporophyla lutulenta</i>	Deep-brown Dart
<i>Arctia caja</i>	Garden Tiger
<i>Argynnis adippe</i>	High Brown Fritillary
<i>Arthothelium dictyosporum</i>	Lichen
<i>Arvicola amphibius</i>	European Water Vole
<i>Arvicola terrestris</i>	Water Vole
<i>Asilus crabroniformis</i>	Hornet robberfly
<i>Asteroscopus sphinx</i>	Sprawler
<i>Atethmia centrigo</i>	Centre-barred Sallow
<i>Atrichum angustatum</i>	Lesser Smoothcap
<i>Austropotamobius pallipes</i>	Freshwater Crayfish
<i>Bacidia incompta</i>	Lichen
<i>Bembidion (Bembidion) quadripustulatum</i>	Scarce Four-dot Pin-palp
<i>Bembidion quadripustulatum</i>	Bembidion quadripustulatum
<i>Blysmus compressus</i>	Flat-Sedge
<i>Boloria euphrosyne</i>	Pearl-bordered Fritillary
<i>Boloria selene subsp. selene</i>	Small Pearl-bordered Fritillary
<i>Bombus (Megabombus) ruders</i>	Large Garden Bumble Bee
<i>Bombus (Subterraneobombus) subterraneus</i>	Short-haired Bumble Bee

<i>Bombus (Thoracobombus) humilis</i>	Brown-banded Carder-bee
<i>Bombus (Thoracobombus) muscorum</i>	Moss Carder-bee
<i>Bombus (Thoracobombus) ruderarius</i>	Red-shanked Carder-bee
<i>Bombus (Thoracobombus) sylvarum</i>	Shrill Carder Bee
<i>Bombus (Thoracombus) humilis</i>	Bombus (Thoracombus) humilis
<i>Bombus (Thoracombus) muscorum</i>	Bombus (Thoracombus) muscorum
<i>Bombus (Thoracombus) ruderarius</i>	Bombus (Thoracombus) ruderarius
<i>Bombus (Thoracombus) sylvarum</i>	Bombus (Thoracombus) sylvarum
<i>Bombus humilis</i>	Brown-Banded Carder Bee
<i>Bombus muscorum</i>	Bombus muscorum
<i>Brachinus sclopeta</i>	Brachinus sclopeta
<i>Brachionycha sphinx</i>	Sprawler
<i>Brachylomia viminalis</i>	Minor Shoulder-knot
<i>Bufo bufo</i>	Common Toad
<i>Bupleurum tenuissimum</i>	Slender Hare's-Ear
<i>Byctiscus populi</i>	Poplar Leaf Roller
<i>Caloplaca atroflava</i>	Caloplaca atroflava
<i>Caloplaca flavorubescens</i>	Caloplaca flavorubescens
<i>Caloplaca herbidella</i>	Caloplaca herbidella
<i>Caloplaca luteoalba</i>	Orange-fruited Elm-lichen
<i>Carabus (Morphocarabus) monilis</i>	Carabus (Morphocarabus) monilis
<i>Carabus monilis</i>	Carabus monilis
<i>Caradrina morpheus</i>	Mottled Rustic
<i>Carex divisa</i>	Divided Sedge
<i>Carex vulpina</i>	True Fox-sedge
<i>Catocala promissa</i>	Light Crimson Underwing
<i>Catocala sponsa</i>	Dark Crimson Underwing
<i>Celaena leucostigma</i>	Crescent
<i>Centaurea cyanus</i>	Cornflower
<i>Cephalanthera damasonium</i>	White Helleborine
<i>Ceramica pisi</i>	Broom Moth
<i>Chaenotheca phaeocephala</i>	Lichen
<i>Chamaemelum nobile</i>	Chamomile
<i>Chesias legatella</i>	Streak
<i>Chesias rufata subsp. rufata</i>	Broom-tip
<i>Chiasmia clathrata subsp. clathrata</i>	Latticed Heath
<i>Cicendia filiformis</i>	Yellow Centaury
<i>Cladonia peziziformis</i>	Lichen
<i>Clinopodium menthifolium</i>	Wood Calamint
<i>Coenonympha pamphilus</i>	Small Heath
<i>Coleophora wockeella</i>	Coleophora wockeella
<i>Collema fasciculare</i>	Collema fasciculare
<i>Collema fragrans</i>	Collema fragrans
<i>Cosmia diffinis</i>	White-Spotted Pinion
<i>Cossus cossus</i>	Goat Moth
<i>Crepis mollis Northern</i>	Hawk's-beard
<i>Cryptolechia carneolutea</i>	Cryptolechia carneolutea
<i>Cucullia lychnitis</i>	Striped Lychnis
<i>Cupido minimus</i>	Small Blue
<i>Cyclophora porata</i>	False Mocha
<i>Cymatophorima diluta</i>	Oak Lutestring

<i>Cymatophorima diluta subsp. hartwegi</i>	Oak Lutestring
<i>Dianthus armeria</i>	Deptford Pink
<i>Diarsia rubi</i>	Small Square-spot
<i>Diloba caeruleocephala</i>	Figure of Eight
<i>Doros conopseus</i>	Hoverfly
<i>Drepana binaria</i>	Oak Hook-Tip
<i>Dromius quadrisignatus</i>	Ground beetle
<i>Dromius vectensis</i>	Dromius vectensis
<i>Dumortiera hirsuta</i>	Dumortier's Liverwort
<i>Ecliptopera silaceata</i>	Small Phoenix
<i>Ennomos erosaria</i>	September Thorn
<i>Ennomos fuscantaria</i>	Dusky Thorn
<i>Ennomos quercinaria</i>	August Thorn
<i>Entoloma bloxamii</i>	Big Blue Pinkgill
<i>Epirrhoe galiata</i>	Galium Carpet
<i>Erinaceus europaeus</i>	West European Hedgehog
<i>Erynnis tages subsp. tages</i>	Dingy Skipper
<i>Eucera longicornis</i>	Long-horned Bee
<i>Eugnorisma glareosa</i>	Autumnal Rustic
<i>Eulithis mellinata</i>	Spinach
<i>Euphrasia anglica</i>	Small-flowered Sticky Eyebright
<i>Euphrasia pseudokernerii</i>	Eyebright
<i>Euxoa nigricans</i>	Garden Dart
<i>Formicoxenus nitidulus</i>	Shining Guest Ant
<i>Galeopsis angustifolia</i>	Red Hemp-Nettle
<i>Graphiphora augur</i>	Double Dart
<i>Harpalus (Cryptophonus) melancholicus</i>	Harpalus (Cryptophonus) melancholicus
<i>Hemistola chrysoprasaria</i>	Small Emerald
<i>Hepialus humuli</i>	Ghost Moth
<i>Heridium erinaceus</i>	Bearded Tooth
<i>Heterodermia leucomelos</i>	Ciliate Strap-Lichen
<i>Hipparchia semele</i>	Grayling
<i>Hoplodrina blanda</i>	Rustic
<i>Hordeum marinum</i>	Sea Barley
<i>Hydnellum aurantiacum</i>	Orange Tooth
<i>Hydnellum concrescens</i>	Zoned Tooth
<i>Hydnellum ferrugineum</i>	Mealy Tooth
<i>Hydnellum peckii</i>	Devil's Tooth
<i>Hydnellum scrobiculatum</i>	Ridged Tooth
<i>Hydnellum spongiosipes</i>	Velvet Tooth
<i>Hydraecia micacea</i>	Rosy Rustic
<i>Hydraecia osseola subsp. hucherardi</i>	Marsh Mallow Moth
<i>Hydroporus rufifrons</i>	Oxbow Diving Beetle
<i>Hygrocybe spadicea</i>	Date-colored Waxcap
<i>Illecebrum verticillatum</i>	Coral-necklace
<i>Jungermannia leiantha</i>	Long-leaved Flapwort
<i>Juniperus communis</i>	Juniper
<i>Laccophilus poecilus</i>	Laccophilus poecilus
<i>Lacerta agilis</i>	Sand Lizard
<i>Lacerta vivipara</i>	Viviparous Lizard
<i>Ladoga camilla</i>	White Admiral

<i>Lampronia capitella</i>	Currant Shoot Borer
<i>Lasiommata megera</i>	Wall
<i>Lebia chlorocephala</i>	Lebia chlorocephala
<i>Lecanora quercicola</i>	Lecanora quercicola
<i>Lecanora sublivescens</i>	Lecanora sublivescens
<i>Lepus europaeus</i>	Brown Hare
<i>Limenitis camilla</i>	White Admiral
<i>Lipsothrix errans</i>	Crane fly
<i>Lipsothrix nervosa</i>	Southern Yellow Splinter
<i>Lobelia urens</i>	Heath Lobelia
<i>Lolium temulentum</i>	Darnel
<i>Lophozia longiflora</i>	Reddish Notchwort
<i>Lophozia ventricosa</i>	Tumid Notchwort
<i>Lophozia ventricosa</i> var. <i>confertifolia</i>	<i>Lophozia ventricosa</i> var. <i>confertifolia</i>
<i>Lophozia ventricosa</i> var. <i>silvicola</i>	<i>Lophozia ventricosa</i> var. <i>silvicola</i>
<i>Lophozia ventricosa</i> var. <i>ventricosa</i>	Tumid Notchwort
<i>Lucanus cervus</i>	Stag Beetle
<i>Luronium natans</i>	Floating Water-plantain
<i>Lutra lutra</i>	European Otter
<i>Lycia hirtaria</i>	Brindled Beauty
<i>Lycopodiella inundata</i>	Marsh Clubmoss
<i>Lythrum hyssopifolia</i>	Grass-Poly
<i>Macrosteles cyane</i>	Macrosteles cyane
<i>Malacosoma neustria</i>	Lackey
<i>Megalospora tuberculosa</i>	Megalospora tuberculosa
<i>Meioneta mollis</i>	Thin Weblet
<i>Melampyrum cristatum</i>	Crested Cow-wheat
<i>Melanchra persicariae</i>	Dot Moth
<i>Melanchra pisi</i>	Broom Moth
<i>Melanthia procellata</i>	Pretty Chalk Carpet
<i>Melaspilea lentiginosa</i>	Melaspilea lentiginosa
<i>Meloe proscarabaeus</i>	Black Oil-beetle
<i>Mentha pulegium</i>	Pennyroyal
<i>Mesoligia literosa</i>	Rosy Minor
<i>Microglossum olivaceum</i>	Olive Earth-tongue
<i>Micromitrium tenerum</i>	Millimetre Moss
<i>Micromys minutus</i>	Harvest Mouse
<i>Minuartia hybrida</i>	Fine-Leaved Sandwort
<i>Muscardinus avellanarius</i>	Dormouse
<i>Muscari neglectum</i>	Grape-hyacinth
<i>Mustela putorius</i>	Polecat
<i>Mythimna comma</i>	Shoulder-striped Wainscot
<i>Natrix natrix</i>	Grass Snake
<i>Nitella gracilis</i>	Slender Stonewort
<i>Noctua orbona</i>	Lunar Yellow Underwing
<i>Oenanthe fistulosa</i>	Tubular Water-dropwort
<i>Opegrapha prosodea</i>	Opegrapha prosodea
<i>Ophrys insectifera</i>	Fly Orchid
<i>Orthodontium gracile</i>	Slender Thread-moss
<i>Orthonama vittata</i>	Oblique Carpet
<i>Orthosia gracilis</i>	Powdered Quaker

<i>Osmerus eperlanus</i>	Smelt
<i>Osmia xanthomelana</i>	Mason bee
<i>Ostrea edulis</i>	Native Oyster
<i>Pallavicinia lyellii</i>	Ribbonwort
<i>Panagaeus cruxmajor</i>	Crucifix Ground Beetle
<i>Paracolax tristalis</i>	Clay Fan-Foot
<i>Paradiarsia glareosa</i>	Paradiarsia glareosa
<i>Pechipogon strigilata</i>	Common Fan-Foot
<i>Peltigera lepidophora</i>	Ear-lobed Dog-lichen
<i>Pelurga comitata</i>	Dark Spinach
<i>Perizoma albulata</i>	Grass Rivulet
<i>Pertusaria hemisphaerica</i>	Pertusaria hemisphaerica
<i>Pertusaria velata</i>	Pertusaria velata
<i>Phellodon confluens</i>	Fused Tooth
<i>Phellodon melaleucus</i>	Grey Tooth
<i>Phellodon niger</i>	Black Tooth
<i>Phocoena phocoena</i>	Common Porpoise
<i>Phyteuma spicatum</i>	Spiked Rampion
<i>Pilularia globulifera</i>	Pillwort
<i>Piptoporus quercinus</i>	Oak Polypore
<i>Platanthera bifolia</i>	Lesser Butterfly-Orchid
<i>Plebejus argus</i>	Silver-studded Blue
<i>Podoscypha multizonata</i>	Zoned Rosette
<i>Polyzonium germanicum</i>	Boring Millipede
<i>Poronia punctata</i>	Nail Fungus
<i>Potamogeton acutifolius</i>	Sharp-leaved Pondweed
<i>Pseudorchis albida</i>	Small-White Orchid
<i>Puccinellia fasciculata</i>	Borrer's Saltmarsh-Grass
<i>Pyrenula macrospora</i>	Pyrenula macrospora
<i>Pyrenula nitida</i>	Pyrenula nitida
<i>Pyrgus malvae</i>	Grizzled Skipper
<i>Raja undulata</i>	Undulate Ray
<i>Ramonia chrysophaea</i>	Ramonia chrysophaea
<i>Rana lessonae</i>	Pool Frog
<i>Ranunculus arvensis</i>	Corn Buttercup
<i>Ranunculus tripartitus</i>	Three-lobed Crowfoot
<i>Rhizdra lutosa</i>	Large Wainscot
<i>Rhytidiadelphus subpinnatus</i>	Scarce Turf-moss
<i>Riccia canaliculata</i>	Channelled Crystalwort
<i>Salmo salar</i>	Atlantic Salmon
<i>Salmo trutta</i>	Brown/Sea Trout
<i>Sarcodon scabrosus</i>	Bitter Tooth
<i>Satyrium w-album</i>	White-letter Hairstreak
<i>Scandix pecten-veneris</i>	Shepherd's Needle
<i>Sciota hostilis</i>	Scarce Aspen Knot-horn
<i>Scleranthus annuus</i>	Annual Knawel
<i>Scopula marginepunctata</i>	Mullein Wave
<i>Scotopteryx bipunctaria subsp. cretata</i>	Chalk Carpet
<i>Scotopteryx chenopodiata</i>	Shaded Broad-bar
<i>Chiasmia (formerly Semiothisa) clathrata</i>	Latticed Heath
<i>Silene gallica</i>	Small-Flowered Catchfly

<i>Sium latifolium</i>	Great Water-Parsnip
<i>Sium latifolium</i> Greater	Water-parsnip
<i>Spilosoma lubricipeda</i>	White Ermine
<i>Spilosoma luteum</i>	Buff Ermine
<i>Stenus longitarsis</i>	Stenus longitarsis
<i>Teucrium scordium</i>	Water Germander
<i>Thecla betulae</i>	Brown Hairstreak
<i>Tholera decimalis</i>	Feathered Gothic
<i>Timandra comae</i>	Blood-Vein
<i>Tortula cuneifolia</i>	Tortula cuneifolia
<i>Tortula freibergii</i>	Freiberg's Screw-moss
<i>Trichiura crataegi</i>	Pale Eggar
<i>Trichopteryx polycommata</i>	Barred Tooth-Striped
<i>Trisateles emortualis</i>	Olive Crescent
<i>Triturus cristatus</i>	Great Crested Newt
<i>Tursiops truncatus</i>	Bottle-Nosed Dolphin
<i>Tyria jacobaeae</i>	Cinnabar
<i>Usnea articulata</i>	Usnea articulata
<i>Usnea florida</i>	Usnea florida
<i>Valerianella rimosa</i>	Broad-Fruited Cornsalad
<i>Viola lactea</i>	Pale Dog-Violet
<i>Vipera berus</i>	Adder
<i>Watsonalla binaria</i>	Oak Hook-tip
<i>Xanthia gilvago</i>	Dusky-lemon Sallow
<i>Xanthia icteritia</i>	Sallow
<i>Xanthorhoe ferrugata</i>	Dark-Barred Twin-Spot Carpet
<i>Xanthorhoe ferrugata</i> Dark-barred	Twin-spot Carpet
<i>Xestia agathina</i>	Heath Rustic
<i>Xestia castanea</i>	Neglected Rustic
<i>Zootoca vivipara</i>	Common Lizard

Appendix C:

Protected species that have been recorded in the High Weald AONB. These species are all protected under various Schedules of either the Wildlife and Countryside Act 1981 (WCA 1981), the Bern Convention, the Bonn Convention, the Habitat Directive, or the Convention in International Trade in Endangered Species (CITES) (currently only includes records for the parts of Sussex and Kent portions of the High Weald AONB, excluding Surrey)

Scientific Name	Common Name
<i>Peltigera lepidophora</i>	Ear-lobed Dog-lichen
<i>Piptoporus quercinus</i>	Oak Polypore
<i>Hericium erinaceus</i>	Bearded Tooth
<i>Leucobryum glaucum</i>	Large White-moss
<i>Sphagnum denticulatum</i>	Sphagnum denticulatum
<i>Sphagnum recurvum</i>	Sphagnum recurvum
<i>Sphagnum capillifolium</i>	Red Bog-moss
<i>Sphagnum denticulatum</i>	Cow-horn Bog-moss
<i>Sphagnum fimbriatum</i>	Fringed Bog-moss
<i>Sphagnum palustre</i>	Blunt-leaved Bog-moss
<i>Sphagnum papillosum</i>	Papillose Bog-moss
<i>Sphagnum pulchrum</i>	Golden Bog-moss
<i>Sphagnum subnitens</i> var. <i>subnitens</i>	Sphagnum subnitens var. subnitens
<i>Sphagnum tenellum</i>	Soft Bog-moss
<i>Galanthus nivalis</i>	Snowdrop
<i>Hyacinthoides non-scripta</i>	Bluebell
<i>Ruscus aculeatus</i>	Butcher's-broom
<i>Anacamptis pyramidalis</i>	Pyramidal Orchid
<i>Cephalanthera damasonium</i>	White Helleborine
<i>Dactylorhiza fuchsii</i>	Common Spotted-orchid
<i>Dactylorhiza fuchsii</i> x <i>maculata</i> = <i>D. x transiens</i>	Marsh-Orchid
<i>Dactylorhiza incarnata</i>	Early Marsh-orchid
<i>Dactylorhiza maculata</i>	Heath Spotted-Orchid
<i>Dactylorhiza maculata</i> subsp. <i>ericetorum</i>	Heath Spotted-Orchid
<i>Dactylorhiza praeternissa</i> Southern	Marsh-orchid
<i>Epipactis helleborine</i>	Broad-leaved Helleborine
<i>Epipactis purpurata</i>	Violet Helleborine
<i>Listera ovata</i> Common Twayblade	Common Twayblade
<i>Neottia nidus-avis</i>	Bird's-nest Orchid
<i>Ophrys apifera</i>	Bee Orchid
<i>Ophrys insectifera</i>	Fly Orchid
<i>Orchis mascula</i>	Early-purple Orchid
<i>Orchis morio</i>	Green-winged Orchid
<i>Platanthera chlorantha</i>	Greater Butterfly-orchid
<i>Spiranthes spiralis</i>	Autumn Lady's-tresses
<i>Menyanthes trifoliata</i>	Bogbean
<i>Cyclamen hederifolium</i>	Sowbread
<i>Clinopodium menthifolium</i>	Wood Calamint
<i>Mentha pulegium</i>	Pennyroyal

<i>Teucrium scordium</i>	Water Germander
<i>Althaea hirsuta</i>	Rough Marsh-mallow
<i>Hirudo medicinalis</i>	Medicinal Leech
<i>Ostrea edulis</i>	Native Oyster
<i>Anisus (Disculifer) vorticulus</i>	Little Whirlpool Ram's-horn Snail
<i>Lucanus cervus</i>	Stag Beetle
<i>Polyommatus (Lysandra) coridon</i>	Chalk Hill Blue
<i>Satyrrium w-album</i>	White-letter Hairstreak
<i>Apatura iris</i>	Purple Emperor
<i>Boloria euphrosyne</i>	Pearl-bordered Fritillary
<i>Nymphalis polychloros</i>	Large Tortoiseshell
<i>Papilio machaon</i>	Swallowtail
<i>Anguilla anguilla</i>	European Eel
<i>Thymallus thymallus</i>	Grayling
<i>Bufo bufo</i>	Common Toad
<i>Pelophylax ridibundus</i>	Marsh Frog
<i>Rana temporaria</i>	Common Frog
<i>Lissotriton vulgaris</i>	Smooth Newt
<i>Triturus cristatus</i>	Great Crested Newt
<i>Anguis fragilis</i>	Slow-worm
<i>Natrix natrix</i>	Grass Snake
<i>Zootoca vivipara</i>	Common Lizard
<i>Vipera berus</i>	Adder
<i>Lampetra planeri</i>	Brook Lamprey
<i>Capreolus capreolus</i>	Roe Deer
<i>Cervus nippon</i>	Sika Deer
<i>Dama dama</i>	Fallow Deer
<i>Muntiacus reevesi</i>	Chinese Muntjac
<i>Lutra lutra</i>	European Otter
<i>Meles meles</i>	Eurasian Badger
<i>Mustela erminea</i>	Stoat
<i>Erinaceus europaeus</i>	West European Hedgehog
<i>Neomys fodiens</i>	Eurasian Water Shrew
<i>Sorex araneus</i>	Eurasian Common Shrew
<i>Sorex minutus</i>	Eurasian Pygmy Shrew
<i>Arvicola amphibius</i>	European Water Vole
<i>Musccardinus avellanarius</i>	Hazel Dormouse
<i>Vipera berus</i>	Adder
<i>Trichomanes speciosum</i>	Killarney Fern
<i>Lacerta vivipara</i>	Viviparous Lizard
<i>Anguis fragilis</i>	Slow-worm
<i>Musccardinus avellanarius</i>	Hazel Dormouse
<i>Musccardinus avellanarius</i>	Common Dormouse
<i>Natrix natrix</i>	Grass Snake
<i>Triturus cristatus</i>	Great Crested Newt
<i>Teloschistes flavicans</i>	Golden Hair-lichen
<i>Arvicola terrestris</i>	Water Vole
<i>Arvicola terrestris</i>	European Water Vole
<i>Phocoena phocoena</i>	Common Porpoise
<i>Lacerta agilis</i>	Sand Lizard
<i>Caloplaca luteoalba</i>	Orange-fruited Elm-lichen

<i>Zootoca vivipara</i>	Common Lizard
<i>Micromitrium tenerum</i>	Millimetre Moss
<i>Tursiops truncatus</i>	Bottle-Nosed Dolphin
<i>Phyteuma spicatum</i>	Spiked Rampion
<i>Dianthus armeria</i>	Deptford Pink
<i>Melampyrum arvense</i>	Field Cow-wheat
<i>Mentha pulegium</i>	Pennyroyal
<i>Papilio machaon</i>	Swallowtail
<i>Heterodermia leucomelos</i>	Ciliate Strap-Lichen
<i>Lutra lutra</i>	European Otter
<i>Lythrum hyssopifolia</i>	Grass-Poly
<i>Argynnis adippe</i>	High Brown Fritillary
<i>Austropotamobius pallipes</i>	Freshwater Crayfish
<i>Muscardinus avellanarius</i>	Dormouse

Appendix D:

Bat species that have been recorded in the High Weald AONB (currently only includes records for the Sussex and Kent portions of the High Weald AONB, excluding Surrey)

Latin Name	Common Name
<i>Barbastella barbastellus</i>	Western Barbastelle
<i>Eptesicus serotinus</i>	Serotine Bat
<i>Myotis alcathoe</i>	Alcathoe Bat
<i>Myotis bechsteinii</i>	Bechstein's Bat
<i>Myotis brandtii</i>	Brandt's Bat
<i>Myotis daubentonii</i>	Daubenton's Bat
<i>Myotis mystacinus</i>	Whiskered Bat
<i>Myotis mystacinus</i>	Whiskered Bat
<i>Myotis nattereri</i>	Natterer's Bat
<i>Nyctalus leisleri</i>	Lesser Noctule
<i>Nyctalus leisleri</i>	Leisler's Bat
<i>Nyctalus noctula</i>	Noctule Bat
<i>Pipistrellus nathusii</i>	Nathusius's Pipistrelle Bat
<i>Pipistrellus pipistrellus</i>	Common Pipistrelle (45 kHz)
<i>Pipistrellus pygmaeus</i>	Soprano Pipistrelle (55 kHz)
<i>Pipistrellus pygmaeus</i>	Soprano Pipistrelle
<i>Plecotus auritus</i>	Brown Long-eared Bat
<i>Plecotus austriacus</i>	Grey Long-eared Bat

Appendix E:

Invasive non-native species that have been recorded in the High Weald AONB (currently only includes records for the Sussex and Kent portions of the High Weald AONB, excluding Surrey)

Latin Name	Common Name
<i>Allium paradoxum</i>	Few-Flowered Garlic
<i>Allium triquetrum</i>	Three-cornered Garlic
<i>Amsinckia micrantha</i>	Common Fiddleneck
<i>Azolla filiculoides</i>	Water Fern
<i>Cameraria ohridella</i>	Horse-Chestnut Leaf-miner
<i>Campylopus introflexus</i>	Heath Star Moss
<i>Centranthus ruber</i>	Red Valerian
<i>Cotoneaster bullatus</i>	Hollyberry Cotoneaster
<i>Cotoneaster horizontalis</i>	Wall Cotoneaster
<i>Cotoneaster integrifolius</i>	Small-Leaved Cotoneaster
<i>Cotoneaster simonsii</i>	Himalayan Cotoneaster
<i>Crassula helmsii</i>	New Zealand Pigmyweed
<i>Crepidula fornicata</i> American	Slipper Limpet
<i>Crocsmia pottsii</i> x <i>aurea</i> = <i>C. x crocosmiiflora</i>	Montbretia
<i>Dreissena (Dreissena) polymorpha</i>	Zebra Mussel
<i>Elodea canadensis</i>	Canadian Pondweed
<i>Elodea nuttallii</i>	Nuttall's Waterweed
<i>Fallopia japonica</i>	Japanese Knotweed
<i>Fallopia japonica</i> var. <i>compacta</i>	Dwarf Japanese Knotweed
<i>Fallopia japonica</i> x <i>sachalinensis</i> = <i>F. x bohemica</i>	Japanese Knotweed x Giant Knotweed = Bohemian Knotweed
<i>Fallopia sachalinensis</i>	Giant Knotweed
<i>Gaultheria shallon</i>	Shallon
<i>Gunnera tinctoria</i>	Giant rhubarb
<i>Harlequin Ladybird</i>	Harlequin Ladybird
<i>Heracleum mantegazzianum</i>	Giant Hogweed
<i>Hyacinthoides hispanica</i>	Spanish Bluebell
<i>Hyacinthoides non-scripta</i> x <i>hispanica</i> = <i>H. x massartiana</i>	Native Bluebell x Spanish Bluebell = Garden Bluebell
<i>Hydrocotyle ranunculoides</i>	Floating Pennywort
<i>Impatiens glandulifera</i>	Indian Balsam
<i>Lagarosiphon major</i>	Curly Waterweed
<i>Lamiastrum galeobdolon</i> subsp. <i>argentatum</i>	Variegated Yellow Archangel
<i>Leptoglossus occidentalis</i>	Western Conifer Seed Bug
<i>Lilioceris lili</i>	Lily Beetle
<i>Lysichiton americanus</i> American	Skunk-cabbage
<i>Muntiacus reevesi</i>	Muntjac
<i>Mustela vison</i>	American Mink
<i>Myriophyllum aquaticum</i>	Parrot's-feather
<i>Neovison vison</i>	American Mink
<i>Nymphoides peltata</i>	Fringed Water-Lily
<i>Pacifastacus leniusculus</i>	Signal Crayfish
<i>Parthenocissus inserta</i>	False Virginia-creeper
<i>Parthenocissus quinquefolia</i>	Virginia creeper

<i>Petasites fragrans</i>	Winter Heliotrope
<i>Petasites fragrans</i> Winter	Heliotrope
<i>Prunus laurocerasus</i>	Cherry Laurel
<i>Rhododendron luteum</i>	Yellow Azalea
<i>Rhododendron ponticum</i>	Rhododendron
<i>Robinia pseudoacacia</i>	False Acacia
<i>Rosa rugosa</i>	Japanese Rose
<i>Sagittaria latifolia</i>	Duck-Potato
<i>Sus scrofa</i>	Wild Boar
<i>Trachemys scripta subsp. elegans</i>	Trachemys scripta subsp. elegans

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Appendix F:

Vascular and non-vascular plants associated with Wealden gills. All information taken from Rose and Patmore (1997 pp.16-21)

Vascular plants associated with Wealden Gill woods.

Oceanic Vascular plants

<i>Dryopteris aemula</i>	over 100 sites or populations known in the Wealden Gills. These are amongst the largest densities of colonies of this fern anywhere in Europe. Western Ireland, Devon and Cornwall are the only other areas within Europe where colonies of hay scented fern are found in such densities.
<i>Hymenophyllum tunbrigense</i>	on sandrocks only, but very much Gill-associated.
<i>Sibthopia europaea</i>	still locally frequent in East Sussex Gills, on rocky stream sites and in flushes.
<i>Wahlenbergia hederacea</i>	found in rides and benefiting from intermittent disturbance by forestry traffic.
<i>Ranunculus omiophyllus</i>	in water or on streamside mud or gravel
<i>Cardamine bulbifera</i>	a bittercress with very attractive flowers. Restricted to the Weald and the Chiterns.
<i>Festuca altissima</i>	occasional sites in the Gills
<i>Phyteuma spicatum</i>	very occasionally found in Gills but easily overlooked. Not found anywhere else in England outside the Weald

Annex 2 Bryophytes and lichens found in Gill woodlands (including some species found on sandrocks which are not confined only to the sandrocks). (1 of 5)
(Estimated abundance on a 'Whole Weald' basis)

Abundant	Frequent	Occasional	Rare
<i>Atrichum undulatum</i>	<i>Amblystegium serpens</i>	<i>Acaulon muticum</i>	<i>Anomodon viticulosus</i>
		<i>Aneura pinguis</i>	
	<i>Aulaacomnium androgynum</i>	<i>Archidium alternifolium</i>	
		<i>Aulaacomnium palustre</i>	<i>Bacomycetes roseus</i>
<i>Brachythecium rutabulum</i>	<i>Barbula convoluta</i>	<i>Bacomycetes rufus</i>	
	<i>Barbula cylindrica</i>		<i>Barbula trifaria</i>
		<i>Barbula recurvirostra</i>	
	<i>Brachythecium plumosum</i>	<i>Barbula unguiculata</i>	
	<i>Brachythecium rivulare</i>	<i>Blepharostoma trichophyllum</i>	
	<i>Brachythecium velutinum</i>		<i>Bryoria fuscescens</i>
<i>Bryum pseudotriquetrum</i>			<i>Bryum bicolor</i>
<i>Calliergon cuspidatum</i>	<i>Bryum capillare</i>		
	<i>Calypogeia arguta</i>		
	<i>Calypogeia fissa</i>		
	<i>Calypogeia muelleriana</i>	<i>Calypogeia integristipula</i>	
		<i>Calypogeia sphagnicola</i>	<i>Campylopus flexuosus</i>
		<i>Campylopus introflexus</i>	
		<i>Campylium paradoxum</i>	<i>Campylostelium saxicola</i>
		<i>Campylopus pyriformis</i>	
	<i>Cephalozia bicuspidata</i>		
		<i>Cephalozia connivens</i>	
		<i>Cephalozia lunulifolia</i>	
<i>Chiloscyphus polyanthos</i>	<i>Ceratodon purpureus</i>		<i>Cephalozia divaricata</i>
			<i>Chrysothrix candelaris</i>
	<i>Cirriophyllum piliferum</i>	<i>Chrysothrix chryophthalma</i>	<i>Cladonia caespiticia</i>
	<i>Cladonia chlorophaea</i>		
<i>Cladonia coniocraea</i>		<i>Cladonia coccifera</i>	
	<i>Cladonia digitata</i>		
	<i>Cladonia fimbriata</i>		
	<i>Cladonia incrassata</i>	<i>Cladonia floerkeana</i>	
	<i>Cladonia macilenta</i>	<i>Cladonia furcata</i>	
	<i>Cladonia polydactyla</i>		
			CONTINUED BELOW...

Abundant	Frequent	Occasional	Rare
Dichodontium pellucidum Dicranella heteromalla Dicranoweisia cirrata	Cladonia pyxidata Conocephalum conicum Cratoneuron filicinum Dicranum majus Dicranum scoparium Diplophyllum albicans	Cladonia portentosa Cladonia ramulosa Cladonia squamosa Cratoneuron commutatum var. commutatum Ctenidium molluscum var. sylvaticum Eurhynchium speciosum Evernia prunastri Fontinalis antipyretica Fossombronina pusilla Fossombronina wondraczekii Frullania tamarisci Funaria obtusa Gymnocolpa inflata Gyroweisia tenuis Heterocladium heterophyllum Homalia trichomanoides	Cololejeunea minutissima Cryptothallus mirabilis Cystocoleus ebeneus Dicranum fuscescens Dicranum scottianum Dumortiera hirsuta Enterographa crassa Epipterygium tozeri Eucladium verticillatum Eurhynchium swartzii Fissidens rivularis Frullania dilatata Funaria hygrometrica Fusoides cyathoides Grimmia pulvinata Harpanthus scutatus Herzogella seligeri CONTINUED BELOW...

Abundant	Frequent	Occasional	Rare
<p><i>Hypnum cupressiforme</i> <i>Hypnum jutlandicum</i></p> <p><i>Hypnum mammillatum</i></p> <p><i>Isopterygium elegans</i> <i>Isoetecium myosuroides</i></p> <p><i>Lecanactis abietina</i> <i>Lecanora conizaeoides</i> <i>Lecanora expallens</i> <i>Lecidella elaeochroma</i></p> <p><i>Lejeunea ulicina</i> <i>Lepidozia reptans</i> <i>Lepraria incana</i></p> <p><i>Lophocolea bidentata</i> <i>Lophocolea heterophylla</i></p> <p><i>Metzgeria furcata</i></p> <p><i>Mnium hornem</i></p>	<p><i>Homalothecium sericeum</i> <i>Hookeria lucens</i> <i>Hylacomium amoricum</i> <i>Hylacomium splendens</i></p> <p><i>Isoetecium myurum</i> <i>Jungermannia gracillima</i> <i>Jungermannia hyalina</i></p> <p><i>Leucobryum glaucum</i> <i>Leucobryum juniperioides</i></p> <p><i>Lophocolea cuspidata</i></p> <p><i>Lunularia cruciata</i></p> <p><i>Neckera pumila</i></p>	<p><i>Hypnum lindbergii</i></p> <p><i>Hypogymnia physodes</i> <i>Hypogymnia tubulosa</i></p> <p><i>Jungermannia pumila</i></p> <p><i>Leproloma vousuxii</i></p> <p><i>Lophozia incisa</i> <i>Lophozia ventricosa</i></p> <p><i>Marchantia polymorpha</i></p> <p><i>Metzgeria temperata</i></p> <p><i>Neckera complanata</i></p> <p><i>Ochrolechia androgyna</i> <i>Odontoschisma denudatum</i> <i>Opegrapha atra</i> <i>Opegrapha corticola</i></p>	<p><i>Kurzia sylvatica</i></p> <p><i>Lecidella scabra</i> <i>Lecanora gangaleoides</i> <i>Lejeunea cavifolia</i></p> <p><i>Lepraria lobificans</i> <i>Leprocaulon microscopicum</i></p> <p><i>Lophozia bicrenata</i></p> <p><i>Marsipella emarginata</i> <i>Metzgeria conjugata</i> <i>Micarea lignaria</i></p> <p><i>Mniacea jungermanniae</i> <i>Mniacea nivea</i> <i>Mylia anomala</i> <i>Nardia compressa</i></p> <p>CONTINUED BELOW...</p>

Abundant	Frequent	Occasional	Rare
	<i>Orthodontium gracilis</i> <i>Orthodontium lineare</i> <i>Orthotrichum affine</i> <i>Orthotrichum diaphanum</i> <i>Orthotrichum lyellii</i>		<i>Orthotrichum striatum</i> <i>Orthotrichum stramineum</i> <i>Oxystegus tenuirostris</i> <i>Pallavicinia lyellii</i>
<i>Parmelia caperata</i> <i>Parmelia glabrata</i> <i>ssp. fuliginosa</i>	<i>Parmelia subrudecta</i> <i>Parmelia sulcata</i>	<i>Parmelia saxatilis</i>	
	<i>Parmelia revoluta</i> <i>Pellia endiviifolia</i>	<i>Parmeliopsis ambigua</i>	
<i>Pellia epiphylla</i>			<i>Peltigera lactucifolia</i> <i>Peltigera membranacea</i> <i>Pertusaria aspergilla</i> <i>Pertusaria corallina</i>
	<i>Pertusaria hemisphaerica</i>	<i>Phascum cuspidatum</i>	<i>Philonotis fontana</i>
	<i>Plagiochila asplenoides</i>	<i>Plagiochila porelloides</i>	
	<i>Plagiomnium affine</i>		<i>Plagiomnium rostratum</i>
	<i>Plagiomnium undulatum</i>	<i>Plagiothecium curvifolium</i> <i>Plagiothecium denticulatum</i> <i>Plagiothecium latebricola</i> <i>Plagiothecium succulentum</i> <i>Plagiothecium undulatum</i> <i>Pleurozium schreberi</i> <i>Pleurodium acuminatum</i>	
<i>Plagiothecium nemorale</i>			
	<i>Pogonatum aloides</i>		<i>Pogonatum urnigerum</i>
	<i>Pohlia nutans</i>	<i>Pohlia prolifera</i> <i>Pohlia wahlenbergii</i>	<i>Pohlia carnea</i>
<i>Polytrichum commune</i> <i>Polytrichum formosum</i>	<i>Polytrichum juniperinum</i>	<i>Polytrichum piliferum</i>	
	<i>Porina seneca</i>	<i>Porphidia cinereoatra</i> <i>Porphidia tuberculosa</i> <i>Pseudophemerum nitidum</i>	<i>Porcia platyphylla</i>
<i>Pseudoscleropodium purum</i>		<i>Psilolechia lucida</i>	<i>Racomitrium aciculare</i> <i>Racomitrium heterostichum</i> CONTINUED BELOW...

Abundant	Frequent	Occasional	Rare
	<i>Ramalina farinacea</i>	<i>Radula complanata</i>	<i>Reboulia hemisphaerica</i>
	<i>Rhizomnium punctatum</i>		<i>Rhynchostegium confertum</i>
	<i>Rhynchostegium riparioides</i>	<i>Rhytidadelphus loreus</i>	
	<i>Rhytidadelphus squarrosus</i>	<i>Riccardia chamedryfolia</i>	
	<i>Rhytidadelphus triquetrus</i>	<i>Riccardia multifida</i>	
		<i>Riccia glauca</i>	
		<i>Riccia sorocarpa</i>	
		<i>Rinodina roboris</i>	
	<i>Scapania gracilis</i>	<i>Scapania irrigua</i>	
<i>Scapania undulata</i>		<i>Scapania nemorea</i>	<i>Scapania umbrosa</i>
	<i>Sphagnum auriculatum</i>		<i>Sphaerophorus globosus</i>
<i>Sphagnum palustre</i>		<i>Sphagnum fimbriatum</i>	<i>Sphaerophorus melanocarpus</i>
<i>Sphagnum recurvum</i>	<i>Tetraphis pellucida</i>		<i>Stenocybe septata</i>
<i>Thamnobryum alopecurum</i>		<i>Thelotrema lepadinum</i>	<i>Tetradontium brownianum</i>
<i>Thuidium tamariscinum</i>	<i>Tortula freiburgii</i>		
	<i>Tortula marginata</i>	<i>Trapelia granulosa</i>	
		<i>Trapelia involuta</i>	
		<i>Trapeliopsis flexuosa</i>	
		<i>Trapeliopsis granulosa</i>	
	<i>Trapeliopsis pseudogranulosa</i>	<i>Trapeliopsis subgranulosa</i>	
	<i>Ulota crispa</i> var. <i>crispa</i>	<i>Trichocolea tomentella</i>	<i>Trichostomum brachydontium</i>
	<i>Ulota crispa</i> var. <i>norvegica</i>		<i>Tritomaria exsectiformis</i>
	<i>Usnea subfloridana</i>	<i>Zygodon baumgartneri</i>	<i>Zygodon conoideus</i>
	<i>Zygodon viridissimus</i>		

Appendix G:

130 priority BAP species known to have significant associations with hedgerows (NB: these species have not necessarily been recorded in the High Weald AONB, although it is likely that many of them are present in the region's hedgerows)

All species	Common name	Latin name	Part of hedgerow used			
			Shrubby part	Tree	Base/bank	Margin
Vascular plants	Bastard balm	<i>Melittis melissophyllum</i>			x	
	Copse-bindweed	<i>Fallopia dumetorum</i>			x	
	Crested cow-wheat	<i>Melampyrum cristatum</i>			x	
	Grape hyacinth	<i>Muscari neglectum</i>			x	
	Plymouth pear	<i>Pyrus cordata</i>		x		
	Purple ramping fumitory	<i>Fumaria purpurea</i>			x	
	Starved wood-sedge	<i>Carex depauperata</i>			x	
Non-vascular plants	Round-leaved feather-moss	<i>Rhynchostegium rotundifolium</i>		x		
Fungi	Sandy stilt puffball fungus	<i>Battarrea phalloides</i> (Dicks.) Pers.		x	x	
	Weathered earthstar fungus	<i>Geastrum corollinum</i> (Batsch) Hollós			x	
	Pepper pot fungus	<i>Myriostoma coliforme</i> (With.) Corda			x	
	Hazel gloves fungus	<i>Hypocreopsis rhododendri</i> Thaxt.	x			
Lichens	a lichen	<i>Anaptychia ciliaris</i> subsp. <i>ciliaris</i> (L.) Körb. ex A. Massal		x		
	a lichen	<i>Bacidia incompta</i> (Borrer) Anzi		x		
	Orange-Fruited Elm-lichen	<i>Caloplaca luteoalba</i> (Turner) Th. Fr.		x		
	a lichen	<i>Caloplaca virescens</i> (Sm.) Coppins		x		
	a lichen	<i>Cryptolechia carneolutea</i> (Turner) A. Massal.		x		
	a lichen	<i>Parmelina quercina</i> (Willd.) Hale NB British material is <i>P. carporrhizans</i>		x		
	Southern grey physcia	<i>Physcia tribacioides</i> Nyl.		x		
	Golden hair-lichen	<i>Teloschistes flavicans</i>		x		

	lichen	(Sw.) Norman				
	A beard lichen (String-of-sausages lichen)	<i>Usnea articulata</i> (L.) Hoffm.		x		
	A beard lichen	<i>Usnea florida</i> (L.) Weber ex F.H. Wigg.		x		
Bees and wasps	Brown-banded carder-bee	<i>Bombus humilis</i>			x	x
	Large or Moss carder-bee	<i>B. muscorum</i>			x	x
	Red-shanked carder-bee	<i>B. ruderarius</i>			x	x
	Large garden bumblebee	<i>B. ruderatus</i>			x	x
	Shrill carder-bee	<i>B. sylvarum</i>			x	x
Beetles	Stag beetle	<i>Lucanus cervus</i>		x		
	Hazel pot beetle	<i>Cryptocephalus coryli</i>	x			
	Six-spotted pot beetle	<i>Cryptocephalus sexpunctatus</i>	x			
	Scarlet malachite beetle	<i>Malachius aeneus</i>				x
	Alder flea weevil	<i>Orchestes testaceus</i>		x		
	Cardinal click beetle or Red-horned cardinal click beetle	<i>Ampedus rufipennis</i>		x		
Flies	A hoverfly	<i>Callicera spinolae</i>		x		
Butterflies	Brown hairstreak	<i>Thecla betulae</i>	x	x		
	White-letter hairstreak	<i>Satyrus w-album</i>	x	x		
Moths						
Rare or restricted species						
	Barberry carpet	<i>Pareulype berberatais</i>	x			
	Heart moth	<i>Dicycla oo</i>		x		
	Pale shining brown	<i>Polia bombycina</i>	x			
	Scarce vapourer	<i>Orgyia recens</i>	x	x		
	Sloe carpet	<i>Aleucis distinctata</i>	x			
	Liquorice piercer moth	<i>Grapholita (Cydia) pallifrontana</i>				x
	Goat moth	<i>Cossus cossus</i>		x		
50 widespread but rapidly declining species likely to be associated						

with hedgerows						
	Deep-brown Dart	<i>Aporophyla lutulenta</i>				
	Mullein Wave	<i>Scopula marginepunctata</i>				
	Grey Dagger	<i>Acronicta psi</i>				
	Knot Grass	<i>Acronicta rumicis</i>				
	Flounced Chestnut	<i>Agrochola helvola</i>				
	Brown-spot pinion	<i>Agrochola litura</i>				
	Beaded Chestnut	<i>Agrochola lychnidis</i>				
	Green-brindled Crescent	<i>Allophyas oxyacanthae</i>				
	Mouse Moth	<i>Amphipyra tragopoginis</i>				
	Large Nutmeg	<i>Apamea anceps</i>				
	Dusky Brocade	<i>Apamea remissa</i>				
	Garden Tiger	<i>Arctia caja</i>				
	Sprawler	<i>Asteroscopus sphinx</i>				
	Centre-barred Sallow	<i>Atethmia centrargo</i>				
	Minor Shoulder-knot	<i>Brachylomia viminalis</i>				
	Mottled Rustic	<i>Caradrina morpheus</i>				
	Streak	<i>Chesias legatella</i>				
	Broom-tip	<i>Chesias rufata</i>				
	Small Square-spot	<i>Diarsia rubi</i>				
	Figure of Eight	<i>Diloba caeruleocephala</i>				
	Small Phoenix	<i>Ecliptopera silaceata</i>				
	September Thorn	<i>Ennomos erosaria</i>				
	Dusky Thorn	<i>Ennomos fuscantaria</i>				
	August Thorn	<i>Ennomos quercinaria</i>				
	Galium Carpet	<i>Epirrhoe galiata</i>				
	Autumnal Rustic	<i>Eugnorisma glareosa</i>				
	Garden Dart	<i>Euxoa nigricans</i>				
	White-line dart	<i>Euxoa tritici</i>				
	Double Dart	<i>Graphiphora augur</i>				
	Small Emerald	<i>Hemistola chrysoprasaria</i>				
	Ghost Moth	<i>Hepialus humuli</i>				
	Rustic	<i>Hoplodrina blanda</i>				
	Rosy Rustic	<i>Hydraecia micacea</i>				
	Brindled Beauty	<i>Lycia hirtaria</i>				
	Lackey	<i>Malacosoma neustria</i>				
	Dot Moth	<i>Melanchra persicariae</i>				

	Broom Moth	<i>Melanchra pisi</i>				
	Pretty Chalk Carpet	<i>Melanthia procellata</i>				
	Shoulder-striped Wainscot	<i>Mythimna comma</i>				
	Powdered Quaker	<i>Orthosia gracilis</i>				
	Shaded Broad-bar	<i>Scotopteryx chenopodiata</i>				
	White Ermine	<i>Spilosoma lubricipeda</i>				
	Buff Ermine	<i>Spilosoma luteum</i>				
	Hedge Rustic	<i>Tholera cespitis</i>				
	Feathered Gothic	<i>Tholera decimalis</i>				
	Blood-vein	<i>Timandra comae</i>				
	Pale Eggar	<i>Trichiura crataegi</i>				
	Oak Hook-tip	<i>Watsonalla binaria</i>				
	Dusky-lemon sallow	<i>Xanthia gilvago</i>				
	Sallow	<i>Xanthia ictertia</i>				
	Dark-barred Twin-spot Carpet	<i>Xanthorhoe ferrugata</i>				
Herptiles (reptiles and amphibians)	Great crested newt	<i>Triturus cristatus</i>			x	
	Common toad	<i>Bufo bufo</i>			x	
	Grass snake	<i>Natrix natrix</i>			x	
	Slow worm	<i>Anguis fragilis</i>			x	
	Common lizard	<i>Zootoca vivipara</i>			x	
Birds	Grey partridge	<i>Perdix perdix</i>			x	x
	Turtle dove	<i>Streptopelia turtur</i>	x			x
	Cuckoo	<i>Cuculus canorus</i>	x	x		x
	Lesser spotted woodpecker	<i>Dendrocopos minor</i>		x		
	Tree pipit	<i>Anthus trivialis</i>		x		
	Hedge accentor (Dunnock) (Hedge sparrow)	<i>Prunella modularis</i>	x		x	
	Song thrush	<i>Turdus philomelos</i>	x	x	x	x
	Spotted flycatcher	<i>Muscicapa striata</i>	x	x		
	Marsh tit	<i>Poecile palustris (Parus palustris)</i>	x	x	x	x
	Willow tit	<i>Poecile montanus (Parus montanus)</i>	x		x	x
	Red-backed shrike	<i>Lanius collurio</i>	x	x		
	Starling (Common starling)	<i>Sturna vulgaris</i>	x	x		x
	House sparrow	<i>Passer domesticus</i>	x	x		x
	Tree sparrow	<i>Passer montanus</i>	x	x		x

	Bullfinch (Common Bullfinch)	<i>Pyrrhula pyrrhula</i>	x	x		x
	Linnet (Common linnet)	<i>Carduelis cannabina</i>	x			x
	Lesser redpoll (Redpoll)	<i>Carduelis cabaret</i> (<i>Carduelis flammea</i>)	x	x		x
	Cirl bunting	<i>Emberiza cirlus</i>	x	x	x	x
	Reed bunting	<i>Emberiza schoeniclus</i>	x	x	x	x
	Yellowhammer	<i>Emberiza citrinella</i>	x	x	x	x
Mammals	Barbastelle	<i>Barbastella barbastellus</i>	x	x		
	Bechstein's bat	<i>Myotis bechsteinii</i>	x	x		
	Brown long-eared bat	<i>Plecotus auritus</i>	x	x		
	Greater horseshoe bat	<i>Rhinolophus ferrumequinum</i>	x	x		
	Lesser horseshoe bat	<i>Rhinolophus hipposideros</i>	x	x		
	Soprano pipistrelle	<i>Pipistrellus pygmaeus</i>	x	x		
	Noctule	<i>Nyctalus noctula</i>		x		
	Hedgehog (West European Hedgehog)	<i>Erinaceus europaeus</i>			x	x
	Harvest mouse	<i>Micromys minutus</i>			x	x
	Dormouse (Hazel dormouse)	<i>Muscardinus avellanarius</i>	x	x	x	x
	Polecat	<i>Mustela putorius</i>			x	x

Source: Wolton (2009), available from: <http://www.hedgelink.org.uk/wildlife-and-hedgerows.htm> (click the link titled "accompanying spreadsheet" under the heading "BAP species linked to hedgerows" towards the bottom of the webpage)

Appendix H:

Notable invertebrates associated with ancient and species-rich hedgerows (NB: these species have not necessarily been recorded in the High Weald AONB, although it is likely that many of them are present in the region's hedgerows)

Spiders and allies (Arachnida: Araneae and Pseudoscorpiones)

<i>Theridion pinastri</i>	RDBK
<i>Achaearanea simulans</i>	Nb
<i>Philodromus albidus</i>	Nb
<i>Philodromus praedatus</i>	Nb on mature oak
<i>Zilla diodia</i>	Nb

Grasshoppers, crickets, earwigs and cockroaches (Orthoptera/Dermaptera/Dictyoptera)

<i>Nemobius sylvestris</i>	Na Ancient hedgerows near woodland
<i>Omocestus rufipes</i>	Nb
<i>Ectobius lapponicus</i>	Nb Ancient hedgerows near woodland
<i>Ectobius pallidus</i>	Nb
<i>Ectobius panzeri</i>	Nb Ancient hedgerows near woodland
<i>Apterygida media</i>	Nb
<i>Forficula lesnei</i>	Nb
<i>Tettigonia viridissima</i> , which has been recorded from this habitat, is not a Notable species, but has become the subject of a BAP in Devon.	

True Bugs (Hemiptera)

Heteroptera

<i>Gonocerus acuteangulatus</i>	RDB1 box, hawthorn
<i>Raglius alboacuminatus</i>	Nb black horehound
<i>Acalypta platycheila</i>	Nb hawthorn
<i>Myrmedobia coleoprata</i>	Nb dead leaves under hedge
<i>Empicoris baerunsprungi</i>	Na predatory
<i>Deraeocoris olivaceus</i>	Nb hawthorn in heavy fruit

Leafhoppers, planthoppers, froghoppers, treehoppers & cicadas (Auchenorrhyncha)

<i>Lassus scutellaris</i>	Nb hedgerow English elm only
<i>Kyboasca bipunctata</i>	Nb hedgerow English elm only
<i>Macropsis mendax</i>	Nb suckering English elm

Flies(Diptera)

Snail-killing flies, picture-wing flies, grass flies and allies (Acalyptrata)

<i>Paraclusia tigrina</i> (Clusiidae)	RDB2 dead wood on live tree trunks
<i>Goniglossum wiedemanni</i> (Tephritidae)	N white bryony berries
<i>Leucopis griseola</i> (Chamaemyiidae)	N predator: in elm leaf-galls
<i>Odinia mejerei</i> (Odiniidae)	N predator: elm dead wood
<i>Sapromyza albiceps</i> (Lauxaniidae)	N leaf litter?

Crane flies (Tipulidae)

<i>Limonia maculipennis</i>	NK
<i>Tipula peliostigma</i>	NK
<i>Limonia stigma</i>	

Blowflies, dung flies, flesh flies and allies (Calypttrata)

<i>Macronychia polyodon</i> (Sarcophagidae)	RDB3
---------------------------------------------	------

<i>Eggisops pecchiolii</i>	(Calliphoridae)	N
<i>Macronychia striginervis</i>	(Sarcophagidae)	N
Beetles (Coleoptera)		
Ground beetles (Carabidae)		
<i>Ophonus laticollis</i>	Species Statement	Na
Leaf beetles (Chrysomelidae)		
<i>Psylliodes luteola</i>		RDBK marsh thistle?
<i>Aphthona nigricaps</i>		Na meadow cranesbill
<i>Chrysolina oricalcia</i>		Nb cow parsley, also upright hedge parsley, hemlock etc.
<i>Chrysolina sanguinolenta</i>		Na toadflax
<i>Cryptocephalus frontalis</i>		Na hawthorn
<i>Longitarsus agilis</i>		Na figwort
<i>Longitarsus ballotae</i>		Nb black horehound and white horehound
<i>Longitarsus suturalis</i>		Nb gromwell
<i>Mantura rustica</i>		Nb broad-leaved docks
Weevils (Curculionidae)		
<i>Dissolucas niveirostris</i>		RDB2 dead wood
<i>Anthonomus chevrolati</i>		RDBIK hawthorn; deformed leaf trusses
<i>Anthonomus rufus</i>		RDB3 sloe: buds & trusses
<i>Anthribus fasciatus</i>		Na predacious on scale insects
<i>Anthribus nebulosus</i>		Nb predacious on scale insects
<i>Platyrhinus resinosus</i>		Nb fungus <i>Daldinia concentrica</i> : mainly on ash
<i>Choragus sheppardi</i>		Na ivy
<i>Attactagenus plumbeus</i>		Nb polyphagous root feeder
<i>Brachysomus echinatus</i>		Nb polyphagous root feeder
<i>Mitoplinthus caliginosus</i>		Na hop hulms
Stag beetles (Lucanidae)		
<i>Lucanus cervus</i>	Greater stag beetle	BAP Priority Nb
Long-horned beetles (Cerambycidae)		
<i>Gracilia minuta</i>		RDB2
<i>Anaglyptus mysticus</i>		Nb
<i>Aromia moschata</i>		Nb
<i>Molochus umbellatarum</i>		Na
<i>Phymatodes alni</i>		Nb
<i>Phytoecia cylindrica</i>		Nb
Click beetles (Buprestidae)		
<i>Agrilus biguttatus</i>		Na
<i>Agrilus laticornis</i>		Nb
<i>Agrilus sinuatus</i>		Na

Caddis flies (Trichoptera)

<i>Stenophylax permistus</i>	Common
<i>Glyptotendipes pallidus</i>	Common
<i>Limnephilus auricula</i>	Common
<i>Limnephilus incisus</i>	Common
<i>Micropterna lateralis</i>	Common

Ants, bees and wasps(Hymenoptera: Aculeata)

<i>Chrysis gracillima</i>	RDB2
<i>Pemphredon austriaca</i>	RDB3
<i>Pemphredon morio</i>	RDB3, Nb, Scarce
<i>Andrena proxima</i>	RDB3
<i>Diodontus tristis</i>	Scarce

Source:

<http://www.buglife.org.uk/Resources/Buglife/Migrated%20Resources/Documents/0120Notable%20invertebrates%20associated%20with%20ancient%20and%20species.pdf>

Also available by clicking the link towards the bottom of the following webpage:

<http://www.buglife.org.uk/conservation/adviceonmanagingbaphabitats/sancientandspeciesrichhedgerows>

Appendix I:

River Ouse biological survey data for portions surveyed within the High Weald AONB, as well as an explanation and key to the Biological Monitoring Working Party (BMWP) scoring system (all biological survey data supplied by John St. Pierre, Vice Chairman of The Ouse and Ardur Rivers Trust)

“The Biological Monitoring Working Party (BMWP) scoring system is a method of assessing water quality using the families of insects - e.g. mayflies and stoneflies - and other aquatic invertebrates such as freshwater shrimps present in a river. Species are allotted points to rank their importance in the ecosystem, the less tolerant a group of invertebrates is to pollution the higher the points they are allotted.” (Teifi Rivers Invertebrate Monitors (date unknown), available from: <http://www.riverfly.co.uk/interesting5.htm>)

The Biological Monitoring Working Party (BMWP) Score	Quality
Over 150!	A. Very good biological quality
101 – 150	B. Good biological quality
51 – 100	C. Fair biological quality
16 – 50	D. Poor biological quality
0 – 15	E. Very poor biological quality

Average Score Per Taxon (ASPT)	Quality
Over 5.4	Very good
4.81 – 5.4	Good
4.21 – 4.8	Fair
3.61 – 4.2	Poor
3.6 or less	Very poor

Location	River Ouse, 30m downstream from Avins Bridge
Date	3.5.11.
Grid Reference	TQ 34077 27173
Local Conditions	Slightly turbid low flow over gravel/boulder substrate, copious filamentous algae, part shaded.
Water Velocity	0.62 m/sec
Discharge Volume	0.55 m ³ /sec
Also Netted	Water mites
Biological Quality Rating	Good
Water Quality Rating	Very good

Type	Family	BMWP Score	Abundance
1. Mayfly nymphs	Heptageniidae – <i>Ecdyonurus insignis</i> (Ginger quill)	10	20+
2. Mayfly nymphs	Leptophlebiidae – <i>Paraleptophlebia submarginata</i> (Turkey brown)	10	3
3. Stonefly nymphs	Perlodidae – <i>Isoperla grammatical</i> (Yellow sally)	10	4
4. Cased caddis	Brachycentridae – <i>B. subnubilis</i> – (Grannom)	10	2
5. Cased caddis	Leptoceridae – <i>Athripsodes cinereus</i> (Brown silverhorn)	10	3
6. Cased caddis	Sericostomatidae – <i>S. personatum</i> (Welshman's button)	10	7
7. Caseless caddis	Philopotamidae – <i>Wormaldia occipitalis</i> .	8	3
8. Damselfly nymphs	Calopterygidae – <i>C. virgo</i> (Beautiful demoiselle)	8	3
9. Caseless caddis	Rhyacophilidae – <i>R. dorsalis</i> (Sandfly sedge)	7	20+
10. Caseless caddis	Polycentropodidae – <i>P. irroratus</i> (Dark spotted sedge)	7	2
11. Cased caddis	Limnephilidae – <i>L. lunatus</i> (Cinnamon sedge) 2 <i>Micropterna sequax</i> 3 <i>Hydatophylax infumatus</i> 5	7	10
12. Shrimp	Gammaridae – <i>G. pulex</i>	6	50+
13. River limpet	Ancylidae – <i>A. fluviatilis</i>	6	1
14. Caseless caddis	Hydropsychidae – <i>H. angustipennis</i> (Brown flag)	5	6
15. Crane fly larvae	Tipulidae – <i>Pedicia sp.</i>	5	20+
16. Riffle beetles	Elmidae – <i>E. aenea</i> , <i>Limnius volckmari</i> (adults and larvae) <i>Oulimnius tuberculatus</i> (1 adult)	5	20+
17. Blackfly larvae	Simuliidae	5	50+
18. Mayfly larvae	Baetidae – <i>B. rhodani</i>	4	9
19. Alderfly larvae	Sialidae	4	4
20. Snail	Hydrobiidae – <i>Potamopyrgus jenkinsi</i>	3	1
21. Bivalve	Sphaeriidae	3	1
22. Midge larvae	Chironomidae	2	7
23. Worm	Oligochaetae (Tubificid)	1	1
Total		146	
ASPT		6.35	

Comments	The highest score so far of all our samples from the Ouse catchment.
Carried out by	St.Pierre, Harrison, Barrow.

DRAFT

Location	Great Bentley Stream – Brook Street
Date	16.9.08
Grid Reference	TQ 307 276
Local Conditions	Low flow, clear water, riffle and glide over clay and sparse gravel substrate. Moderate shading, copious woody debris.
Water Velocity	0.09 m/sec
Discharge Volume	0.004 m ³ /sec
Also Netted	1 Bullhead and water mites.
Biological Quality Rating	Fair to good
Water Quality Rating	Very good

Type	Family	BMWP Score	Abundance
24 Mayfly nymphs	Ephemeraeidae – <i>E. ignita</i>	10	2
25 Mayfly nymphs	Leptophlebiidae – <i>Paraleptophlebia</i> sp.	10	3
26 Cased caddis	Leptoceridae – <i>Mystacides azurea</i>	10	100+
27 Cased caddis	Odontoceridae – <i>O. albicorne</i>	10	7
28 Damsel nymphs	Calopterygidae – <i>C. virgo</i>	8	4
29 Cased caddis	Limnephilidae – <i>Micropterna sequax</i> , <i>Halesus</i> sp. (1)	7	50+
30 Shrimp	Gammaridae – <i>G. pulex</i>	6	100+
31 Caseless caddis	Hydropsychidae	5	7
32 Screech beetle	Hygrobiidae	5	1
33 Riffle beetles (adult)	Elmidae – <i>E. aenea</i> , <i>Oulimnius tuberculatus</i> (1)	5	4
34 Alderfly larva	Sialidae – <i>S. lutaria</i>	4	1
35 Bivalves	Sphaeriidae	3	50+
36 Snails	Hydrobiidae – <i>Potamopyrgus jenkinsi</i>	3	200+
37 Leeches	Glossiphoniidae – <i>G. complanata</i> , <i>Helobdella stagnalis</i>	3	20+
38 Leeches	Erpobdellidae – <i>E. testacea</i>	3	4
39 Crane fly larvae	Tipulidae	3	2
40 Midge larvae	Chironomidae	2	30+
41 Worms	Oligochaetae – <i>Lumbriculus</i> , <i>tubificid</i>	1	20+
42			
43			
Total		98	
ASPT		5.44	

Comments	The Gammaridae were heavily infested with the Echinorhynchus parasite. This very small stream supports a varied invertebrate population with a remarkable abundance of some species.
Carried out by	Barrow/Harrison/St.Pierre

Location	River Ouse, Cherry Lane
Date	16 February 2011
Grid Reference	TQ304280
Local Conditions	Good flow over fine gravel substrate. No shade. Dormant reeds along one bank. Water temp; 5.7 ⁰ C
Water Velocity	0.61 m/sec
Discharge Volume	0.74 m ³ /sec
Also Netted	Water mite
Biological Quality Rating	Fair
Water Quality Rating	Very good

Type	Family	BMWP Score	Abundance
44 Mayfly larva	Ephemeraeidae; <i>E. vulgata</i>	10	15
45 Cased caddis fly larva	Leptoceridae; <i>Arthripsodes albifrons</i> (Brown or Black Silverhorn)	10	9
46 Cased caddis fly larva	Goeridae; <i>Silo nigricornis</i> (Black sedge)	10	1
47 Cased caddis fly larva	Sericostomatidae; <i>S. personatum</i> (Welshman's button)	10	3
48 Cased caddis fly larva	Limnephilidae; <i>Potamophylax</i> sp (Large Cinnamon Sedge)	7	2
49 Stone fly larva	Nemouridae; (Brown Stoneflies)	7	2
50 Shrimp	Gammaridae; <i>G. pulex</i>	6	10
51 Caseless caddis fly larva	Hydropsychidae; <i>H. siltalai</i> (Grey Flag)	5	6
52 Riffle beetle	Elmidae; <i>Elmis aenea</i> (ad 2, larva 1)	5	3
53 Crane fly larva	Tipulidae;	5	2
54 Blackfly larva	Simuliidae;	5	6
55 Mayfly larva	Baetidae; <i>B. rhodani</i> (Large Dark Olive)	4	1
56 Leech	Erpobdellidae; <i>E. testacea</i> ;	3	2
57 Mussel	Sphaeriidae;	3	2
58 Spire shell snail	Hydrobiidae; <i>Potamopyrgus jenkinsi</i>	3	3
59 Midge larva	Chironomidae;	2	20
60 Round worm	Tubificidae;	1	20
Total		96	
ASPT		5.6	

Comments	Although the Water Quality Rating was very good this was tempered by the general lack of abundance of some common species (<i>Gammarus</i> & <i>Baetis</i>) and by the abundance of Tubifex worms.
Carried out by	R. Pepper & J. Harris.

Location	Annwood Beck
Date	28 March 2012
Grid Reference	TQ416250
Local Conditions	Very silty substrate through woodland & garden. Temp 9 ⁰ C.
Water Velocity	0.3 m/sec
Discharge Volume	0.12 m ³ /sec
Also Netted	Water mites.
Biological Quality Rating	Fair
Water Quality Rating	Very good

	Family	Type	BMWP Score	Abundance
61	Ephemeraeidae; <i>E. vulgata</i> .	Mayfly larva	10	3
62	Leptoceridae;	Cased caddis larva	10	1
63	Sericostomatidae; <i>S. personatum</i> Welshman's Button.	Cased caddis larva	10	5
64	Limnephilidae; <i>Limnephilus lunatus</i> . Cinnamon Sedge.	Cased caddis larva	7	1
65	Rhyacophilidae; <i>R. mundi</i> , (2) <i>R. dorsalis</i> , Sand fly Sedge.	Caseless caddis larva	7	3
66	Polycentropodidae; <i>P. kingii</i> Dark Spotted Sedge.	Caseless caddis larva	7	1
67	Gammaridae; <i>G. pulex</i> .	Shrimp	6	50
68	Simuliidae;	Blackfly larva	5	10
69	Elmidae;	Riffle beetle	5	1
70	Hydropsychidae; <i>H. angustipennis</i> (2), Brown Flag, <i>H. siltalai</i> (2), Grey Flag	Caseless caddis larva	5	4
71	Sialidae; <i>S. lutaria</i> .	Alder fly larva	4	1
72	Sphaeriidae;	Pea Mussel	3	5
73	Erpobdellidae; <i>E. testacea</i> .	Leech	3	1
74	Chironomidae;	Midge larva	2	10
75	Tubificidae;	Tubifex worm	1	2
Total			85	
ASPT			5.6	

Comments	A very silty site with very few stones to be found. The ASPT was surprisingly high considering the apparently poor habitat.
Carried out by	R. Pepper & J. Wood.

Location	Tributary of River Ouse, Ketches Lane near junction with Sliders Lane.
Date	31.7.12
Grid Reference	TQ 39820 25040
Local Conditions	A small deeply incised stream with moderate flow of clear water over rocky substrate, heavily shaded riffle and pool.
Water Velocity	0.7 m/sec
Discharge Volume	0.02 m ³ /s
Also Netted	
Biological Quality Rating	Fair – bordering on poor
Water Quality Rating	Fair

Type	Family	BMWP Score	Abundance
76 Cased caddis	Sericostomatidae – <i>S. personatum</i>	10	1
77 Shrimp	Gammaridae – <i>G. pulex</i>	6	50+
78 Black fly larva	Simuliidae	5	1
79 Riffle beetle	Elmidae – <i>E. aenea</i> (adults and larvae	5	5
80 Flatworm	Planariidae – <i>polycelis</i> sp.(3), <i>P. torva</i> (2)	5	5
81 Diving beetle	Dytiscidae – <i>Dytiscus</i> sp. (larva)	5	1
82 Water cricket	Mesovellidae	5	3
83 Mayfly larvae	Baetidae – <i>B. rhodani</i>	4	18
84 Hoglouse	Asellidae – <i>A. aquaticus</i> (6), <i>A. meridianus</i> (1)	3	7
85 Leech	Glossiphoniidae – <i>G. complanata</i>	3	1
86 Midge larvae	Chironomidae	2	9
87 Worms	Oligochaetae – <i>Tubifex tubifex</i>	1	5
Total		54	
ASPT		4.5	

Comments	This is a poor result for a high weald stream. It mirrors the poor chemical water quality found in OART tests, which show consistently high levels of ammonia. We noted a large stack of manure close to the bank, albeit just downstream of the sampling site. The stream is possibly impacted by agricultural activity.
Carried out by	St.Pierre, Barrow, Harrison, Deacon.

Location	Tickerage Stream – Great Streele
Date	29.5.12
Grid Reference	TQ 49880 21825
Local Conditions	Low flow of clear water in riffle and glide with clay/gravel substrate. Part shaded.
Water Velocity	0.18 m/sec
Discharge Volume	0.13 m ³ /s
Also Netted	One unidentified organism, possibly a beetle larva.
Biological Quality Rating	Good
Water Quality Rating	Very good

Type	Family	BMWP Score	Abundance
88 Mayfly nymphs	Ephemeridae – <i>E. vulgata</i> (1) (Drake mackerel) <i>E. danica</i> (Greendrake)	10	10
89 Mayfly nymphs	Ephemerellidae – <i>Serratella ignita</i> (Blue winged olive)	10	30+
90 Stonefly	Capniidae - <i>C. bifrons</i>	10	1
91 Cased caddis	Sericostomatidae – <i>S. personatum</i> (Welshman's button)	10	8
92 Cased caddis	Leptoceridae – <i>Athripsodes aterrimus</i> (Brown silverhorn)	10	13
93 Caseless caddis	Rhyacophilidae – <i>R. septentrionis</i> (Sandfly sedge)	7	1
94 Caseless caddis	Polycentropodidae- <i>Cyrnus trimaculatus</i> (Dark spotted sedge)	7	1
95 Mayfly nymphs	Caenidae – <i>C. horaria</i> (Angler's curse)	7	4
96 Shrimp	Gammaridae – <i>G. pulex</i>	6	7
97 Caseless caddis	Hydropsychidae – <i>H. angustipennis</i> (Brown flag)	5	1
98 Blackfly larvae	Simuliidae	5	100+
99 Crane fly larvae	Tipulidae	5	20+
10 Riffle beetles	Elmidae – <i>E. aenea</i> (adults 2) <i>Limnius volckmari</i> (adults and larvae) <i>Oulimnius tuberculatus</i> (1)	5	15
10 Snails	Hydrobiidae – <i>Potamopyrgus jenkinsi</i>	3	2
10 Midge larvae	Chironomidae	2	6
10 Worms	Oligochaetae – <i>Tubifex tubifex</i>	1	2
Total		103	
ASPT		6.44	

Comments	A good result from one of our new chemical testing sites.
Carried out by	St.Pierre, Barrow, Harrison.

Location	River Uck – Huggets Furnace Farm
Date	3.4.12
Grid Reference	TQ 52325 : 25694
Local Conditions	Low flow of clear water, riffle/glide, over fine gravel/clay substrate. Part shaded.
Water Velocity	0.10 m/sec
Discharge Volume	0.03 m ³ /s
Also Netted	2 Bullheads (<i>Cottus gobio</i>) water mites, Diptera larvae, 1 empty river limpet shell.
Biological Quality Rating	Very good
Water Quality Rating	Very good

Type	Family	BMWP Score	Abundance
10 Mayfly nymphs	Ephemeraidae – <i>E. danica</i> (Greendrake) (4), <i>E. vulgata</i> (Drake Mackerel)	10	30+
10 Mayfly nymphs	Heptageniidae – <i>Rhithrogena semicolorata</i> (5) (Olive upright), <i>Ecdyonurus</i> sp.(14)	10	19
10 Stonefly nymphs	Perlodidae – <i>Isoperla grammatica</i>	10	20+
10 Cased caddis	Sericostomatidae – <i>S. personatum</i> (Welshman's button)	10	30+
10 Cased caddis	Lepidostomatidae – <i>L. hirtum</i> (Small silver sedge)	10	12
10 Cased caddis	Leptoceridae – <i>Mystacides azurea</i> (4), <i>Mystacides nigra</i> (3) (Black silverhorns)	10	7
11 Cased caddis	Goeridae – <i>Silo pallipes</i> (Black sedge)	10	8
11 Damselfly nymphs	Calopterygidae – <i>C. splendens</i> (Banded demoiselle)	8	2
11 Cased caddis	Glossosomatidae – <i>Agapetus</i> sp. (Tiny grey sedge)	8	3
11 Mayfly nymphs	Caenidae (Angler's curse)	7	8
11 Stonefly nymphs	Nemouridae – <i>N. erratica</i>	7	5
11 Cased caddis	Limnephilidae – <i>Chaeopteryx villosa</i> (2), <i>Micropterna sequax</i> (4), <i>Potamophylax cingulatus</i> (4) <i>Potamophylax latipennis</i> (13) (Large cinnamon sedge), <i>Hydatophylax infumatus</i> (14) <i>Halesus</i> sp.(5) Caperer)	7	42
11 Cased caddis	Hydroptilidae – <i>Hydroptila</i> sp.	6	1
11 Shrimps	Gammaridae – <i>G. pulex</i>	6	10
11 Water cricket	Vellidae – <i>V. caprai</i>	5	1
11 Riffle beetles	Elmidae – <i>E. aenea</i> (3) <i>Oulimnius tuberculatus</i> (5)	5	8
12 Blackfly larvae	Simuliidae	5	2
12 Flatworms	Planariidae – <i>Polycelis</i> sp.	5	2
12 Caseless caddis	Hydropsychidae – <i>H. angustipennis</i> (Brown flag)	5	3
12 Crane fly larvae	Tipulidae	5	3
12 Fish leech	Piscicolidae – <i>P. geometra</i>	4	1
12 Alder fly larvae	Sialidae – <i>S. lutaria</i>	4	3
12 Mayfly larvae	Baetidae – <i>B. rhodani</i>	4	8
12 Hoglouse	Asellidae – <i>A. aquaticus</i>	3	1
12 Midge larvae	Chironomidae	2	20+
Total		166	
ASPT		6.64	

Comments	This site on the upper reaches of the River Uck has excellent invertebrate biodiversity. Unfortunately the quality deteriorates downstream. All parts of the Ouse catchment would produce scores like this if it were not for pollutants.
Carried out by	Barrow, St.Pierre, Deacon.

DRAFT

Location	River Uck – The White Hart - Buxted
Date	15.5.12.
Grid Reference	TQ 494 233
Local Conditions	Robust flow of turbid water in glide over gravel/clay substrate, open aspect.
Water Velocity	0.34 m/sec
Discharge Volume	0.44 m ³ /s
Also Netted	1 empty caddis case, possibly <i>Sericostoma personatum</i> .
Biological Quality Rating	Poor
Water Quality Rating	Fair

Type	Family	BMWP Score	Abundance
12 Mayfly nymph	Ephemereillidae – <i>Serratella ignita</i> (Blue winged olive)	10	1
13 Mayfly nymph	Caenidae – <i>C. horaria</i> (Angler's curse)	7	1
13 Cased caddis	Limnephilidae – <i>Halesus sp.</i> (Caperer) <i>Potamophylax cingulatus</i> (Large cinnamon sedge)	7	2
13 Shrimp	Gammaridae – <i>G. pulex</i>	6	2
13 Mayfly	Baetidae – <i>B. rhodani</i> (5) (Large dark olive) <i>Centroptilium luteolum</i> (1) (Small spurwing)	4	7
13 Snail	Hydrobiidae – <i>Potamopyrgus jenkinsi</i>	3	3
13 Midge larvae	Chironomidae – <i>Chironomus sp.</i> and others	2	4
13 Worms	Oligochaetae – <i>Tubifex tubifex</i>	1	2
Total		40	
ASPT		5	

Comments	Although similar in morphology to the site upstream near Hadlow Down, this shows a significant deterioration in bio-diversity and a paucity of abundance in the organisms present. A causative factor may be the effluent from Buxted STW, which enters a short distance upstream.
Carried out by	St.Pierre, Harrison, Barrow.

Location	Cockhaise Brook – Wild Boar Bridge, just upstream of bridge.
Date	23.8.11.
Grid Reference	TQ 377 257
Local Conditions	Moderate flow over gravel/silt substrate. Turbid from recent rain, part shaded.
Water Velocity	0.15 m/sec
Discharge Volume	0.10 m ³ /sec
Also Netted	1 stoneloach (<i>Barbatula barbatula</i>) Dipteran larvae, water mites.
Biological Quality Rating	Good
Water Quality Rating	Very good

Type	Family	BMWP Score	Abundance
13 Stonefly nymphs	Perlodidae – <i>Perlodides microcephala</i> (Orange striped stonefly)	10	15
13 Mayfly nymphs	Ephemeraeidae – <i>E. danica</i> (Greendrake)	10	5
13 Mayfly nymphs	Ephemeraeidae – <i>Serratella ignita</i>	10	30+
14 Cased caddis	Leptoceridae – <i>Ceraclea dissimilis</i> (Black silverhorn)	10	4
14 Caed caddis	Odontoceridae – <i>O. albicorne</i> (Silver sedge)	10	1
14 Damselfly larva	Calopterygidae – <i>C. virgo</i> (Banded demoiselle)	8	1
14 Cased caddis	Hydroptilidae – <i>H. tineodes</i> (Micro caddis)	6	2
14 Shrimp	Gammaridae – <i>G. pulex</i>	6	100+
14 Blackfly nymphs	Simuliidae	5	3
14 Diving beetle	Dytiscidae – <i>Dytiscus sp.</i> (larvae)	5	4
14 Riffle beetles	Elmidae – <i>E. aenea</i> (larvae), <i>Limnius volckmari</i> (larvae & adults)	5	12
14 Caseless caddis	Hydropsychidae – <i>H. angustipennis</i> (Brown flag)	5	1
14 Crane fly larvae	Tipulidae – <i>Pedicia sp.</i>	5	3
15 Alderfly larvae	Sialidae – <i>S. lutaria</i>	4	2
15 Mayfly larvae	Baetidae – <i>B. rhodani</i> , <i>B. muticus</i>	4	50+
15 Fish leech	Piscicolidae – <i>P. geometra</i>	4	1
15 Leech	Glossiphoniidae – <i>G. complanata</i>	3	1
15 Hoglouse	Asellidae – <i>A. aquaticus</i>	3	1
15 Bivalves	Sphaeriidae	3	15
15 Snails	Hydrobiidae – <i>Potamopyrgus jenkinsi</i>	3	20+
15 Midge larvae	Chironomidae	2	7
15 Worms	Oligochaetae – <i>Tubifex tubifex</i>	1	3
Total		122	
ASPT		5.55	

Comments	A healthy stream with good biodiversity as indicated by our chemical tests.
Carried out by	St.Pierre/Harrison

Location	R. Ouse. Great Bentley Farm
Date	23 March 07
Grid Reference	TQ315283
Local Conditions	Mainly stony riffle
Water Velocity	0.48 m/sec
Discharge Volume	0.29 m ³ /sec
Also Netted	Not netted but a mink was seen crossing the river.
Biological Quality Rating	Fair
Water Quality Rating	Very

Type	Family	BMWP Score	Abundance
15 Mayfly larva	Heptageniidae <i>Heptagenia sulphurea</i>	10	10
16 Mayfly larva	Leptophlebiidae <i>Paraleptophlebia submarginata</i>	10	1
16 Cased caddis larva	Sericostomatidae <i>S. personata</i>	10	2
16 Cased caddis larva	Limnephilidae <i>Micropterna sequax</i>	10	1
16 Caseless caddis larva	Polycentropidae <i>Polycentropus sp</i>	7	2
16 Stonefly larva	Capniidae <i>Capnia sp probably bifrons</i>	10	2
16 Shrimp	Gammaridae <i>G. pulex</i>	6	30
16 Caseless caddis larva	Hydropsychidae <i>H. angustipennis & H. siltalai</i>	5	10
16 Riffle beetle	Elminthidae <i>E. aenea</i>	5	2
16 Blackfly larva	Simuliidae	5	1
16 Mayfly larva	Baetidae <i>B. rhodani</i>	4	20
17 Leech	Glossiphoniidae <i>G. complanata</i>	3	1
17 Midge larva	Chironomidae	2	5
17 Round worm	Oligochaetae <i>Tubifex</i>	1	5
Total		89	
ASPT		6.4	

Comments	The site is a few hundred metres below a STW outfall. This is therefore a reasonable result with a pleasing average score.
Carried out by	R.Pepper & J. Harris

Location	River Ouse, Cherry Lane
Date	16 February 2011
Grid Reference	TQ304280
Local Conditions	Good flow over fine gravel substrate. No shade. Dormant reeds along one bank. Water temp; 5.7 ⁰ C
Water Velocity	0.61 m/sec
Discharge Volume	0.74 m ³ /sec
Also Netted	Water mite
Biological Quality Rating	Fair
Water Quality Rating	Very good

Type	Family	BMWP Score	Abundance
17 Mayfly larva	Ephemeraeidae; <i>E. vulgata</i>	10	15
17 Cased caddis fly larva	Leptoceridae; <i>Athripsodes albifrons</i> (Brown or Black Silverhorn)	10	9
17 Cased caddis fly larva	Goeridae; <i>Silo nigricornis</i> (Black sedge)	10	1
17 Cased caddis fly larva	Sericostomatidae; <i>S. personatum</i> (Welshman's button)	10	3
17 Cased caddis fly larva	Limnephilidae; <i>Potamophylax</i> sp (Large Cinnamon Sedge)	7	2
17 Stone fly larva	Nemouridae; (Brown Stoneflies)	7	2
17 Shrimp	Gammaridae; <i>G. pulex</i>	6	10
18 Caseless caddis fly larva	Hydropsychidae; <i>H. siltalai</i> (Grey Flag)	5	6
18 Riffle beetle	Elmidae; <i>Elmis aenea</i> (ad 2, larva 1)	5	3
18 Crane fly larva	Tipulidae;	5	2
18 Blackfly larva	Simuliidae;	5	6
18 Mayfly larva	Baetidae; <i>B. rhodani</i> (Large Dark Olive)	4	1
18 Leech	Erpobdellidae; <i>E. testacea</i> ;	3	2
18 Mussel	Sphaeriidae;	3	2
18 Spire shell snail	Hydrobiidae; <i>Potamopyrgus jenkinsi</i>	3	3
18 Midge larva	Chironomidae;	2	20
18 Round worm	Tubificidae;	1	20
Total		96	
ASPT		5.6	

Comments	Although the Water Quality Rating was very good this was tempered by the general lack of abundance of some common species (<i>Gammarus</i> & <i>Baetis</i>) and by the abundance of Tubifex worms.
Carried out by	R. Pepper & J. Harris.

Location	River Ouse, Great Bentley Farm
Date	1 March 2011
Grid Reference	TQ316281
Local Conditions	Good flow between steep banks. Light shade. Silt & gravel substrate. Water temperature; 5.6 ⁰ C.
Water Velocity	0.67 m/sec
Discharge Volume	0.65 m ³ /sec
Also Netted	Water mite, unidentified beetle larva
Biological Quality Rating	Good
Water Quality Rating	Very Good

Type	Family	BMWP Score	Abundance
19 Mayfly larva	Ephemeraeidae; <i>E. vulgata</i>	10	30
19 Mayfly larva	Heptageniidae; <i>Rhithrogena semicolorata</i> March Brown	10	1
19 Mayfly larva	Leptophlebiidae; <i>Habrophlebia fusca</i> Ditch Dun	10	1
19 Mayfly larva	Ephemereillidae; <i>Serratella ignita</i> Blue-winged Olive	10	2
19 Cased caddis fly larva	Leptoceridae;	10	1
19 Cased caddis fly larva	Lepidostomatidae; <i>L. hirtum</i> Small Silver Sedge	10	3
19 Cased caddis fly larva	Sericostomatidae; <i>S. personatum</i> Welshman's Button	10	2
19 Stonefly larva	Nemouridae; <i>N. cambrica</i>	7	5
19 Cased caddis fly larva	Limnephilidae; <i>Halesus radiatus</i> , Caperer <i>Limnephilus rhombicus</i>	7	2
19 Cased caddis fly larva	Glossosomatidae; <i>Agapetus fuscipes</i> Tiny Grey Sedge	7	1
20 River limpet	Ancylidae; <i>A. fluviatilis</i>	6	1
20 Shrimp	Gammaridae; <i>G. pulex</i>	6	100
20 Blackfly larva	Simuliidae;	5	50
20 Caseless caddis fly larva	Hydropsychidae; <i>H. siltalai</i> (1), <i>H. angustipennis</i> (2)	5	3
20 Riffle beetle	Elmidae; <i>E. aenea</i>	5	1
20 Mayfly larva	Baetidae; <i>B. rhodani</i>	4	30
20 Alderfly	Sialidae; <i>S. lutaria</i>	4	1
20 Leech	Glossiphoniidae; <i>G. complanata</i>	3	1
20 Leech	Erpodellidae; <i>E. testacea</i>	3	1
20 Spire shell snail	Hydrobiidae – <i>Potamopyrgus jenkinsi</i>	3	10
21 Wandering snail	Lymnaeidae; <i>L. peregra</i>	3	1
21 Mussel	Sphaeriidae;	3	3
21 Round worm	Tubificidae;	1	10
Total		142	
ASPT		6.2	

Comments	This is an excellent result even though it is close to the outflow of a major Sewage Treatment Plant. The extra nutrients added could even be beneficial. The total BMWP score could be increased by another 5 points if the unidentified beetle larva is included.
Carried out by	R. Pepper & J. Harris

Location	River Ouse, Great Bentley Farm
Date	23 October 2012
Grid Reference	TQ316280
Local Conditions	Good flow over stony riffle. Temp 12.6° C.
Water Velocity	0.48 m/sec.
Discharge Volume	0.32 m ³ /sec..
Also Netted	
Biological Quality Rating	Fair
Water Quality Rating	Very good

	Family	Type	BMWP Score	Abundance
21	Goeridae; <i>Silo pallipes/nigricornis</i>	Cased caddis fly	10	6
21	Sericostomatidae; <i>S. personatum</i> .	Cased caddis fly	10	2
21	Leptoceridae;	Cased caddis fly	10	6
21	Rhyacophilidae; <i>R. dorsalis</i> .	Caseless caddis fly	7	2
21	Gammaridae; <i>G. pulex</i> .	Shrimp	6	50
21	Tipulidae/Pediciidae;	Crane fly larva	5	5
21	Elmidae; <i>Elmis aenea</i> (10 adult, 1 larva), <i>Limnius volkmari</i> (2 larvae).	Riffle Beetle	5	13
22	Hydropsychidae; <i>H. angustipennis</i> .	Caseless caddis fly	5	3
22	Simuliidae;	Blackfly larva	5	3
22	Baetidae; <i>B. rhodani</i> .	Mayfly larva	4	20
22	Hydrobiidae; <i>Potamopyrgus jenkinsi</i> .	Spire shell snail	3	20
22	Limbriculidae;	Round worm	1	3
Total			71	
ASPT			5.9	

Comments	The biodiversity of this sample was not good but the water quality is very good especially considering the proximity of a sewage treatment plant outfall.
Carried out by	R. Pepper & J. Harris.

Location	River Ouse, Great Bentley Farm
Date	30 March 09
Grid Reference	TQ314283
Local Conditions	Moderate flow over mainly clay silt. Unshaded
Water Velocity	0.25 m/sec
Discharge Volume	0.2 m ³ /sec
Also Netted	Hair worm, Meniscus midge Larvae (Dixidae)
Biological Quality Rating	Good
Water Quality Rating	Very good.

Type	Family	BMWP Score	Abundance
225. Stonefly	Perlodidae	10	2
226. Mayfly	Heptageniidae	10	2
227. Cased caddis	Leptoceridae <i>Athripsodes sp</i>	10	5
228. Cased caddis	Lepidostomatidae <i>L. hirtum</i>	10	3
229. Cased caddis	Goeridae	10	1
230. Cased caddis	Limnephilidae <i>Potamophylax latipennis</i>	7	5
231. Caseless caddis	Rhyacophilidae <i>R. obliterated</i>	7	2
232. Stonefly	Nemouridae <i>Amphinemura sulcicollis</i>	7	3
233. Shrimp	Gammarus <i>G. pulex</i>	6	50
234. Caseless caddis	Hydropsychidae <i>H. angustipennis & siltalai</i>	5	20
235. Riffle beetle	Elminthidae <i>E. aenea & Limnius volkmari</i>	5	20
236. Blackfly	Simulidae	5	3
237. Mayfly	Baetidae <i>B. rhodani</i>	4	100
238. Mussel	Sphaeriidae	3	1
239. Hoglouse	Asellidae	3	1
240. Snail	Hydrobiidae <i>Potamopyrgus jenkinsii</i>	3	5
241. Roundworm	Oligochaetae <i>Tubifex</i>	1	1
Total		106	
ASPT		6.2	

Comments	This sample was taken above the sewage treatment works outfall (cf sample on 23 March). It is a very good result especially in view of the substrate.
Carried out by	R. Pepper & J. Harris.

Appendix J:

Definitions of the terrestrial and freshwater biodiversity broad habitat types. All definitions are taken from “*Report 307 – Guidance on the interpretation of the Biodiversity Broad Habitat Classification (terrestrial and freshwater types): Definitions and the relationship with other classifications*” (Jackson, 2000). Report available from: <http://jncc.defra.gov.uk/page-2433#1763>

2 Definitions of the terrestrial and freshwater biodiversity broad habitat types

The following definitions are based upon the descriptions of the revised broad habitat types agreed by the UK Biodiversity Group.

2.1 Broadleaved, mixed and yew woodland

This broad habitat type is characterised by vegetation dominated by trees that are more than 5 m high when mature, which form a distinct, although sometimes open canopy with a canopy cover of greater than 20%. It includes stands of both native and non-native broadleaved tree species and yew *Taxus baccata*, where the percentage cover of these trees in the stand exceeds 20% of the total cover of the trees present. Woodlands that are dominated by conifer trees with less than 20% of the total cover provided by broadleaved or yew trees are included in the 'Coniferous woodland' broad habitat type. Stands of broadleaved, mixed and yew woodland may be either ancient or recent woodland and either semi-natural arising from natural regeneration of trees, or planted. Recently felled broadleaved, mixed and yew woodland is also included in this broad habitat type where there is a clear indication that it will return to woodland. Otherwise it is classified according to the field layer composition.

Scrub vegetation, where the woody component tends to be mainly shrubs usually less than 5 m high, and carr (woody vegetation on fens and bog margins) is included in this broad habitat type if the woody species form a canopy cover of greater than 30% and the patch size of scrub is greater than 0.25ha. Exceptions to this include dwarf gorse *Ulex minor* and western gorse *Ulex gallii* which are included in the 'Dwarf shrub heath' broad habitat type, montane willow scrub which is included in the 'Montane habitats' broad habitat type, and scrub on sand dunes and shingle which is included in 'Supralittoral sediment' broad habitat type. Stands of bog-myrtle *Myrica gale* are included in this broad habitat type as scrub if they are more than 1.5 m tall. This habitat type does not include hedges (woody vegetation that has been managed as a linear feature) as these are included in the 'Boundary and linear features' broad habitat type.

2.2 Coniferous woodland

This broad habitat type is characterised by vegetation dominated by trees that are more than 5 m high when mature, which form a distinct, although sometimes open canopy which has a cover of greater than 20%¹. It includes stands of both native and non-native coniferous trees species (with the exception of yew *Taxus baccata*) where the percentage cover of these trees in the stand exceeds 80% of the total cover of the trees present². Woodlands that are made up of broadleaved, yew and conifer trees with less than 80% of the total cover provided by conifer trees are included in the 'Broadleaved, mixed and yew woodland' broad habitat type. Recently felled coniferous woodland is included in this broad habitat type where there is a clear indication that it will return to woodland. Otherwise it is classified according to the field layer composition.

Scots pine *Pinus sylvestris* is the only pine tree that is native to the UK, and forms native woodland only in Scotland. Semi-natural woods of Scots pine are normally called native pinewoods. The majority of coniferous woodlands in the UK are plantations of species that are either not native to the UK or to the sites on which they occur.

2.3 Boundary and linear features

This broad habitat type covers a diverse range of linearly arranged landscape features such as hedgerows, lines of trees (whether constituting part of a hedgerow or not), walls, stone and earth banks, grass strips and dry ditches. These features may occur separately or in combinations forming multi-element boundaries. This habitat type also includes some of the built components of the rural landscape including roads, tracks and railways and their associated narrow verges of semi-natural habitat.

This habitat type does not include roads, tracks and railways in urban areas as these are included in the '*Built-up areas and gardens*' broad habitat type. It also does not include canals and ditches that are water-filled for the majority of the year, which are included in the '*Standing open water and canals*' broad habitat type, rivers and streams which are in the '*Rivers and streams*' broad habitat type, and linear features in woodland such as rides and fire breaks which are included in either the '*Broadleaved, mixed and yew woodland*' or '*Coniferous woodland*' broad habitat types. Cereal field margins managed for nature conservation are included in the '*Arable and horticultural*' broad habitat type.

2.4 Arable and horticultural

This broad habitat type covers arable cropland (including perennial, woody crops, and intensively managed, commercial orchards), commercial horticultural land (such as nurseries, commercial vegetable plots and commercial flower growing areas), freshly-ploughed land, annual leys, rotational set-aside and fallow. This habitat type includes cereal field margins but not field boundaries as these are included in the '*Boundary and linear features*' broad habitat type. This habitat type also does not include domestic gardens and allotments as these are included in the '*Built-up areas and gardens*' broad habitat type.

2.5 Improved grassland

This broad habitat type is characterised by vegetation dominated by a few fast-growing grasses on fertile, neutral soils. It is frequently characterised by an abundance of rye-grass *Lolium* spp. and white clover *Trifolium repens*. Improved grasslands are typically either managed as pasture or mown regularly for silage production or in non-agricultural contexts for recreation and amenity purposes; they are often periodically resown and are maintained by fertiliser treatment and weed control. They may also be temporary and sown as part of the rotation of arable crops but they are only included in this broad habitat type if they are more than one year old. Sown grasslands which are less than one year old are included in the '*Arable and horticultural*' broad habitat type.

2.6 Neutral grassland

This broad habitat type is characterised by vegetation dominated by grasses and herbs on a range of neutral soils usually with a pH of between 4.5 and 6.5. It includes enclosed dry hay meadows and pastures, together with a range of grasslands which are periodically inundated with water or permanently moist.

Neutral grasslands are sometimes referred to as mesotrophic grasslands. The plant species assemblages that develop on neutral soils are different from those that develop on acid soils (acid or calcifugous grassland) and calcareous soils (calcareous or calcicolous grassland). For the most part neutral grassland communities have few diagnostic indicator species but lack strong calcicoles or

calcifuges characteristic of base-rich and acid soils respectively. The National Vegetation Classification describes 12 types of unimproved and semi-improved neutral grassland (Rodwell 1992).

These types are listed in Box 2, below:

Box 2: NVC types included in the 'Neutral grassland' broad habitat type

- MG1 *Arrhenatherum elatius* grassland
- MG2 *Arrhenatherum elatius-Filipendula ulmaria* tall-herb grassland
- MG3 *Anthoxanthum odoratum-Geranium sylvaticum* grassland
- MG4 *Alopecurus pratensis-Sanguisorba officinalis* grassland
- MG5 *Cynosurus cristatus-Centaurea nigra* grassland
- MG6 *Lolium perenne-Cynosurus cristatus* grassland (part only)
- MG8 *Cynosurus cristatus-Caltha palustris* grassland
- MG9 *Holcus lanatus-Deschampsia cespitosa* grassland
- MG10 *Holcus lanatus-Juncus effusus* rush pasture
- MG11 *Festuca rubra-Agrostis stolonifera-Potentilla anserina* grassland
- MG12 *Festuca arundinacea* grassland
- MG13 *Agrostis stolonifera-Alopecurus geniculatus* grassland

Unimproved or species-rich neutral grasslands are usually managed traditionally as hay-meadows and pastures. Semi-improved neutral grasslands are also included in this broad habitat type and these grasslands are usually managed for pasture or for silage or hay. Neutral grassland differs from improved grasslands by having a less lush sward, a greater range and higher cover of herbs, and usually less than 25% cover of perennial rye-grass *Lolium perenne*.

2.7 Calcareous grassland

This broad habitat type is characterised by vegetation dominated by grasses and herbs on shallow, well-drained soils which are rich in bases (principally calcium carbonate) formed by the weathering of chalk and other types of limestone or base-rich rock. Although the base status of such soils is usually high, with a pH of above 6, it may also be more moderate and calcareous grassland communities can occur on soils with a pH as low as 5.

Calcareous grasslands are also called calcicolous grasslands and are sometimes referred to as chalk or limestone grasslands. The plant species assemblages that develop on calcareous soils are different from those that occur on neutral soils (neutral or mesotrophic grassland) and acid soils (acid or calcifugous grassland), and characteristically include a range of strict calcicoles. The National Vegetation Classification describes 14 types of calcareous grassland (Rodwell 1992). These types are listed in Box 3 below.

Box 3: NVC types included in the 'Calcareous grassland' broad habitat type

- CG1 *Festuca ovina-Carlina vulgaris* grassland
- CG2 *Festuca ovina-Avenula pratensis* grassland

- CG3 *Bromus erectus* grassland
- CG4 *Brachypodium pinnatum* grassland
- CG5 *Bromus erectus*-*Brachypodium pinnatum* grassland
- CG6 *Avenula pubescens* grassland
- CG7 *Festuca ovina*-*Hieracium pilosella*-*Thymus praecox/pulegioides* grassland
- CG8 *Sesleria albicans*-*Scabiosa columbaria* grassland
- CG9 *Sesleria albicans*-*Galium sternerii* grassland
- CG10 *Festuca ovina*-*Agrostis capillaris*-*Thymus praecox* grassland
- CG11 *Festuca ovina*-*Agrostis capillaris*-*Alchemilla alpina* grass-heath
- CG12 *Festuca ovina*-*Alchemilla alpina*-*Silene acaulis* dwarf-herb community
- CG13 *Dryas octopetala*-*Carex flacca* heath
- CG14 *Dryas octopetala*-*Silene acaulis* ledge community

2.8 Acid grassland

This broad habitat type is characterised by vegetation dominated by grasses and herbs on a range of lime-deficient soils which have been derived from acidic bedrock or from superficial deposits such as sands and gravels. Such soils usually have a low base status, with a pH of less than 5.5. This habitat type includes a range of types from open communities of very dry sandy soils in the lowlands, which may contain many annual species, through closed pastures on red brown earths, to damp acidic grasslands typically found on gleys and shallow peats.

Acid grasslands are also referred to as calcifugous swards. The plant species assemblages that develop on acid soils are different from those that develop on neutral soils (neutral or mesotrophic grassland) and calcareous soils (calcareous or calcicolous grassland) and are characterised by the presence of a combination of calcifuge species. The National Vegetation Classification describes six types of acid grassland (Rodwell 1992). These types are listed in Box 4 below. This habitat type also includes inland sand dune communities (Rodwell 2000). Acid grassland types and snow-bed communities which occur exclusively in the montane (Alpine) zone are included in the 'Montane habitats' broad habitat type and acid grassland types found on shingle habitats are included in the 'Supralittoral sediment' broad habitat type.

Box 4 NVC types included in the 'Acid grassland' broad habitat type

- U1 *Festuca ovina*-*Agrostis capillaris*-*Rumex acetosella* grassland
- U2 *Deschampsia flexuosa* grassland
- U3 *Agrostis curtisii* grassland
- U4 *Festuca ovina*-*Agrostis capillaris*-*Galium saxatile* grassland
- U5 *Nardus stricta*-*Galium saxatile* grassland
- U6 *Juncus squarrosus*-*Festuca ovina* grassland
- SD10 *Carex arenaria* dune (inland sub-communities only)
- SD11 *Carex arenaria*-*Cornicularia aculeata* dune (inland sub-communities only)

2.9 Bracken

This broad habitat type covers areas dominated by a continuous canopy cover of bracken *Pteridium aquilinum* at the height of the growing season. It does not include areas with scattered patches of bracken or areas of bracken which are less than 0.25 ha which are included in the broad habitat type

with which they are associated. It also does not include areas of bracken under forest or woodland canopy which are included in either the '*Broadleaved, mixed and yew woodland*' or the '*Coniferous woodland*' broad habitat types.

2.10 Dwarf shrub heath

This broad habitat type is characterised by vegetation that has a greater than 25% cover of plant species from the heath family (ericoids) or dwarf gorse *Ulex minor*. It generally occurs on well-drained, nutrient-poor, acid soils. Heaths do occur on more basic soils but these are more limited in extent and can be recognised by the presence of herbs characteristic of calcareous grassland. Dwarf shrub heath includes both dry and wet heath types and occurs in the lowlands and the uplands.

This habitat type does not include dwarf shrub dominated vegetation in which species characteristic of peat-forming vegetation such as cotton-grass *Eriophorum* spp. and peat-building sphagna are abundant, or that occurs on deep peat (greater than 0.5 m) as these are included in the '*Bog*' broad habitat type. It also does not include heath types which are exclusively alpine in distribution as these are included in the '*Montane habitats*' broad habitat type. Heath types on sand dunes or shingle are included in the '*Supralittoral sediment*' broad habitat type and heath types on maritime cliffs and slopes that are influenced by salt spray are included in the '*Supralittoral rock*' broad habitat type.

2.11 Fen, marsh and swamp

This broad habitat type is characterised by a variety of vegetation types that are found on minerotrophic (groundwater-fed), permanently, seasonally or periodically waterlogged peat, peaty soils, or mineral soils. Fens are peatlands which receive water and nutrients from groundwater and surface run-off, as well as from rainfall. Flushes are associated with lateral water movement, and springs with localised upwelling of water. Marsh is a general term usually used to imply waterlogged soil; it is used more specifically here to refer to fen meadows and rush-pasture communities on mineral soils and shallow peats. Swamps are characterised by tall emergent vegetation. Reedbeds (i.e. swamps dominated by stands of common reed *Phragmites australis*) are also included in this type.

This habitat type does not include neutral and improved grasslands on floodplains and grazing marshes which are included in the '*Neutral grassland*' and '*Improved grassland*' broad habitat types respectively, nor ombrotrophic mires (blanket, raised and intermediate bogs) as these are included in the '*Bogs*' broad habitat type. It also does not include areas of carr (fen woodland dominated by species such as willow *Salix* spp., alder *Alnus glutinosa* or birch *Betula* spp.) as these are covered in the '*Broadleaved, mixed and yew woodland*' broad habitat type unless cover is less than 30%.

2.12 Bog

This broad habitat type covers wetlands that support vegetation that is usually peat-forming and which receive mineral nutrients principally from precipitation rather than ground water. This is referred to as ombrotrophic (rain-fed) mire. Two major bog types are identified, namely raised bog and blanket bog. These two types are for the most part fairly distinctive but they are extremes of what can be considered an ecological continuum and intermediate (or mixed) types occur.

The vegetation of bogs which have not been modified by surface drying and aeration or heavy grazing is dominated by acidophilous species such as bog-mosses *Sphagnum* spp., cotton-grass *Eriophorum* spp. and cross-leaved heath *Erica tetralix*. The water-table on these types of bogs is usually at or just below the surface.

This habitat type also includes modified bog vegetation that essentially resembles wet or dry dwarf shrub heath but occurs on deep acid peat which would have once supported peat-forming

vegetation. Modified bog also includes impoverished vegetation dominated by purple moor-grass *Molinia caerulea* or hare's-tail cotton-grass *Eriophorum vaginatum*. Although there is no agreed minimum depth of peat that can support ombrotrophic vegetation, unmodified bog can be identified floristically by the presence of characteristic species such as cotton-grass *Eriophorum* spp. and peat-forming sphagna. Peat depth, although somewhat arbitrary, is used as the primary criterion to separate types of modified bog vegetation from the 'Dwarf shrub heath' broad habitat type and certain types of 'Fen, marsh and swamp' broad habitat type. Therefore vegetation dominated by dwarf-shrubs, cotton-grass *Eriophorum* spp., or purple moor-grass *Molinia caerulea* vegetation on peat greater than 0.5 m deep is classified as bog for the purposes of the Broad Habitat Classification.

In lowland areas with predominantly acid substrata there are examples of valley and basin mires that receive acid surface seepage, which gives rise to vegetation similar to that of bogs. However, these types are covered in the 'Fen, marsh and swamp' broad habitat type.

2.13 Standing water and canals

This broad habitat type includes natural systems such as lakes, meres and pools, as well as man-made waters such as reservoirs, canals, ponds and gravel pits. It includes the open water zone (which may contain submerged, free-floating or floating-leaved vegetation) and water fringe vegetation. Ditches with open water for at least the majority of the year are also included in this habitat type.

Standing waters are usually classified according to their nutrient status and this can change naturally over time or as a result of pollution. There are three main types of standing waters, namely: oligotrophic (nutrient-poor), eutrophic (nutrient-rich), and mesotrophic (intermediate). These lake types exist along an environmental gradient and intermediate types occur. Other types of standing water include dystrophic (highly acidic, peat-stained water), marl lakes, brackish-water lakes, turloughs and other temporary water bodies. Coastal saline lagoons are not included in this habitat type but are covered by the 'Inshore sublittoral sediment' broad habitat type.

The transition between open water and land is often occupied by tall emergent vegetation called swamp or reedbed, or wet woodland called carr. In practice this vegetation often forms a continuum but for the purposes of the Broad Habitat Classification marginal emergent vegetation that is greater than 5 m wide, or areas of wetland habitat adjacent to the waterbody that are greater than 0.25 ha, are included in the 'Fen, marsh and swamp' broad habitat type. Areas of wet woodland greater than 0.25ha are included in the 'Broadleaved, mixed and yew woodland' broad habitat type unless the cover of the canopy is less than 30%.

2.14 Rivers and streams

The 'Rivers and streams' broad habitat type covers rivers and streams from bank top to bank top, or where there are no distinctive banks or banks are never overtopped, it includes the extent of the mean annual flood. This includes the open channel (which may contain submerged, free-floating or floating-leaved vegetation) water fringe vegetation and exposed sediments and shingle banks. Adjacent semi-natural wetland habitats such as unimproved floodplain grasslands, marshy grassland, wet heath, fens, bogs, flushes, swamps and wet woodland, although intimately linked with the river, are covered in other broad habitat types.

2.15 Montane habitats

This broad habitat type includes a range of vegetation types that occur exclusively in the montane zone such as prostrate dwarf shrub heath, snow-bed communities, sedge and rush heaths, and moss heaths. The distinction between the sub-montane and montane zone is often blurred and the two

usually merge through a band of transitional vegetation. Exclusively montane habitat types can be recognised by their floristic composition and their physiognomy (prostrate vegetation). Widespread arctic-alpine species such as stiff sedge *Carex bigelowii*, crowberry *Empetrum nigrum hermaphroditum*, trailing azalea *Loiseleuria procumbens*, dwarf willow *Salix herbacea*, and alpine clubmoss *Diphasium alpinum*, in association with frequent to abundant woolly fringe-moss *Racomitrium lanuginosum* or cladonia lichens *Cladonia* spp., and other macro-lichens such as *Cetraria islandica*, are useful indicators of montane communities.

Calcareous grasslands including those dominated by mountain avens *Dryas octopetala*, fens and springs, blanket bog and rock habitats which also occur in the montane zone are not included in this habitat type but in the 'Calcareous grassland', 'Fen, marsh and swamp', 'Bog', and 'Inland rock' broad habitat types respectively. This type also does not include dwarf shrub heaths and grasslands that straddle the notional boundary of the former tree-line with little change in floristics and physiognomy and these should be treated as components of other broad habitat types.

2.16 Inland rock

This broad habitat type covers both natural and artificial exposed rock surfaces which are greater than 0.25ha, such as inland cliffs, caves, and screes and limestone pavements, as well as various forms of excavations and waste tips such as quarries and quarry waste.

A number of vegetation types associated with rock habitats are also included in this broad habitat type. These are: chasmophytic vegetation (plant communities that colonise the cracks and fissures of rock faces); calaminarian grassland (a grassland type which is found on soils which have levels of heavy metals, such as lead, chromium and copper, that are toxic to most plant species); and certain types of tall herb and fern vegetation, which as a result of grazing pressure are much reduced in extent and confined to areas inaccessible to grazing animals such as cliff faces and ledges, and to a lesser extent, on lightly-grazed steep rocky slopes and boulder fields.

2.17 Built-up areas and gardens

This broad habitat type covers urban and rural settlements, farm buildings, caravan parks and other man-made built structures such as industrial estates, retail parks, waste and derelict ground, urban parkland and urban transport infrastructure. It also includes domestic gardens and allotments. This type does not include amenity grassland which should be included in the 'Improved grassland' broad habitat type.