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 Commitee

April 2014

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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.

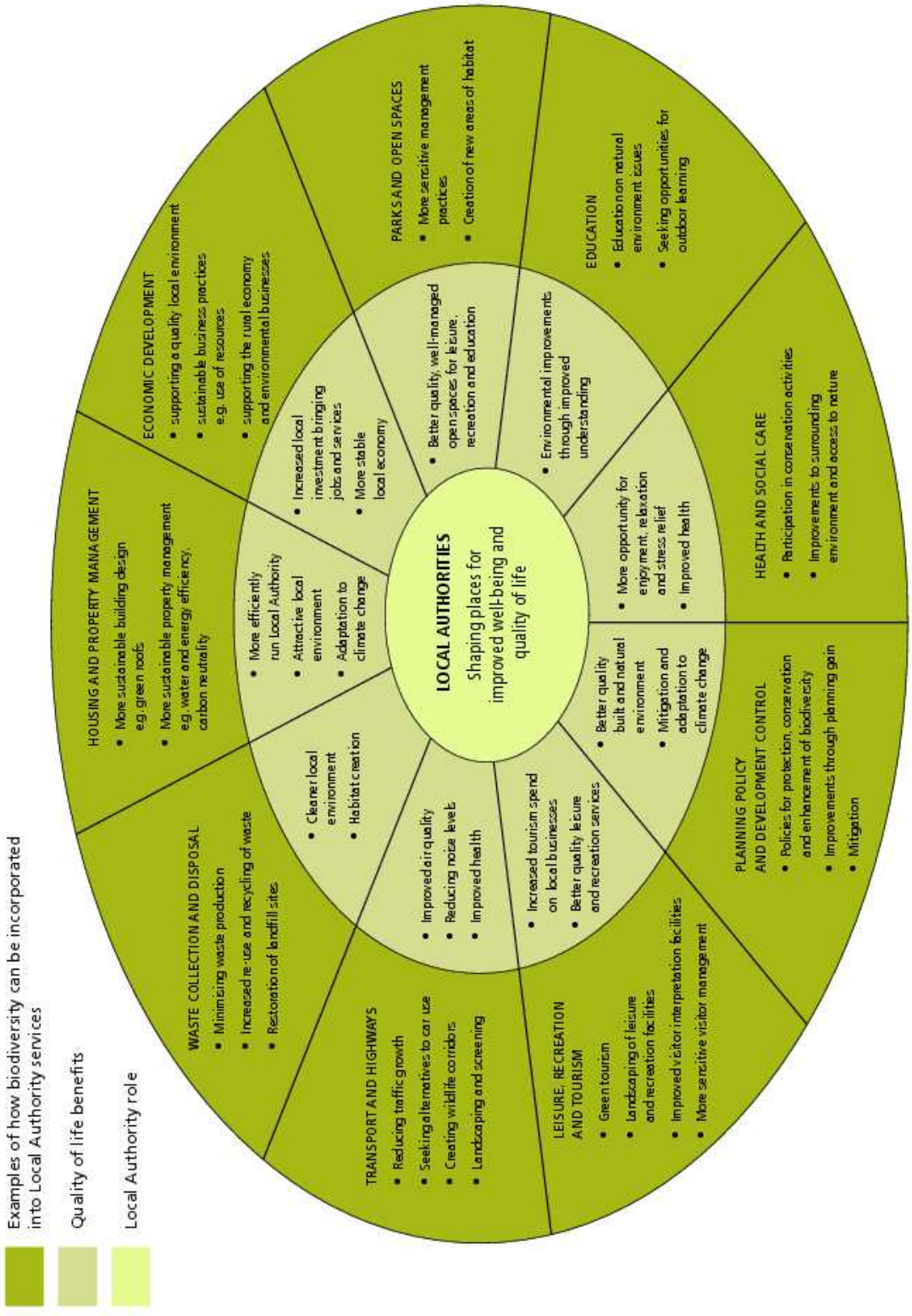
2. The duty of local authorities with respect to biodiversity

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 extripation 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 miltifacted 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 scientist 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 uconsciously) about how we think the world should be, or can be better than it currently is. Although we usually sidestep, whether deliberatlely or unthinkingly, the potentially "messy" ethical issues and assumptions embodied within our actions, it is a mistake to think that we excape 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 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 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 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.

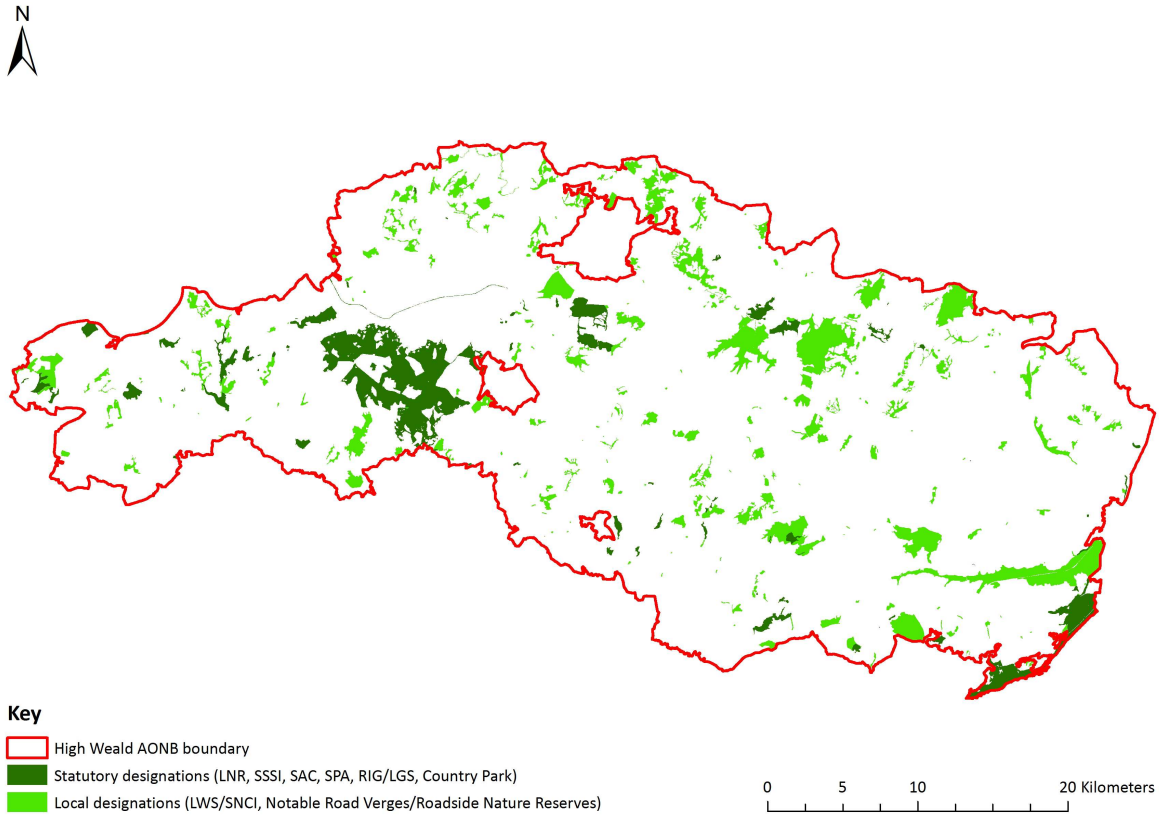
Generic term	Variations
Local Wildlife Site	County Wildlife Site
	Wildlife Site
	Special Wildlife Site
	Key Wildlife Site
	Site of Importance for Nature Conservation
	Site of Nature Conservation Importance
	Site of Nature Conservation Interest
	Site of Local Importance for Nature Conservation
	Site of 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.

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).

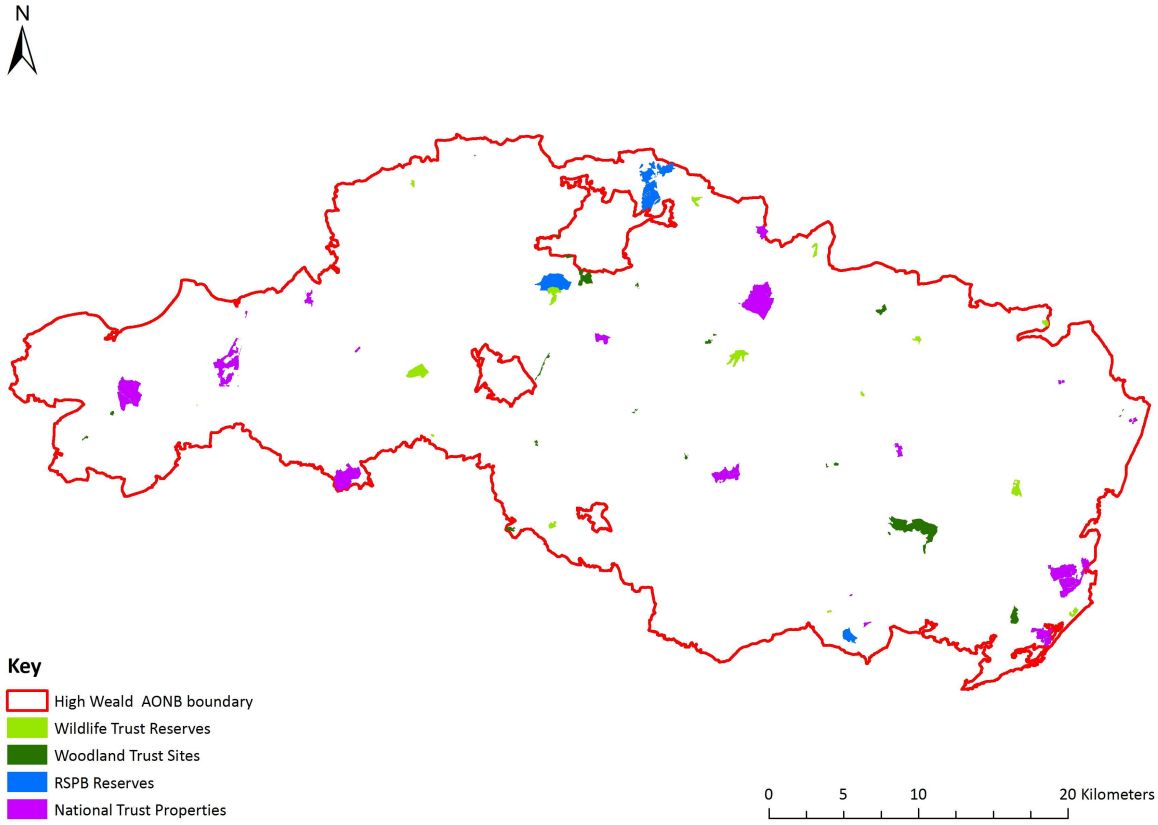
Table 2. Number and area of sites/reserves owned by conservation organisations in the High Weald AONB

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 organistions 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.

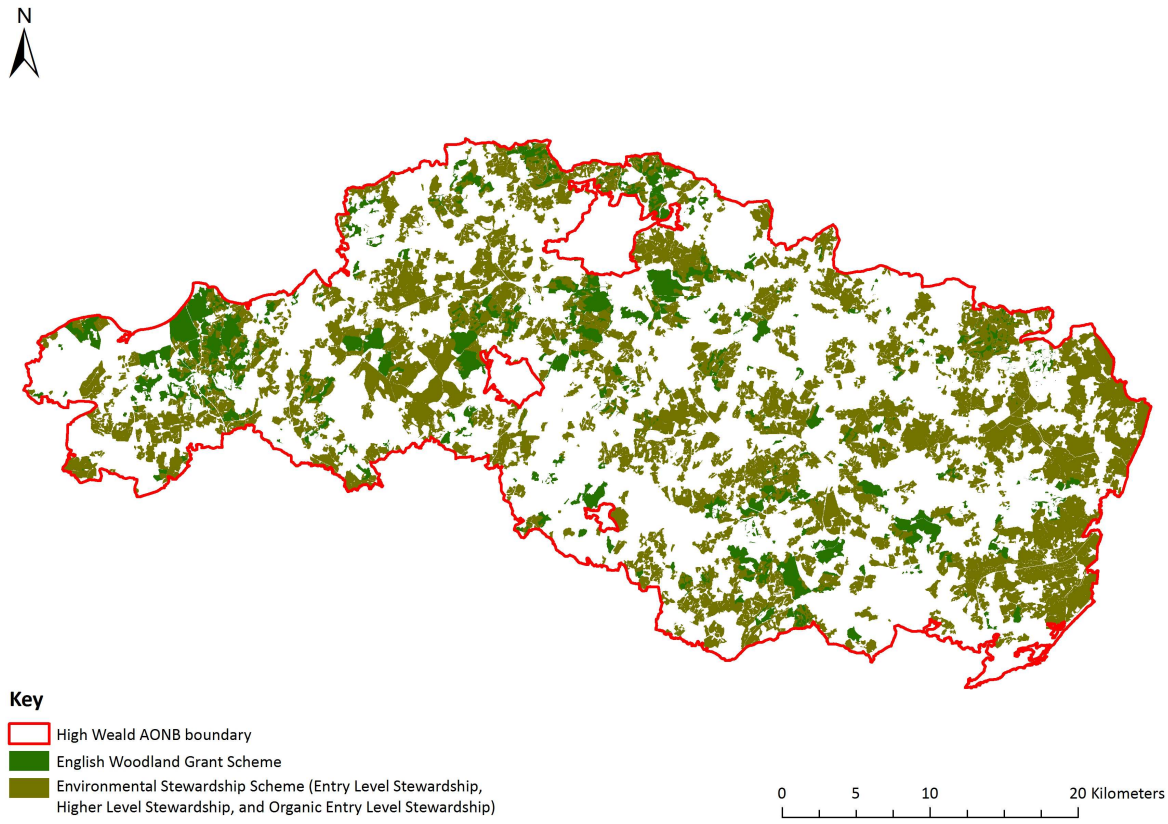


Data sources: National Trust Land dataset, RSPB UK reserves dataset, Wildlife Trust Reserves dataset (Sussex, Kent and Surrey) Woodland Trust Sites dataset, and Natural England's AONBs (England) boundary data.

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.

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.

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 herafter 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 Rurual 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).

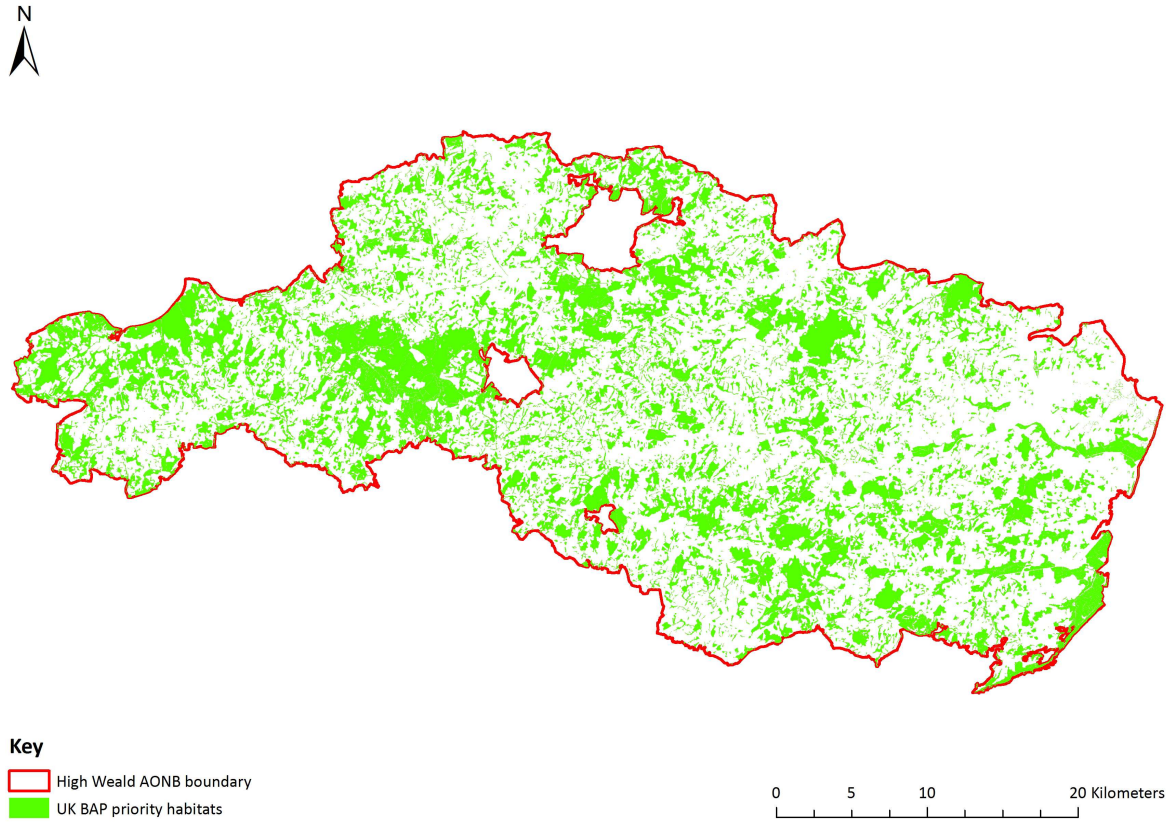
For a list of the UK BAP priority species found in the High Weald AONB, please refer to Appendix B, pp.95-100, for a list of the UK BAP priority habitats found in the High Weald AONB, please refer to Table 3, p.12, and for a map showing the location and spatial extent of these UK BAP priority habiats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

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

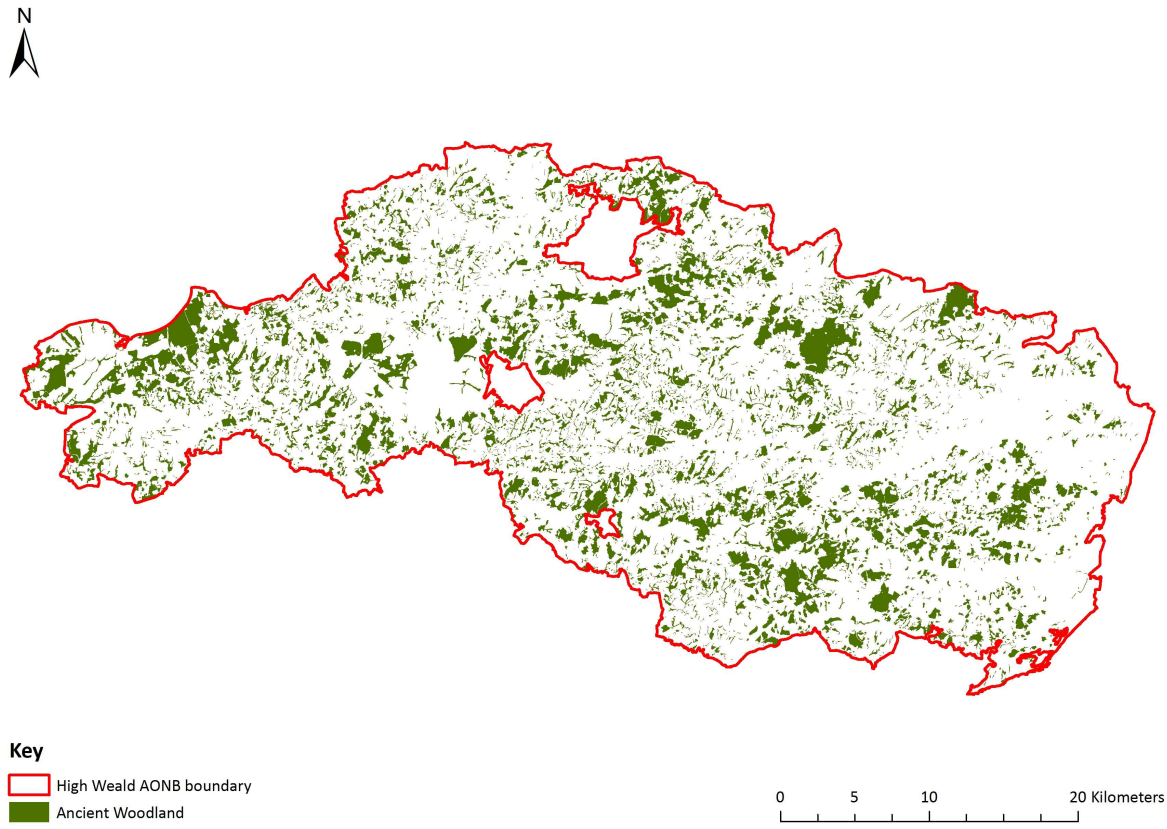
Ancient woodland in the region covers 27,676ha (18.7% of the AONB's total area), compared to a national average cover of just 2.68%

Defined as land that has supported continuous woodland cover since at least 1600 AD, ancient woodland may be divided into two broad catagories: 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).

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.

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 spiked 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).

Biodversity 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 abundancies 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 *Betlua* 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	*Alnus glutinosa*	Alder
	Salix fragilis	Crack willow
	Quercus robur	Oak
	Populus nigra ssp. Betulifolia	Black poplar
	Betula puescens	Downy birch
	Fraxinus excelsior	Ash
	Salix alba	Salix alba
Understory	*Salix cinerea*	Grey willow
	Salix viminalis	Osier
	Crataegus monogyna	Hawthorne
	Ulnus glabra	Wych elm
	Sambucus nigra	Elder
	Salix caprea	Goat willow
	Ilex aquilifolium	Holly
	Corylus avellana	Hazel
	Viburnum opulus	Guelder rose
	Prunus spinosa	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 popular *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

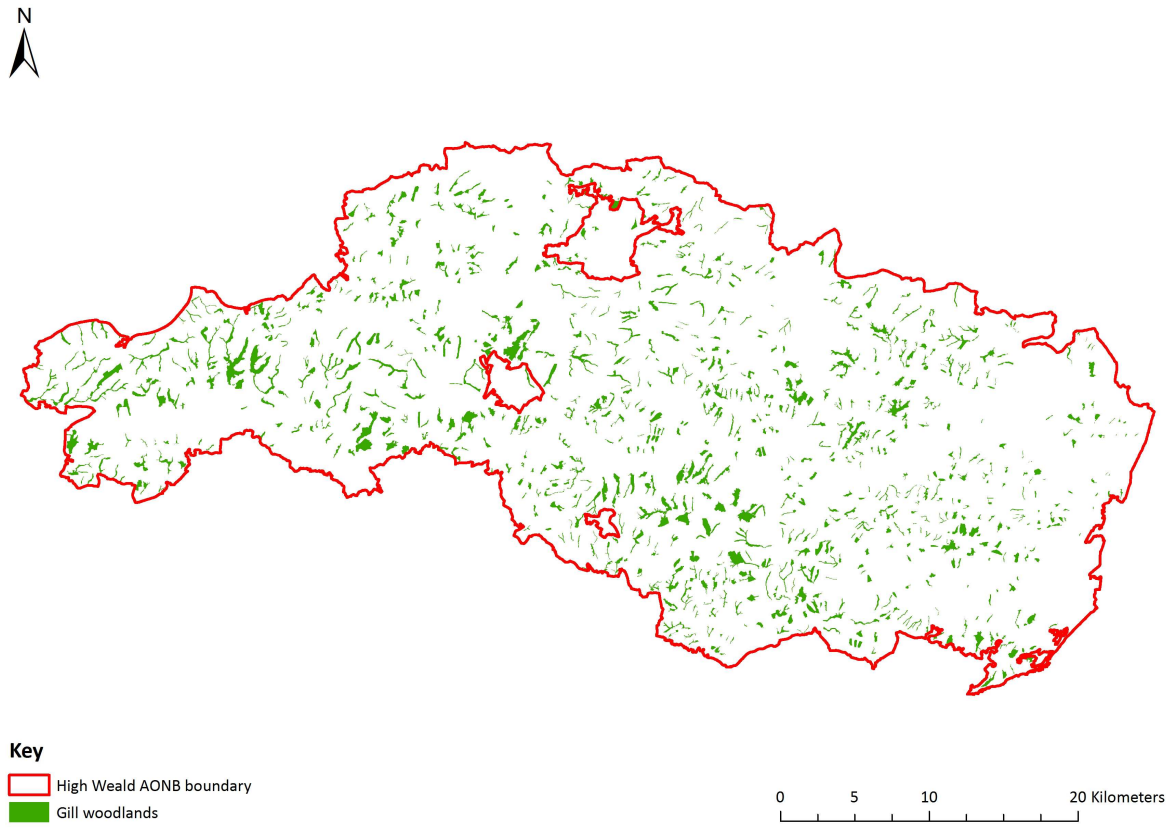
management of willow for weaving and cricket bat manufacture) may play a key role in the conservation of their biodiversity.

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.

Cruicially, 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 (*Leiostyla 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 angustutum*
- The epiphytic lichen flora is also very rich, with a range of species characteristic of ancient woodland, such as *Thelotrama 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 studies 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.

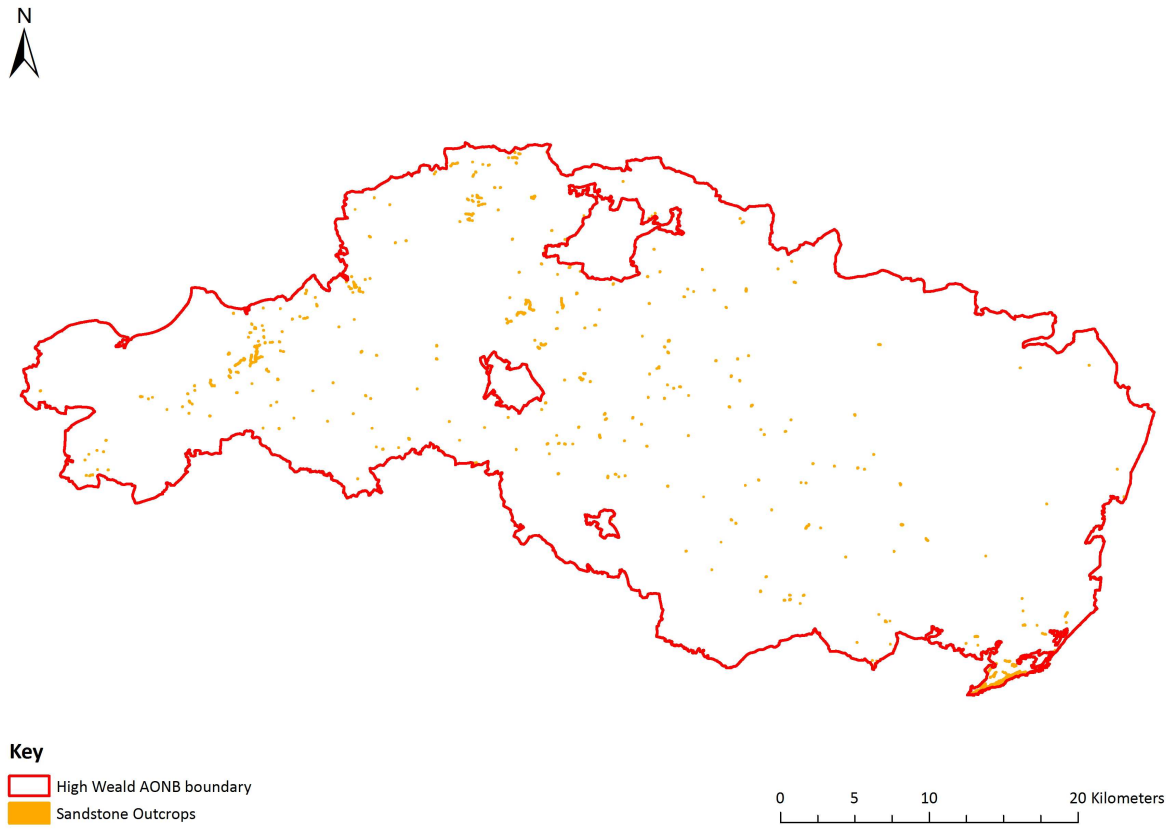
5.4 Sandstone outcrops

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.

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.

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*, eggyolk 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 veilwort'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 fruticisus* 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).

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*, *Tetrodontium 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 aquiifolium* 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 pericylmer* 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*, *Leiostyla 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.

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, 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.).

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

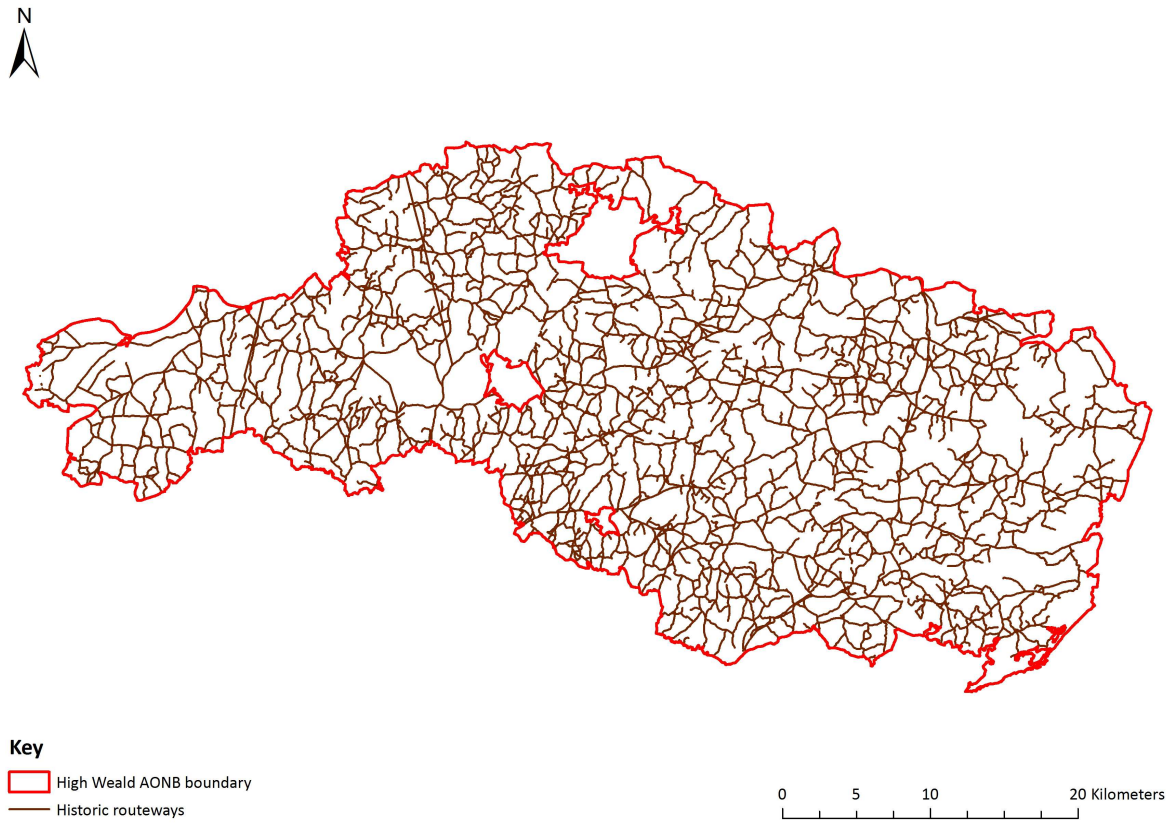
Due to the fact that routeways have not traditionally been considered as natural features in their own right (with the variety of habitats that they support typically being treated as the relevant unit of biological interest), there are no detailed species or habitat surveys of routeways on which to 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 exposured 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 invertabrates, 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.

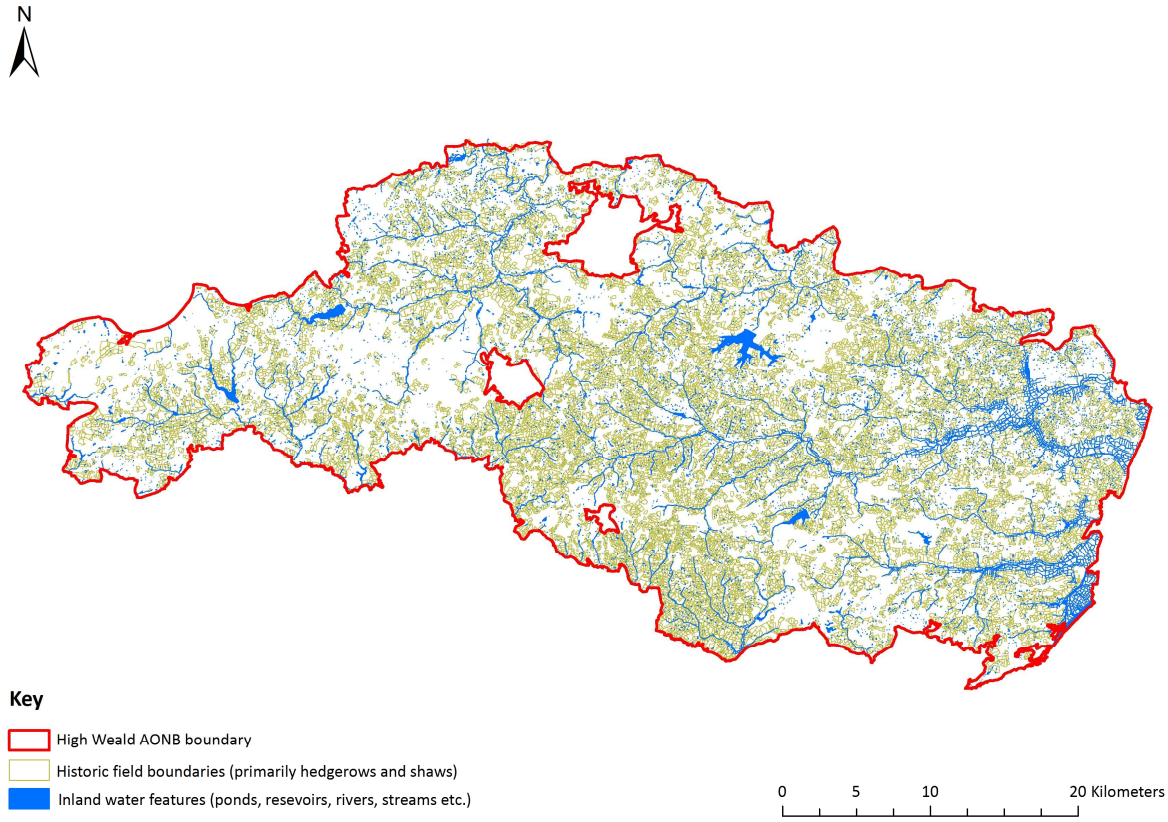
In light of the fact that sunken historic routeways appear to provide suitable environmental conditions for a significant proportion of woodland plants, as well as the uncertainty regarding the ability of other linear woody features, like hedgerows, to act as corridors for woodland biodiversity (see, 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.

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

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

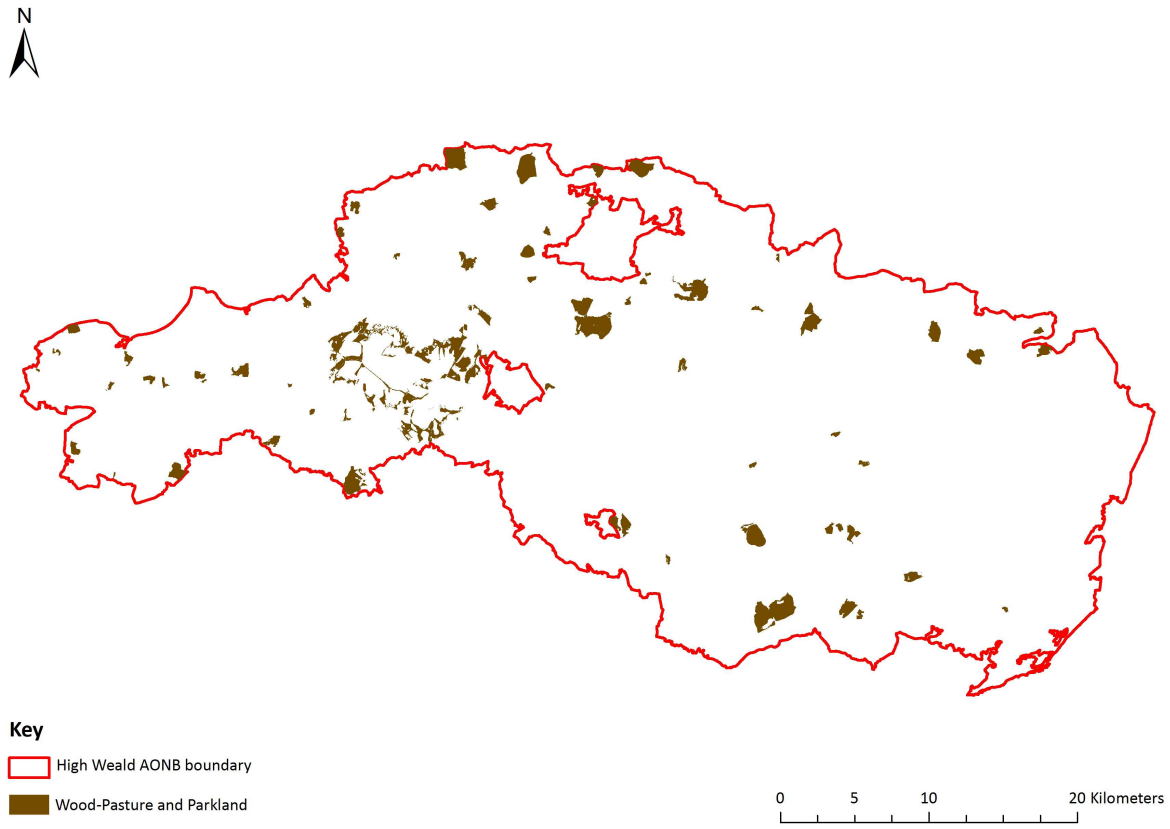
Wood-pasture and parklands may be defined as mosaic habitats that support a combination of mature – veteran and/or ancient[1] – trees and a ground flora composed of either grassland, which may be unimproved (see the section specifically on unimproved grassland, pp.55-59), or heathland (see the section 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." The extent of Wood-Pasture and Parkland that survives in the present day landscape of the High Weald – and is considered to qualify for UK BAP priority habitat status – is displayed in Figure 11, p.41.

Figure 11. The extent of wood-pasture and parkland within the High Weald AONB.



Data sources: Natural England's Priority Habitats Inventory, and Natural England's AONBs (England) boundary data. © Crown copyright. All rights reserved. 100019601, 100019238, 100018485, 100019613 (2013).

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.

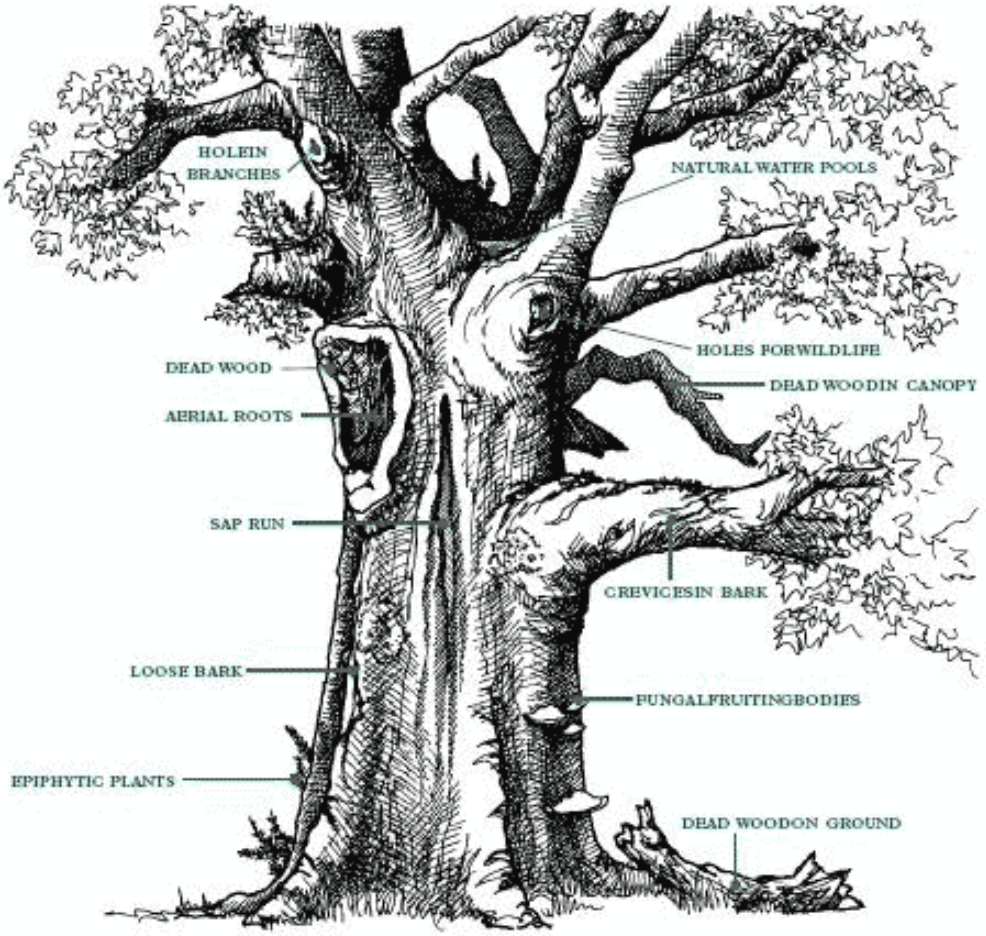
Latin name	Common name	No. recorded	Girth of largest tree (m)	From of largest tree
Quercus robur & *Quercus petraea*	Pendunculate oak & sessile oak	236	8.06	Pollard
Fagus sylvatica	Beech	233	8.4	Pollard
Castanea sativa	Sweet chestnut	88	7.2	Pollard
Fraxinus excelsior	Ash	58	6.5	Pollard
carpinus betulus	Hornbeam	43	2.92	Maiden
Taxus baccata	Yew	43	8.5	Maiden split
Tilia x europaea	Common Lime	20	6.38	Pollard
Betula pendula	Silver Birch	19	2.58	Maiden
Salix alba	White willow	17	5.85	Pollard
Alder glutinosa	Alder	15	4.04	Coppice
Pinus sylvestris	Scots pine	15	4.7	Maiden
Acer campestre	Field maple	14	4.2	Maiden
Betula pubescens	Downy birch	11	3.9	Maiden
Prunus Avium	Wild cherry	11	3.17	Maiden
Ulmus procera	English elm	10	3.7	Pollard
Populus nigra ssp. betulifolia	Wild black poplar	9	4.27	Maiden
Sequoiadendron giganteum	Giant sequoia	8	8.86	Maiden
Ilex aquifolium	Holly	8	1.95	Maiden
Pinus radiata	Monterey pine	8	5.65	Maiden
Aesculus hippocastanum	Horse chestnut	5	5.07	Maiden
Cedrus libani	Cedar of Lebanon	4	6.5	Maiden
Malus sylvestris	Crab apple	4	2.26	Maiden
Salix caprea	Goat willow	4	2.8	Pollard
Crataegus monogyna	Hawthorn	4	2.77	Multi-stem
Populus x canadensis	Hybrid black poplar	4	4.95	Maiden
Acer pseudoplatanus	Sycamore	4	5.02	Maiden
Ulmus glabra	Wych elm	4	3.15	Maiden
Sorbus aucuparia	Rowan	3	1.8	Maiden
Quercus cerris	Turkey oak	3	6.22	Maiden

Populus canescens	Grey poplar	2	5.22	Maiden
Cupressus sempervirens	Italian Cyprus	2	3.4	Maiden
Juglans regia	Walnut		3.74	Maiden
Pyrus communis	Wild pear	2	2.17	Maiden
Buxus sempervirens	Box	1	0.5	Multi-stem
Acer cappadocicum	Cappadocian maple	1	2.95	Maiden
Sequoia sempervirens	Coast redwood	1	4.5	Maiden
Ulmus minor subsp. angustifolia	Cornish elm	1	3.25	Maiden
Pinus nigra var. maritime	Corsican pine	1	3.2	Maiden
Larix decidua	European larch	1	2.94	Maiden
Abies cephalonica	Grecian fir	1	4.6	Maiden
Corylus avellana	Hazel	1	2.7	Multi-stem
Quercus ilex	Holm oak	1	4.5	Pollard
Quercus frainetto	Hungarian oak	1	5.9	Maiden
Ulmus × hollandica 'Vegeta'	Huntingdon elm	1	4.87	Maiden
Tilia platyphyllos	Large-leaved lime	1	6.85	Pollard
Quercus x hispanica 'Lucombeana'	Lucombe oak	1	4.4	Maiden
Acer campestre	Maple	1	3.74	Pollard
Cupressus macrocarpa	Monterey cypress	1	3.75	Maiden
Abies procera	Noble fir	1	3.85	Maiden
Acer platanoides	Norway maple	1	3.9	Unknown
Quercus rubra	Red oak	1	3.45	Maiden
Metasequoia glyptostroboides	Redwood	1	4.2	Maiden
Ulmus minor var. minor	Smooth-leaved elm	1	2.9	Maiden
Taxodium distichum	Swamp cypress	1	3.4	Maiden
Liriodendron tulipifera	Tulip tree	1	4	Maiden
Tsuga heterophylla	Western hemlock	1	3.78	Maiden
Thuja plicata	Western red cedar	1	4.6	Maiden
Ulmus minor subsp. sarniensis	Wheatley elm	1	3.65	Maiden
Populus alba	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 12, below), these long-lived trees support a staggering abundance and diversity of species (Wright, 2008; Sussex Biodiversity Record Centre, 2013; Woodland Trust, 2013c).

Figure 12. Features (habitats and species) associated with ancient/veteran trees.



Source: Wealden Ancient Tree Project (available from: http://sxbrc.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

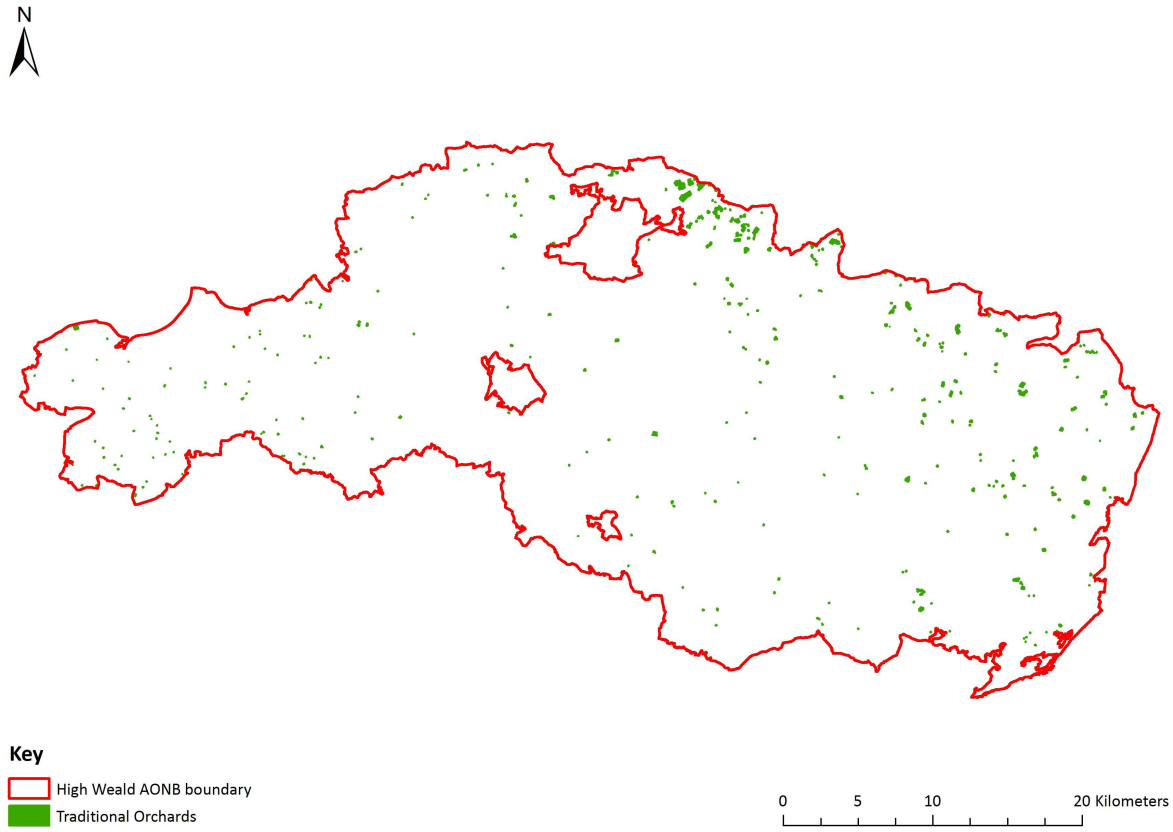
(Information from the Eridge Park SSSI citation, available from: http://www.sssi.naturalengland.org.uk/Special/sssi/sssi_details.cfm?sssi_id=1003196).

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 13, p.48, for a map displayin the extent of traditional orchards in the High Weald AONB).

Figure 13. 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.

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 orchard may contain a mosaic of other habitats, including scrub, hedgerows, unimproved grassland and ponds

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

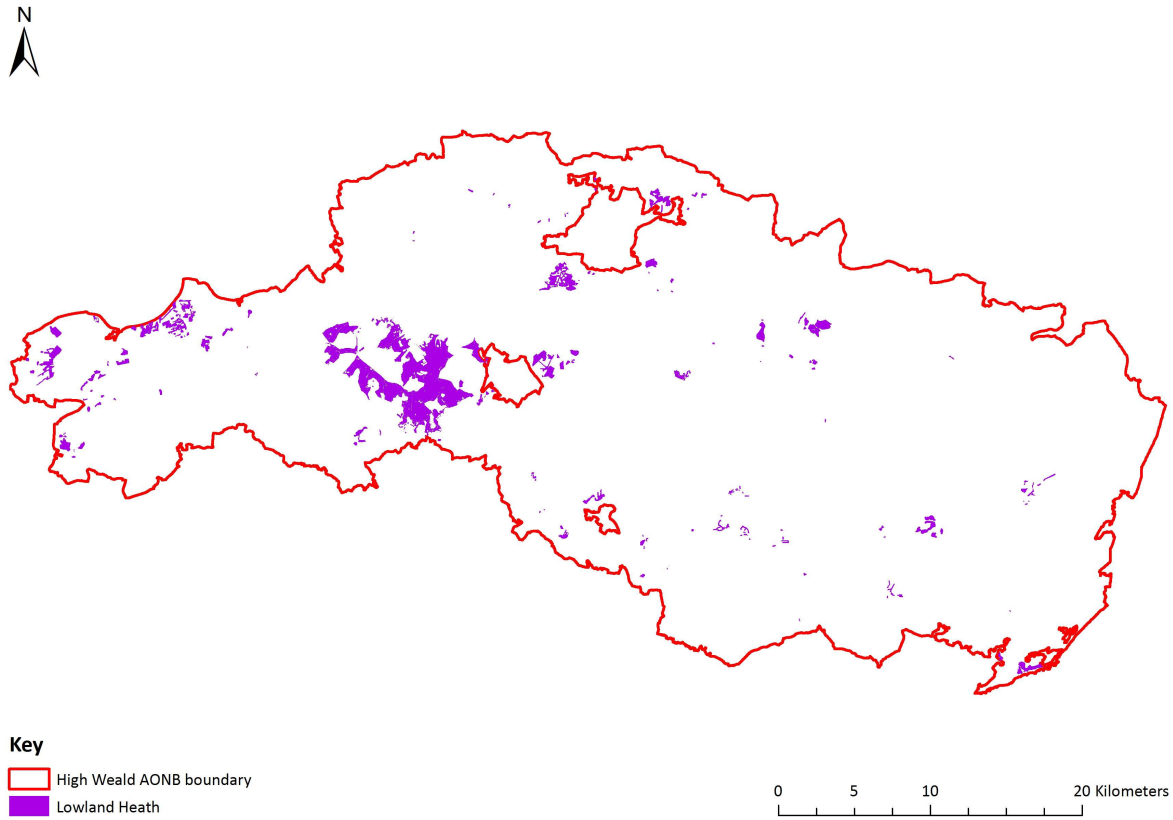
Although the importance of agricultural genetic diversity if often underappreciated, it will undoubtedly be of critical importance in meeting the challenge of feeding a growing population in the face of climatic change and the ever-present threat of new pests, parasites and disease (Convention on Biological 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 14, p.52).

Figure 14. 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.

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	*Calluna vulgaris-Ulex minor* heath (sub-communities *Vaccinium myrtillus* and *Molinia caerulea*)
M16	*Erica tetralix-Sphagnum compactum* wet heath
M25	*Molina caerulea-Potentilla erecta* mire
U1	*Festuca ovina-Agrostis capillaries-Rumex acetosella* acid grassland
U20	*Pteridium aquilinum-Gallium saxatile* community
W10	*Quercus robur-Pteridium auilinum-Rubus Fruticosa* woodland
W15	*Fagus sylvatica-Deschampsia flexusa* woodland
W16	*Quercus* spp.*-Betula* spp.*-Deschampsia flexosa* 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 *Genriana pneumonanthe* and marsh clubmoss *Lycopodiella indundata* (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 myrtilli*, 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 *Ceriagrion 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.).

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

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.58.

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).

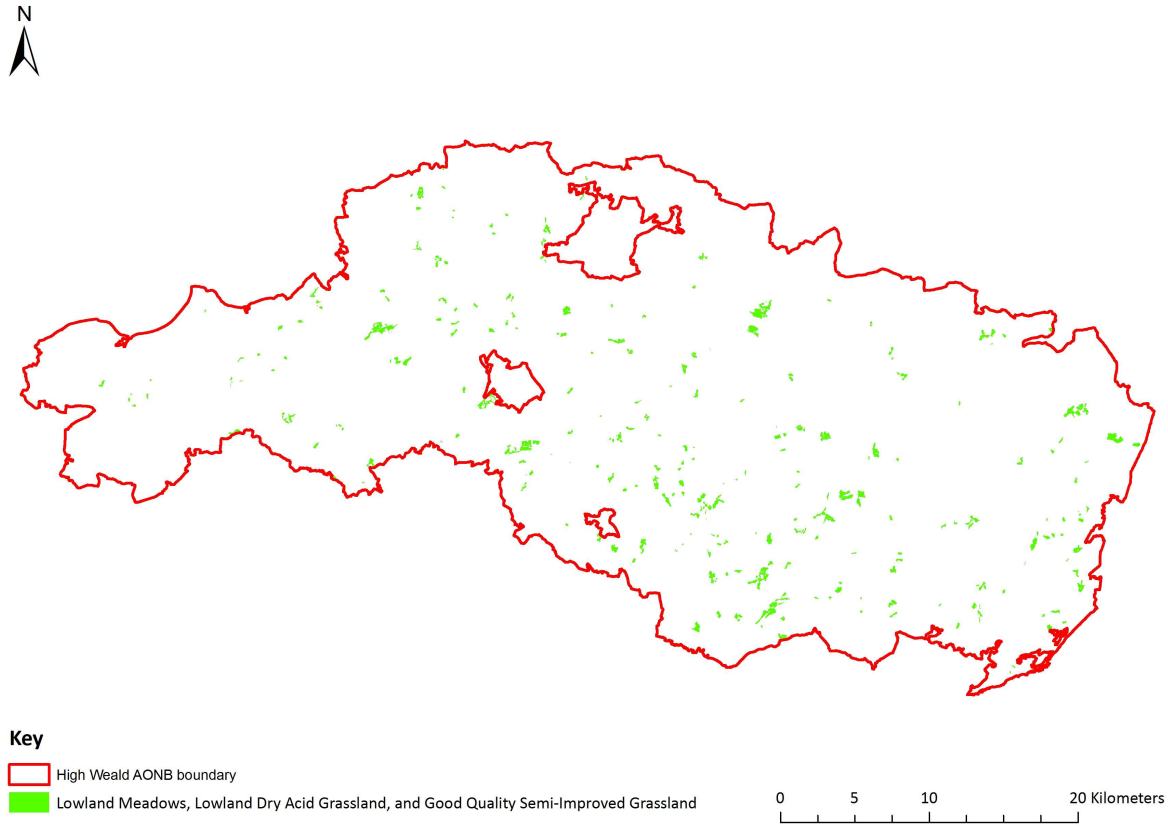
A diverse fauna is also associated with this type of grassland (JNCC, 2013d). Bird species of conservation concern which utilise acid grassland for breeding or wintering include woodlark *Lullula arborea*, green woodpecker *Picus viridis*, nightjar *Caprimulgus europaeus*, lapwing *Vanellus vanellus*, 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 habiat, "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 reseeding, 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 15, p.60.

Figure 15. 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.

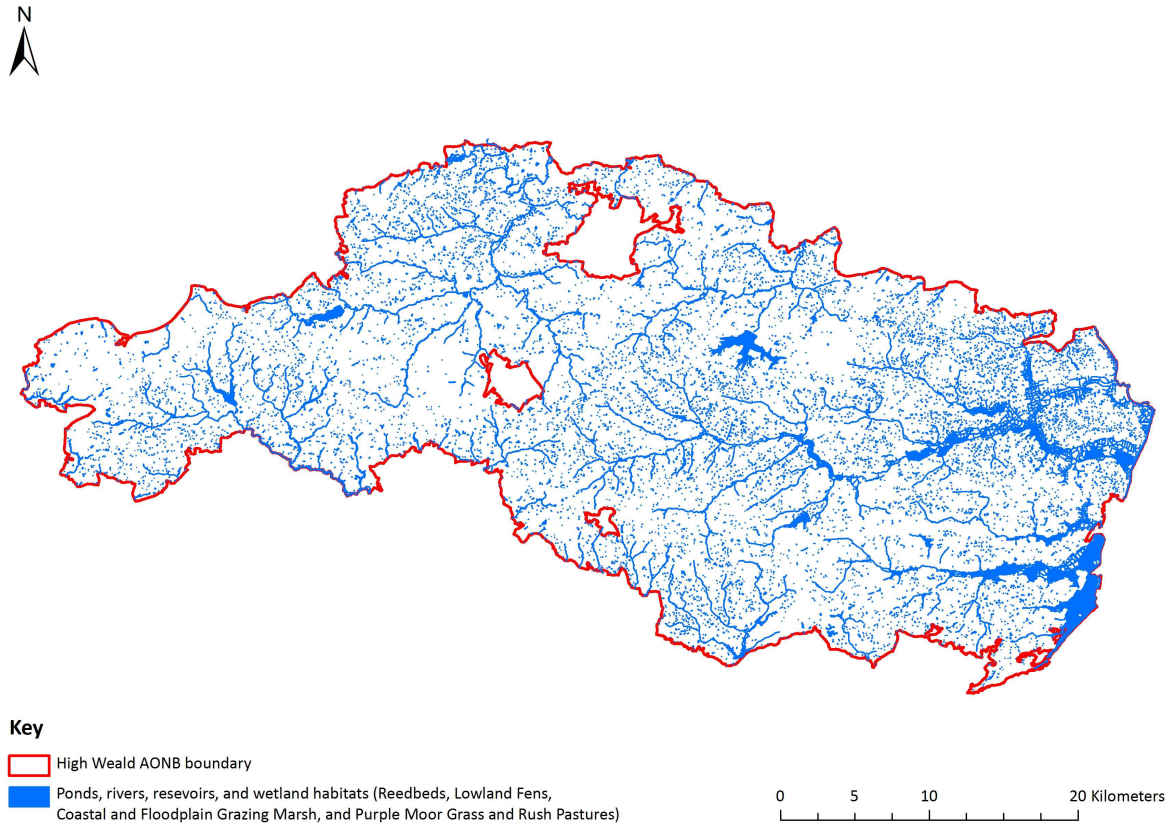
Collectively, the ecological signifance of the High Weald's grasslands is much greater than this relatively small and scattered habitat resource would suggest (Ryland, 2007). Indeed, with sites scattered across the entire AONB (Ryland, 2007 and 2013), much of the value of unimproved lowland meadows lies 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 fact 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 resevoirs (Ardingly, Bewl Water, Darwell, Powdermill and Wier Wood). For an illustration of the extent of aquatic habitats in the High Weald AONB, see Figure 16, p.62.

Figure 16. 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.

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

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 *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.64, 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	Ephemeridae	*E. danica* (Greendrake) *(4), E. vulgata* (drake mackerel)	30+
Mayfly nymphs	Heptageniidae	*Rhithrogena semicolorata* (olive upright) (5), *Ecdyonurus sp.(14)*	19
Stonefly nymphs	Perlodidae	*Isoperla grammatica*	20+
Cased caddis	Sericostomatidae	*S. personatum* (Welshman's button)	30+
Cased caddis	Lepidostomatidae	*L.. hirtum* (Small silver sedge)	12
Cased caddis	Leptoceridae	*Mystacides azurea (4), Mystacides nigra (3)* (Black silverhorns)	7
Cased caddis	Goeridae	*Silo pallipes* (black sedge)	8
Damselfly nymphs	Calopterygidae	*C. splendens* (banded demoiselle)	2
Cased caddis	Glossosomatidae	*Agapetus sp.* (tiny grey sedge)	3
Mayfly nymphs	Caenidae (Angler's curse)	Unknown	8
Stonefly nymphs	Nemouridae	*N. erratica*	5
Cased caddis	Limnephilidae	*Chaeopteryx villosa (2), Micropterna sequax (4), Potamophylax cingulatus (4), Potamophylax latipennis)* (large cinnamon sedge) (13), *Hydatophylax infumatus (14), Halesus sp* (Caperer) (5)	42
Cased caddis	Hydroptilidae	*Hydroptila sp.*	1
Shrimps	Gammaridae	*G. pulex*	10
Water cricket	Vellidae	*V. caprai*	1
Riffle beetles	Elmidae	*E. aenea (3) Oulimnius tuberculatus (5)*	8
Blackfly larvae	Simuliidae	Unkown	2
Flatworms	Planariidae	*Polycelis sp.*	2
Caseless caddis	Hydropsychidae	*H. angustipennis* (brown flag)	3
Cranefly larvae	Tipulidae	Unkown	3
Fish leech	Piscicolidae	*P. geometra*	1
Alderfly larvae	Sialidae	*S. lutaria*	3
Mayfly larvae	Baetidae	*B. rhodani*	8
Hoglouse	Asellidae	Unknown	1
Midge larvae	Chironomidae	*A. aquaticus*	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 *(Cottus gobio)* 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 to 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

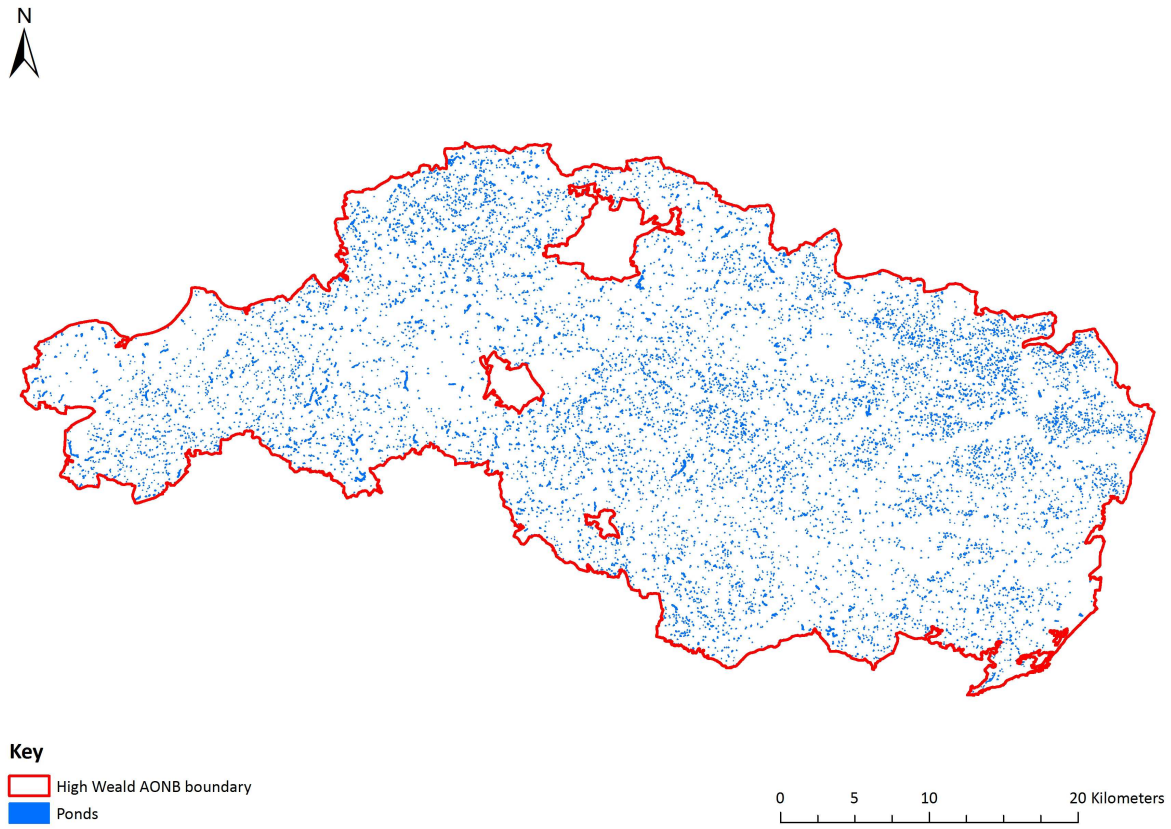
In addition to the biodiversity associated with the region's rivers, the ponds of the High Weald AONB are also critical for a wide array of species.

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

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 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 17, p.66, for a map of the ponds in the High Weald AONB).

Figure 17. 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.

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*

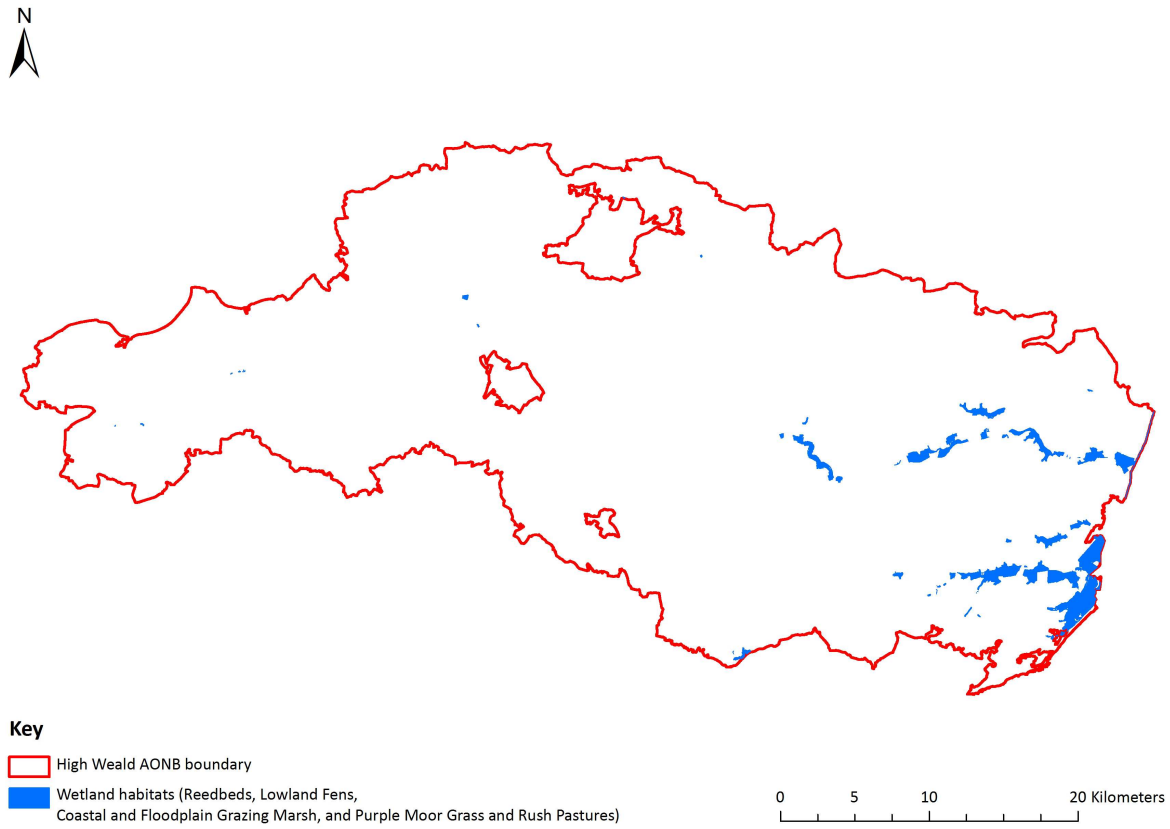
(Information from the Buchan Hill Ponds SSSI citation, available from: http://www.sssi.naturalengland.org.uk/special/sssi/sssi_details.cfm?sssi_id=1004098).

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 18, p.69, for a map illustrating their location and distribution).

Figure 18. 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.

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, know 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).

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

Finally, the Brede Valley also supports a variety of invertebrates (Friends of the Brede Valley, 2013h). These include the rare weevil *Ceuthorrynchus 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.71, presents a selection of the species of *Odonata* which may be found there.

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

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

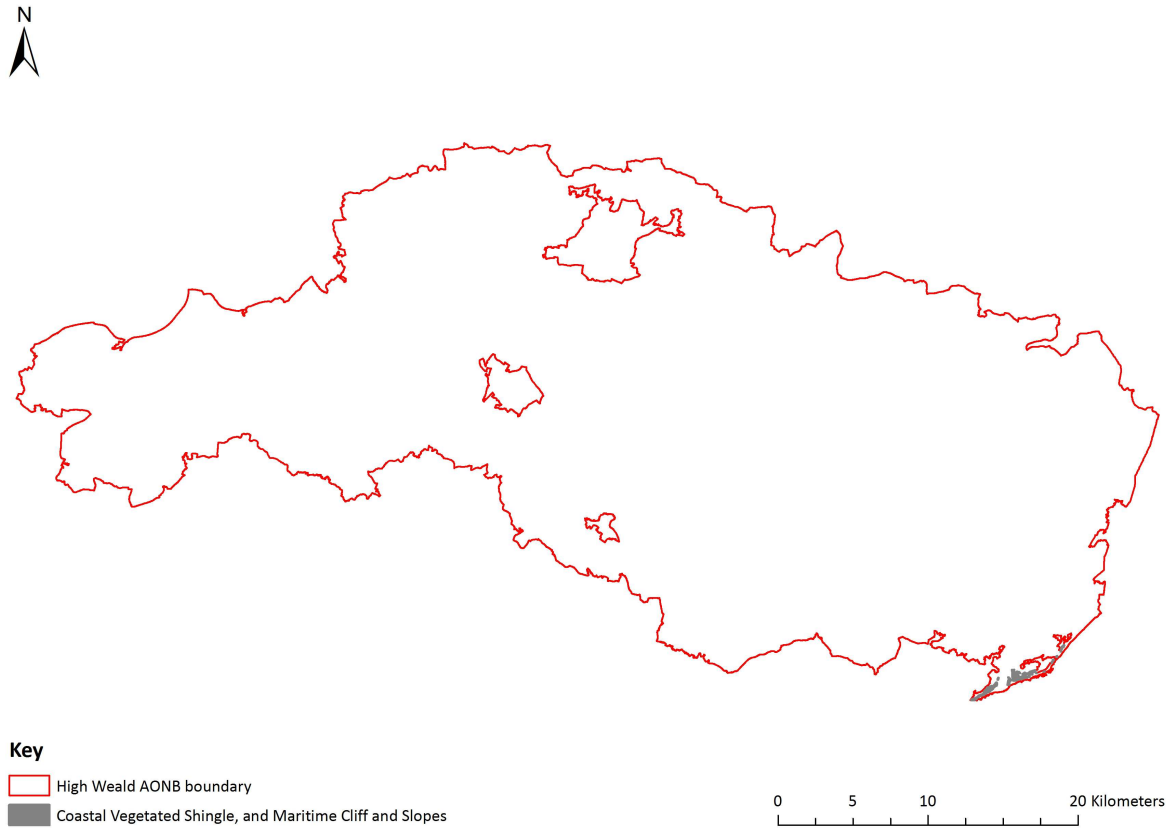
- There is a brackish influence near the sea and also inland in the large ditches or where peat deposits, which leach salt, lie close to the surface. The majority of the ditches have high plant species richness. Indeed, recently cleared ditches rapidly become invaded by aquatic plants, such as fennel 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. albifrons*, 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 19, p.73), they nevertheless makes a noteworthy contribution to the region's biodiversity interest.

Figure 19. 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.

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 *Centaurium 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 kilmoter 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 characterisitic 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 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 enourmous value we attach to regional differences in biodiversity and the horror that is elicited by the prospect of a coming "homogecene" (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).

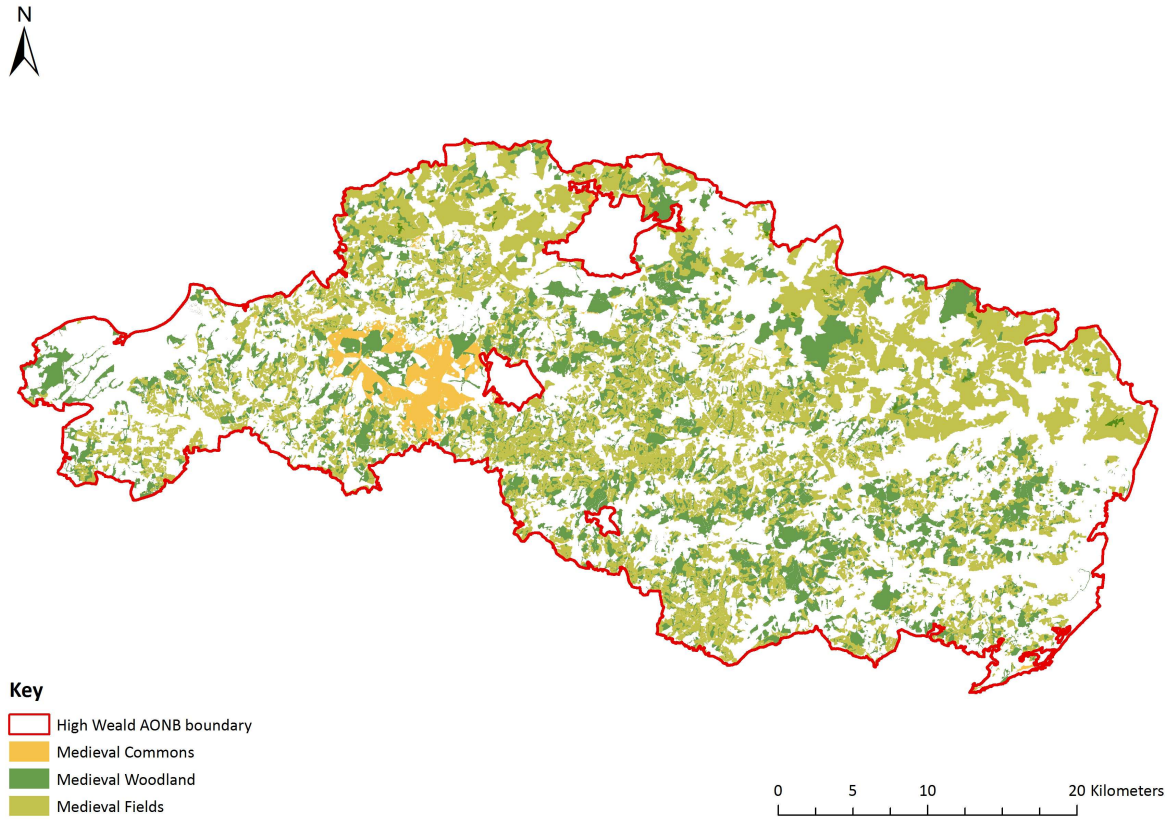
Consequently, the value of the High Weald AONB'S biodiversity should not only be located in the total number of species it supports, or has the potential to support, but also in the degree to which it differs from both surrounding regions, and internally between the various landscape features and habitat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

6.3 Ancientness

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

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 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 20, p.78, 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 20. 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.

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 mircrolimates 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.

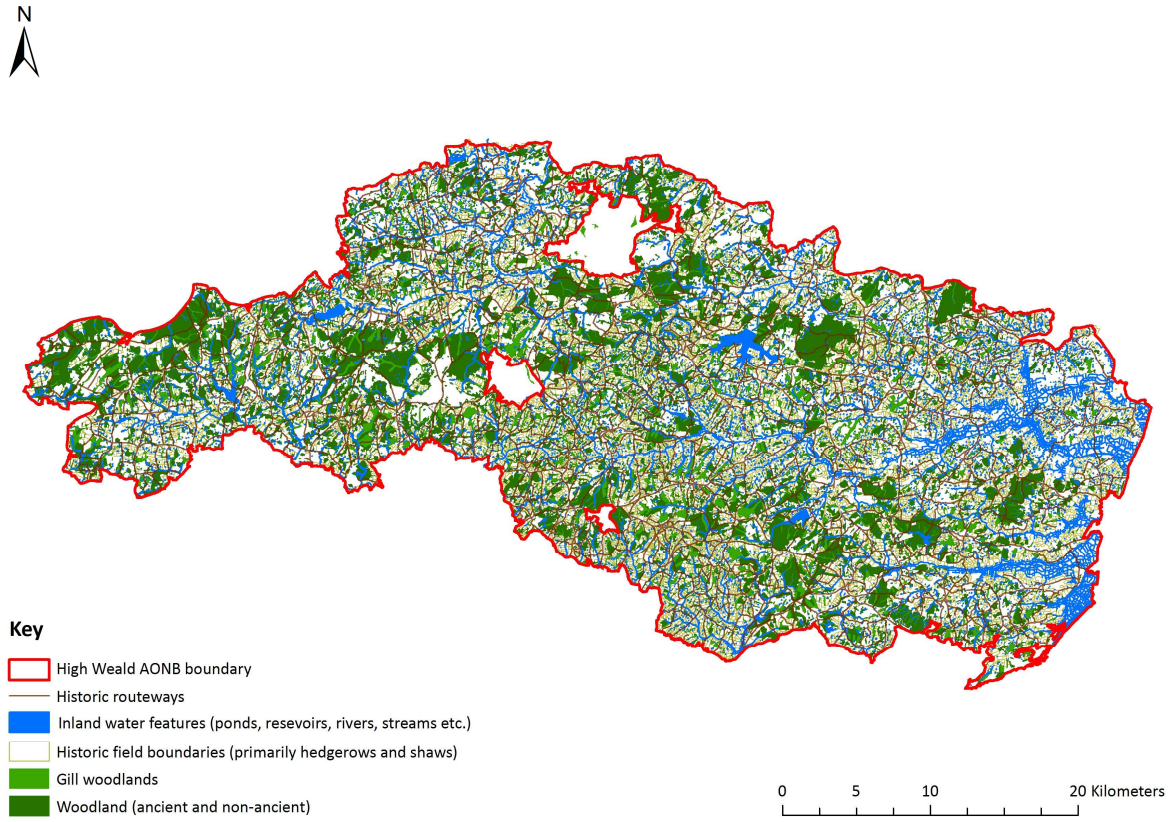
Finally, the importance of "ancientness" is also evident in the sunken, historic routeways of the High Weald. Like gills, sunken routeways seem to create microclimatic conditions, and a diversity of ecological niches, that enable them to act as repositories of biodiversity (Deckers et al., 2005; Sansum, 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 21, p.80).

Figure21. 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.

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).

"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)

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 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 corridors which species – of both flora and fauna – can use to move though 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 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 theirhistory. 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).

"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)

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 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 classisfied 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.

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

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

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

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

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

Sium latifolium	Great Water-Parsnip
Sium latifolium Greater	Water-parsnip
Spilosoma lubricipeda	White Ermine
Spilosoma luteum	Buff Ermine
Stenus longitarsis	Stenus longitarsis
Teucrium scordium	Water Germander
Thecla betulae	Brown Hairstreak
Tholera decimalis	Feathered Gothic
Timandra comae	Blood-Vein
Tortula cuneifolia	Tortula cuneifolia
Tortula freibergii	Freiberg's Screw-moss
Trichiura crataegi	Pale Eggar
Trichopteryx polycommata	Barred Tooth-Striped
Trisateles emortualis	Olive Crescent
Triturus cristatus	Great Crested Newt
Tursiops truncatus	Bottle-Nosed Dolphin
Tyria jacobaeae	Cinnabar
Usnea articulata	Usnea articulata
Usnea florida	Usnea florida
Valerianella rimosa	Broad-Fruited Cornsalad
Viola lactea	Pale Dog-Violet
Vipera berus	Adder
Watsonalla binaria	Oak Hook-tip
Xanthia gilvago	Dusky-lemon Sallow
Xanthia icteritia	Sallow
Xanthorhoe ferrugata	Dark-Barred Twin-Spot Carpet
Xanthorhoe ferrugata Dark-barred	Twin-spot Carpet
Xestia agathina	Heath Rustic
Xestia castanea	Neglected Rustic
Zootoca vivipara	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
Peltigera lepidophora	Ear-lobed Dog-lichen
Piptoporus quercinus	Oak Polypore
Hericium erinaceus	Bearded Tooth
Leucobryum glaucum	Large White-moss
Sphagnum denticulatum	Sphagnum denticulatum
Sphagnum recurvum	Sphagnum recurvum
Sphagnum capillifolium	Red Bog-moss
Sphagnum denticulatum	Cow-horn Bog-moss
Sphagnum fimbriatum	Fringed Bog-moss
Sphagnum palustre	Blunt-leaved Bog-moss
Sphagnum papillosum	Papillose Bog-moss
Sphagnum pulchrum	Golden Bog-moss
Sphagnum subnitens var. subnitens	Sphagnum subnitens var. subnitens
Sphagnum tenellum	Soft Bog-moss
Galanthus nivalis	Snowdrop
Hyacinthoides non-scripta	Bluebell
Ruscus aculeatus	Butcher's-broom
Anacamptis pyramidalis	Pyramidal Orchid
Cephalanthera damasonium	White Helleborine
Dactylorhiza fuchsii	Common Spotted-orchid
Dactylorhiza fuchsii x maculata = D. x transiens	Marsh-Orchid
Dactylorhiza incarnata	Early Marsh-orchid
Dactylorhiza maculata	Heath Spotted-Orchid
Dactylorhiza maculata subsp. ericetorum	Heath Spotted-Orchid
Dactylorhiza praetermissa Southern	Marsh-orchid
Epipactis helleborine	Broad-leaved Helleborine
Epipactis purpurata	Violet Helleborine
Listera ovata Common Twayblade	Common Twayblade
Neottia nidus-avis	Bird's-nest Orchid
Ophrys apifera	Bee Orchid
Ophrys insectifera	Fly Orchid
Orchis mascula	Early-purple Orchid
Orchis morio	Green-winged Orchid
Platanthera chlorantha	Greater Butterfly-orchid
Spiranthes spiralis	Autumn Lady's-tresses
Menyanthes trifoliata	Bogbean
Cyclamen hederifolium	Sowbread
Clinopodium menthifolium	Wood Calamint
Mentha pulegium	Pennyroyal

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

Zootoca vivipara	Common Lizard
Micromitrium tenerum	Millimetre Moss
Tursiops truncatus	Bottle-Nosed Dolphin
Phyteuma spicatum	Spiked Rampion
Dianthus armeria	Deptford Pink
Melampyrum arvense	Field Cow-wheat
Mentha pulegium	Pennyroyal
Papilio machaon	Swallowtail
Heterodermia leucomelos	Ciliate Strap-Lichen
Lutra lutra	European Otter
Lythrum hyssopifolia	Grass-Poly
Argynnis adippe	High Brown Fritillary
Austropotamobius pallipes	Freshwater Crayfish
Muscardinus avellanarius	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
Barbastella barbastellus	Western Barbastelle
Eptesicus serotinus	Serotine Bat
Myotis alcathoe	Alcathoe Bat
Myotis bechsteinii	Bechstein's Bat
Myotis brandtii	Brandt's Bat
Myotis daubentonii	Daubenton's Bat
Myotis mystacinus	Whiskered Bat
Myotis mystacinus	Whiskered Bat
Myotis nattereri	Natterer's Bat
Nyctalus leisleri	Lesser Noctule
Nyctalus leisleri	Leisler's Bat
Nyctalus noctula	Noctule Bat
Pipistrellus nathusii	Nathusius's Pipistrelle Bat
Pipistrellus pipistrellus	Common Pipistrelle (45 kHz)
Pipistrellus pygmaeus	Soprano Pipstrelle (55 kHz)
Pipistrellus pygmaeus	Soprano Pipistrelle
Plecotus auritus	Brown Long-eared Bat
Plecotus austriacus	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
Allium paradoxum	Few-Flowered Garlic
Allium triquetrum	Three-cornered Garlic
Amsinckia micrantha	Common Fiddleneck
Azolla filiculoides	Water Fern
Cameraria ohridella	Horse-Chestnut Leaf-miner
Campylopus introflexus	Heath Star Moss
Centranthus ruber	Red Valerian
Cotoneaster bullatus	Hollyberry Cotoneaster
Cotoneaster horizontalis	Wall Cotoneaster
Cotoneaster integrifolius	Small-Leaved Cotoneaster
Cotoneaster simonsii	Himalayan Cotoneaster
Crassula helmsii	New Zealand Pigmyweed
Crepidula fornicata American	Slipper Limpet
Crocosmia pottsii x aurea = C. x crocosmiiflora	Montbretia
Dreissena (Dreissena) polymorpha	Zebra Mussel
Elodea canadensis	Canadian Pondweed
Elodea nuttallii	Nuttall's Waterweed
Fallopia japonica	Japanese Knotweed
Fallopia japonica var. compacta	Dwarf Japanese Knotweed
Fallopia japonica x sachalinensis = F. x bohemica	Japanese Knotweed x Giant Knotweed = Bohemian Knotweed
Fallopia sachalinensis	Giant Knotweed
Gaultheria shallon	Shallon
Gunnera tinctoria	Giant rhubarb
Harlequin Ladybird	Harlequin Ladybird
Heracleum mantegazzianum	Giant Hogweed
Hyacinthoides hispanica	Spanish Bluebell
Hyacinthoides non-scripta x hispanica = H. x massartiana	Native Bluebell x Spanish Bluebell = Garden Bluebell
Hydrocotyle ranunculoides	Floating Pennywort
Impatiens glandulifera	Indian Balsam
Lagarosiphon major	Curly Waterweed
Lamiastrum galeobdolon subsp. argentatum	Variegated Yellow Archangel
Leptoglossus occidentalis	Western Conifer Seed Bug
Lilioceris lilii	Lily Beetle
Lysichiton americanus American	Skunk-cabbage
Muntiacus reevesi	Muntjac
Mustela vison	American Mink
Myriophyllum aquaticum	Parrot's-feather
Neovison vison	American Mink
Nymphoides peltata	Fringed Water-Lily
Pacifastacus leniusculus	Signal Crayfish
Parthenocissus inserta	False Virginia-creeper
Parthenocissus quinquefolia	Virginia creeper

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

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

Dryopteris aemula	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.
Hymenophyllum tunbrigense	on sandrocks only, but very much Gill-associated.
Sibthopia europaea	still locally frequent in East Sussex Gills, on rocky stream sites and in flushes.
Wahlenbergia hederacea	found in rides and benefiting from intermittent disturbance by forestry traffic.
Ranunculus omiophyllus	in water or on streamside mud or gravel
Cardamine bulbifera	a bittercress with very attractive flowers. Restricted to the Weald and the Chiterns.
Festuca altissima	occasional sites in the Gills
Phyteuma spicatum	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
	Amblystegium serpens	Acaulon muticum	Anomodon viticulosus
Atrichum undulatum		Aneura pinguis	
	Aulacomnium androgynum	Archidium alternifolium	
		Aulacomnium palustre	Bacomyces roseus
	Barbula convoluta Barbula cylindrica	Bacomyces rufus	
		Barbula recurvirostra	Barbula trifaria
		Barbula unguiculata	
	Brachythecium plumosum Brachythecium rivulare	Blepharostoma trichophyllum	
Brachythecium rutabulum			
	Brachythecium velutinum		Bryoria fuscescens Bryum bicolor
Bryum pseudotriquetrum Calliergon cuspidatum	Bryum capillare		
	Calypogeia arguta Calypogeia fissa		
	Calypogeia muelleriana	Calypogeia integristipula	
		Calypogeia sphagnicola	Campylopus flexuosus
		Campylopus introflexus Campylium paradoxum Campylopus pyriformis	Campylostelium saxicola
	Cephalozia bicuspidata		
		Cephalozia connivens Cephalozia lunulifolia	
Chiloscyphus polyanthos	Ceratodon purpureus		Cephaloziella divaricata
	Cirriphyllum piliferum	Chrysothrix chryophthalma	Chrysothrix candelaris
			Cladonia caespiticia
	Cladonia chlorophaea		
Cladonia coniocraea			
	Cladonia digitata Cladonia fimbriata	Cladonia coccifera	
		Cladonia floerkeana Cladonia furcata	
	Cladonia incrassata Cladonia macilenta Cladonia polydactyla		
			CONTINUED BELOW...

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

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

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

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

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

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

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

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

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

Theridion pinastri	RDBK
Achaearanea simulans	Nb
Philodromus albidus	Nb
Philodromus praedatus	Nb on mature oak
Zilla diodia	Nb

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

Nemobius sylvestris	Na Ancient hedgerows near woodland
Omocestus rufipes	Nb
Ectobius lapponicus	Nb Ancient hedgerows near woodland
Ectobius pallidus	Nb
Ectobius panzeri	Nb Ancient hedgerows near woodland
Apterygida media	Nb
Forficula lesnei	Nb

Tettigonia viridissima, 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

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

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

Lassus scutellaris	Nb hedgerow English elm only
Kyboasca bipunctata	Nb hedgerow English elm only
Macropsis mendax	Nb suckering English elm

Flies(Diptera)

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

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

Craneflies (Tipulidae)

Limonia maculipennis	NK
Tipula peliostigma	NK
Limonia stigma	

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

Macronychia polyodon	(Sarcophagidae)	RDB3

Eggisops pecchiolii	(Calliphoridae)	N
Macronychia striginervis	(Sarcophagidae)	N

Beetles (Coleoptera)

Ground beetles (Carabididae)

Ophonus laticollis	Species Statement	Na

Leaf beetles (Chrysomelidae)

Psylliodes luteola	RDBK marsh thistle?
Aphthona nigriceps	Na meadow cranesbill
Chrysolina oricalcia	Nb cow parsley, also upright hedge parsley, hemlock etc.
Chrysolina sanguinolenta	Na toadflax
Cryptocephalus frontalis	Na hawthorn
Longitarsus agilis	Na figwort
Longitarsus ballotae	Nb black horehound and white horehound
Longitarsus suturalis	Nb gromwell
Mantura rustica	Nb broad-leaved docks

Weevils (Curculionoidea)

Dissoleucas niveirostris	RDB2 dead wood
Anthonomus chevrolati	RDBIK hawthorn; deformed leaf trusses
Anthonomus rufus	RDB3 sloe: buds & trusses
Anthribus fasciatus	Na predacious on scale insects
Anthribus nebulosus	Nb predacious on scale insects
Platyrhinus resinosus	Nb fungus *Daldinia concentricus*: mainly on ash
Choragus sheppardi	Na ivy
Attactagenus plumbeus	Nb polyphagous root feeder
Brachysomus echinatus	Nb polyphagous root feeder
Mitoplinthus caliginosus	Na hop hulms

Stag beetles (Lucanidae)

Lucanus cervus	Greater stag beetle	BAP Priority Nb

Long-horned beetles (Cerambycidae)

Gracilia minuta	RDB2
Anaglyptus mysticus	Nb
Aromia moschata	Nb
Molorchus umbellatarum	Na
Phymatodes alni	Nb
Phytoecia cylindrica	Nb

Click beetles (Buprestidae)

Agrilus biguttatus	Na
Agrilus laticornis	Nb
Agrilus sinuatus	Na

Caddis flies (Trichoptera)	
Stenophylax permistus	Common
Glyphotaelius pellucidus	Common
Limnephilus auricula	Common
Limnephilus incisus	Common
Micropterna lateralis	Common
Ants, bees and wasps(Hymenoptera: Aculeata)	
Chrysis gracillima	RDB2
Pemphredon austriaca	RDB3
Pemphredon morio	RDB3, Nb, Scarce
Andrena proxima	RDB3
Diodontus tristis	Scarce

Source:
http://www.buglife.org.uk/Resources/Buglife/Migrated%20Resources/Documents/0120Notable20invertebrates20associated20with20ancient20and20species.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 – *Ecdyonurus insignis* (Ginger quill)	10	20+
2.	Mayfly nymphs	Leptophlebiidae – *Paraleptophlebia submarginata* (Turkey brown)	10	3
3.	Stonefly nymphs	Perlodidae – *Isoperla grammatical* (Yellow sally)	10	4
4.	Cased caddis	Brachycentridae – *B. subnubilis* – (Grannom)	10	2
5.	Cased caddis	Leptoceridae – *Athripsodes cinereus* (Brown silverhorn)	10	3
6.	Cased caddis	Sericostomatidae – *S. personatum* (Welshman's button)	10	7
7.	Caseless caddis	Philopotamidae – *Wormaldia occipitalis.*	8	3
8.	Damselfly nymphs	Calopterygidae – *C. virgo* (Beautiful demoiselle)	8	3
9.	Caseless caddis	Rhyacophilidae – *R. dorsalis* (Sandfly sedge)	7	20+
10	Caseless caddis	Polycentropodidae – *P. irroratus* (Dark spotted sedge)	7	2
11	Cased caddis	Limnephilidae – *L.lunatus* (Cinnamon sedge) 2 *Micropterna sequax* 3 *Hydatophylax infumatus* 5	7	10
12	Shrimp	Gammaridae – *G. pulex*	6	50+
13	River limpet	Ancylidae – *A. fluviatilis*	6	1
14	Caseless caddis	Hydropsychidae – *H. angustipennis* (Brown flag)	5	6
15	Crane fly larvae	Tipulidae – *Pedicia sp.*	5	20+
16	Riffle beetles	Elmidae – *E. aenea, Limnius volckmari* (adults and larvae) *Oulimnius tuberculatus* (1 adult)	5	20+
17	Blackfly larvae	Simuliidae	5	50+
18	Mayfly larvae	Baetidae – *B. rhodani*	4	9
19	Alderfly larvae	Sialidae	4	4
20	Snail	Hydrobiidae – *Potamopyrgus jenkinsi*	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.

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

Comments	The Gammaridae were heavily infested with the Echinorrhyncus 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	Ephemeridae; *E. vulgata*	10	15
45	Cased caddis fly larva	Leptoceridae; *Arthripsodes albifrons* (Brown or Black Silverhorn)	10	9
46	Cased caddis fly larva	Goeridae; *Silo nigricornis* (Black sedge)	10	1
47	Cased caddis fly larva	Sericostomatidae; *S. personatum* (Welshman's button)	10	3
48	Cased caddis fly larva	Limnephilidae; *Potamophylax* sp (Large Cinnamon Sedge)	7	2
49	Stone fly larva	Nemouridae; (Brown Stoneflies)	7	2
50	Shrimp	Gammaridae; *G. pulex*	6	10
51	Caseless caddis fly larva	Hydropsychidae; *H. siltalai* (Grey Flag)	5	6
52	Riffle beetle	Elmidae; *Elmis aenea* (ad 2, larva 1)	5	3
53	Crane fly larva	Tipulidae;	5	2
54	Blackfly larva	Simuliidae;	5	6
55	Mayfly larva	Baetidae; *B. rhodani* (Large Dark Olive)	4	1
56	Leech	Erpobdellidae; *E. testacea;*	3	2
57	Mussel	Sphaeriidae;	3	2
58	Spire shell snail	Hydrobiidae; *Potamopyrgus jenkinsi*	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 (*Gammarus* & *Baetis*) 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	Ephemeridae; *E. vulgata.*	Mayfly larva	10	3
62	Leptoceridae;	Cased caddis larva	10	1
63	Sericostomatidae; *S. personatum* Welshman's Button.	Cased caddis larva	10	5
64	Limnephilidae; *Limnephilus lunatus.* Cinnamon Sedge.	Cased caddis larva	7	1
65	Rhyacophilidae; *R. mundi, (2) R. dorsalis,* Sand fly Sedge.	Caseless caddis larva	7	3
66	Polycentropodidae; *P. kingii* Dark Spotted Sedge.	Caseless caddis larva	7	1
67	Gammaridae; *G. pulex.*	Shrimp	6	50
68	Simuliidae;	Blackfly larva	5	10
69	Elmidae;	Riffle beetle	5	1
70	Hydropsychidae; *H. angustipennis (2),* Brown Flag, *H. siltalai (2),* Grey Flag	Caseless caddis larva	5	4
71	Sialidae; *S. lutaria.*	Alder fly larva	4	1
72	Sphaeriidae;	Pea Mussel	3	5
73	Erpobdellidae; *E. testacea.*	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 – *S, personatum*	10	1
77	Shrimp	Gammaridae – *G. pulex*	6	50+
78	Black fly larva	Simuliidae	5	1
79	Riffle beetle	Elmidae – *E. aenea* (adults and larvae	5	5
80	Flatworm	Planariidae – *polycelis sp.(3), P. torva (2)*	5	5
81	Diving beetle	Dytiscidae – *Dytiscus sp. (larva)*	5	1
82	Water cricket	Mesovellidae	5	3
83	Mayfly larvae	Baetidae – *B. rhodani*	4	18
84	Hoglouse	Asellidae – *A. aquaticus (6), A. meridianus (1)*	3	7
85	Leech	Glossiphoniidae – *G. complanata*	3	1
86	Midge larvae	Chironomidae	2	9
87	Worms	Oligochaetae – *Tubifex tubifex*	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 – *E. vulgata (1)* (Drake mackerel) *E. danica* (Greendrake)	10	10
89	Mayfly nymphs	Ephemerellidae – *Serratella ignita* (Blue winged olive)	10	30+
90	Stonefly	Capniidae - *C. bifrons*	10	1
91	Cased caddis	Sericostomatidae – *S. personatum* (Welshman's button)	10	8
92	Cased caddis	Leptoceridae – *Athripsodes aterrimus* (Brown silverhorn)	10	13
93	Caseless caddis	Rhyacophilidae – *R. septentrionis* (Sandfly sedge)	7	1
94	Caseless caddis	Polycentropodidae- *Cyrnus trimaculatus* (Dark spotted sedge)	7	1
95	Mayfly nymphs	Caenidae – *C. horaria* (Angler's curse)	7	4
96	Shrimp	Gammaridae – *G. pulex*	6	7
97	Caseless caddis	Hydropsychidae – *H. angustipennis* (Brown flag)	5	1
98	Blackfly larvae	Simuliidae	5	100+
99	Cranefly larvae	Tipulidae	5	20+
10	Riffle beetles	Elmidae – *E. aenea (adults 2)* *Limnius volckmari (adults and larvae)* *Oulimnius tuberculatus (1)*	5	15
10	Snails	Hydrobiidae – *Potamopyrgus jenkinsi*	3	2
10	Midge larvae	Chironomidae	2	6
10	Worms	Oligochaetae – *Tubifex tubifex*	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 *(Cottus gobio)* 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	Ephemeridae – *E. danica* (Greendrake) *(4),* *E. vulgata* (Drake Mackerel)	10	30+
10	Mayfly nymphs	Heptageniidae – *Rhithrogena semicolorata (5)* (Olive upright), *Ecdyonurus sp.(14)*	10	19
10	Stonefly nymphs	Perlodidae – *Isoperla grammatica*	10	20+
10	Cased caddis	Sericostomatidae – *S. personatum* (Welshman's button)	10	30+
10	Cased caddis	Lepidostomatidae – *L. hirtum* (Small silver sedge)	10	12
10	Cased caddis	Leptoceridae – *Mystacides azurea (4), Mystacides nigra (3)* (Black silverhorns)	10	7
11	Cased caddis	Goeridae – *Silo pallipes* (Black sedge)	10	8
11	Damselfly nymphs	Calopterygidae – *C. splendens* (Banded demoiselle)	8	2
11	Cased caddis	Glossosomatidae – *Agapetus sp.* (Tiny grey sedge)	8	3
11	Mayfly nymphs	Caenidae (Angler's curse)	7	8
11	Stonefly nymphs	Nemouridae – *N. erratica*	7	5
11	Cased caddis	Limnephilidae – *Chaeopteryx villosa (2),* *Micropterna sequax (4),* *Potamophylax cingulatus (4)* *Potamophylax latipennis (13)* (Large cinnamon sedge), *Hydatophylax infumatus (14)* *Halesus sp.(5)* Caperer)	7	42
11	Cased caddis	Hydroptilidae – *Hydroptila sp.*	6	1
11	Shrimps	Gammaridae – *G. pulex*	6	10
11	Water cricket	Vellidae – *V. caprai*	5	1
11	Riffle beetles	Elmidae – *E. aenea (3) Oulimnius tuberculatus (5)*	5	8
12	Blackfly larvae	Simuliidae	5	2
12	Flatworms	Planariidae – *Polycelis sp.*	5	2
12	Caseless caddis	Hydropsychidae – *H. angustipennis* (Brown flag)	5	3
12	Cranefly larvae	Tipulidae	5	3
12	Fish leech	Piscicolidae – *P. geometra*	4	1
12	Alderfly larvae	Sialidae – *S. lutaria*	4	3
12	Mayfly larvae	Baetidae – *B. rhodani*	4	8
12	Hoglouse	Asellidae – *A. aquaticus*	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.

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 *Sericostoma personatum.*
Biological Quality Rating	Poor
Water Quality Rating	Fair

	Type	Family	BMWP Score	Abundance
12	Mayfly nymph	Ephemerellidae – *Serratella ignita* (Blue winged olive)	10	1
13	Mayfly nymph	Caenidae – *C. horaria* (Angler's curse)	7	1
13	Cased caddis	Limnephilidae – *Halesus sp.* (Caperer) *Potamophylax cingulatus* (Large cinnamon sedge)	7	2
13	Shrimp	Gammaridae – *G. pulex*	6	2
13	Mayfly	Baetidae – *B. rhodani (5)* (Large dark olive) *Centroptilium luteolum (1)* (Small spurwing)	4	7
13	Snail	Hydrobiidae – *Potamopyrgus jenkinsi*	3	3
13	Midge larvae	Chironomidae – *Chironomus sp.* and others	2	4
13	Worms	Oligochaetae – *Tubifex tubifex*	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 (*Barbatula barbatula)* Dipteran larvae, water mites.
Biological Quality Rating	Good
Water Quality Rating	Very good

	Type	Family	BMWP Score	Abundance
13	Stonefly nymphs	Perlodidae – *Perlodides microcephala* (Orange striped stonefly)	10	15
13	Mayfly nymphs	Ephemeridae – *E. danica* (Greendrake)	10	5
13	Mayfly nymphs	Ephemerellidae – *Serratella ignita*	10	30+
14	Cased caddis	Leptoceridae – *Ceraclea dissimilis* (Black silverhorn)	10	4
14	Caed caddis	Odontoceridae – *O. albicorne* (Silver sedge)	10	1
14	Damselfly larva	Calopterygidae – *C. virgo* (Banded demoiselle)	8	1
14	Cased caddis	Hydroptilidae – *H. tineodes* (Micro caddis)	6	2
14	Shrimp	Gammaridae – *G. pulex*	6	100+
14	Blackfly nymphs	Simuliidae	5	3
14	Diving beetle	Dytiscidae - *Dytiscus sp.*(larvae)	5	4
14	Riffle beetles	Elmidae – *E. aenea (larvae), Limnius volckmari (larvae & adults)*	5	12
14	Caseless caddis	Hydropsychidae – *H. angustipennis* (Brown flag)	5	1
14	Cranefly larvae	Tipulidae – P*edicia sp.*	5	3
15	Alderfly larvae	Sialidae – *S. lutaria*	4	2
15	Mayfly larvae	Baetidae – *B. rhodani, B. muticus*	4	50+
15	Fish leech	Piscicolidae – *P. geometra*	4	1
15	Leech	Glossiphoniidae – *G. complanata*	3	1
15	Hoglouse	Asellidae – *A. aquaticus*	3	1
15	Bivalves	Sphaeriidae	3	15
15	Snails	Hydrobiidae – P*otamopyrgus jenkinsi*	3	20+
15	Midge larvae	Chironomidae	2	7
15	Worms	Oligochaetae – *Tubifex tubifex*	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 *Heptagenia sulphurea*	10	10
16	Mayfly larva	Leptophlebiidae *Paraleptophlebia submarginala*	10	1
16	Cased caddis larva	Sericostomatidae *S. personata*	10	2
16	Cased caddis larva	Limnephilidae *Micropterna sequax*	10	1
16	Caseless caddis larva	Polycentropidae *Polycentropus sp*	7	2
16	Stonefly larva	Capniidae *Capnia sp probably bifrons*	10	2
16	Shrimp	Gammaridae *G. pulex*	6	30
16	Caseless caddis larva	Hydropsychidae *H. angustipennis & H. siltalai*	5	10
16	Riffle beetle	Elminthidae *E. aenea*	5	2
16	Blackfly larva	Simuliidae	5	1
16	Mayfly larva	Baetidae *B. rhodani*	4	20
17	Leech	Glossiphoniidae *G. complanata*	3	1
17	Midge larva	Chironomidae	2	5
17	Round worm	Oligochaetae *Tubifex*	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	Ephemeridae; *E. vulgata*	10	15
17	Cased caddis fly larva	Leptoceridae; *Athripsodes albifrons* (Brown or Black Silverhorn)	10	9
17	Cased caddis fly larva	Goeridae; *Silo nigricornis* (Black sedge)	10	1
17	Cased caddis fly larva	Sericostomatidae; *S. personatum* (Welshman's button)	10	3
17	Cased caddis fly larva	Limnephilidae; *Potamophylax* sp (Large Cinnamon Sedge)	7	2
17	Stone fly larva	Nemouridae; (Brown Stoneflies)	7	2
17	Shrimp	Gammaridae; *G. pulex*	6	10
18	Caseless caddis fly larva	Hydropsychidae; *H. siltalai* (Grey Flag)	5	6
18	Riffle beetle	Elmidae; *Elmis aenea* (ad 2, larva 1)	5	3
18	Crane fly larva	Tipulidae;	5	2
18	Blackfly larva	Simuliidae;	5	6
18	Mayfly larva	Baetidae; *B. rhodani* (Large Dark Olive)	4	1
18	Leech	Erpobdellidae; *E. testacea;*	3	2
18	Mussel	Sphaeriidae;	3	2
18	Spire shell snail	Hydrobiidae; *Potamopyrgus jenkinsi*	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 (*Gammarus* & *Baetis*) 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	Ephemeridae; *E. vulgata*	10	30
19	Mayfly larva	Heptageniidae; *Rhithrogena semicolorata* March Brown	10	1
19	Mayfly larva	Leptophlebiidae; *Habrophlebia fusca* Ditch Dun	10	1
19	Mayfly larva	Ephemerellidae; *Serratella ignita* Blue-winged Olive	10	2
19	Cased caddis fly larva	Leptoceridae;	10	1
19	Cased caddis fly larva	Lepidostomatidae; *L. hirtum* Small Silver Sedge	10	3
19	Cased caddis fly larva	Sericostomatidae; *S. personatum* Welshman's Button	10	2
19	Stonefly larva	Nemouridae; *N. cambrica*	7	5
19	Cased caddis fly larva	Limnephilidae; *Halesus radiatus,* Caperer *Limnephilus rhombicus*	7	2
19	Cased caddis fly larva	Glossosomatidae; *Agapetus fuscipes* Tiny Grey Sedge	7	1
20	River limpet	Ancylidae; *A. fluviatilis*	6	1
20	Shrimp	Gammaridae; *G. pulex*	6	100
20	Blackfly larva	Simuliidae;	5	50
20	Caseless caddis fly larva	Hydropsychidae; *H. siltalai* (1), *H. angustipennis* (2)	5	3
20	Riffle beetle	Elmidae; *E. aenea*	5	1
20	Mayfly larva	Baetidae; *B. rhodani*	4	30
20	Alderfly	Sialidae; *S. lutaria*	4	1
20	Leech	Glossiphoniidae; *G. complanata*	3	1
20	Leech	Erpodellidae; *E. testacea*	3	1
20	Spire shell snail	Hydrobiidae – *Potamopyrgus jenkinsi*	3	10
21	Wandering snail	Lymnaeidae: *L. peregra*	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^{0} 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; *Silo pallipes/nigricornis*	Cased caddis fly	10	6
21	Sericostomatidae; *S. personatum.*	Cased caddis fly	10	2
21	Leptoceridae;	Cased caddis fly	10	6
21	Rhyacophilidae; *R. dorsalis.*	Caseless caddis fly	7	2
21	Gammaridae; *G. pulex.*	Shrimp	6	50
21	Tipulidae/Pediciidae;	Cranefly larva	5	5
21	Elmidae; *Elmis aenea* (!0 adult, 1 larva), *Limnius volkmari* (2 larvae).	Riffle Beetle	5	13
22	Hydropsychidae: *H. angustipennis.*	Caseless caddis fly	5	3
22	Simuliidae;	Blackfly larva	5	3
22	Baetidae; *B. rhodani.*	Mayfly larva	4	20
22	Hydrobiidae; *Potamopyrgus jenkinsi.*	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 *Athripsodes sp*	10	5
228.	Cased caddis	Lepidostomatidae *L. hirtum*	10	3
229.	Cased caddis	Goeridae	10	1
230.	Cased caddis	Limnephilidae *Potamophylax latipennis*	7	5
231.	Caseless caddis	Rhyacophilidae *R. obliterata*	7	2
232.	Stonefly	Nemouridae *Amphinemura sulcicollis*	7	3
233.	Shrimp	Gammarus *G. pulex*	6	50
234.	Caseless caddis	Hydropsychidae *H. angustipennis & siltalai*	5	20
235.	Riffle beetle	Elminthidae *E. aenea & Limnius volkmari*	5	20
236.	Blackfly	Simulidae	5	3
237.	Mayfly	Baetidae *B. rhodani*	4	100
238.	Mussel	Sphaeridae	3	1
239.	Hoglouse	Asellidae	3	1
240.	Snail	Hydrobiidae *Potamopyrgus jenkinsii*	3	5
241.	Roundworm	Oligochaetae *Tubifex*	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 present[2]. 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 sterneri* 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.