APPENDIX 2:
The State of Nature in Buckinghamshire

Table of Contents

Figures: Ecosystem services maps

Tables

Maps

1. Introduction

Our nature is precious and valuable, but under threat; the Local Nature Recovery Strategy aims to support nature's recovery.

1.1 The varied geology and topography of Buckinghamshire gives rise to a countryside rich in landscape and wildlife value. Many of the habitats and associated species in Buckinghamshire are of national or even international importance.

1.2 For example, in the very north of Buckinghamshire are the remains of historic hunting forests, hedgerow networks and wet pastures, with relics of heathland vegetation on the Bedfordshire border. In the clay vales to the north of the Chilterns we find pasture, damper grasslands, slow-flowing brooks and black poplars – a tree found in greater numbers in Buckinghamshire than anywhere else in the UK. In the central area of Buckinghamshire are the distinctive, beautiful and varied habitats and landscapes of the Chilterns. Our chalk grasslands are attractive, specialised but fragile landscapes, and are home to many plants that do not live in other habitats, including the Chilterns gentian and many orchids. More than 85% of the world's chalk streams – an internationally-rare habitat – are found in England, with many in the Chilterns. Other precious and valuable habitats here include hedgerows, arable field margins, ancient woodlands, areas of rare box woodland, and traditional orchards. Black Hedge, at Princes Risborough, is thought to be England's oldest hedge. In the south of our county, we find heathlands, pockets of acid grassland and birch woodland. For example, Burnham Beeches is a previous area of ancient wood-pasture. The majestic trees here lie within a diverse area of habitats and species, including woodland, grassland, heath, bog, ponds and ditches; and over 60 nationally-rare species under threat have been recorded; many are rare flies and beetles.

1.3 Our river landscapes are equally as impressive - a function of geology, post-glacial processes, direct human intervention and trends in land management. Broadly, there are two major river catchments in the county: the central and southern part contains several tributaries of the Thames; and the northern third contains parts of the upper Great Ouse catchment. Waters from these two rivers head in separate directions towards the North Sea – at the Thames estuary and The Wash respectively. Otters are now found throughout the county; our chalk streams fish communities are dominated by brown trout; water voles are only found in restricted areas; but invasive signal crayfish are widespread.

1.4 In terms of land area, 63% of Buckinghamshire's land area is cultivated land and grassland. Only 13% of our county is covered with high quality habitats, such as broadleaved woodland, mixed woodland or semi-natural grassland. And only 5.5% of the county by land area receives some level of formal designated site protection.

1.5 The habitats and wild spaces of Buckinghamshire are not just valuable for nature or for their beauty; they also provide people and communities with vital benefits that we all rely on - but

often take for granted. These include providing us with cleaner air – for example with trees absorbing air pollutants; and with shade in warmer town centres. Careful planting of vegetation can improve water quality, slow the flow of water and reduce the risk of flooding. Nature also provides habitats and refuge for pollinating insects – essential for crop production; and we all benefit directly from local and natural green spaces for our recreation, for our physical and mental health and wellbeing. Our nature and wildlife also provide economic opportunities – such as education, tourism and green jobs.

1.6 But despite their value to us all, our Buckinghamshire habitats, species and natural spaces are subject to many external pressures that are threatening or changing them, and therefore are threatening or changing their ability to provide those benefits.

1.7 Globally, we are in the middle of a mass extinction event. In the UK, 41% of species have declined in recent decades and a quarter of the UK's mammals face extinction.[1] In Buckinghamshire, none of our chalk streams have reached "good" ecological status. The pressures on nature come from and operate at international sources, national and local scales.

1.8 These include climate change, with its associated changes in seasonal patterns, temperatures and rainfall; increases in pests and diseases; and the growth in development - housing and infrastructure and population. Development pressures can, for example, cause direct impacts on habitats, as well as increase demand for natural resources such as water and green space for recreation and wellbeing, and resulting growing waste and pollution – whether that is air, water, light or noise pollution. The way we manage our land is also important to how our wildlife and habitats survive and adapt to such threats. For example, habitats that are fragmented, or separated, perhaps as a result of changing land ownership or development, mean a less connected network of habitats which reduces the resilience of wildlife; a connected network of habitats is shown to be more beneficial. And how we manage our water courses, river channels and land bordering them is also important. Changes to the natural pattern of water flow, meandering, deposition and the linkage between rivers and floodplains will affect the survival of habitats and species including wetlands, wet grassland and wading birds.

1.9 Our nature around us is therefore precious, provides benefits to all, but is under threat - and therefore deserves proper attention and acknowledgement in decision-making, such as planning and funding decisions, so we can work to conserve it appropriately and enhance it, and safeguard the benefits that nature provides for our collective futures.

1.10 This Local Nature Recovery Strategy sets out the priority objectives for nature's recovery in Buckinghamshire, how they will be achieved and where. We start by describing the current state of nature in Buckinghamshire – what there is and where, why it is valuable, and the pressures and threats it faces, to provide context for determining where the focus for nature's recovery should be, which is described in later sections.

[1] State of Nature Report, 2019 – this is a health-check on how the UK's wildlife is fairing, using wildlife data from 50 conservation organisations. Available here: https://nbn.org.uk/stateofnature2019/reports/

2. Description of the Strategy Area: State of Nature in Buckinghamshire

i) The Biodiversity of Buckinghamshire: key habitats and species

2.1 The varied geology and topography of Buckinghamshire give rise to a countryside rich in landscape and wildlife value. Many of the habitats and associated species in Buckinghamshire are of national or even international importance. Whilst landscapes, habitats and species do not stop or adhere to administrative borders, the following gives a narrative description of the habitats, landscapes and wildlife of the area travelling from north to south.

Ancient Chalk Grassland, Yoesden Bank

Photo credit: John Morris

2.2 In the very north of Buckinghamshire, wide, meandering alluvial floodplains lie interspersed with harder limestone outcrops. The remains of **historic hunting forests, networks of hedgerows, flood meadows and wet pastures** along river corridors and the enigmatic patterns of ancient ridge and furrow, combine to provide a variety of important and wildlife-rich natural habitats. Brown and black hairstreak butterflies, barn owls and green-winged orchids may be found where suitable conditions persist.

2.3 In the Brickhills area, on the Bedfordshire border, the acidic soils of the greensands, with its many springs, relics of **heathland vegetation** and pockets of marshy ground, support unusual species such as marsh fern and bog bush cricket.

2.4 The clay vales immediately to the north of the Chilterns are characterised by pasture, the damper grasslands being occasionally carpeted with great burnet, meadow sweet and ragged robin. Slow-flowing brooks are lined with willow pollards and **black poplars**; the latter being

found in greater numbers in Buckinghamshire than anywhere else in the UK. Regular winter flooding provides good feeding grounds for wetland birds such as snipe and curlew.

Curlew (Numenius arquata)

Photo credit: David Richardson, BBOWT

2.5 Rising from the vale is the chalky backbone of Buckinghamshire, the **Chiltern Hills**. The past actions of ice and melt-waters, combined with the geology, soils and climate, and generations of human influence in the Central Chilterns give rise to distinctive, beautiful and varied habitats rich in wildlife and historical value.

2.6 **Lowland chalk (i.e. calcareous) grassland** is an attractive, specialised and fragile habitat. It results from centuries of grazing on nutrient-poor chalk soils, producing a short turf (or 'sward') that can be rich in herbs, flowers and grasses. Many chalk grassland plants do not live in other habitats. The Chilterns has nationally-important concentrations of such chalk grassland, particularly along the slopes of the steep scarps and dry valleys.

Ivinghoe Beacon

Photo credit: Nicola Thomas, Bucks & MK NEP

2.7 Here, the now-familiar red kites soar above the steep scarp and valleys. In many areas, the scarp is cloaked by species-rich chalk grassland where Chalkhill blue butterflies, glow worms and Roman snails are found amongst aromatic swards of thyme and marjoram. Luxuriant stands of orchids and other specialities such as the Chiltern gentian are a vital component of the distinctiveness of this part of the county. Many of the insects found here rely on chalk-grassland plants.

2.8 Low trees and bushes, or '**scrub**', are often found in managed grassland habitats, and provide important shelter and niches for other species. As it grows quickly, scrub needs to be managed to allow chalk grassland species to thrive. Three valleys in the hills at Ellesborough are covered in rare **box woodland**. Elsewhere along the escarpment, stands of juniper still remain. Cathedral-like beech hangers, heathy wooded commons and the more elusive chalk heaths are a feature of the clay-capped hills with fast flowing chalk streams running through the valleys below.

2.9 **Chalk streams** are a characteristic and attractive feature of the Chilterns landscape. Flowing from chalk groundwater, they rise as springs or largely flow over a chalk geology. An internationally-rare and special habitat, more than 85% of all the chalk streams in the world are found in England, and many lie in the Chilterns – where there are eight main chalk rivers in the Chilterns flowing generally in two major river catchments, with a total length of approximately 150km. Chalk streams and rivers are beautiful and important habitats for wildlife and support a huge range of plants - such as rare starworts growing midstream and watercress at the edges. They also support animals such as Britain's fastest-declining mammal, the water vole, and fish including brown trout. The Chilterns escarpment is also home to many sources, or headwaters, of the Chilterns chalk streams, such as the Wye headwaters in the beautiful Radnage Valley.

River Chess at Latimer Photo credit: Allen Beechey

2.10 Agriculture has taken place over thousands of years in the Chilterns. Arable farming is especially suited to the gentler slopes of the plateau where there are thicker soils than on the steep scarp slopes. Natural England and Plantlife surveys have revealed that the Chilterns is particularly rich in plants that grow in arable fields and margins, including some rare and threatened species. **Arable field margins**, if managed appropriately, can create beneficial conditions for key farmland species. Cornfield annuals, poppies and knapweed, which have suffered national declines in distribution and abundance can find a home there. Arable field margins are also important nesting and feeding sites for game birds and songbirds including the skylark and corn bunting. Butterflies, grasshoppers and invertebrates may breed or spend the winter in the grassy banks between crops and hedges.

2.11 **Hedgerows** have been scrubbed out to make way for large-scale agriculture in much of the country, but tracts of species-rich hedgerows remain among the arable landscape and rural areas of the Central Chilterns. They are home to native woody species and shrubs such as hawthorn, beech, ash, hazel and blackthorn. Hedgerows are essential corridors for wildlife movement and provide habitats, food and shelter for insect pollinators including the brown hairstreak butterfly and moths, as well as for farmland birds, bats and dormice. Occasional standard trees along the hedge-line are home to tree-nesting birds. Hedgerows have been part of our landscape for centuries and provide a direct cultural link to our past; they still bear the marks of traditional hedgerow management and help to uncover human activity in the area. Black Hedge at Princes Risborough, for example, is known to have been in existence since AD 903 and is thought to be England's oldest hedge.

2.12 The Central Chilterns has been well-wooded for hundreds of years. The richest woodlands lie on the scarp slope of the chalky ridge where the nutrient poor, calcareous soils also support many rare orchid species. Although ash, cherry and oak are widespread, the area's famous beech woods, such as at the Bradenham Estate, are the jewel in the crown. Sapphire carpets of bluebells and bright emerald leaves in spring give way to the rich golden hues of autumn.

2.13 **Ancient woodland** is a nationally important and threatened habitat, where tree cover has been continuous since at least AD 1600, and irreplaceable ecological and historical features survive. In addition to ground flora, ancient woodlands often support protected species such as bats and dormice, as well as woodland birds and butterflies. There are particular concentrations in the Central Chilterns. Most of the ancient woods are found on the Clay with flint soils which cap the chalk hilltops, such as at Wendover Woods. Penn Wood, one of the largest ancient woodlands in the Chilterns, was once part of Wycombe Heath common, and part of it is still grazed and managed as traditional wood-pasture.

Trees in Ashridge, Buckinghamshire Photo credit: Nicola Thomas, Bucks & MK NEP

2.14 **Traditional orchards** are low-intensity managed landscapes. They are hotspots for biodiversity and have layers of habitats similar to wood-pasture and parkland. Below the trees is an understorey of scrub and hedgerows, and the orchard floor includes fallen dead wood. The variety of different fruit trees leads to extended periods of flowering and fruiting, benefiting insects, birds and mammals. Traditional orchards in the Central Chilterns produced varieties of fruit including dessert, cooking and dual-purpose apples, and cherries such as the Prestwood Black. The majority of traditional orchards lie south of the Chilterns Ridge, including around High Wycombe and Beaconsfield, such as at Little Kingshill and Seer Green.

2.15 To the south, the chalky dip slope gives way to the acid drift gravels, where the largest extent of **heathlands** in the county are found. These heathlands frequently include **pockets of acid grassland, bare ground and birch woodland**, which offer valuable niches to invertebrates and reptiles. Notable bird species of our heathlands include nightjar, woodlark and hobby. The wetter areas are home to some of our more unusual plants, like the insectivorous bladderwort and sundews, whilst in tiny bog pools and ditches, patches of sphagnum mosses are found. These bodies of standing water are also readily utilised by resident populations of darting bejewelled dragonflies and beetles. Scattered clumps of hilltop and valley-side woodland may host wild service tree, early purple orchid and white admiral butterfly.

2.16 Burnham Beeches, a tract of **ancient wood-pasture** and a Site of Special Scientific Interest, National Nature Reserve and a Special Area of Conservation, lies in the south of the county, where majestic pollards stand and support a wide variety of fungi and insects. They are found within a diverse area of habitats and species, including woodland, grassland, heath, bog, ponds

and ditches. Notable species include marsh violet and the Lesser Spotted Woodpecker. Over 60 Red Data Book species (rare of under threat nationally) have been recorded for Burnham Beeches, most of which are rare flies and beetles.

Cows grazing at Burnham Beeches Photo credit: Jeremy Young, City of London

Broad habitat types / land use in Buckinghamshire

2.17 Map 1, below, shows the distribution of broad habitat types across Buckinghamshire and the area and percentage cover is shown in more detail in Table 1.

2.18 Buckinghamshire is dominated by cultivated land and improved grassland, making up 63% of the area (98,000 ha), although this is less than surrounding counties. The combined cover of all woodland, scrub and tree habitat types make up 13.0% of the area (20,400 ha), considerably higher than surrounding counties. Semi-natural and marshy grasslands make up 5.6%, while water (surface water features, not groundwater – i.e. rivers, canals, streams, ditches, ponds, lakes etc) makes up just 0.8%. Built-up areas, and infrastructure (roads, railways, pavements and paths) make up 6.2% of the land area, with gardens comprising 6.0%.

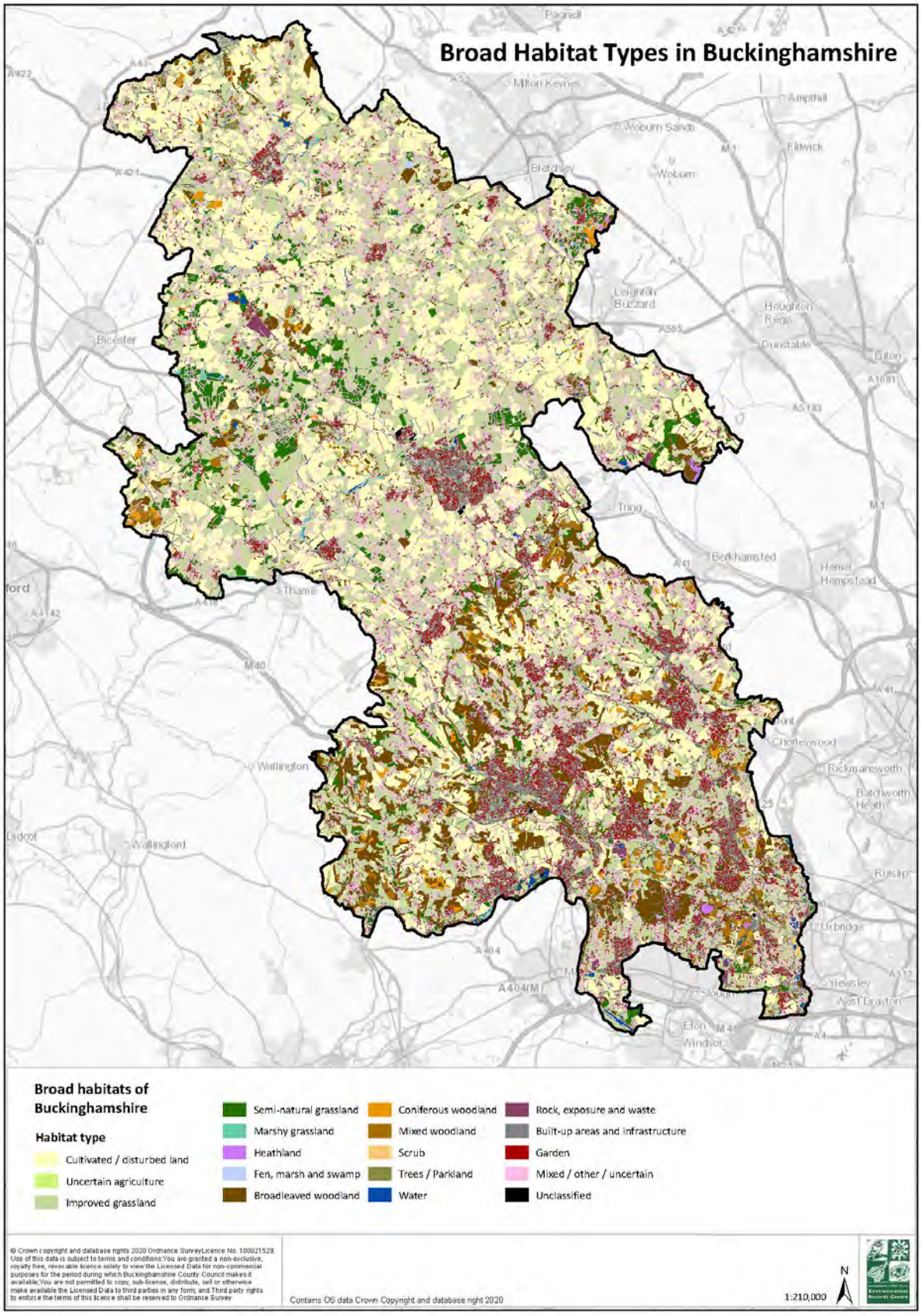
2.19 Most of the area's semi-natural grassland (i.e. grasslands that are not intensely cultivated or fertilised, including meadows and pasture) is found in the northern part of Bucks, particularly the north-west and north-east tips; whereas most of the existing broadleaved woodland is found in the south.

Table 1: Area and percentage cover of broad habitat types across Buckinghamshire

Broad habitat / land use	Area of Bucks (Ha)	% Cover
Cultivated / disturbed land	47,828	30.56
Uncertain agriculture	886	0.57
Improved grassland	50,519	32.28
Amenity grassland	5,165	3.30
Semi-natural grassland	8,454	5.40
Marshy grassland	267	0.17
Heathland	164	0.10
Fen, marsh and swamp	81	0.05
Scrub	348	0.22
Trees / Parkland	1,613	1.03
Broadleaved woodland	14,365	9.18
Coniferous woodland	1,788	1.14
Mixed woodland	2,265	1.45
Hedgerows	928	0.59
Water	1,222	0.78
Built-up areas	5,416	3.46
Infrastructure	4,235	2.71
Garden	9,429	6.03
Rock, exposure and waste	425	0.27
Unclassified	176	0.11
Mixed / other /uncertain	916	0.59
TOTAL	**156,489**	**100.00**

Source: "Mapping Natural Capital, Ecosystem Services and Opportunities for Habitat Creation in Buckinghamshire" Jim Rouquette, Natural Capital Solutions (2020). Report available at: https://bucksmknep.co.uk/projects/natural-capital-mapping/

Map 1: **Broad habitat types and land use in Buckinghamshire**



Supplied by and with thanks to: BMERC — based on maps supplied by Natural Capital Solutions[2]

High value habitats - protection and designation

High quality habitats

2.20 The highest quality semi-natural habitats in Buckinghamshire, identified from the habitats base-map (Map 1), are shown in Map 2, below - although note that this is based on habitat type and not on condition.

2.21 In total 20,274 ha, which represents **13.0% of Buckinghamshire, contain these high-quality habitats.** The greatest amounts are 14,365 ha of broadleaved woodland, 2,265 ha of mixed woodland and 2,297 ha of neutral grassland. However, this includes all broadleaved and mixed woodland, some of which will not have been high quality. There are also 658 ha of calcareous grassland, 109 ha of acid grassland, and 267 ha of floodplain grazing marsh and marshy grassland.[3]

Nature conservation designations

2.22 A sample of the best sites for biodiversity or geology are protected under the Countryside and Rights of Way Act 2000 and are classified as **Sites of Special Scientific Interest (SSSIs).** In some instances, sites are designated for their international importance, such as Burnham Beeches, which is a **Special Area of Conservation (SAC).** Such sites are protected under the European Habitats Directive.

2.23 It is important to recognise that there are hundreds of other sites which can be equally important as our SSSIs or SACs for their wildlife interest, but which do not have the same level of protection in conservation or planning terms. Many of these sites have been identified in Buckinghamshire and are classified as **Local Wildlife Sites (LWS**). Whereas SSSIs (see previous slide) are only a sample of the best sites, Local Wildlife Sites include all sites that meet specified criteria – so are a crucial part of the ecological network. Other potentially important sites have also been listed as **Biological Notification Sites (BNS**), which are awaiting assessment to see if they qualify as LWS.

2.24 The locations of Buckinghamshire's designated sites are shown in Map 3. Key sites include the Chilterns Beechwoods, Burnham Beeches and Aston Rowant, which are considered to be of international importance for their woodland assemblages and have been designated as Special Areas of Conservation (SACs) and SSSIs.

[2] Mapping natural capital, ecosystem services and opportunities for habitat creation in Buckinghamshire. Jim Rouquette, Natural Capital Solutions (2020). See Boxes 1 and 2, pages 9 and 10 regarding the data used to classify habitats in the basemap and how habitats were assigned, respectively. Report available at: https://bucksmknep.co.uk/projects/natural-capital-mapping/

[3] Note that it was not possible to distinguish high quality parkland from any areas containing scattered trees, or higher quality rivers, streams and standing water, hence these habitat types have not been included on this map. Mixed habitats were also not included as although some of these areas are likely to be high quality habitat, not all such areas will be.

2.25 In total, 932 ha are designated as SACs within Buckinghamshire (0.60% of the total land area). The total amount of land designated as **SSSIs** within Buckinghamshire is 2,516 ha, or 1.61% of the total area, with an additional 5,983 ha (3.82%)[4] designated across Buckinghamshire as **Local Wildlife Sites** (currently 366 sites) and 200 ha (0.13%) designated as a Local Nature Reserves. However, Local Wildlife Sites do not enjoy the same level of protection in planning as SSSIs and are more vulnerable to inappropriate management, neglect and being impacted by development. When last assessed (2011–12), 51% of Local Wildlife Sites in Bucks were assessed as in positive conservation management.[5]

2.26 More land is therefore designated as a Local Wildlife Site than as a SSSI or SAC. All the SACs are also designated as SSSIs, and there is a little overlap in the other designations, hence **the total amount of land receiving some level of protection amounts to 8,577 ha, or 5.48% of the total area of Buckinghamshire**. A number of additional, non-statutory, schemes are used to show sites of local biological interest, such as **Biological Notification Sites** (awaiting assessment under Local Wildlife criteria), and **Road Verge Nature Reserves**.

2.27 With appropriate management, Local Wildlife Sites can make an enormous contribution to ensuring more, bigger, better, and more connected spaces for wildlife in Buckinghamshire, and in helping ensure greater resilience in the face of the many pressures on our natural environment.

2.28 In addition to the SSSIs, SACs and LWSs, Buckinghamshire is also home to the **Chilterns Area of Outstanding Natural Beauty (AONB).**

2.29 An AONB is a designation for an area of land that is of national importance for its natural beauty. The origins of AONBs are in the National Parks and Access to the Countryside Act of 1949. In June 2000, the government confirmed that AONBs have the same level of landscape quality and share the same level of protection as National Parks. The single purpose of AONB designation is 'to conserve and enhance the natural beauty of the area'. All public bodies have a legal duty to 'have regard' to the purpose of conserving and enhancing the natural beauty of an AONB'.[6]

2.30 The term 'natural beauty' is enshrined in the 1949 National Parks and Access to the Countryside Act. Legislation has made it clear that natural beauty is not just the look of the landscape since, but includes the landform and geology, the plants and animals, the landscape features and the rich history of human settlement over the centuries. In 2006, legislation clarified that land is not prevented from being treated as of natural beauty by the fact that it is used for agriculture,

[4] Mapping natural capital, ecosystem services and opportunities for habitat creation in Buckinghamshire. Jim Rouquette, Natural Capital Solutions (2020). Available at: https://bucksmknep.co.uk/projects/natural-capital-mapping/

[5] BMERC, Buckinghamshire & Milton Keynes – Single Data List 160 Report 2011-2012.

[6] Chilterns AONB Management Plan 2019-2024, Chilterns Conservation Board (2019). Accessed November 2020. Available at: https://www.chilternsaonb.org/conservation-board/management-plan.html; also Countryside and Rights of Way Act 2000: Section 85

woodlands or as a park; or because its physiographical features are partly the product of human intervention in the landscape[7].

Priority habitats

2.31 The Government's "Biodiversity 2020: A Strategy for England's Wildlife and Ecosystem Services (2011)"[8] includes national targets for the condition and extent of **priority habitats and protected species** by 2020: to achieve an increase in overall extent of priority habitats by at least 200,000 ha; and 90% of priority habitats in favourable or recovering condition.

2.32 The Strategy's priority habitats are embedded in law through Section 41 of the Natural Environment and Rural Communities (NERC) (2006) Act. This **lists 56 priority habitats of principal importance for conservation in England**; the same as those that have historically been addressed by UK Biodiversity Action Plan work.

2.33 In terms of extent and proportion of the area, according to the latest available Natural England Priority Habitat data[9], Buckinghamshire had less priority habitat than the average English county at nearly 11% of the land area, compared to 14% of England as a whole. However - more fine-grained local habitat mapping data held by BMERC suggests the latest Priority Habitat land area in Buckinghamshire is in fact only just above 3%.

2.34 Priority habitats and local sites occur throughout the area - as shown in Map 4, below - although woodlands and conservation organisation ownership of land is mainly in the south of the county in the Chilterns AONB southwards. There are also a number of national sites, particularly throughout the southern half of the county, and along the western edge of the northern part of the county.

2.35 Despite this, Buckinghamshire has above average extent of traditional orchards, lowland dry acid grassland and lowland meadows; lowland mixed deciduous woodland is the single most extensive priority habitat in the county (1,682 ha) followed by Beech and Yew Woodland (1,191 ha) and lowland wood pasture and parkland (536 ha).[10]

2.36 The Buckinghamshire and Milton Keynes Natural Environment Partnership ("NEP") has set out restoration and creation targets for 14 of the English priority habitats, as a proxy for species, to achieve an overall 20% increase in the area of priority habitat - to retain, enhance and improve Priority Habitats. The NEP and partners are supporting a number of initiatives at a landscape scale to help meet the targets.

---

[7] Natural Environment and Rural Communities Act 2006: Section 99

[8] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69446/pb13583-biodiversity-strategy-2020-111111.pdf

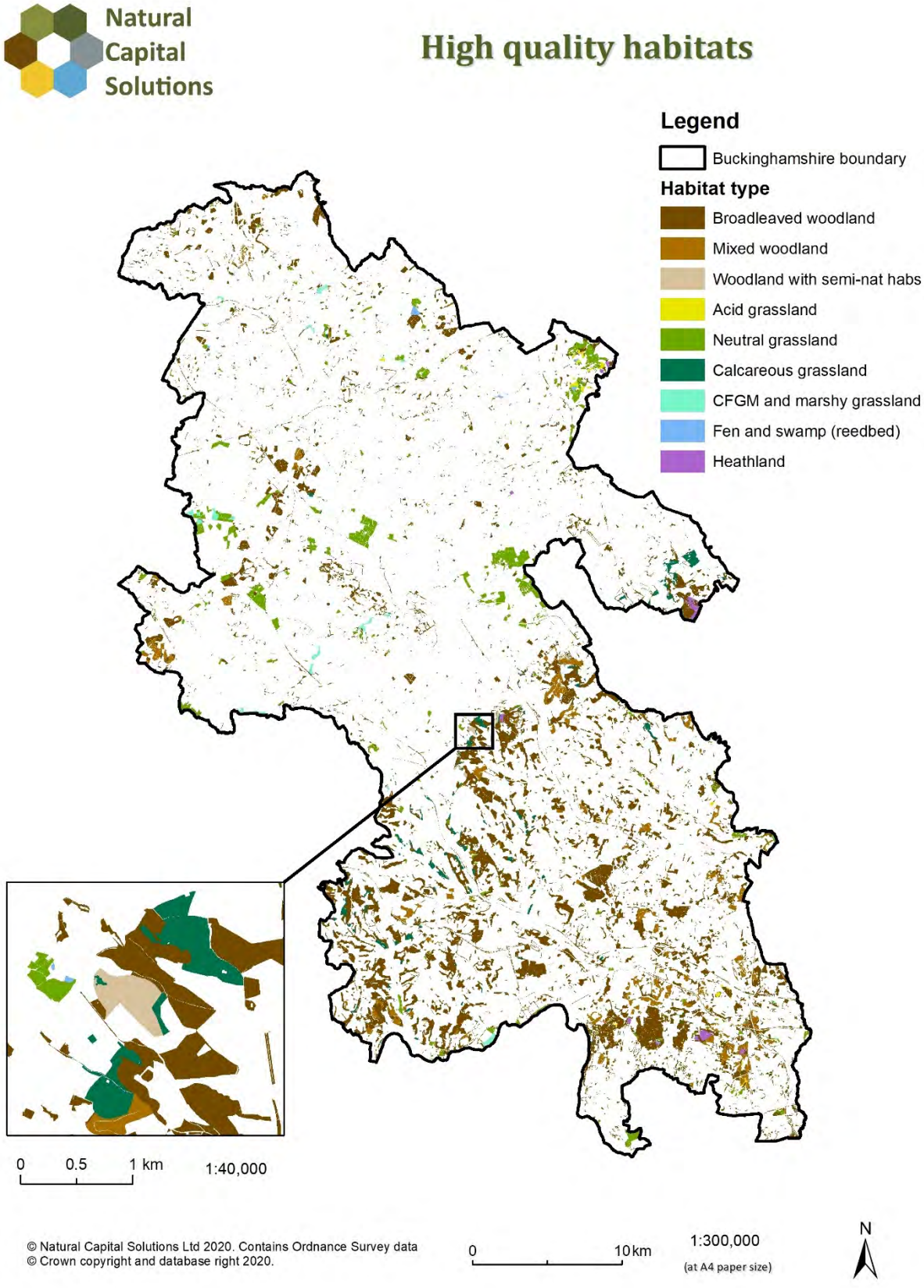
[9] Data from Natural England, national priority habitat inventory on the Open.Gov portal. Available at: Priority Habitat Inventory (Central) (England) | Natural England Open Data Geoportal (arcgis.com)

[10] NEP's State of the Environment Report, 2016. Available at: https://bucksmknep.co.uk/projects/state-of-the-environment-report/ Accessed Sep 2020.

2.37 The following maps 2-6 show Buckinghamshire's high quality habitats, designated and local sites, priority habitats and also various boundary areas relevant to habitats and conservation – river catchments, "national character areas" in Buckinghamshire and also the Chilterns AONB and land owned by conservation organisations, which tends to be of high conservation value. Map 5 shows the composite layering of Maps 3 and 4, combining the designated national and local sites that cover 5.5% of Buckinghamshire and the location of the UK BAP Priority habitats and ancient woodland across Buckinghamshire. This illustrates the complexity of the underlying conservation baseline; that there are important sites for biodiversity found across the county, and more in the southern half than the northern half.

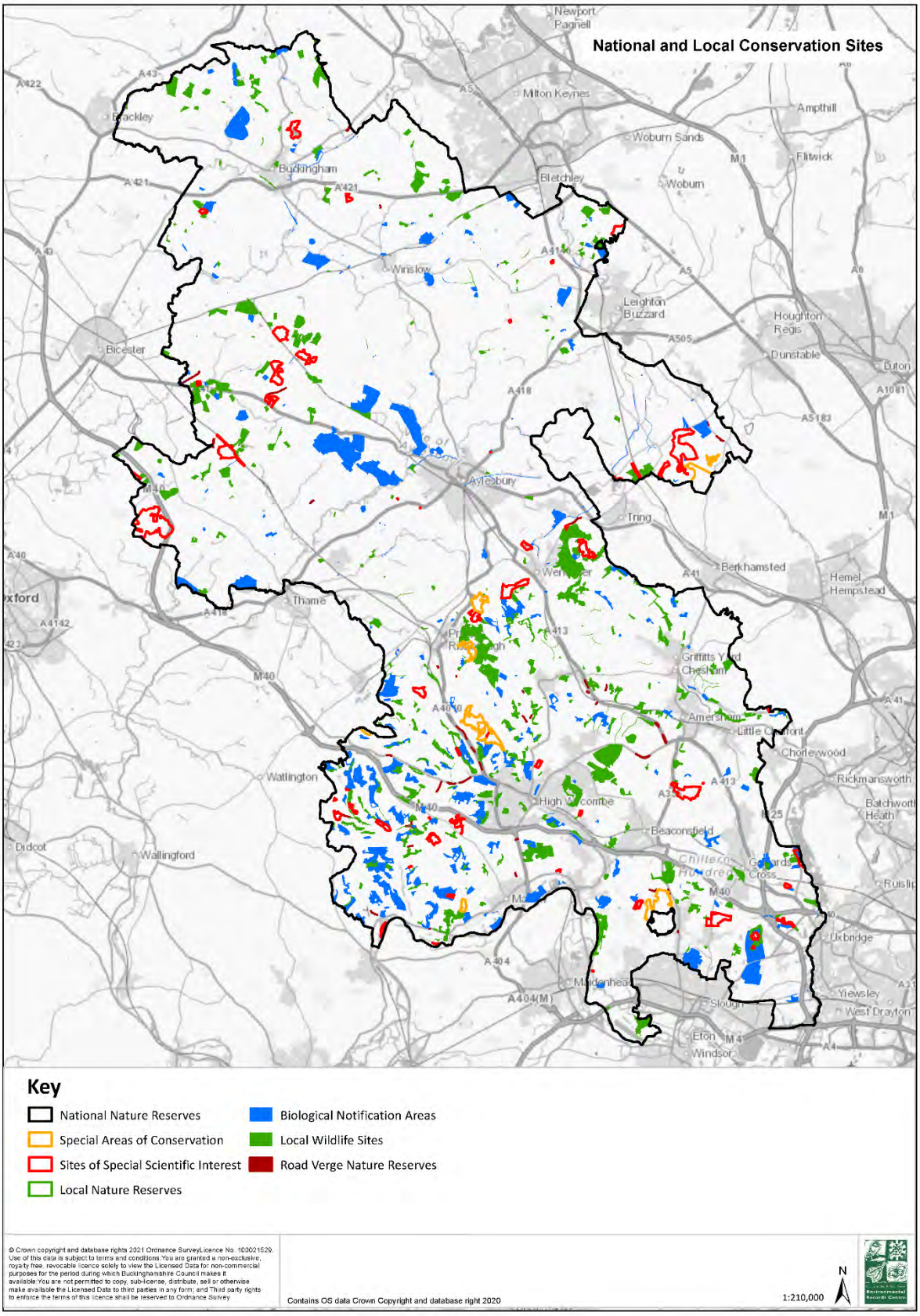
Map 2: High quality habitats in Buckinghamshire

High quality habitats cover 13% of Buckinghamshire

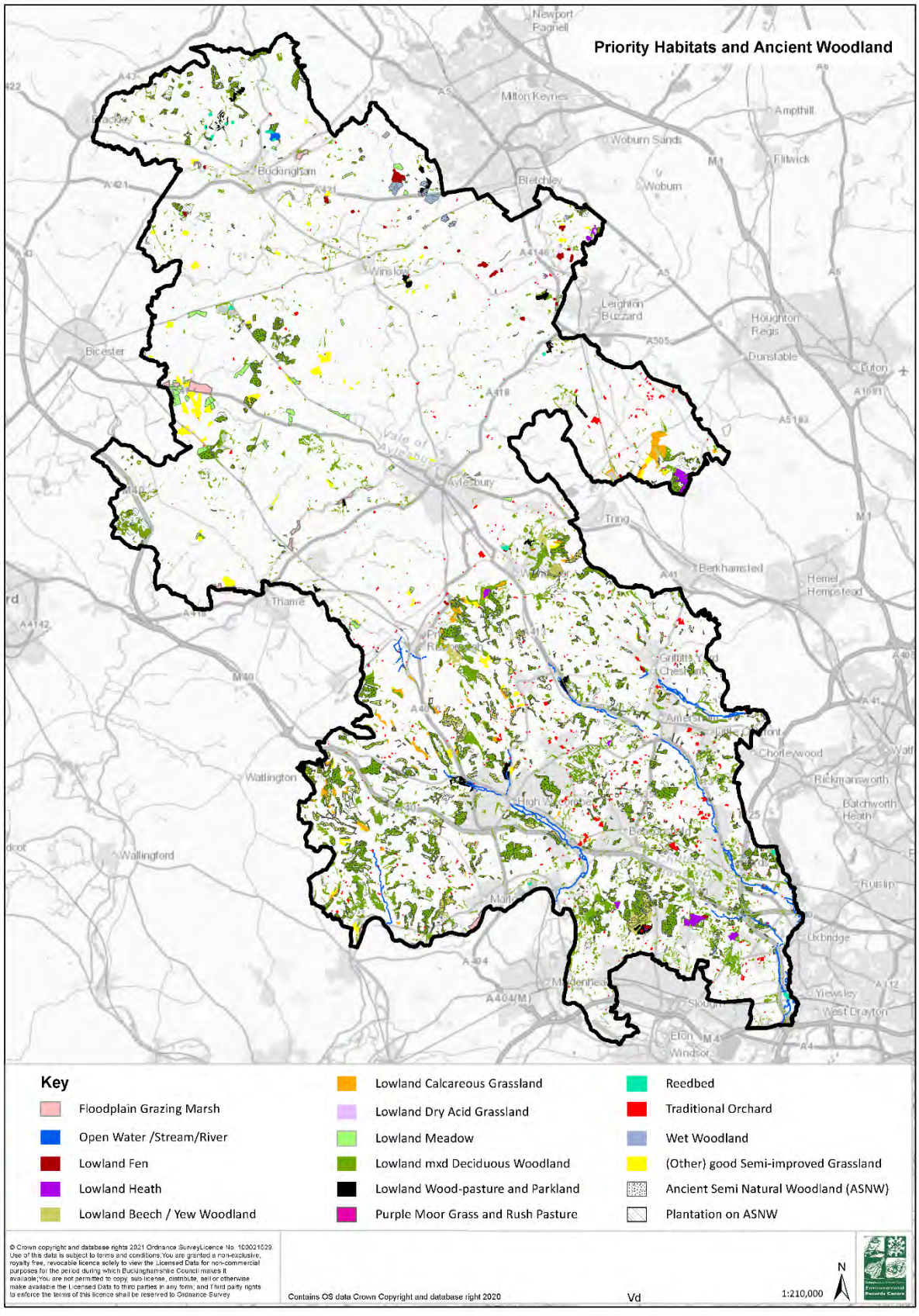


Map 3: Designated national and local conservation sites in Buckinghamshire

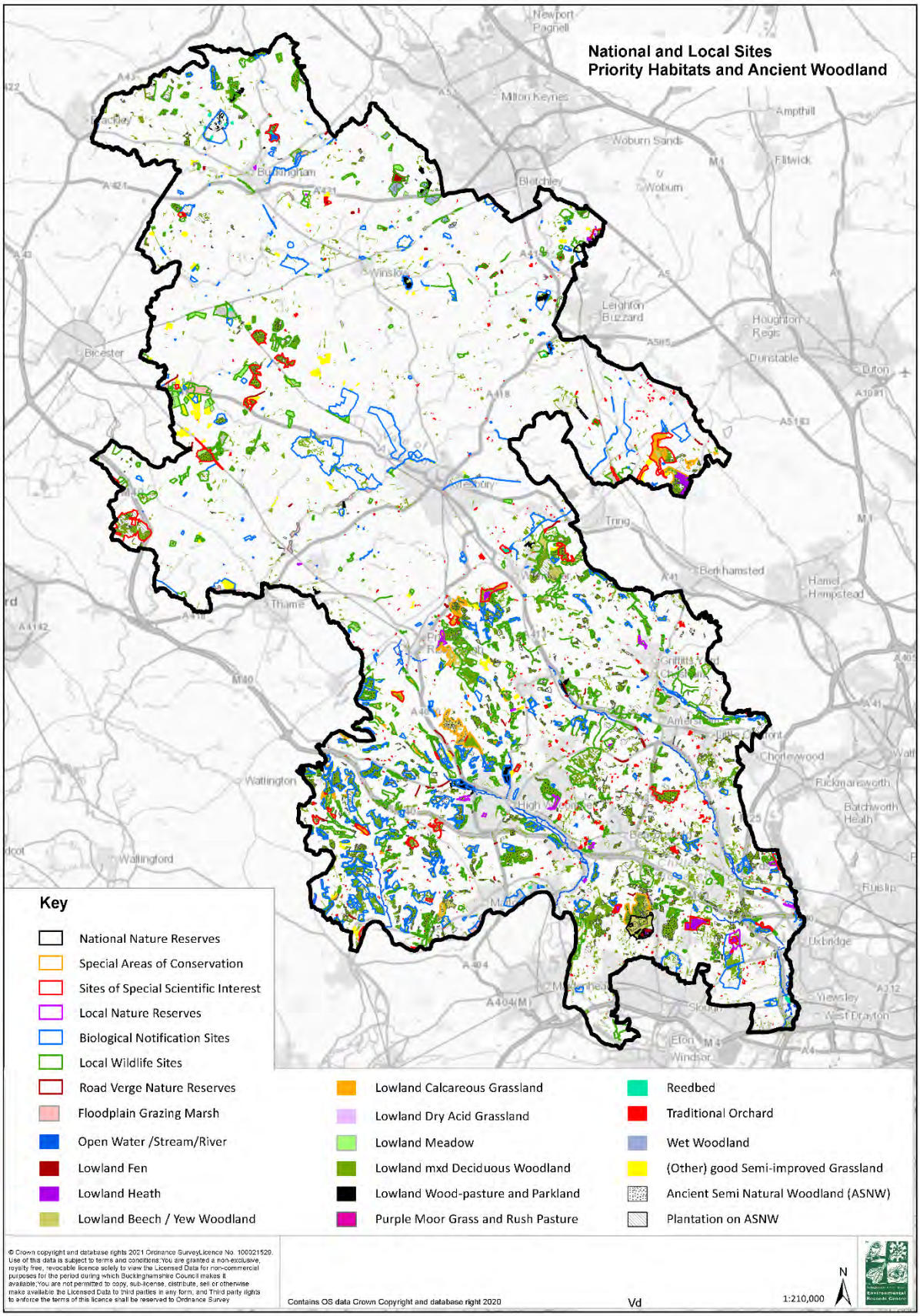
(*Designated sites cover 5.5% of the land area of Buckinghamshire*)



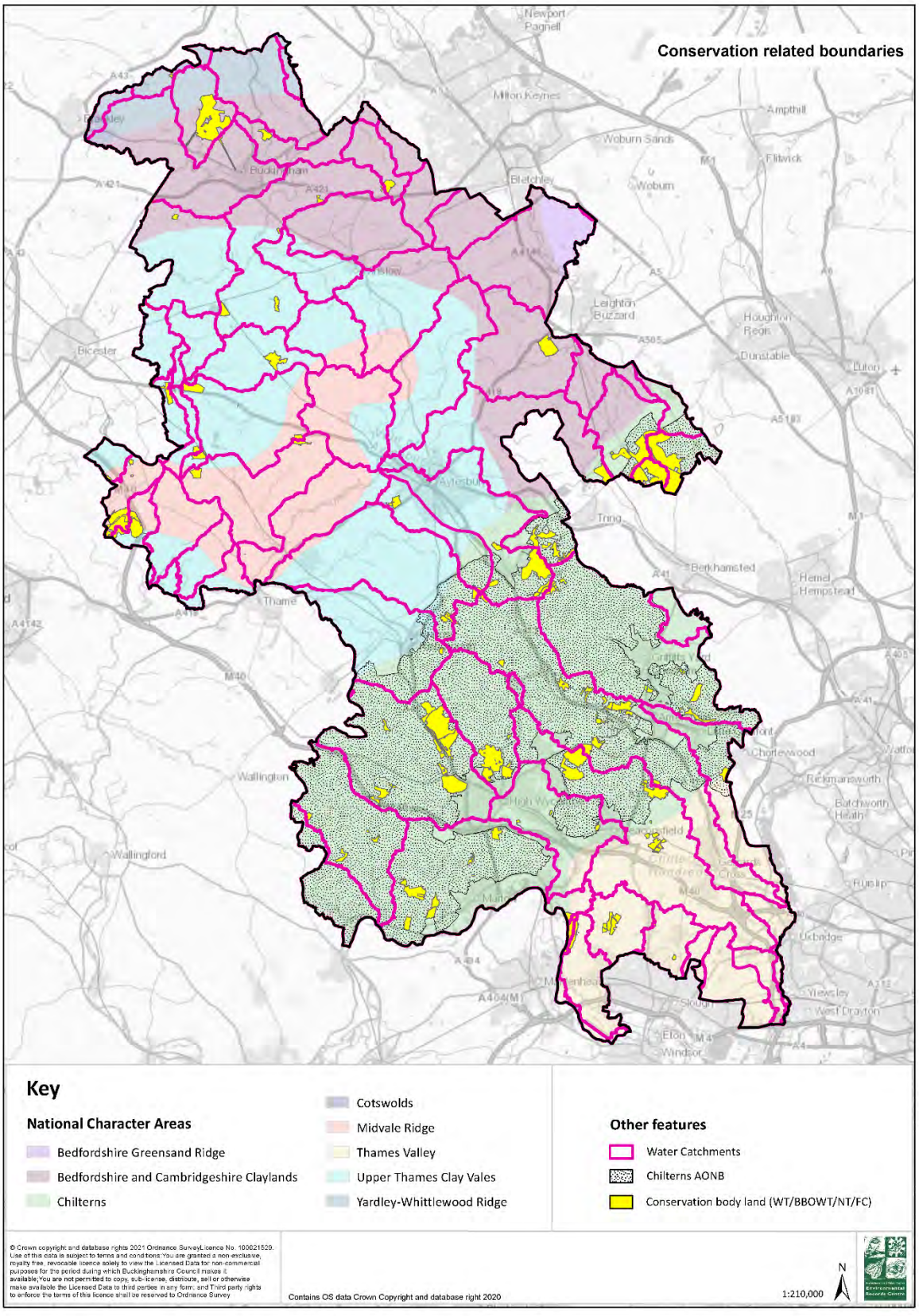
Map 4: Priority habitats *(from Natural England and BMERC data)* and ancient woodland *(Ancient Woodland Inventory – comprising ASNW and PAWS, Natural England)*



Map 5: Composite of maps 3 and 4: Designated national and local conservation sites plus priority habitats in Buckinghamshire



Map 6: Boundary of areas relevant to conservation: National Character Areas, River Catchment boundaries, the Chilterns Area of Outstanding Natural Beauty and Conservation organisation ownership.



ii) Our water landscape in Buckinghamshire

2.38 The contemporary river landscapes of Buckinghamshire are a function of geology, post-glacial processes, direct human intervention and trends in land management. There are two major river catchments represented in the county; the central and southern part of the county contains parts of several tributaries of the Thames, and the northern third of the county contains parts of the upper great Ouse catchment, with the waters of these two rivers heading in their separate directions to enter the North Sea at the Thames estuary and at The Wash respectively. The southern fringes of the county also abut the left (north) bank of the Thames, with the county boundary running down the centre of the river for about 30km from near Fawley Court, downstream of Henley, to Boveney, between Slough and Windsor. The upper reaches of the Jubilee River, a Thames-sized flood channel built in the 1990s, is also within the county.

2.39 The county's watercourses are mainly of a gentle gradient, reflecting the predominantly broad alluvial and clay vales that they occupy, but the Chiltern Hills provide an important contrast, with a number of chalk streams draining the dip slope south-eastwards either direct to the Thames or to one its major tributaries, the Colne, which in places forms the eastern boundary of the county. There are also a number of short chalk spring-fed streams issuing from the base of the Chiltern scarp and flowing onto the clays of the Aylesbury Vale. The Thames itself meanders gently along the southern boundary of the county with the Chiltern Hills as an attractive backdrop, at its most dramatic at the steep slopes of Cliveden.

River environment in the north of Buckinghamshire

2.40 In the north, the county contains some of the headwaters of the **Great Ouse**, including tributaries such as the Padbury Brook, Claydon Brook and part of the River Ouzel. The upper Great Ouse has headwaters just in Northamptonshire but soon flows into Buckinghamshire, passing through a clay-based catchment with much of the river corridor running through a rural landscape which is largely agricultural. Much of the riparian land use consists of improved pasture. The main urban area found on the upper river in the county is Buckingham. In common with many lowland rivers the Great Ouse has historically been extensively re-profiled resulting in a uniform, widened and deepened channel. This has also resulted in the river having limited connectivity with its floodplain. There are a number of weirs and obstructions present in the upper catchment that affect river flow patterns as well as being barriers to migration for fish and wildlife. Mature riparian willows are relatively common along the Great Ouse and its tributaries in the upper catchment. These trees provide important habitat features along the river corridor, particularly in areas along the Padbury Brook where some are still actively managed as pollards, retaining their ecological value.

2.41 A short distance below Buckingham is the confluence where the **Padbury Brook** joins the Great Ouse. In common with the Great Ouse, the Padbury Brook and its main tributary the Claydon Brook, are clay catchments that flow through a predominantly rural agricultural landscape. The riparian land use along the river corridor consists predominantly of improved grassland used for grazing livestock. The Padbury Brook catchment has also historically been engineered, resulting in the channel often being over widened, deepened and with reduced floodplain connectivity.

2.42 The River **Ouzel** is another tributary of the Great Ouse that flows through the eastern part of the county. The Ouzel flows in a generally northerly direction through a clay catchment, flowing into Milton Keynes Unitary Authority area near Bletchley before joining the Great Ouse at Newport Pagnell. The character of the Ouzel is similar to the Great Ouse and other tributaries, being a typical lowland river that has historically been modified.

River environment in the central part of Buckinghamshire

2.43 The river environment in the central swathe of the county is dominated by the broad clay vales at the upper reaches of the River **Ray** (which joins the Cherwell in Oxfordshire), rising in an extensively low-lying landscape, as well as the headwaters and the upper half of the Thame catchment, a major tributary of the Thames which it joins in Dorchester, also in Oxfordshire. The **Thame** south of Aylesbury flows through a more defined valley landscape to the county boundary near the market town of Thame, in Oxfordshire. These two predominantly clay catchments have been subject to substantial land drainage improvement works in the past, not least in part due their innate flashiness, with the River Ray having been subject to some of the most extensive interventions. However, both rivers still flood their predominantly rural floodplains quite readily after heavy rain, although only the upper Ray has retained a reasonable extent of high quality floodplain and alluvial grassland. The Buckinghamshire Ray provides one of the last refuges for the True Fox Sedge in the Thames catchment. The Ray has one of the lowest gradients of any tributary of the Thames, with the area around Marsh Gibbon prone to frequent flooding and containing valuable remnant floodplain habitat for breeding waders; a small number of curlew also breed in the Thame catchment. The Thame river corridor and floodplain is still predominantly dominated by pasture, other than the considerable urban development at Aylesbury.

2.44 The main stems of these two rivers have been subject to considerable re-sectioning (widening and/or deepening) works in the past, and the need to restore physical habitat quality through restoration work and removing barriers to fish passage are important requirements for improving the ecological quality of these watercourses, and properly re-connecting them with their floodplains, particularly on the Thame. The degree of historic engineering adds a substantial challenge to restoring natural functioning and diversity to these watercourses, along with addressing challenges from diffuse and point source pollution and intensive land-use. The urban development at Aylesbury adds another pressure for the Thame. River channel and floodplain habitat enhancement works have been undertaken at a few locations on the Thame in Buckinghamshire, between Aylesbury and the county boundary near Thame, as well as the provision of fish bypass channels, but there is still much more that can be done to improve the quality of habitat here and on the Ray, and to promote floodplain wetland creation.

2.45 Some of the smaller tributaries to the Ray and Thame have been equally subject to land drainage improvements. The Hardwick Brook, a tributary of the Thame which it joins at Quarrendon near Aylesbury, is however notable for the amount of reasonably good quality semi-natural gravel-bedded habitat which has been retained. Another tributary of the Thame, the Bear Brook, fed by chalk-influenced streams in its very upper reaches, also has some remnant good quality habitat. There are several other short lengths of chalk stream tributaries flowing from the base of the Chiltern scarp with some semi-natural morphology, feeding into the larger tributary of the Scotsgrove Brook, which runs across the floor of the Aylesbury Vale

to join the Thames just north of Thame town, just inside the county. Few of the Ray tributaries in Buckinghamshire have survived with much if any of their post-glacial hard gravel beds intact.

Our chalk streams

2.46 A number of chalks streams rise on the south-east facing dip slope of the Chilterns, running either directly to the Thames or to one of its larger tributaries at the eastern edge of the county, the River Colne. Chalk streams are priority habitats, with the UK having by far the greatest proportion of the global resource *(see section 2.9*). The whole 17km of the **River Wye** lies within the county from its source near West Wycombe to its confluence with the Thames at Bourne End. Although much of the Wye's course is highly urbanised through High Wycombe and Wooburn Green, with many impoundments including at one time over 30 mills, it retains some very good quality gravel bed habitat, in part due to its relatively steep gradient, ideal for brown trout. Improvements to channel habitat and fish passage secured through development and collaborative projects are helping the river to recover from the worst of its industrial past, along with reductions in abstraction pressure by the closure or reductions of groundwater abstractions. As with most chalk streams, the upper reaches of the Wye and its tributary the Hughenden Stream are subject to seasonal downstream migration of the source as groundwater levels drop in the summer.

2.47 To the west of the Wye, a much smaller chalk stream flows out of the Chiltern slopes to the Thames, the **Hamble Brook**, which flows for its roughly 6km southward through an iconic Chiltern landscape to the Thames at Mill End. The flows in the Hamble Brook are highly ephemeral, and the often dry channel is in places under pressure from intensive grazing.

2.48 Several chalk stream or chalk-influenced tributaries of the Colne rise from the Chilterns in the county, including the Chess, Misbourne and Alderbourne. The **Chess** is a classic winterbourne rising near Chesham, with about half of its 20km length in the county before flowing into Hertfordshire to join the Colne at Rickmansworth. An upper tributary of the Chess, the Vale Brook, is entirely culverted under Chesham. Historic channel dredging and milling, eutrophication pressures and livestock poaching all compromise ecological quality, exacerbated by abstraction pressures which can substantially increase the risk and longevity of drying in the upper reaches. Floodplain grazing marsh has been largely replaced with improved pasture and arable cropping. The Chess still maintains a valuable population of water voles.

2.49 The River **Misbourne** is a groundwater fed chalk stream that rises at the northern edge of the village of Great Missenden. It flows in a south-easterly direction within a shallow, rural valley in its upper sections and becomes more influenced by suburban settlements in its lower reaches, including Old Amersham, Chalfont St Giles, Chalfont St Peter, Gerrard's Cross, Higher Denham and Denham. The catchment has been influenced by a history of milling, fisheries, watercress production, groundwater abstraction and urban development. There are also a series of large, on-line, artificial landscaped lakes along the river, for example at Denham Place. The Old Rectory Meadows SSSI sits next to the Misbourne and meadow flowers grow on its floodplain. Groundwater abstraction in the chalk catchment has significantly affected water flows in the River Misbourne, sometimes limiting natural geomorphological processes. The River Misbourne is stable and channel narrowing is the dominant process along the lower reaches of the stream. Much of it is wider and deeper than would be expected for a natural chalk stream.

River environment in the south of Buckinghamshire

2.50 Although the **Alderbourne** rises from the Chiltern chalk just above Fulmar village, it then flows over alluvium and clay from below the village for approximately 8km across a gentle gradient to join the Colne Brook at Elk Meadows. Much of the catchment lies within London's Green Belt with agriculture and deciduous woodland the dominant land use. Notably, as the river flows beneath the M25, it passes through Kingscup Meadow and Oldhouse Wood SSSI, designated for its mosaic of wet and dry habitats adjacent to the river. Historic dredging and other agricultural management practices are key pressures to the river, with physical modifications likely to be limiting habitat quality here. Finally, these chalk tributaries flow into the Colne, part of which runs along the eastern edge of the county.

2.51 The River **Colne** follows the Buckinghamshire- Greater London border from Harefield flowing south to Thorney. Many of the Colne tributaries rise in the Chiltern chalk, and the River Colne remains in connection with the chalk until it reaches Denham. Here the geology changes from the clay, silt and sand of the Lambeth group to the London Clay that takes it to join the Thames at Staines. Historic gravel and mineral workings characterise much of the land adjacent to the river on the Bucks border. These have been redeveloped to form lakes and wetlands used for both angling, watersports and as local nature reserves, most notably the Mid Colne Valley local wildlife site includes 3 SSSIs, a stronghold for both watervole and otter in the catchment. The Colne Brook forms one of the distributaries of the River Colne, flowing from Uxbridge Moor to the River Thames at Hythe End, Wraysbury for 15km. The river corridor is well shaded by deciduous woodland at its upstream end, flowing through agricultural land and becoming less covered through old mineral workings and several golf courses before leaving Buckinghamshire at Thorney. The **Colne Brook** is under pressure from several invasive species with significant amounts of Floating Pennywort present as well as Himalayan Balsam and Japanese Knotweed stands. Historical physical modifications and weir structures present within the channel impact on fish populations here and work to improve floodplain connectivity is needed. The Colne Brook also faces increased pressure from phosphate pollution, apportioned to sewage discharge and runoff from the roads and surrounding urban areas.

2.52 The River **Thames** forms the southern boundary of the county from just downstream of Henley. The Thames has been highly modified for navigation, an impounded river flowing on a gentle gradient between a series of lock and weir complexes, eight of which are found on the county boundary from Hambledon Lock to Boveney Lock. This is a much larger river than all the other watercourses in the county, a highly modified channel with the more important flow-dependent habitats being restricted to weir streams and some side-channels, but with the main Thames providing a degree of contemporary stability and depth quite unlike the shallower, multi-thread channel that would have existed before human influence. The Thames is the main focus for informal waterside recreation in the county, as well as for pleasure boating, but also provides habitat for a range of species which benefit from stable water levels and generally benign flow rates, although the river carries huge volumes of water during flood events. The **Jubilee River** leaves the Thames at Taplow and flows out of the county at Dorney just upstream of the main wetland complex there; designed to take flood flows under high flow events, under normal conditions the Jubilee provides a quieter refuge from the powered navigation on the main Thames.

Species and habitats supported by the river environment

2.53 The **chalk streams** in the county have fish communities dominated by brown trout along with 'minor' fish species such as bullhead, brook lamprey and gudgeon, whereas the Thame and Great Ouse have a greater representation of coarse fish species such as dace, chub and roach, although brown trout are found in the upper Great Ouse and one or two of the Thame tributaries as well. The Thames has the greatest diversity of fish species and provides relatively stable conditions in deep and generally slow-flowing water. The Buckinghamshire part of the Ray has an impoverished fish fauna in part due to its inherent low summer baseflow as well as due to historic river engineering and loss of habitat. Otters are now found throughout the county's rivers, following their substantive recovery in the last few decades, whereas water voles are currently restricted to populations on the Great Ouse, Chess and Misbourne. There is still possibly one isolated population of white-clawed crayfish just hanging on in the upper Thame catchment. Kingfishers are generally widespread, and great crested grebe nest on the main Thames. Invasive signal crayfish are widespread in the county, and can be particularly abundant on the Ouse, Thames and Thames. Old and mature pollard willows are a characteristic feature of many of the county's watercourses.

Protection for water bodies

2.54 **Rivers, lakes and groundwater** in Buckinghamshire are protected under the Water Framework Directive (WFD). The WFD requires that all EU member states work to have their waterbodies in 'good ecological status' (or 'good ecological potential' for heavily modified waterbodies) with full compliance by 2027 if not possible by 2015. In addition to improving the status, there must be no deterioration. Map 7, below, shows the ecological status of WFD water bodies.

Water bodies in "good" ecological status

2.55 When last surveyed in 2019, there were 80 Water Framework Directive waterbodies within Buckinghamshire: 62 rivers, 11 groundwater, 5 canals, 1 lakes and 1 water transfer (a reach of the Jubilee River).

2.56 All surface waterbodies in Buckinghamshire have been found to fail for the chemical components of the classification and this has impacted on overall WFD status. It is, however, possible to identify the ecological status of each waterbody by removing the chemical status data and reviewing the ecological elements. This is summarised at Table 2, below.

Table 2: A summary of the ecological status of water framework waterbodies in Buckinghamshire (*NB there is no ecological status measured for groundwater)*

		Ecological status (2019)				
		High	Good	Moderate	Poor	Bad
Waterbody type	River	0	1	45	14	2
	Groundwater	N/A	N/A	N/A	N/A	N/A
	Canal	0	2	3	0	0
	Lake	0	1	0	0	0
	Water transfer	0	0	1	0	0

Source: Environment Agency

2.57 Due to the changes in measurement methodology[11], it is not possible to directly compare data from 2009 and 2019. However, the 2019 ecological classification found that there were 69 Water Framework Directive watercourses and waterbodies in Buckinghamshire: 62 rivers, 5 canals and 1 lake. The assessment found that only 4 of these were in 'good ecological status', 49 were 'moderate', 14 were 'poor', 2 were 'bad'. Therefore, only 6% of WFD water bodies in Buckinghamshire achieve "good" ecological status or higher – compared with 16% at the national level (and <1% nationally achieving "high" status). Therefore 94% of Buckinghamshire WFD water bodies failed to achieve good status, compared with 83% failing nationally[12]. None of the chalk streams in Bucks achieved "good" status, compared to 23% nationally.[13]

2.58 In Buckinghamshire, the main reason for waterbodies not reaching 'good ecological status' under the Water Framework Directive[14] (WFD) has been identified as high phosphate levels and the legacy of historic river engineering and land drainage, affecting habitat quality – including barriers to fish passage – e.g. by weirs.

2.59 The effects of pollution can be heightened when combined with poor watercourse habitat quality; where watercourses have been over-dredged or artificially straightened, this results in

[11] In terms of Water Bodies reaching Water Framework Directive "good" status, a number of changes have been made to the way the Water Framework Directive has been implemented across England in the last 10 years. In addition to the change in number of overall WFD waterbodies (due to some being merged and others divided), the frequency of monitoring of the different elements which are used to determine the status of each waterbody has reduced, as has the number of survey sites. Furthermore, in 2019, the overall WFD classifications were updated to include the chemical status of each waterbody.

[12] Nationally, of al of the individual biological and physical-chemical parameters on each waterbody for which the EA had data, which contribute to ecological status, 77% were at good or better status – although for each waterbody this is included as a "one out all out" statistic.

[13] WWF-UK and Waterlife, The State of England's Chalk Streams report (2014); and Chilterns Conservation Board

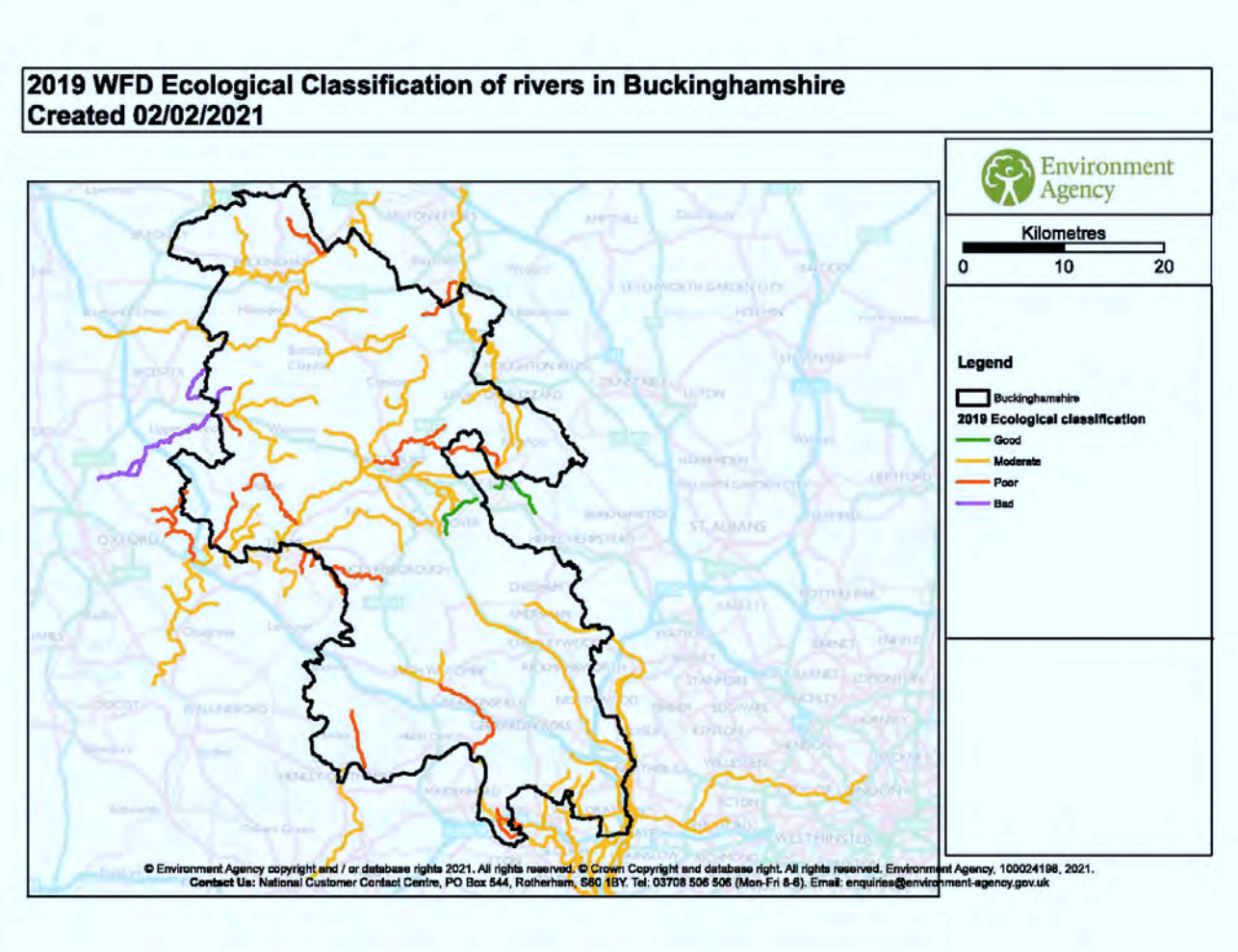
[14] The latest Water Framework Directive legislation applicable to the UK is available here (Accessed October 2020): https://www.legislation.gov.uk/uksi/2017/407/contents

loss of habitat diversity, good quality gravels and natural processes of erosion and deposition. Damage, as a result of historic dredging, can also increase the risk of downstream flooding due to the increase in conveyance.

2.60 Additional pressure points within Buckinghamshire include urban areas through surface water runoff with particular hotspots at High Wycombe, Chesham, Aylesbury, Marlow and Amersham Old Town.

2.61 Whilst the headlines are not particularly promising, the WFD status of the waterbodies is based on the worst performing measure and many parameters are at good or high status; therefore, this should not in any way detract from the hard work which is going on in the catchments to address the failures and improve aquatic and semi-aquatic habitats. There is no single action which can reverse the decline, but steps are being taken to improve all aspects of the water environment which will contribute towards their overall improvement.

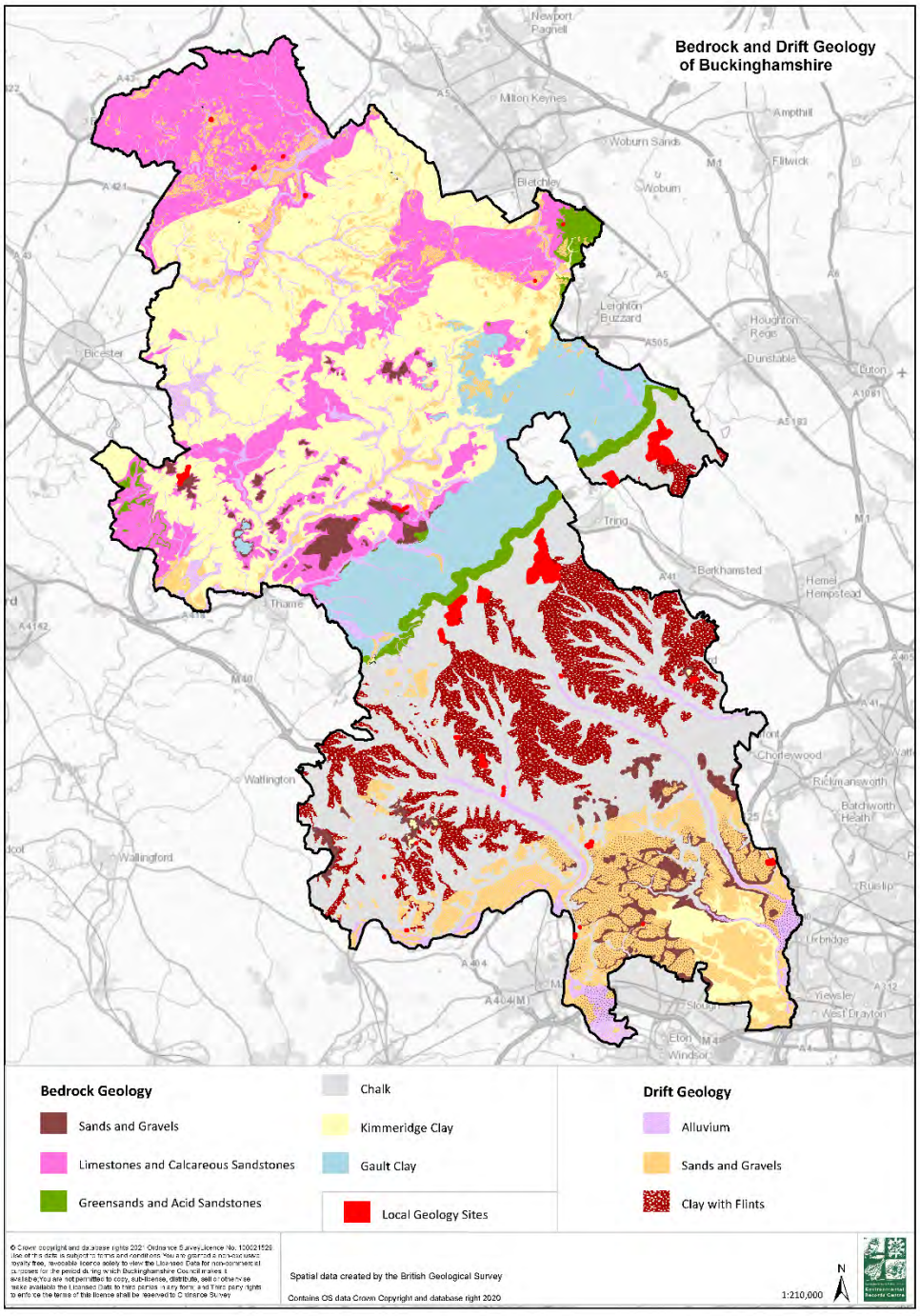
Map 7 – Ecological Status of WFD Waterbodies in Buckinghamshire



iii) Geology and soil types in Buckinghamshire

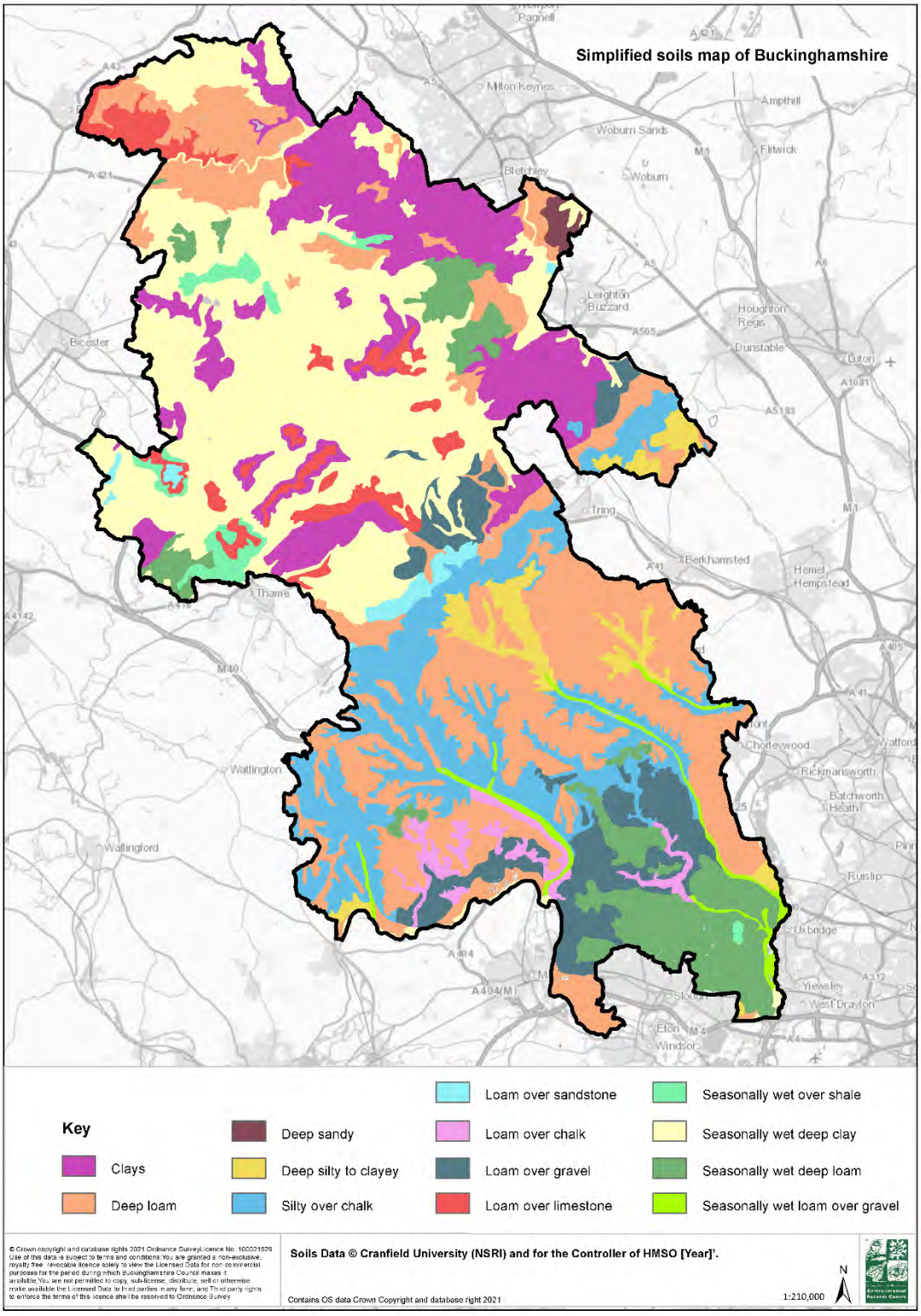
2.62 Map 8, below, shows a simplified map of the underlying and surface geology of Buckinghamshire. Its clearly shows the chalk, sands and gravels in the Chilterns and to the south of the county, the areas of clays and bands of limestones and calcareous sandstones in the north. The Greensands band is also clearly visible across the county and towards the Bedfordshire border. Several Local Geology Sites are also visible, including larger sites on the northern edge of the Chilterns.

Map 8: Combined geology of Buckinghamshire and Local Geological Sites



Map 9: Simplified soil types across Buckinghamshire

2.63 This map shows, in the main, the clays in the northern part of Buckinghamshire, and loams in the south. There is local variation throughout, including the deep loams in the far north, sandy soils in the greensand ridge area in the north-east and loams over chalk in the Chilterns and over gravel further south.



iv) Ecological sub-areas – Landscape Areas of Buckinghamshire

National Character Areas

2.64 The area-based actions set out later in this LNRS are largely centred around Natural England's National Character Areas (NCAs) 15 that cover the area, which are, broadly from north to south:

- Cotswolds (just a small area in the far north-west of the county)
- Bedfordshire and Cambridgeshire Claylands with Bedfordshire Greensand Ridge and Yardley Whittlewood Ridge.
- The Upper Thames Clay Vales
- Midvale Ridge
- Chilterns
- Thames Valley

Each of these areas is defined by its landscape and a distinctive and characteristic mosaic of habitats and species that sets them apart from other parts of Buckinghamshire and England. Map 10, below, shows the location of each of the NCAs across Bucks and beyond.

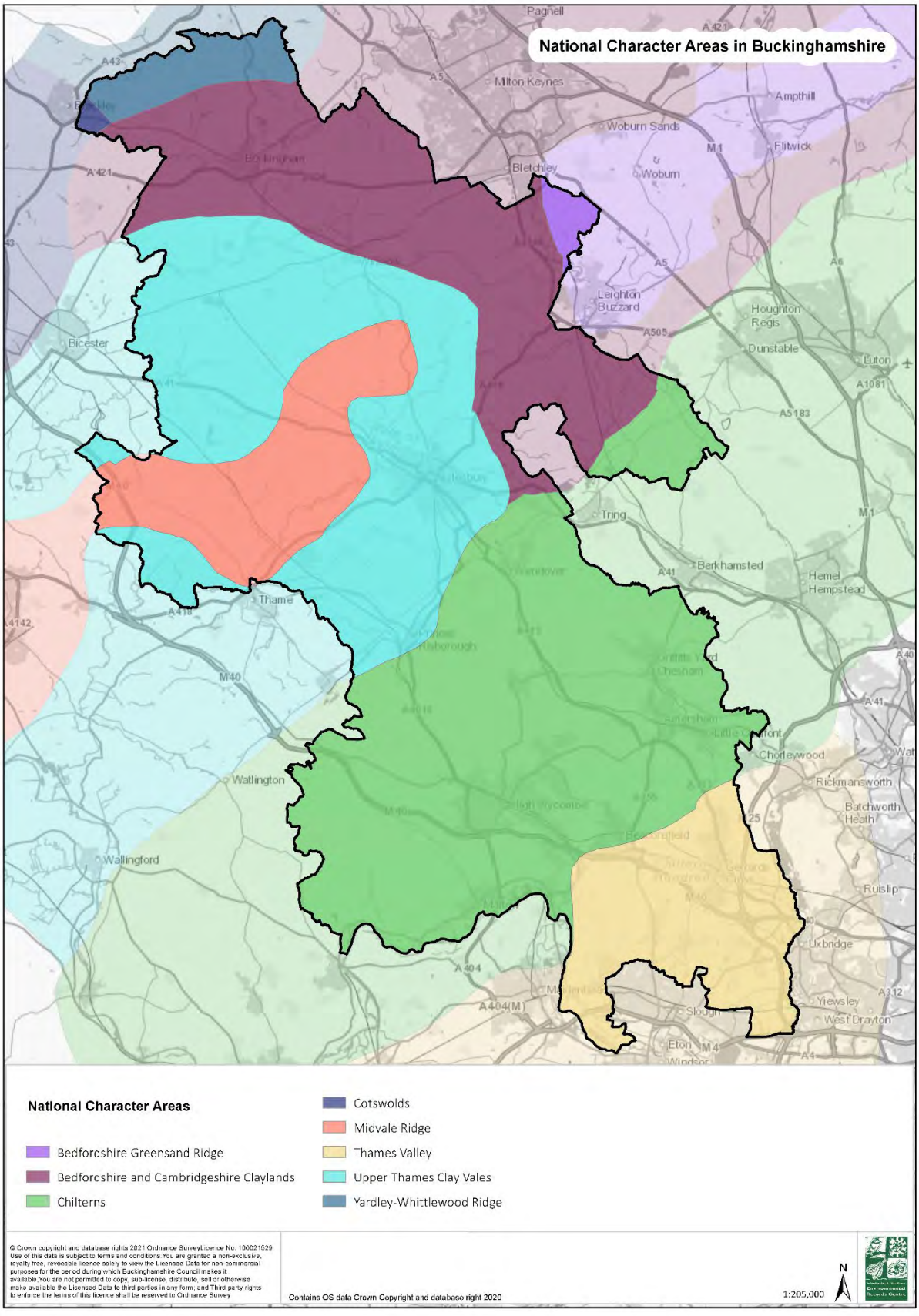
2.65 National Character Areas follow natural subdivisions, rather than administrative ones, with the purpose of forming a good decision-making framework for the natural environment. NCA profiles are working documents and are available for each NCA.

2.66 The relevant biodiversity and broader geology, topography and pressures upon them of each of the NCAs applicable to the Buckinghamshire area are summarised below, to inform the identification of outcomes and prioritised actions to achieve them, required by the pilot LNRS processes Steps 3 and 4.

2.67 Alongside the area-wide actions applicable to the whole of Buckinghamshire, we have identified below more locally-specific actions needed within each National Character Area, based on a summary of that national character area's biodiversity and wildlife, and a description of the challenges each faces.

[15] According to Natural England, "There are 159 Character Areas, each of which is distinctive with a unique 'sense of place'. These broad divisions of landscape form the basic units of cohesive countryside character, on which strategies for both ecological and landscape issues can be based. The Character Area framework is used to describe and shape objectives for the countryside, its planning and management." (Statement from: https://data.gov.uk/dataset/21104eeb-4a53-4e41-8ada-d2d442e416e0/national-character-areas-england)

Map 10: Natural England's National Character Areas, covering Buckinghamshire



Supplied by and with thanks to: BMERC

i. North Buckinghamshire NCAs[16]

Description: topography, landscape, geology and soil type

2.68 The **Yardley Whittlewood Ridge** NCA is a low and gently undulating limestone plateau commonly referred to locally as the Ridge. It runs in a south-west to north-east direction inbetween the nearby towns of Northampton and Milton Keynes and the elevated topography creates a physical boundary between the catchments of the River Nene to the north and River Great Ouse to the south. The Ridge is more distinctly elevated in the south-west where it rises from the adjacent low-lying claylands. From the top, the land slopes away gently in most directions, giving long views over the surrounding countryside.

2.69 The Ridge contains a variety of semi-natural habitats, including ancient woodland, wood pasture and parkland, mature, species-rich hedgerows, lowland meadow and flood plain grazing marsh, fens and reedbeds. It is a well-wooded landscape with a historic feel stemming from the former Royal Hunting Forests of the 13th century around Yardley Chase, Salcey and Whittlewood forests. The Ridge retains a high proportion of ancient woodland of national importance designated as Sites of Special Scientific Interest and supports a wide range of species, particularly scarce species of butterfly such as the white admiral and wood white. The planting of conifers has formed dense plantations in some areas, but a sense of history is maintained by the still extensive ancient semi-natural broadleaved woodland, which has networks of rides and occasional open grasslands ('forest lawns'), containing typical species such as oak, ash and field maple, with birch and aspen present locally.

2.70 Despite being close to Northampton, Milton Keynes and Towcester, the Ridge retains a rural character due to its sparse population and lack of major settlements but with a large number of historic houses and designed parkland landscapes, which along with the woodlands, provide opportunities for recreation and visitors.

2.71 The **Bedfordshire and Cambridgeshire Claylands** is a broad, gently undulating, lowland plateau dissected by shallow river valleys that gradually widen as they approach The Fens NCA in the east. Within it, but distinct from it, is the **Bedfordshire Greensand Ridge**, a contrasting narrow and elevated outcrop of Greensand, with its associated habitats on acidic soils such as grassland, heathland and woodland. Views of the Bedfordshire and Cambridgeshire Claylands NCA and its large-scale arable farmland can be seen in most directions, from the elevated ground of the **Yardley Whittlewood Ridge, Bedfordshire Greensand Ridge**, East Anglian Chalk and **Chilterns** NCAs. The NCA contains the Forest of Marston Vale – one of 12 Community Forests in England – and to the south, around Luton, a small proportion of the Chilterns Area of Outstanding Natural Beauty (AONB).

2.72 While predominantly an arable and commercially farmed landscape, a wide diversity of seminatural habitats are also present here, including a number of internationally important and designated sites that support a range of species – some rare and scarce – and offer opportunities for people to have contact with the natural environment. The River Great Ouse and its tributaries meander slowly and gently across the landscape, with the source just north of

[16] Information from the NCA profile 91 (NE501) and NCA profile 88 (NE555). Natural England, 2013 and 2014 respectively; and a review by the Bucks & MK NEP's Biodiversity Action Plan working group.

Brackley (just within the adjacent Yardley Whittlewood Ridge NCA). Flowing in an easterly direction, the Great Ouse meanders gently in characteristic broad loops through Buckinghamshire, around the northern edge of Milton Keynes through an enclosed landscape of watermeadows and attractive limestone villages towards Bedford and on into Cambridgeshire.

2.73 The **Bedfordshire Greensand Ridge is** a narrow ridge running north-east, south-west, rising out of – and entirely surrounded by – the Bedfordshire and Cambridgeshire Claylands NCA. It is a distinctive ridge with a north-west-facing scarp slope, formed by the underlying sandstone geology which has shaped the landscape and industry of the Ridge. Its historic landscapes, including the farmland, parklands and historic architecture, combined with small settlements, greenbelt and woodlands ancient and modern, give parts of the NCA a more timeless feel than the Bedfordshire and Cambridgeshire Claylands which surround it. There is a patchwork of semi-natural habitats throughout the NCA, including flood plain grazing marshes, lowland heathland and meadows and mixed deciduous woodland.

Only the very south-western part of the ridge falls into the Buckinghamshire & Milton Keynes area, to the south-east of Milton Keynes. The north-west facing scarp has a mix of coniferous and deciduous woodland, pasture, arable and heathland, overlooking Milton Keynes.

Designated Sites and Biodiversity Opportunity Areas

2.74 The north Bucks area contains several designated sites and the following Biodiversity Opportunity Areas:

- Whittlewood Forest BOA
- Whaddon Chase BOA
- Ouse Valley BOA
- Greensand Ridge BOA

Habitats and species of importance

2.75 The northern part of Buckinghamshire contain a diverse range of habitats and species of importance – such as lowland mixed deciduous woodland, wood pasture and parkland with ancient and veteran trees; and species often associated with the remnant ancient woodland – including butterflies such as the purple and black hairstreaks and white admiral butterflies; and the nationally-rare Barbistelle and Bechstein bats, as well as other locally-rare species.

2.76 Riparian and wetland habitats provide valuable habitat connectivity within the landscape and support populations of breeding and overwintering birds, water vole, otter, great crested newt and species of stonewort. The farm-scape supports farmland birds such as skylark and grey partridge, and brown hare.

2.77 Within the greensand ridge, there is a patchwork of semi-natural habitats, including flood plain grazing marshes, lowland heathland and meadows and mixed deciduous woodland. On the acidic soils, numerous rare species of fungi are found. The Ridge is important for species including adders, woodlarks, natterjack toads and specialised mire (waterlogged) plants. The scarp and upper ridge have poor quality acidic soils. Here, there are important heath habitats,

some of significant wildlife value. The Grand Union Canal cuts through the very south-west. Ancient, semi-natural woodland is found on a mix of soil types ranging from heavy, poorly drained clays to acid well drained soils associated with the Lower Greensand.

2.78 The lowland heathland, typified by heather and wavy hair grass, supports a characteristic mix of species, which along the Ridge include notables such as the natterjack toad, nightjar, adder and proliferous pink. Open sandy areas provide excellent conditions for a range of specialised invertebrates, especially bees, wasps and spiders. Lowland acid grassland is characterised by fine-leaved grasses such as fescues and bents, with a range of plants such as tormentil, heath bedstraw, shepherd's cress and clovers. Bryophytes, rare and/or scarce macro-fungi and lichens are a special feature. Common blue and small copper butterflies can be abundant and there are records for bugs such as the bishop's mitre shield bug.

2.79 The variety of semi-natural habitats of the Yardley-Whittlewood Ridge support a range of rare species of butterflies including white admiral and wood white, as well as dormouse, barbastelle and noctule bats, and numerous scarce moths and specialist beetles.

ii. Aylesbury Vale Area NCAs[17]

Description: topography, landscape, geology and soil type

2.80 The **'Upper Thames Clay Vales'** is a broad belt of open, gently undulating lowland farmland on predominantly Jurassic and Cretaceous clays. The area encircles the Midvale Ridge and covers an extensive area of low-lying land extending to Aylesbury in the east. The area is dominated by watercourses, including the River Thame and Upper Ray, and there are also lakes associated with mineral extraction areas. Ponds are commonly found in grazed fields. There is little woodland cover except for the Bernwood Forest complex to the east. Hedgerows and mature field and hedgerow trees are a feature, and many watercourses are fringed with willow or poplar. There are several major transport routes, the large town of Aylesbury and patches of intensive industrial influence.

2.81 The **'Midvale ridge'** is a band of low-lying limestone hills stretching east–west from the Vale of Aylesbury. It is a predominantly agricultural area with a mixed arable/pastoral farming landscape, cereals being the most important arable crop. The unusual geology gives rise to habitats that are uncommon in the south of England, such as calcareous flushes and grassland. The ridge is notably more wooded in character than the surrounding Upper Thames Clay Vales with about 9 per cent woodland coverage. To the north-west lies Shabbington Wood, the largest remnant of the former Royal Forest of Bernwood, and about a third of the woodland in the area is designated as ancient woodland.

Designated Sites and Biodiversity Opportunity Areas

2.82 The Vale of Aylesbury contains several designated sites and the following Biodiversity Opportunity Areas, including:

[17] Information from the NCA profiles 108 and 109 (NE570 and NE417) Natural England, 2014 and 2013 respectively; and a review by the Bucks & MK NEP's Biodiversity Action Plan working group.

- Bernwood BOA
- Upper Ray BOA
- Brill and Muswell Hill BOA
- Thame Valley BOA

Habitats and species of importance

2.83 The 'Upper Thames Clay Vales' river valley meadows and pastures are regionally important for **wading birds,** including small breeding numbers of lapwing, snipe, curlew and redshank, and large wintering numbers of lapwing and golden plover. Nationally important numbers of breeding and wintering wildfowl are associated with water-filled gravel pits and reservoirs. Nationally significant populations of **native black poplar** occur in the area.

2.84 The 'Midvale Ridge's calcareous flushes and grassland support a variety of rare plants and invertebrates. The woodlands support important populations of **Bechstein's Bat**, as well as uncommon and rare butterflies including the nationally rare **black hairstreak butterfly**. The brown hairstreak butterfly, a priority species, is also found in the area. The arable land supports nationally important assemblages of **farmland birds**. Arable weed communities are also favoured by the light soils and many rapidly declining plants are present.

iii. Chilterns Area NCAs[18]

Description: topography, landscape, geology and soil type

2.85 The **'Chilterns'** is an extensively wooded and farmed landscape which is designated as an Area of Outstanding Natural Beauty (AONB). This designation has helped preserve the landscape and associated habitats. It is underlain by chalk bedrock that rises up as a dip slope from the London Basin to form a steep north-west facing escarpment offering long views over the adjacent Upper Thames Clay vales to the Mid Vale Ridge and beyond. The dip slope is divided by valleys which descend south-east towards the River Thames. Although many of the valleys are dry, some contain internationally-rare chalk streams and rivers and the north-west facing scarp foot also contains several small streams.

Habitats of importance

2.86 The Chilterns is home to a wonderful variety of wildlife including many protected and notable species. The AONB is particularly important for its chalk grassland, chalk streams, ancient woodlands (especially beech) and habitats provided by arable farmland. Species-rich ancient hedgerows and hedgerow trees provide important wildlife habitat. Fine-grained variations in soils, topography and past management have given rise over millennia to rich habitat mosaics. These include box woodland and juniper scrub, scarp slope and dip slope chalk streams, wayside verges and disused quarries. Wood pasture and veteran trees, heathland and acid

[18] Information from the NCA profile 110 (NE 406): Chilterns. Natural England, 2013; the AONB Management Plan for the Chilterns; and a review by Chilterns Conservation Board.

grassland (habitats often associated with common land), plus traditional orchards and parkland add to the mix.

2.87 The habitats associated with the Chilterns are often a by-product of traditional management – grazing, woodland management and quarrying – over many millennia by farmers, woodland owners and other land managers. Its chalk escarpment provides a crucial stepping-stone for species moving through the landscape, often in response to climate change and other pressures.

Woodlands

2.88 The Chilterns is one of the most wooded areas of the country, famous for its extensive beech woods and ancient woodland.

2.89 Much of the woodland in the Chilterns is found where agriculture would be more difficult on steeper slopes and poorer soils. Priority habitats include Lowland Beech and Yew Woodland, mixed deciduous woodland and wood pasture and parkland. The Chilterns has a rich heritage of parkland, wood pasture and common land, with high concentrations of veteran trees, associated deadwood invertebrates and fungi.

2.90 Ancient woodland contributes greatly to the biodiversity resource of the Chilterns supporting species such as red helleborine, coralroot and wood barley. Ancient woodland makes up around 13% of the Chilterns AONB – this compares to 2% of England as a whole.

2.91 Small areas of rare box wood are also found at the Kimble and Ellesborough Warrens. Some of the best examples of Lowland Beech and Yew Woodland are protected by SSSI and SAC status with many others being identified as Local Wildlife Sites. And traditional orchards, particularly cherry, were once important in the Chilterns, and the mix of old trees and grassland are valuable for wildlife.

Farmland habitats

2.92 Farmland is the main land use in the Chilterns, covering over 60% of the Chilterns AONB and providing a wide range of wildlife habitats. There has been a history of mixed farming in the Chilterns AONB however, arable systems now predominate. Farming has created a mosaic of arable and grassland habitats, stitched together by hedgerows and interspersed with woodland, commons and downland. Much of the wildlife interest in arable areas is limited to the field margins and hedgerow network.

2.93 Some plant species that were once considered problem weeds (e.g. field cow wheat and shepherds needle) are now amongst Britain's rarest plants. Field margins can also provide habitats for declining bird species, such as corn bunting and grey partridge, plus numerous invertebrates and small mammals.

2.94 Arable fields provide attractive nesting sites for skylarks and lapwing, while winter stubble provides a valuable food supply for seed eating birds such as the corn bunting and yellowhammer.

2.95 Farmland contains most of the hedgerows within the AONB. Hedges and hedgerow trees provide important cover and nesting habitat for birds and form important linear habitats. Many of the hedgerows which remain in the Chilterns are of a great age, containing a diverse mix of species.

Chalk grassland

2.96 The Chilterns supports important concentrations of species-rich chalk grassland, found mainly along the escarpment and steep valley sides. Most of the chalk grassland in the county is in the Chilterns, and it has developed over centuries of grazing on nutrient -poor chalk soils.

2.97 Chalk grassland and scrub mosaics have a high conservation value and are home to populations of chalk specialist species including wild candytuft, pasque flower, silver-spotted skipper and glow-worm.

Chalk streams

2.98 Chalk streams are an internationally rare landscape feature and habitat, found mainly in England and North West Europe. There are 224 chalk streams in England1, which represents approximately 80% of the global resource. As such the UK has a special duty to conserve these habitats.

2.99 Chalk streams are a key feature of the Chilterns AONB landscape. They are important habitats for wildlife and support a massive range of plants and animals and support some of the AONB's most threatened species including otter, water vole and brown trout.

2.100 The most significant of these found in the Buckinghamshire Chilterns are: The Hambleden Brook, The River Wye, The Hughenden Stream, The River Misbourne, and The River Chess.

Species of importance

2.101 The extent of woodland in the Chilterns means that bats are a common protected group of species. The hazel dormouse is still recorded at a small number of sites, but it has been in continuous decline over recent decades. A range of Fungi and saproxylic invertebrates are of particular importance.

2.102 The Lowland Calcareous Grassland (chalk grassland) areas support plant and moth and butterfly species – for example, including rare species such as the Chiltern Gentian, Juniper, Striped Lychnis Moth and Chalkhill Blue Butterfly.

2.103 The Chalk streams and rivers are associated with plant species such as water-crowfoot, fish such as brown trout and bullhead and birds such as the kingfisher, Water vole where previously found but are now probably extinct locally, otter may be starting to re-establish a presence.

2.104 The Chilterns also contains a number of farmland bird and arable flora hotspots, although many of these species are declining.

Designated Sites and Biodiversity Opportunity Areas

2.105 The Chilterns NCA contains several designated sites and the following Biodiversity Opportunity Areas, including:

- Ashridge & Ivinghoe Beacon BOA,
- Wendover Woodlands BOA,
- Dunsmore woods BOA,
- Chiltern Escarpment BOA,
- Central Chiltern Chalk Rivers BOA,
- Hambleden and Wormsley Valleys BOA,
- Medmenham BOA,
- South Western Commons BOA,
- Radnage Valley BOA,
- Gomm Valley BOA,
- Upper Hughenden Valley BOA,
- Chess Valley BOA.

iv. Thames Valley

Description: topography, landscape, geology and soil type

2.106 The **Thames Valley**[19] stretches from Reading to the Colne Valley in south-east Buckinghamshire. The catchment of the Thames and its tributaries drains from surrounding areas and provide ecological links to them, for example with rivers feeding in from south and north-east, as well as from the Chilterns, including chalk streams, to the north. The Thames area plays a key part in the flood defence strategy for London. The Colne Valley Regional Park, in the south-east corner of Bucks, is a mosaic of farmland, woodland and water with rivers, canals and lakes. The River Colne provides a valuable route for species movement between the Thames and Hertfordshire. To the west of the Colne Valley Regional Park is the area of South Bucks Heathland and Parkland, which has high biodiversity value and includes a number or protected areas, including acid grasslands and heaths and ancient woodlands.

[19] Text and information from the NCA Profile 115 (Thames Valley) (NE379). Natural England, 2012; and a review by the Bucks & MK NEP's Biodiversity Action Plan working group .

Designated Sites and Biodiversity Opportunity Areas

2.107 The Thames Valley contains several designated sites and the following Biodiversity Opportunity Areas, including:

- South Bucks Heaths and Parkland BOA
- Colne Valley BOA

Habitats and species of importance

2.108 Across the area there are many notable habitats including reedbeds, wet woodlands, lowland meadows (for example around Stoke Poges and Wexham), river valley pastures important for breeding birds, acid and calcareous grasslands, fens (at Burnham Beeches and Black Park), orchards (for example those around Langley that are of potential BAP-quality traditional orchards) and hedgerows. There are BAP-quality woodland and ponds in Littleworth Common and Burnham Beeches and potential BAP-quality ponds across the area. Temporary ponds on heathlands are important for starfruit. Burnham Beeches Special Area for Conservation (SAC) contains wood pasture with large number of ancient pollards. There are also many parkland sites including Black Park, Langley Park, Dorney, Cliveden and Dropmore.

v) Natural capital in Buckinghamshire

All habitats have a part to play in nature's recovery

2.109 Alongside the key habitats and species, **it is important to recognise that *all* habitats, wherever they occur, have the potential to benefit wildlife and contribute to nature's recovery.** Water bodies and river catchments are also a fundamental element of ecosystem function. Managed sensitively these habitats can also benefit people.

Taking a natural capital approach

2.110 Taking a "natural capital" approach recognises that all these habitats (or natural "assets") can benefit wildlife and nature's recovery - but can also provide benefits to people. Such benefits are wide-ranging and essential to the way we live and are known as "ecosystem services" – as outlined in Box 1, below.

2.111 Much work is progressing on how to deliver the natural capital and ecosystem services approach on the ground and how to use it to inform and influence management and decision-making. One of the most important steps is to recognise and quantify ecosystem service delivery (the physical flow of services derived from natural capital). Additional insight can be gained by taking a spatial perspective on the variation in ecosystem service supply and demand across a study area using a Geographic Information System (GIS).

2.112 Maps are able to highlight hotspots and coldspots of ecosystem service delivery, highlight important spatial patterns that provide much additional detail, and are inherently more user friendly than non-spatial approaches. When information on supply and demand for ecosystem services is known, it is also then possible to determine objectively the best areas to create habitat to increase the supply of each particular ecosystem service – here referred to as habitat opportunity mapping.[20]

[20] Habitat opportunity mapping more broadly, refers to identifying opportunities for habitats to meet other purposes and functions; in this LNRS it refers to provision of ecosystem services through habitat creation or improvement.

Box 1 Ecosystem services:
Benefits that Buckinghamshire's habitats provide to wildlife and people

- New or improved and better-connected habitats provide **can improve biodiversity and resilience of wildlife to external pressures** – e.g. through appropriate land management, restoration or creation schemes. Appropriate management and linkage between habitats can reverse the effects of habitat fragmentation;

- Trees can absorb pollutants and help improve **local air quality**;

- **Pollinators** need habitats, shelter and nectar to secure our **food provision**;

- Vegetation slows the flow of water over the ground, **reducing flood risk** and improving **water quality and supply** in our water courses – e.g. through appropriate land management in headwater catchments, restoring functioning floodplains and associated wetland habitats;

- Vegetation can **dampen noise**;

- Trees in particular **absorb carbon** (carbon "sequestration"), contributing to climate change mitigation;

- Vegetation can also adjust the micro-climate, for example by providing **shade** which can reduce the "urban heat island" effect in built-up areas;

- Habitats and natural green spaces, as well as vital for nature, can provide **access for recreation, with health and wellbeing benefits** for the people who live and work nearby;

- **Economic opportunities and benefits** –e.g. visitor / tourism economy and associated businesses; impacts on land values; opportunities for new commercial activity – e.g. in conservation, agriculture, food production, timber, renewable energy, outdoor environmental education, recreation, land management

Ecosystem services – supply and demand maps for Buckinghamshire

2.113 Natural Capital Solutions has recently quantified and mapped the benefits that the habitats of Buckinghamshire provide to people. The following benefits ("ecosystem services") were assessed:

1 Carbon storage
2 Carbon sequestration
3 Air purification
4 Noise regulation
5 Local climate regulation
6 Water flow regulation
7 Water quality regulation
8 Agricultural production
9 Timber production
10 Accessible nature

The detailed assessment methodology is described in the Natural Capital Solutions report[21]

2.114 The models are based on the detailed habitat information determined in the broad habitats map (see Map 1), together with a variety of other external data sets (e.g. digital terrain model, UK census data 2011, open space data, and many other data sets and models mentioned in the methods for each ecosystem service). Note, however, that many of the models are indicative (showing that certain areas have higher capacity or demand than other areas) and are not process-based mathematical models (e.g. hydrological models). In all cases the capacity and demand for ES is mapped relative to the values present within the study area.

2.115 For every ecosystem service listed, the capacity of the natural environment to deliver that service – or the current supply – was mapped. For air purification, noise regulation, local climate regulation, and accessible nature, it was also possible to map the local demand (the beneficiaries) for these services. The importance and value of ecosystem services can often be dependent upon its location in relation to the demand for that service, hence capturing this information provides useful additional insight – we can start to uncover where the demand for ecosystem services may lie, and the current habitat capacity to deliver them are – which can be helpful with trying to identify where best to create new habitats providing different services. Mapping demand was not, however, possible, for the other services where there was no obvious method to apply, or local demand is not relevant, such as food or timber production.

2.116 NB - in the ecosystem services maps that follow (Figures 1-14), the highest amounts of service provision and demand (hotspots) are shown in red, with a gradient of colour to blue, the lowest amounts (coldspots).

[21] Rouquette, J.R. , Natural Capital Solutions (2020). Mapping natural capital, ecosystem services and opportunities for habitat creation in Buckinghamshire. Report for Buckinghamshire Council. Available at: https://bucksmknep.co.uk/projects/natural-capital-mapping/

1. Carbon Storage

Carbon storage capacity - what is it and why is it important?

2.117 **Carbon storage capacity indicates the amount of carbon stored naturally in soil and vegetation.** Carbon storage and sequestration is seen as increasingly important as we move towards a low-carbon future. The importance of managing land as a carbon store has been recognised by the UK government, and land use has a major role to play in national carbon accounting. Changing land use from one type to another can lead to major changes in carbon storage, as can restoration of degraded habitats. Note that carbon storage measures the stock of carbon in the natural environment, whereas carbon sequestration (see below) measures its flow – carbon capture from the atmosphere, taking account of annual flux.

Results for Buckinghamshire

2.118 **Carbon storage capacity in the region, as shown in Figure 1, is clustered in areas of habitats such as broadleaved woodland and other woodland types,** which are particularly efficient at carbon storage. These are **particularly prevalent in the southern half of the county**. However, **most green spaces of the region support some level of carbon storage,** with much lower levels in urban areas dominated by buildings and sealed surfaces. The score is out of a maximum possible of 100 (given to broadleaved woodland).

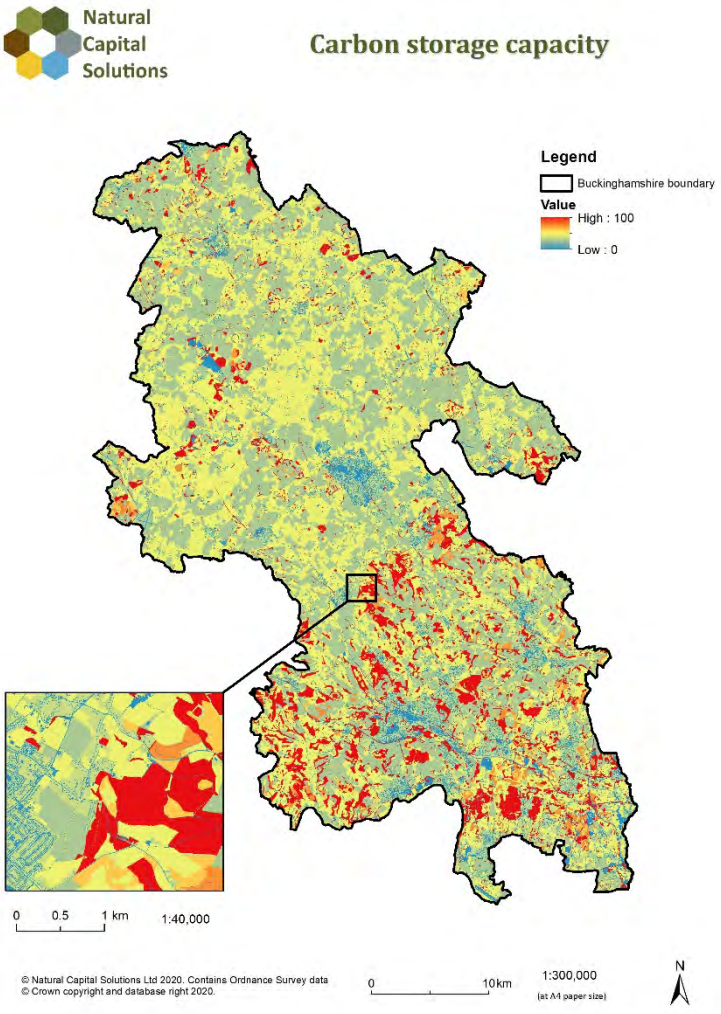


Figure 1: Baseline carbon storage capacity across Buckinghamshire

Carbon sequestration

Carbon sequestration capacity – what is it and why is it important?

2.119 **Carbon is sequestered (captured) by growing plants.** Plants that are harvested annually (e.g. arable crops, improved grassland) will be approximately carbon neutral over the course of a year as the sequestered carbon is immediately harvested. There is very little information about sequestration in other habitats (apart from woodland), but these are likely to be lower.[22] Therefore, estimates are solely based on woodland carbon sequestration.

Results for Buckinghamshire

2.120 The baseline carbon sequestration map (Figure 2) **shows high areas of carbon sequestration (in red) predominantly in the south of the county, which are areas of mostly broadleaved woodland**. Coniferous woodland plantations show up as orange, and are also reasonably good at sequestering carbon. Coniferous woodland sequesters carbon at a faster rate than broadleaved woodland; but it is usually managed for timber, which involves regular thinning, hence reducing the accumulation of carbon overall. Although managed woodland provides a range of other benefits and can lock in carbon for some time – e.g. when used as a building material.

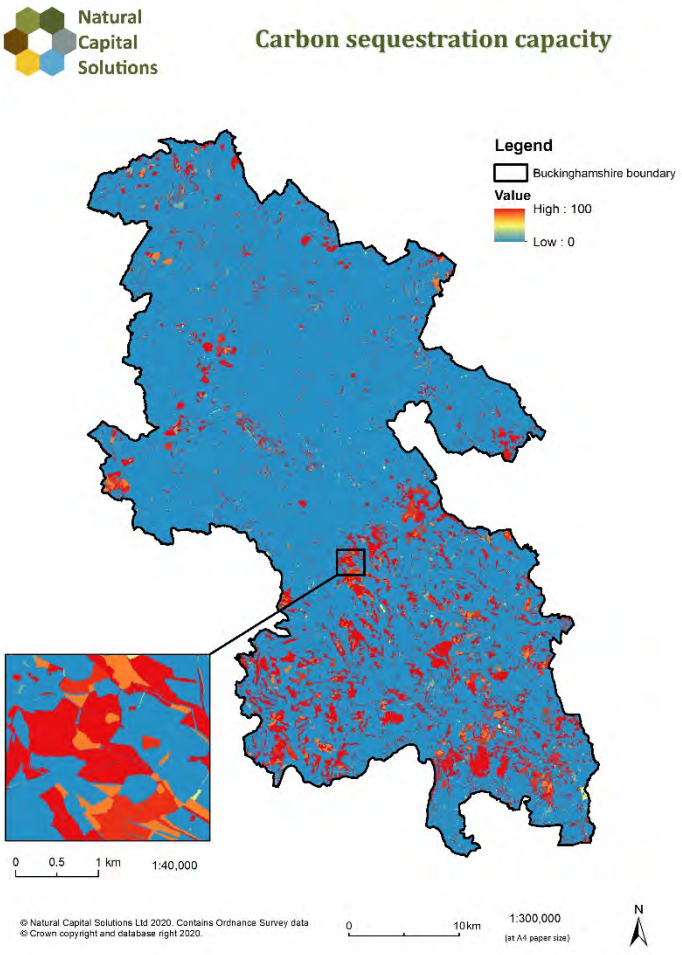


Figure 2: Carbon sequestration capacity across Buckinghamshire

[22] NB carbon sequestration potential may also be great in permanent grasslands, especially with high potential to develop (restore) organic matter content, and also wetlands, although more details on-the-ground data would be needed as well as further research, to identify this.

2. Air quality (purification capacity and demand)

Air purification capacity – What is it and why is it important?

2.121 According to the World Health Organisation, **air pollution is the greatest environmental health risk in Western Europe and globally**. In the UK alone, it is estimated to have an effect equivalent to 29,000 deaths each year and is expected to reduce the life expectancy of everyone in the UK by 6 months on average, at a cost of around £16 billion per year (Defra 2016[23]). Air pollution also contributes to climate change, reduces crop yields, and damages biodiversity.

2.122 **Air purification capacity estimates the relative ability of vegetation to trap airborne pollutants or ameliorate air pollution.** Vegetation can be effective at mitigating the effects of air pollution, primarily by intercepting airborne particulates (especially PM_{10} and $PM_{2.5}$) but also by absorbing ozone, SO_2 and NO_x. **Trees provide more effective mitigation than grass or low-lying vegetation, although this varies depending on the species of plant.** Coniferous trees are generally more effective than broadleaved trees due to the higher surface area of needles and because the needles are not shed during the winter.

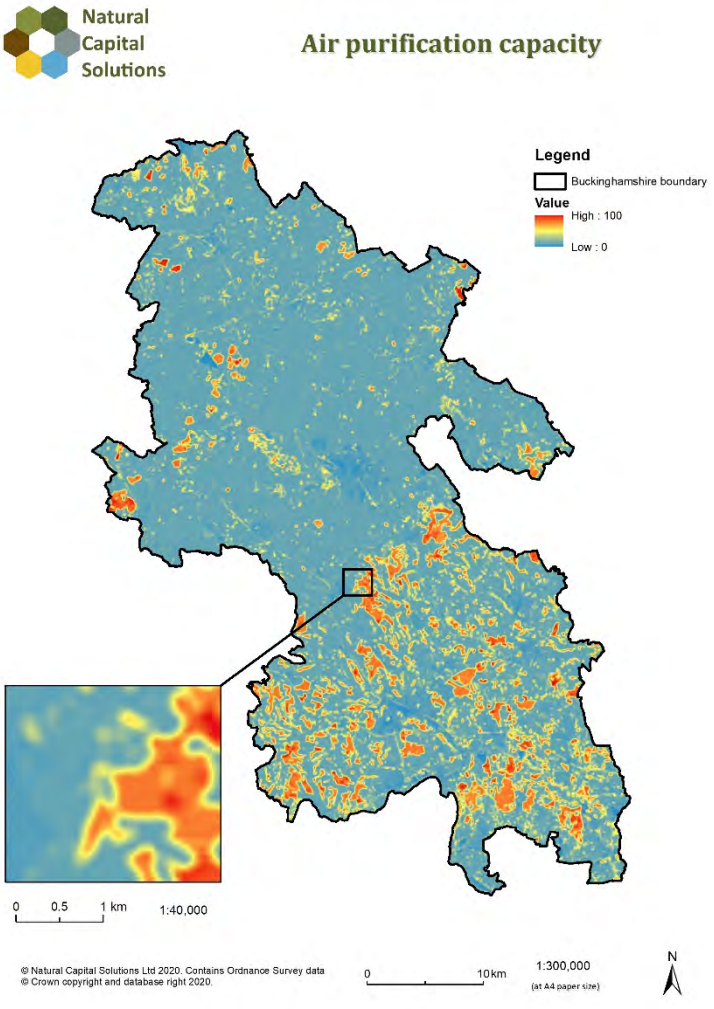


Figure 3: Air purification capacity across Buckinghamshire

[23] Defra (2016) Air pollution in the UK 2015. Crown Copyright.

Results for Buckinghamshire

2.123 **Woodland is by far the best habitat at intercepting and absorbing air pollution, with the very highest scores from coniferous forests**. **The lowest scores (dark blue) are from man-made sealed surfaces and water features which effectively have zero capacity to ameliorate air pollution**. Of particular note are the densely forested areas, apparent as dark red patches of high air purification capacity in Figure 3. These include much of southern Buckinghamshire, with more isolated patches in Aylesbury Vale. Urban areas display much lower levels of air purification capacity in general.

Air purification demand - What is it and why is it important?

2.124 **Air purification demand estimates societal and environmental need for ecosystems that can absorb and ameliorate air pollution**. Demand is assumed to be highest in areas where there are likely to be high air pollution levels and where there are lots of people who could benefit from the air purification service.

Results for Buckinghamshire

2.125 **Air purification demand is highest in urban centres** as these have both higher air pollution levels and higher populations that would benefit from better air quality. The main road network is also clearly visible as a major pollution source, and where these main roads pass through built-up areas, there is increased demand for air purification.

2.126 In Figure 4, **the areas of highest demand are clustered around major towns in the region, particularly in Aylesbury and High Wycombe, but also in Buckingham and the towns in the Chilterns and South Bucks**. Outside of these clusters, demand is relatively low across the study region.

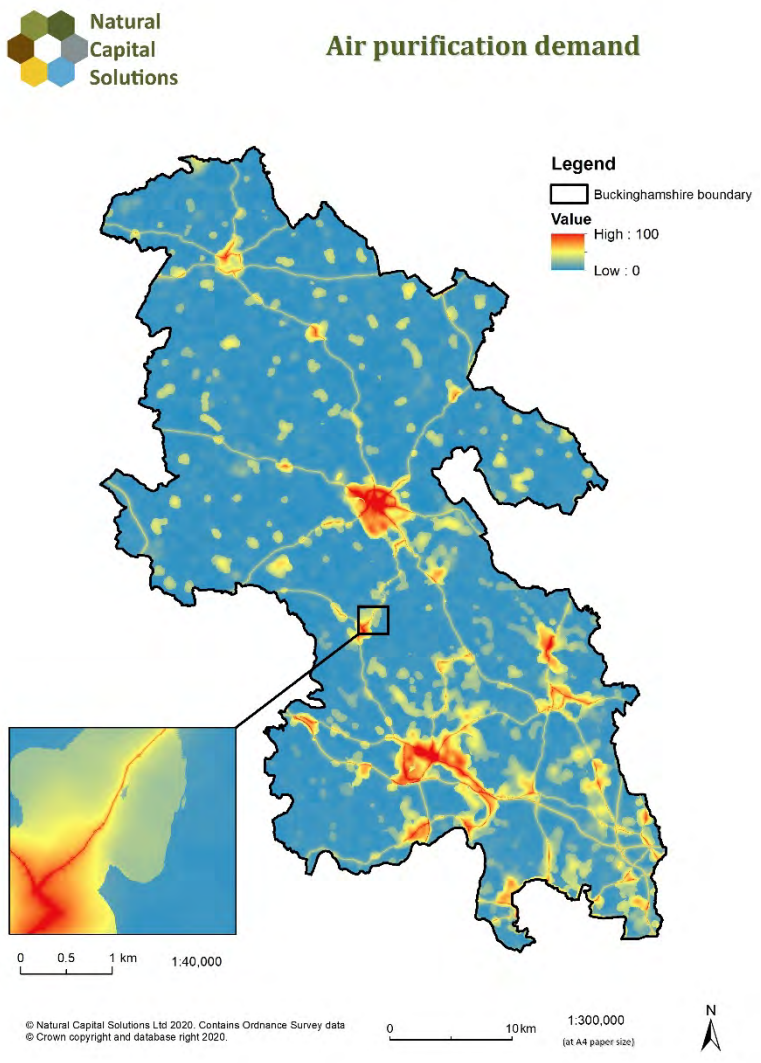


Figure 4: Air purification demand across Buckinghamshire

Balancing supply and demand for air purification services

2.127 By considering both the air purification capacity and demand maps (Figures 3 and 4), it is clear that **there is a significant spatial disparity in air purification capacity and demand**, with the former being higher in rural areas and the latter higher in urban areas. **Planting (or maintaining) trees and woodland close to main roads and other pollution sources in built-up areas would be highly beneficial, with considerable benefits to society**. Air pollution can be very localised, hence it is important to consider the specific location of trees to gain the maximum benefit of this service.

2.128 **Trees are very effective at mitigating the effects of air pollution. However, there are major differences in the ability of different species** to intercept pollution. The location of trees relative to pollution sources also determines how effective they are at removing pollutants, with **trees close to sources being the most effective. Urban woodland is particularly effective** as it has high capacity to absorb pollution and is also situated in locations likely to have high demand for the service.

3. Noise regulation (capacity and demand)

Noise regulation capacity – What is it and why is it important?

2.129 **Noise regulation capacity is the capacity of the land to diffuse and absorb noise pollution**. Noise can impact on health, wellbeing, productivity and the natural environment and the World Health Organisation (WHO) have identified environmental noise as the second largest environmental health risk in Western Europe (after air pollution). It is estimated that the annual social cost of urban road noise in England is £7 to £10 billion (Defra 2013[9]). **Major roads, railways, airports and industrial areas can be sources of considerable noise, but use of vegetation can screen and reduce the effects on surrounding neighbourhoods. Complex vegetation cover, such as woodland, trees and scrub, is considered to be most effective,** although any vegetation cover is more effective than artificial sealed surfaces, and the effectiveness of vegetation increases with width.

Results for Buckinghamshire

2.130 This model is similar to the air purification capacity model and similarly to that, **woodland is by far the most effective habitat at absorbing noise. However, the effects are modest**, with reductions of 2-4 dB typically recorded across dense tree belts. Figure 5, below, shows a broadly similar spatial pattern to Figure 3, air purification capacity. **Noise regulation capacity is relatively low in urban areas, and highest in forested areas, concentrated in the south of the county.** Outside of this area, noise regulation capacity is variable and occurs mainly in clusters around green spaces across the region.

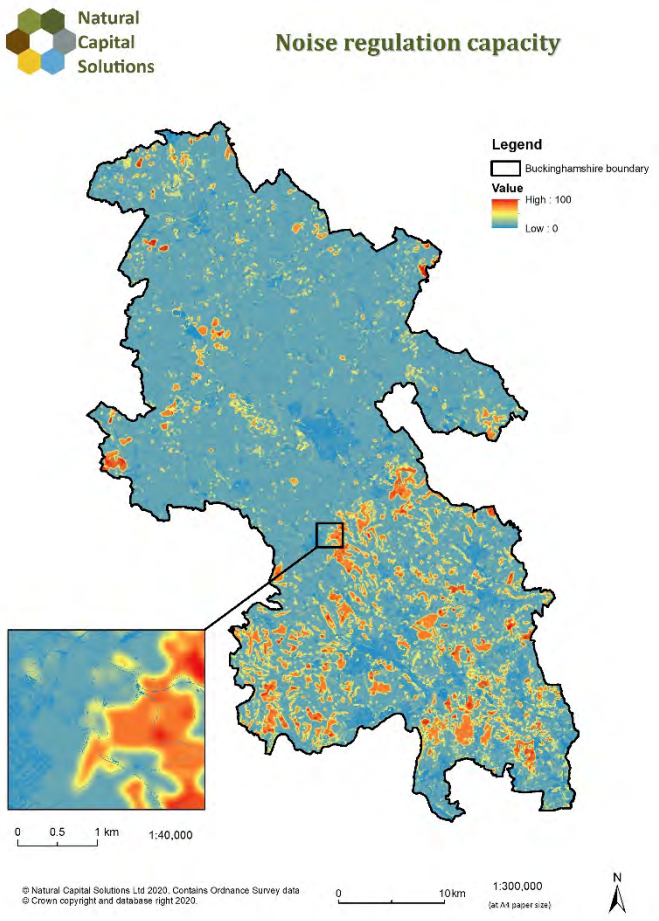


Figure 5: Noise regulation capacity across Buckinghamshire

Noise regulation demand – What is it and why is it important?

2.131 Noise regulation demand estimates societal and environmental need for ecosystems that can absorb and reflect anthropogenic noise.

Results for Buckinghamshire

2.132 Figure 6 shows **that demand is greatest in urban areas close to major roads**, as these contain large populations, with potentially poor health scores, that would benefit from noise abatement from the main roads**. The greatest demand occurs in Aylesbury and High Wycombe and there is also significant demand in Chesham**. Note the **major impact of the M40 motorway along the south of the county and the M25 in the south-east corner**, with noise pollution spreading much further than for the A roads and railways.

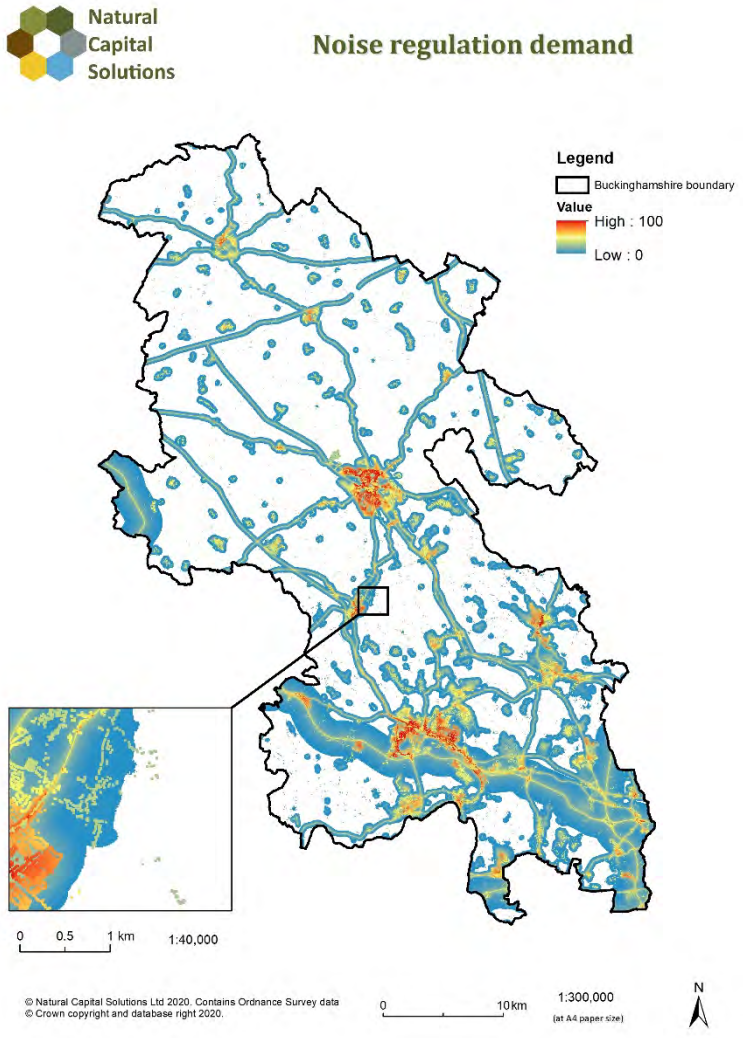


Figure 6: Noise regulation demand across Buckinghamshire. (Areas with zero demand have been excluded to improve map legibility)

Balancing supply and demand for noise regulation services

2.133 The pattern of supply and demand for this service is rather similar to that of air purification, with a spatial disparity between capacity and demand - **capacity is concentrated in more rural areas and demand is clustered around urban areas, as well as roads and railways. Again, planting trees close to main roads and other noise sources would be the most effective mitigation.**

2.134 Studies in many countries have shown that **densely planted tree belts can reduce noise levels, but the effects are modest**, with reductions of 2-4 dB typically recorded. Note however, that there is some evidence to suggest that the presence of **vegetation blocking views of a noise source such as a road can enhance the perception of noise reduction. Densely planted and complex vegetation cover such as trees mixed with scrub is considered to be most effective,** although **any vegetation cover is more effective than artificial sealed surfaces**.

4. Local climate regulation (capacity and demand)

Local climate regulation capacity - what is it and why is it important?

2.135 Land use can have a significant effect on local temperatures. **Urban areas tend to be warmer than surrounding rural land due to a process known as the "urban heat island effect".** This is caused by urban hard surfaces absorbing more heat, which is then released back into the environment, coupled with energy released by human activity such as lighting, heating, **vehicles and industry**. Climate change impacts are predicted to make the overheating of urban areas and urban buildings a major environmental, health and economic issue over the coming years. **Natural vegetation, especially trees / woodland and rivers, are able to have a moderating effect** on local climate, making nearby areas cooler in summer and warmer in winter. **Local climate regulation capacity estimates the capacity of an ecosystem to cool the local environment and cause a reduction in urban heat maxima.**

Results for Buckinghamshire

2.136 Figure 7 shows that, in the absence of large bodies of water, **larger areas of woodland, such as Burnham Beeches, Wendover Woods, Ashridge, Common Wood and Penn Wood provide the highest local climate regulation capacity in the region**. For this reason, Figure 10 shows a similar capacity pattern to Figures 7 and 9, with **service provision greatest in the south. These benefits can extend into adjacent urban areas**. In much of the remaining region, away from woodland and water bodies, capacity is significantly lower.

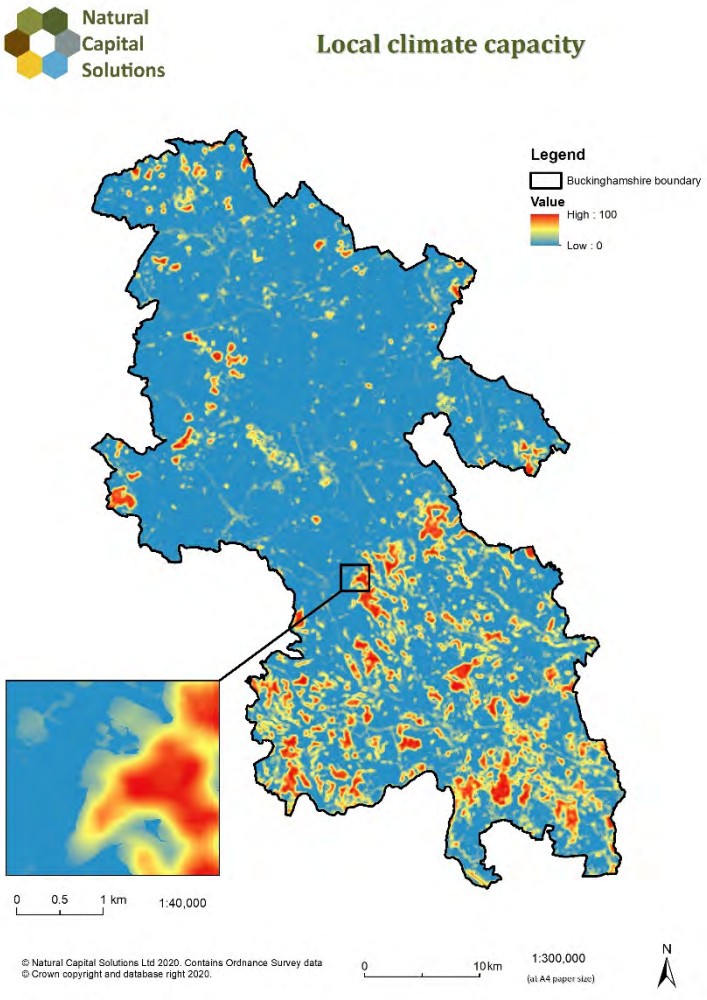


Figure 7: Local climate regulation capacity across Buckinghamshire

Local climate regulation demand

2.137 Local climate regulation demand **estimates societal and environmental need for ecosystems that can regulate local temperatures and reduce the effects of the urban heat island.** Although regulating local climate and moderating the impacts of the urban heat island effect may be considered to be a relatively low priority at present, its importance is likely to increase over time due to climate change and an increasing (and ageing) population.

Results for Buckinghamshire

2.138 Figure 8 shows that by removing areas of zero demand, it is immediately clear that **demand is heavily clustered around urban centres, with Aylesbury and High Wycombe providing particularly large areas of high demand, but also a number of other towns, particularly in the south**. Demand for local climate regulation is effectively zero outside of these centres, and so **interventions looking to reduce the disparity between capacity and demand in this service would benefit heavily from investing in capacity in urban areas** to meet this concentrated demand.

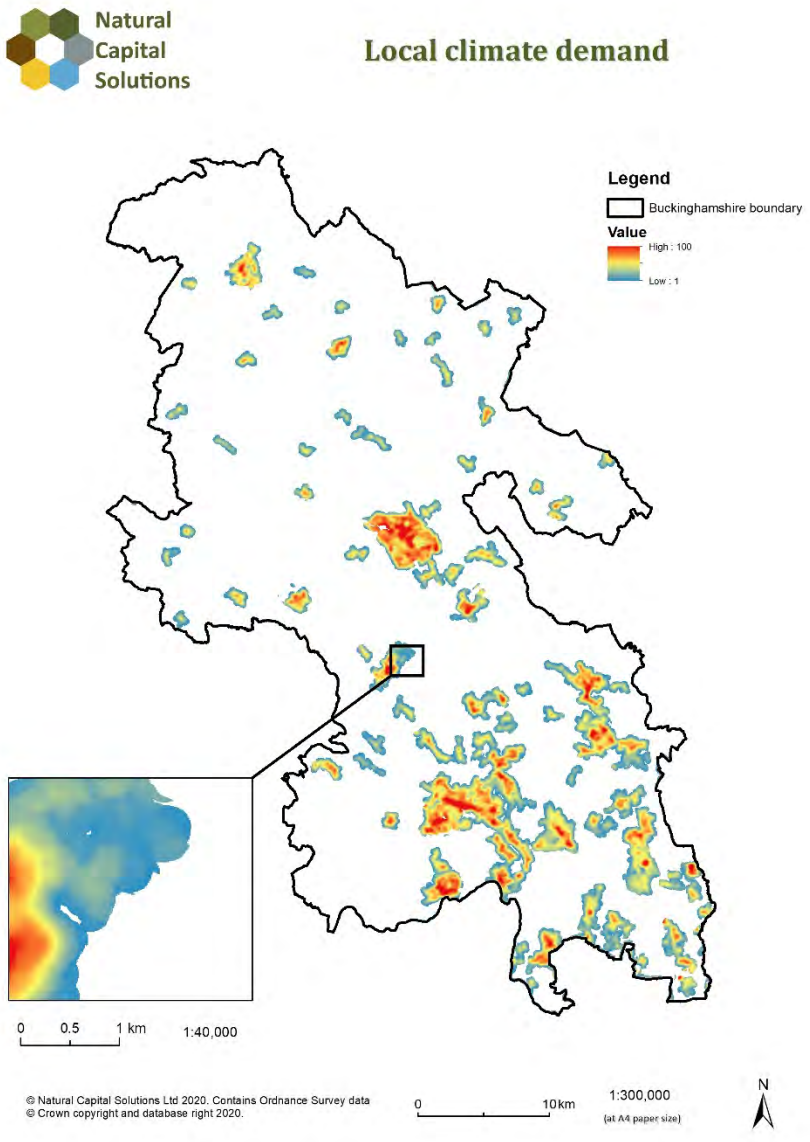


Figure 8: Local climate regulation demand across Buckinghamshire. (Areas with zero demand have been excluded to improve map legibility)

Balancing supply and demand for noise regulation services

2.139 Demand for this service is focussed around the larger, more densely populated communities. The **large areas of woodland adjacent to towns in the south** of the county, and especially those that extend into urban areas, **are particularly beneficial** with respect to local climate regulating services as they are able to bring moderating conditions into the heart of these urban areas. **Installing water features and planting trees would be the most effective way to extend these benefits to other areas**, particularly when these are installed close to or within built-up areas.

5. Water flow regulation

Water flow regulation capacity - what is it and why is it important?

2.140 Water flow regulation capacity is **the capacity of the land to slow water runoff and thereby potentially reduce flood risk downstream**. Following a number of recent flooding events in the UK and the expectation that these will become more frequent over the coming years due to climate change, there is growing interest in working with natural process to reduce downstream flood risk. **These projects aim to "slow the flow**" and retain water in the upper catchments for as long as possible**. Maps of water flow capacity can be used to assess relative risk and help identify areas where land use can be changed**.

Results for Buckinghamshire

2.141 **Some of the best locations for slowing catchment run-off and attenuating flood flows are areas of woodland on flat land. The worst** areas for slowing run-off (blue on the map, Figure 9) **are areas of impermeable surface and slopes**. Though not particularly visible at a regional scale, impermeable sealed surfaces are prominent in urban areas, where water flow regulation capacity is quite poor, and the slopes that are prevalent in the Chilterns will also be poor for this service, where soil permeability is compromised by land management and land-use change.

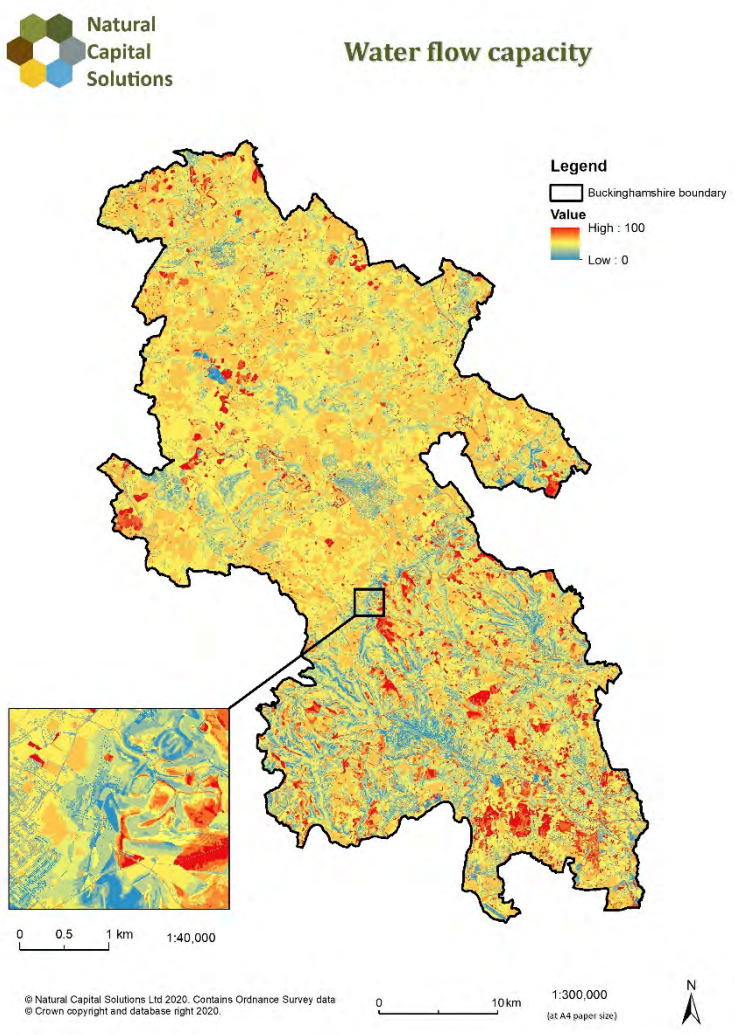


Figure 9: Water flow regulation capacity across Buckinghamshire

2.142 In comparison, areas such as Penn Wood, Naphill Common, Dropmore, Farnham Common, and a number of other woodland patches throughout the county, are characterised by **gentle slopes and woodland, which slows surface water flow**, and have **excellent water flow regulation capacity**.

6. Water quality regulation

Water quality regulation capacity - what is it and why is it important?

2.143 Water quality capacity maps the risk of surface runoff becoming contaminated with high pollutant and sediment loads before entering a watercourse. Higher water quality capacity indicates that water is likely to be less contaminated.

Results for Buckinghamshire

2.144 Once again, the results are different in the north compared to the south of the county (Figure 10). **In the north, scores are generally lower, with arable fields, and especially those parts on slopes and close to watercourses scoring least well**. **Scores in the south are generally higher,** especially those areas away from watercourses **with woodland land covers**.

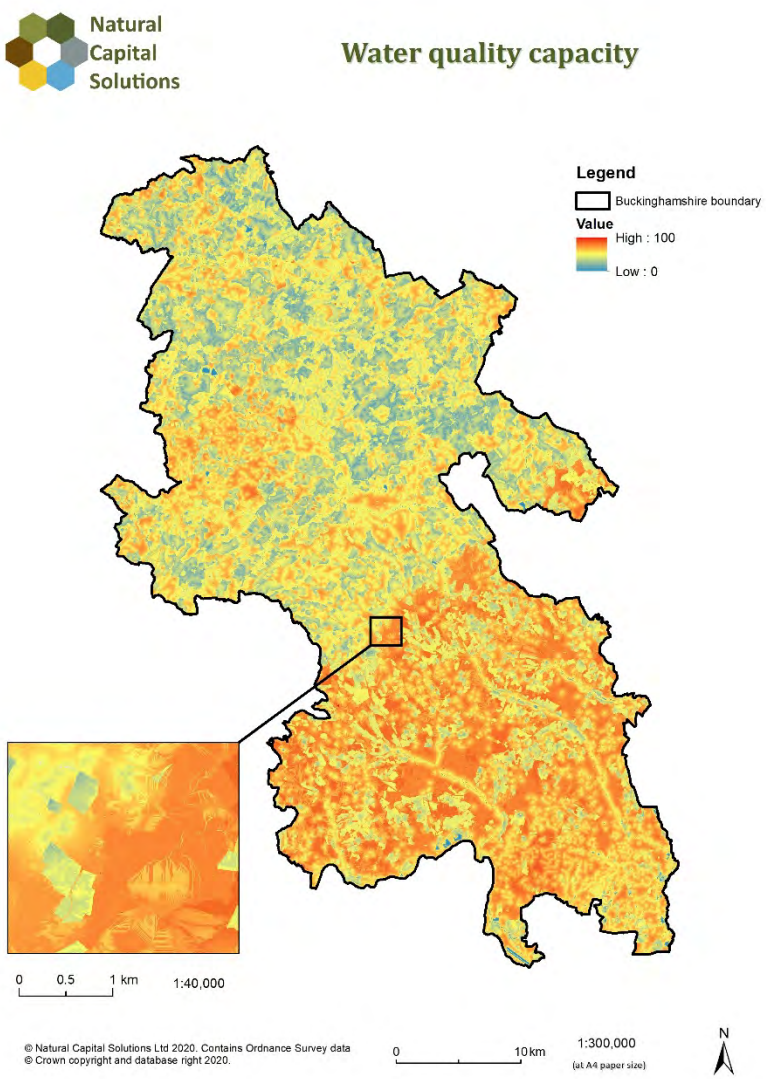


Figure 10: Water quality regulation capacity across Buckinghamshire

(Note that although urban diffuse pollution is partially captured in the model at catchment scale, the focus is on sedimentation risk from agricultural diffuse pollution, mostly based on land-use impacts. Hence built-up areas are not particularly well accounted for in the existing model.

Equally, point source impacts are not taken into account in this methodology; different farming types would also have an impact on the map if that data was available).

7. Agricultural /food production

Food production capacity - what is it and why is it important?

2.145 Agricultural production **models the capacity of the land to produce food under current farming practices.** Farming is the dominant land-use in Buckinghamshire, with an approximately equal spilt between arable and grassland for livestock. These land covers provide the largest proportion of food, however, food is produced from a range of other habitats, albeit to a lesser extent. **The ability of habitats to provide food, based on broad habitats in Buckinghamshire, accounting for Agricultural Land Classification, was mapped**.

Results for Buckinghamshire

2.146 The majority of Buckinghamshire has a medium to low food production capacity (yellow/light blue in Figure 11). This is due to the predominant Agricultural Land Classification for the region being Grade 3, along with significant areas of Grade 4. **The high (orange to red) food production areas are areas of Grade 2 and 1 land, which is predominantly down to arable and likely to be highly productive**. Urban areas have a very low production capacity reflecting the limited production resulting from gardens (clearly this can be high in some cases, but it is beyond the scope of this project to consider this).

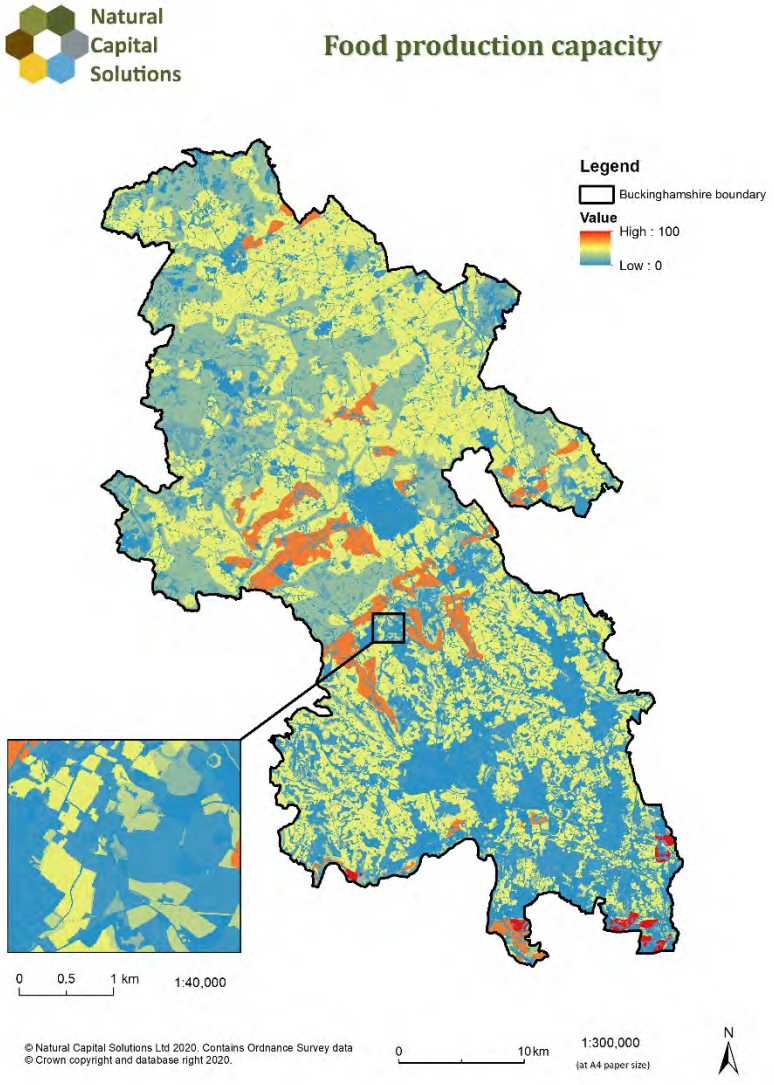


Figure 11: Food production capacity across Buckinghamshire

8. Timber production / woodfuel

Food production capacity - what is it and why is it important?

2.147 Forestry remains an important component of the rural economy and many areas of woodland are still valued primarily on their timber value. Timber is an important product of woodlands and is the raw resource of the timber industry. Sustainably managed woodland produces timber that is important in contributing to processing mills and factories that produce wood-based products, and also produces wood fuel for the generation of renewable heat and electricity **This map looks at the average yield of timber per hectare per year**, according to the species mix and yield class, and scored on a scale 0-100..

Results for Buckinghamshire

2.148 **There are patches of high timber and woodfuel production capacity scattered throughout the south of Buckinghamshire and some in the west** (Figure 12). Coniferous woodland gives the highest capacity and is shown in red whereas broadleaved woodland produces medium levels of timber / woodfuel and is shown in yellow / green. Broadleaved woodland is the dominant woodland cover type in Buckinghamshire, although small pockets of coniferous woodland are scattered throughout the area.

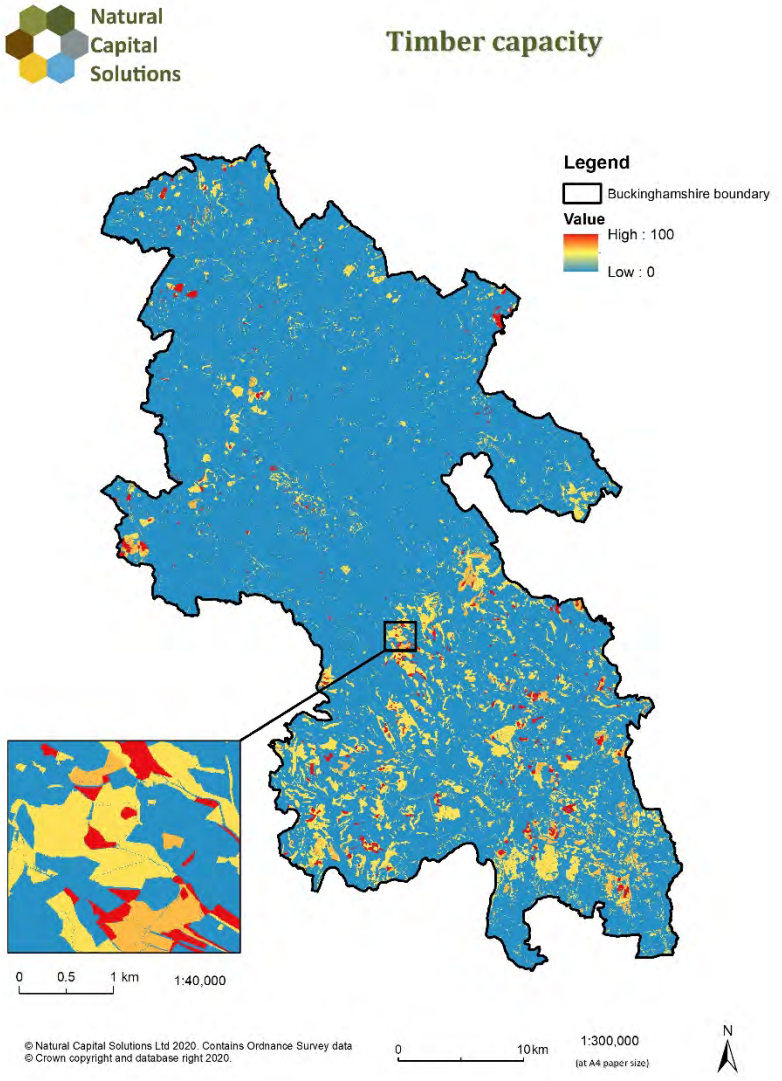


Figure 12: Timber / woodfuel capacity across Buckinghamshire

9. Accessible nature

Accessible nature capacity - what is it and why is it important?

2.149 **Access to greenspace is being increasingly recognised for the multiple benefits that it can provide to people**. In particular, there is strong evidence linking access to greenspace to a variety of health and wellbeing measures. Research has also shown that there is a link between wellbeing and perceptions of biodiversity and naturalness. Natural England and others have published guidelines that promote the enhancement of access, naturalness and connectivity of greenspaces.

2.150 **The two key components of accessible nature capacity are therefore public access and perceived naturalness.** Both of these components are captured in the model, which maps the availability of natural areas and scores them by their perceived level of "naturalness".

Results for Buckinghamshire

2.151 Figure 13 shows that accessible nature capacity is highest in Burnham Beeches, Penn Wood, Ashridge Estate and Bernwood Forest. Hotspots also occur around other large accessible sites, especially in the south. Accessible nature capacity is moderate around the outskirts of major urban centres, especially High Wycombe, which has a number of accessible greenspaces nearby. **Access is lowest in more rural areas in the northern half of the county**, where public footpaths provide the only access in predominantly agricultural areas.

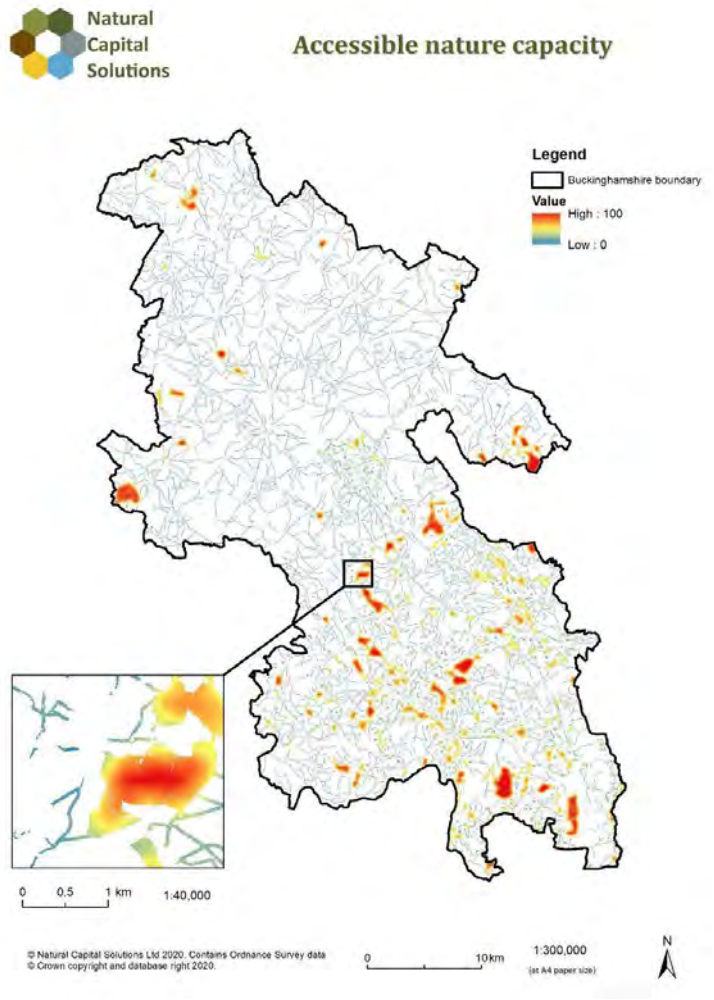


Figure 13: Accessible nature capacity across Buckinghamshire

NB – this shows accessible nature capacity for publicly accessible land only. (Areas with zero demand have been excluded to improve map legibility.)

Accessible Nature demand – what is it and why is it important?

2.152 Accessible Nature Demand indicates where there is greatest demand for accessible nature, which is strongly related to where people live. Research, including large surveys such as the Monitor of Engagement with the Natural Environment (MENE), have shown that there is greatest demand for accessible greenspace close to people's homes, especially for sites within walking distance.

Results for Buckinghamshire

2.153 Results for Buckinghamshire Demand for accessible nature (see Figure 18) is focussed around where people live, hence Aylesbury and High Wycombe provide the largest demand across the county. There is also significant demand from the numerous other urban areas in the south of the county, with lowest demand in the northwest.

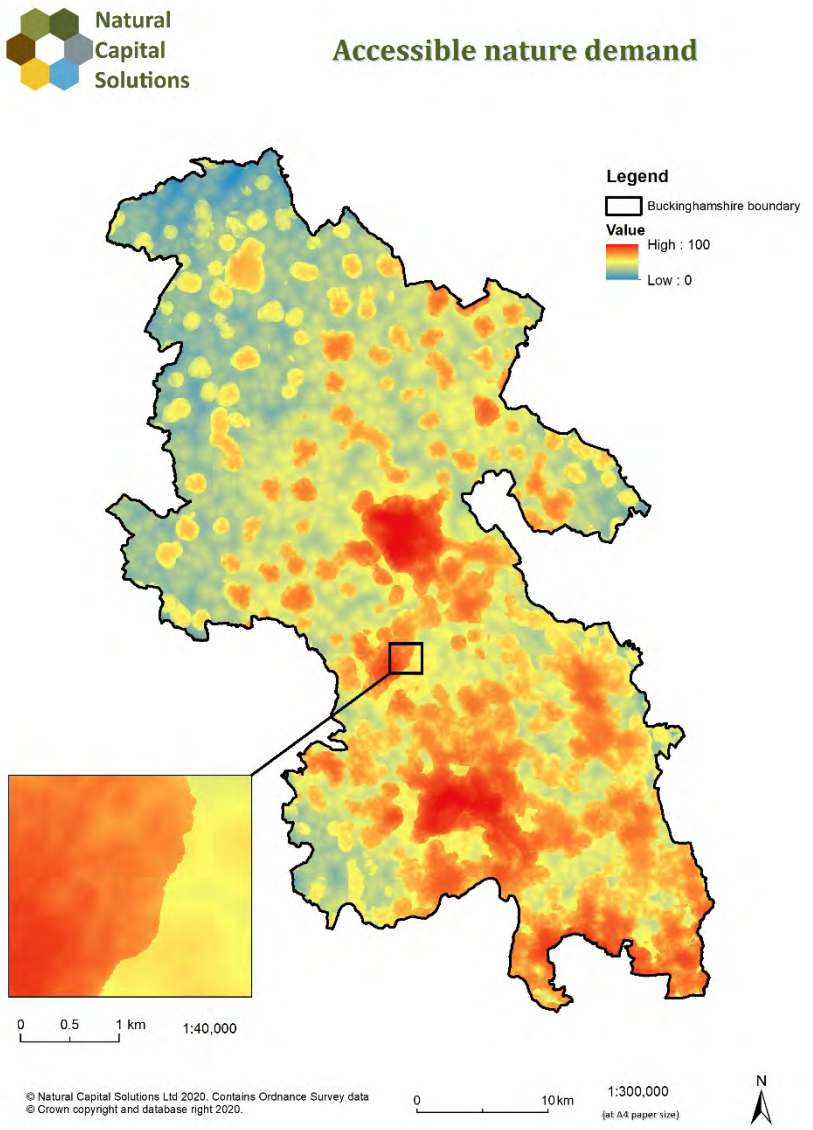


Figure 14: Demand for accessible nature capacity across Buckinghamshire

Balancing supply and demand for accessible nature

2.154 Numerous research has shown that people travel most frequently to greenspaces very close to their homes and Natural England recommend that everyone should have access to at least some greenspace within 300m (5 minutes walk) and larger sites within 2 km. Furthermore, surveys have shown that the majority of people will typically travel less than 3.2 km to visit greenspace. Any new accessible greenspace being created should therefore be close to housing areas. New housing areas will also create increased demand for accessible greenspace, so it is important that this demand is met on-site.

2.155 There is now a vast amount of evidence showing the benefits of greenspace, particularly in built-up areas. Furthermore, research has shown that people gain greater well-being from visiting sites that they perceive to be more natural and richer in biodiversity. This shows that as well as providing access to greenspace, it is important that the greenspace is of a high quality and as natural as possible.

vi) Pressures facing Buckinghamshire's nature: area-wide

Significant pressures on biodiversity and ecosystems in Buckinghamshire - and their impacts

2.156 In common with other parts of the country, and particularly the developed south-east, Buckinghamshire has severely damaged ecosystems as a result of a combination of various pressures, including climate change, population growth and development, changes in land use and land management, pollution, invasive species and diseases. It is important to recognise that pressures can also act in combination – so that any one habitat or species could be affected by multiples pressures. For example, the effects of river pollution or poor water quality can be heightened by historic river engineering and poor watercourse management. Where watercourses have been artificially straightened, this can result in bed or bank instability, loss of habitat diversity and increased flood risk downstream.

2.157 These pressures and their impacts are summarised in Tables 3 and 4, below, including the impact of combined, or cumulative pressures. The tables show pressures affecting the Buckinghamshire environment in two ways:

- Table 3 – Pressures on the Buckinghamshire environment, impacts and specific habitats and species affected;
- Table 4 – turns this analysis around to show how these pressures act cumulatively and collectively – that multiple pressures are affecting nature, wildlife and the benefits it provides to society.

Schedule A, below, (page 78+) contains further information about each of the pressures.

2.158 These summary Tables provide the context for understanding stakeholder priorities and the possible actions required to address and respond to the impacts of these pressures – whilst at the same time, look to enhance and improve our biodiversity, habitats and their connectivity, and provide multiple broader benefits.

2.159 The environmental pressures related specifically to the NCA area of Buckinghamshire are then described after Tables 3 and 4, at Section vii), page 76, below.

Table 3 – Pressures on the Buckinghamshire environment, impacts and the habitats and species affected

Pressure on the environment	Impacts	Habitats / species negatively affected
Climate change - Hotter, drier summers; - Warmer, wetter winters; - Increased number of extreme weather events – rainfall drought, storms, changes in seasonal timings)	• Threat to species that cannot adapt quickly enough / relocate to other refuges – e.g. some pollinators, various plants, etc • Increase in pests, invasive species and diseases • Changes to composition and location of ecological communities – if affecting the health of local species, specimens of plants and trees and local habitats, can affect local habitat quality and therefore e.g. ability of vegetation to absorb air pollutants, provide shade, slow the flow of surface runoff that poses flood and water quality risks. • Intensification of other human pressures on the environment, particularly during droughts – e.g. frequency and intensity of flooding; urban heat island effect.	All habitats, species and biodiversity
Development - Urbanisation - New development – housing - Infrastructure growth	• Direct impacts of development: - Loss of habitats and biodiversity where they become development sites – and loss of ecosystem services they provided (e.g local air quality, water quality, carbon sequestration, habitats for wildlife, etc) - Fragmentation / loss of connectivity of habitats e.g. due to development disconnecting habitats, or where buffers around development are not sufficient to keep habitats connected - Some species affected more than others – e.g. displaced farmland birds, and rarer species of bats and invertebrates that rely on certain food or habitats.	All, depending on development location and specific circumstances Differential species impacts – esp farmland birds and rarer species of bats and invertebrates Loss of ancient woodland (e.g HS2)

Pressure on the environment	Impacts	Habitats / species negatively affected
	- Some positive impacts if new green infrastructure replaces wildlife-depleted land • Indirect impacts – development causes multiple pressures and risks on nearby habitats, sites, species and wildlife – e.g. - loss of habitat connectivity, - increased recreational pressures, - changes to hydrology for development, e.g. to river channel structures or runoff rates and patterns due to hard surfaces - increased demand on water supplies – e.g. unsustainable abstraction from the chalk aquifer affects chalk streams and their river ecology and habitats - increased loading from sewage treatment works, - increased pollution (particulates, light, sound), - obstacles to species dispersal - cats and dogs can predate native species, - changes in balance of animal and plant diversity with human activity. - New species and pests can change the function of surrounding habitats.	
Inappropriate river and flood plain management - Flood risk management; - land drainage; and - river/riparian management e.g. creating land drains, dredging channels,	• Damage to river structure and river habitats; loss of biodiversity: - Straightened rivers are shortened, with stronger flows - no longer flow and flood naturally - Less meandering, loss of form and diversity in river channel affects structure, deposition and substrate – and the aquatic habitats that rely on channel diversity - Rivers disconnected from flood plains by historic engineering – drying of some habitats and change in water regime for others.	Decline of habitats and species that rely on seasonal water inundation in the floodplain, e.g. - Loss of natural areas of wetland and reedbed - lowland wet meadows - characteristic plants and animals Loss of habitats and species relying on natural channel form, meandering and deposition regime and different flow characteristics

Pressure on the environment	Impacts	Habitats / species negatively affected
straightening and raising bank height	- Engineering and straightening of rivers and intensive bank management can increase bank instability and lead to proposals of hard bank protection – which fragments natural bank and nearby habitats - In-river structures can be barriers to fish migration and have negative impacts on upstream habitat and sediment dynamics - Damaged river morphology is one of the biggest causes of failure of ecological objectives under the Water Framework Directive	Changes in habitats and species composition on the floodplains – e.g. loss of wetlands and wet grassland has led to a decline in wading birds.
Natural flooding risk	e.g. large rainfall events and high groundwater recharge (climate change and historic engineering could exacerbate the risk). - Fluvial flood risk – e.g. Marlow (now more protected with a scheme), Buckingham, Denham, Bourne End, Medmenham. - Groundwater flood risk – esp Chesham, Chalfonts, Amersham old town, valleys leading into Wycombe – Hughenden, Saunderton/Bradenham and Hambleden	
Land management – changes and inappropriate management	**Loss of biodiversity, habitats and possible fragmentation**	**Riparian habitats, woodland, grasslands, heathland, farmland affected.**
Riparian management	• Intensive vegetation management alongside watercourses can increase sediment and other pollutants reaching water	Riparian habitats Changes in habitat structure

Pressure on the environment	Impacts	Habitats / species negatively affected
	• Inappropriate valley slope land management can increase soil loss with associated nutrients and negatively impact watercourses • Mowing: timing and sensitivity - timing v bird breeding season - affects habitat structure - food and shelter needs of invertebrates • Grazing: timing and intensity can impact on grassland habitat quality and damage riparian habitat structure • Historic river channel engineering or development on the floodplain – can lead to rivers disconnected from the floodplain, pollution levels in water, drying of floodplain habitats.	Birds and invertebrates: Grazing and mowing can interrupt bird breeding season and destroy nests Food and shelter needs of invertebrates
Woodland management	• Changes and decline in woodland management. • Subdivision into smaller plots (esp Chilterns)	Woodland habitats Changing ecology of woodlands – e.g. Loss of larger predators controlling deer or creating open spaces, dams and influencing rivers and wetlands (e.g. beavers) Introduced species and diseases
Grassland and heathland management	• changes of use (e.g. cattle to horses) • undergrazing: scrubbing over of habitats • overgrazing and tightly grazed sheep pasture produces a uniform grass (sward)	Grassland and heathland Scrubbing over reduces ecological value Overgrazing and tight grazing degrades habitat for invertebrates Changes in biodiversity and habitats impacts in species structure – e.g. pollinators

Pressure on the environment	Impacts	Habitats / species negatively affected
Farming practices - Hedgerow removal to enlarge fields (loss of habitats for e.g. pollinators and other species; can affect local air quality for plant health) - Reduced hedgerow management - Hedgerow and field margin management – can negatively affect biodiversity value if too frequent, or seasonally inappropriate - Soil erosion from fields		Loss of hedgerows Loss of structure, connectivity and therefore ecological value of hedgerows Reduction in farmland birds and arable weed species
Pollution	**Loss of biodiversity and habitats**	**Damage and loss of habitats, species and biodiversity**
Waste – e.g. - Isolated pollution incidents – e.g. direct source pollution from industry - Agricultural runoff – e.g. high phosphate levels - Poor water treatment or unconsented discharges from sewage treatment works (often due to aging equipment higher demand as a result of increased development pressure) - Road /hard surface runoff	Direct impacts on watercourses Connected habitats Fish kills Sedimentation of gravels Eutrophication from increase in nutrients – algal blooms Impacts of pollution events can spread many kms downstream Chronic impacts on water quality and failure to achieve ecological quality targets (set under the Water Framework Directive) The effects of water pollution can be heightened when combined with poor watercourse management; where watercourses have been artificially straightened this results in erosion and deposition in the wrong places. Alongside dredging, this is also a cause of downstream flooding.	Damage to in-channel and riparian habitats Loss of in-channel plant species diversity Flood meadows – competitive advantage to coarse grasses and other plans can displace a more diverse flora Fish development can be impaired by sedimented gravels Particular pressure points within Buckinghamshire include urban areas through surface water runoff with particular hotspots at High Wycombe, Chesham, Aylesbury, Marlow and Amersham Old Town.

Pressure on the environment	Impacts	Habitats / species negatively affected
Sound - Human activities – roads, railways, aircraft, construction, factories	Can deter wildlife from living in certain areas Interrupts wildlife communications Can hinder wildlife finding food	According to tolerances of different species. Noise affects bats (hunting via echolocation)
Light - Night light is particularly bright in Aylesbury and High Wycombe as well as along the M40 corridor	e.g. artificial light	Nocturnal species – e.g. some species of bat avoid well-lit areas; lighting affects their foraging and community areas.
Chemicals, dust, particulates - Nitrates and phosphates in agriculture - Particulates from vehicles and road surfaces - Dust – from construction, quarrying and cement works	Changes in soil composition Changes in species composition – e.g. course grasses can out-compete native meadow flowers Reduces food and resources to invertebrates Changes vegetation composition Dust drifts and lands on nearby vegetation	Grassland meadow Bees and butterflies Birds and mammals Road verges – esp. busy A-roads. Dust negatively affects ecosystems
Policy - changes - inability to influence policy, - resourcing difficulties to implement	Threatens managing the land sustainably for biodiversity, habitats and wildlife. For example: - Uncertainty with Brexit and England's alignment of future environmental policy in England with EU - Impacts of new Environment Bill, new Environmental Land Management System	All

Pressure on the environment	Impacts	Habitats / species negatively affected
	e.g. stewardship - there has been a recent trend in landowners not renewing or taking up stewardship, or waiting until the policy uncertainty surrounding ELM is resolved. - Planning Policy changes and impacts on environmental protection and sustainable development - Lack of ecologists in local authorities – less equipped to identify possible impacts and factor in the natural environment into decision-making. - Resource pressure – affects ability to monitor and survey	
Non-native species, diseases and "pests"	- Loss of ("native") biodiversity and habitats – on land and in rivers -and therefore the benefits provided: e.g. can affect tree health – and therefore local air quality, flood risk and water quality, pollination ability, etc. - Now over 3,000 species of non-native plant and animals established in the wild in Britain – e.g. grey squirrels and Muntjac deer. - These can establish in a way that poses threats to native wildlife	For example: Native white-clawed crayfish, freshwater invertebrates and fish populations – affected by the Signal Crayfish. Water vole population - decimated by American mink Freshwater ecosystems also affected by New Zealand pygmy weed Ecosystems affected by expanding range of edible dormice Specific tree species suffering specific diseases e.g. Ash Dieback, Oak Processionary moth – many more diseases present and more expected; Box moth blight. Loss of key tree species affects lichens, invertebrates, birds and animals; canopy gaps affect woodland ecosystems; Fungal diseases expected in trees – e.g. could threaten the juniper.

Table 4: Multiple and cumulative pressures on valuable aspects of nature in Buckinghamshire[24]

Qualities of nature under threat (e.g. habitat, habitat qualities or species)	**Major causes: cumulative and multiple pressures** (environmental and otherwise)
Biodiversity	Climate change – which can exacerbate many of the other pressures and become a threat to species unable to adapt quick enough Pests, invasive species, diseases Land use change / intensification Development and infrastructure projects Changes in land management – e.g. change of use, under- or over-grazing, changes in farming practices (e.g. hedgerows and field margins) Historic river channel engineering – leading to change habitat and species composition Pollution – waste, polluted runoff, soil erosion, sound, light, noise, chemicals and particulates Habitat loss / change / fragmentation Changes in policy and policy impacts / effectiveness Insufficient: - Biodiversity targets, data and monitoring of progress - Resources to create, enhance and connect biodiversity and habitats; and manage appropriately into the long-term - GI and biodiversity designed in development

[24] Information based on work of the Bucks and MK NEP and Rouquette, J.R. Natural Capital Solutions (2020). Mapping natural capital, ecosystem services and opportunities for habitat creation in Buckinghamshire. Report for Buckinghamshire Council. Available at: https://bucksmknep.co.uk/projects/natural-capital-mapping/

	- Sustainable land management - Number and wildness of local spaces insufficient focus on BOAs, buffers and linkages.
Habitat protection, enhancement and connectivity	Land use change / intensification - Remaining habitats become fragmented / isolated from areas of similar habitat – less able to adapt to external pressures. Development and infrastructure projects - Direct and indirect impacts / loss of habitats - Insufficient buffers around development connecting habitats - Obstacles to species dispersal - Fragmentation and loss of connectivity of habitats – reduces species dispersal ability and resilience to change - Increased demand for water and increased sewerage needs Changes in land management, e.g. - Habitat loss: removal of hedgerows, corners and wooded copses for larger fields - Subdivision of habitat parcel (e.g. woodland) into smaller plots – creates more isolated ecological communities increasingly isolated from each other and less resilient to e.g. climate change or pollution. E.g. sub-lotting woodland management becomes inconsistent at scale - Historic river channel engineering and/or development on the floodplain – leads to rivers disconnected from floodplain – drying of some habitats – e.g. wetland and reedbed, lowland wet meadows and change in water regime for others – change in characteristic plants and animals. Such as a decline in wading birds. Resources – to identify habitats needing protection, management, enhancement, connecting and ongoing monitoring
Local air quality - for plant growth and human health	Climate change Land use change / intensification Development and infrastructure projects Pests and diseases e.g. affecting tree / plant / human health

Local climate regulation **e.g. urban heat island effect**	Urban hard surfaces absorb more heat than natural surfaces and vegetation – released into environment Energy released by human activity – e.g. lighting, heating, vehicles, industry Climate change likely to exacerbate
Water: **Natural river channels and hydrology** **Water quality and supply** Health of water-centred habitats (in the channel, on the bank, surrounding); including natural connection between river and the floodplain. **Affected e.g. by:** - Channel structure - sediment loads from surrounding land - water quality - Bank stability - Channel habitats - Diversity and structure of habitats - Channel structure	Land use change / intensification - Affects connectivity of rivers with flood plain, channel structures, runoff rates, levels of pollution, water usage, non-natural erosion and deposition, loss of habitat. Development and infrastructure projects (e.g. unsustainable abstraction from the chalk aquifer to low flows, poorer quality and shorter river habitats in precious chalk streams, and associated loss of river ecology and habitats). Historic river channel engineering Pollution – diffuse and non-diffuse, including eutrophication Changes in land management – including riparian management beside river channels Non-native invasive species
Flooding regulation	Development and infrastructure projects - changes to river channel structure and capacity; hard / impermeable surfaces increasing surface runoff without sufficient sustainable and nature-based solutions designed into development

	Climate change likely to exacerbate frequency and intensify impacts Awareness and understanding of the issues and relating to demand for water
Pollination - bees, hoverflies, beetles, butterflies, moths, etc.	Climate change Land use change / intensification Habitat loss (e.g. hedgerow removal or under-management, loss of field margins, woodland, etc) Habitat fragmentation Pests and diseases Non-native invasive species
Tranquillity, dark skies, etc.	Major roads, railways airports, construction, industrial areas, agricultural runoff (if inappropriately managed)
Connection between people and nature	Lack of awareness of the importance of biodiversity to health and wellbeing can threaten biodiversity and habitat protection and sensitive management Lack of knowledge and appropriate management can reduce access to nature Lack of sufficient planting and access to nature in built-up areas – new development and existing
Timber / fuel / food /agricultural production	Climate change Land use / intensification Habitat loss Pests and diseases Policy – agricultural and food, pricing, etc.

Carbon storage / sequestration / climate change adaptation	Anthropogenic emissions Biodiversity degradation and loss (e.g. due to multiple impacts on biodiversity, impacts of development, pests and diseases, habitat management, pollination, policy changes, people, etc) Local air quality (e.g. air pollution can affect plant growth and carbon uptake) Changes in policy and policy impacts / effectiveness Land use change /intensification – impacts on soil and plant growth / crop management Planting choices – future proofing

vii) Pressures, threats and specific challenges facing the local areas of Buckinghamshire

2.160 Alongside the generic pressures such as climate change and pests and diseases, different areas of Bucks are faced with specific localised pressures, or impacts of them, for protecting the character and biodiversity of the areas:

Northern Bucks

- High levels of future growth and associated increases in leisure and recreation
- Increasing demand for resources, particularly water.
- Managing water resources, including impacts downstream
- Land use change
- Development and infrastructure improvements

Aylesbury Vale Area

- High development pressure – e.g. urban areas and possible infrastructure related to the Oxford-Cambridge Arc concept
- Associated land use change
- Possible further habitat fragmentation as a result of the expected growth

Chilterns

- Poorer management of woodlands:
  Woodlands have been facing a variety of threats for many years. The decline in the furniture industry and the value of timber has meant that **management** of woodlands has in some instances stopped, reduced or changed. Areas which would have been managed in coppice rotation has disappeared and woodland flowers, butterflies and hazel dormice have declined. Conifer woodlands: light management regimes has changed the type of humus accumulating and affected conditions needed for native species.
- Ash die-back
  Where ash has grown up in gaps made by the storms of 1989 and 1991, these stands are now being devastated by ash dieback.
- Invasive species, and non-native invasive species
  Non-native grey squirrel, edible dormice and deer are well established to detriment of some native fauna and flora.

Non-native species such as signal crayfish (which has led to the likely local extinction of the white clawed crayfish) and Japanese knotweed and Himalayan balsam which continually spread in the river.

- Reduction in livestock farming and grazing to retain grassland landscapes
  The remaining Lowland Calcareous grassland is on steep slopes with thin soils which is less suitable to agricultural intensification. These areas have been historically maintained through livestock grazing, however with a **reduction of livestock farming** in some areas, a succession towards scrub and then woodland takes place.

- Over-abstraction and channel modification threatens chalk streams
  Chalk streams have been subject to a range of threats in recent years. The pumping of water and **over-abstraction** from the chalk aquifer in combination with a changing climate has resulted in large lengths drying out with the death of fauna and flora. The presence of **weirs and culverts** stops the movement of species up and down stream and reduces the ability of upper reaches being recolonised.

- Lack of buffers with development
  In more urban areas, **development** has often not respected the need to maintain a buffer to protect watercourses and in rural areas nitrate and phosphate levels are sometimes increased through agricultural runoff.

Thames Valley

- Climate change - Drier summers and increasing temperatures could lead to deterioration in the area's semi-natural wetland habitats, including ancient wet meadows and could also lead to lower river flows and increased demand for water resources; the area's woodlands, particularly its highly characteristic and ecologically important veteran trees may be affected by increased storminess, periods of drought and the prevalence of pests and diseases, with the loss of shallow-rooting beech and previously-pollarded ancient trees to wind and drought-stress.

- Development pressures - include major roads, lighting and signage, expansion of urban areas and airport development, much unrelated to the surrounding area and contributing to the overall fragmentation of the landscape and threats via declines in air quality and pollution.

- Incipient pressure from non-farming use of small-sized holdings - notably horse grazing and land held for 'hope value'. Also pressure from recreational uses, particularly golf course development, often at the expense of commons and heathland.

- Designed parkland features at risk from changing agricultural activities, development pressure and lack of management for individual trees.

- Fly-tipping, casual illegal use such as motorbike scrambling and incursion by travellers are common.

Schedule A:

1. What is Natural Capital?

1.1 Natural capital refers to the stock of assets provided by the natural environment with capacity to produce goods and services that are of value to people (NCC 2014)[1], often classified into provisioning, regulating and cultural ecosystem services (EEA, 2016[2], Hein et al., 2016[3]). Natural capital comprises land and minerals, fresh, tidal and marine waters, air, species and ecological systems, together with supporting natural processes and functions[3]. In many respects, it supports all forms of other capital on which human systems depend, whether man-made, human or social. However, many of the outputs produced by natural capital, such as the regulation of flooding and atmospheric gases by forest lands, are not included in the decisions of individuals or organisations. This is because they often involve non-priced public goods that are not traded in the market place and are not subject to formal property rights and entitlements (TEEB, 2010[4]). Elements of natural capital are therefore liable to be overused, degraded, depleted and eventually lost, with consequences for long term welfare and the sustainability of economic systems. There is now much greater awareness of the role of natural capital in the design and achievement of economic and social development strategies, with strong links to business and enterprise[5]. Furthermore, the central role of natural capital in delivering quality of place is being increasingly recognised.

1.2 Natural capital is also becoming increasingly embedded across multiple policy domains, including the mandatory requirement for biodiversity net gain for all new developments, as set out in the Environment Bill, with an ambition to move towards environmental and natural capital net gain in the future, backed by changes to the National Planning Policy Framework and the new Planning White Paper. The Environment Bill also sets out the requirement for nature recovery networks and strategies, while the Agriculture Bill paves the way for a new Environmental Land Management Scheme (ELMs), with a central tenet of farmers and land managers being paid public money for public goods, based on natural capital principles. Further policy alignment is achieved through the requirements for action on climate change and commitments to go carbon neutral, including the planting of large areas of new woodland.[25]

[25] Mapping natural capital, ecosystem services and opportunities for habitat creation in Buckinghamshire. Jim Rouquette, Natural Capital Solutions (2020) Pg 6-7 Available at: https://bucksmknep.co.uk/projects/natural-capital-mapping/

2. Methodology behind the Buckinghamshire Natural Capital Maps

2.1 The methodology and data sources used in the natural capital mapping completed by Natural Capital Solutions, 2020, for Buckinghamshire, are outlined in the following places:

- Rouquette, J.R. (2020). Mapping natural capital, ecosystem services and opportunities for habitat creation in Buckinghamshire. Natural Capital Solutions. Available at: https://bucksmknep.co.uk/projects/natural-capital-mapping/ .

  Section 2.1 and Boxes 1 and 2 provide information about the data used to classify habitats in the basemap, and how habitats were assigned.

  Section 3 outlines the modelling process and the mapping of ecosystem services. Specific information about how each ecosystem service is measured is provided in the text. A weighted scoring on a scale of 0-100 of the ecosystem services was produced, within the mapped area.

- Further information about the basemap methodology and the data sources used to create it can be found in the following report created for the OxCam Arc. (although for habitat data – theOxCam Arc report makes reference to local Phase 1 habitat data for Oxfordshire and Habitat data for Bedfordshire; in Buckinghamshire, however, data supplied by BMERC was used instead.

  See: Rouquette, J.R. (2020). OxCam LNCP Natural Capital Baseline Assessment: Data Report. Report for OxCam Local Natural Capital Plan Project, Environment Agency. Natural Capital Solutions.

  Available at: https://www.oxcamlncp.org/building-our-evidence-base (the tab is "How we created our baseline")

3. Pressures on the Buckinghamshire environment – further details

i) Climate change

Expected changes in climate

3.1 As well as direct local impacts, increased stress on our priority habitats and ecosystems has come from climate change, and will continue to do so. The State of Nature report (2019) found that climate change was the second greatest cause of change, positive and negative, in wildlife, and that only agricultural management was greater[26].

3.2 The Met Office published its latest projections of climate in the UK in 2018 (UKCP18). The key messages are that the UK will experience:

- **Hotter, drier summers,** with the greatest increase in southern England
- **Milder, wetter winters**

3.3 We are already locked into some extent of these changes – they are inevitable for many decades because of the greenhouse gas emissions that have already happened. However, the extent of future change, particularly beyond 2050, will depend on how successful the world is at reducing atmospheric greenhouse gas concentrations from 2020 onwards. While there is uncertainty around the predicted impacts, it is important to aid the ability for habitats and species to cope with climate change and the predicted profound changes to wildlife.

3.4 Box 2, below, outlines the likely changes for our area, based on available predictions for the Thames River Basin.

[26] Other causes identified were urbanisation, pollution, woodland management, fisheries, invasive species and freshwater management. *[The State of Nature Report is available at: https://www.rspb.org.uk/our-work/state-of-nature-report/ and is a health-check on how the UK's wildlife is faring. It is put together using wildlife data from a group of 50 conservation organisations.*

Box 2: UK Climate Predictions (Met Office) – Thames River Basin

The Thames river basin is the closest standard geographical area from UKCP18, and is chosen as a good indication of climate change projections for Buckinghamshire and Milton Keynes.

- Climate change has already increased the chance of seeing a summer as hot as 2018 to between 12-25%. With future warming, hot summers by mid-century could become even more common, near to 50%. (UKCP18 Headline Findings, September 2019, Version 2, paragraph 3.1.2)

- The frequency of hot spells (maximum daytime temperatures exceeding 30 °C for two or more consecutive days) is projected to increase further. Rising from an average of 0.25 occurrences per year in the present-day to 4.3 by 2070. (UKCP18 HF 3.1.6)

- Thames river basin precipitation amounts by 2080, in the high emission scenario, are expected (10%-90% likelihood) to be between -68% to -34% in summer, and -3% to +23% in winter (where a negative change indicates less accumulated precipitation and a positive change indicates more accumulated precipitation). (UKCP18 HF 3.2.2)

- Despite overall summer drying trends in the future, the intensity of heavy summer rainfall events is projected to increase (UKCP18 HF 3.2.4)

- Significant increases in heavy hourly rainfall intensity in the autumn are expected (UKCP18 HF 3.2.4)

- A decrease in UK soil moisture during summers is projected, consistent with the reduction in summer rainfall.

UK Climate Projections 2018 for the Thames river basin. Mean temperature and precipitation for winter and summer 2070-2089 relative to 1981-2000.
https://www.metoffice.gov.uk/research/approach/collaboration/ukcp/key-results

Variable	Time Horizon	Emissions Scenario	10th percentile change	50th percentile change	90th percentile change
mean winter temperature (°C)	2070-2089	Low	0	1.2	2.4
mean winter temperature (°C)	2070-2089	High	1.2	3.0	4.9
mean summer temperature (°C)	2070-2089	Low	0.8	2.0	3.3
mean summer temperature (°C)	2070-2089	High	2.3	4.8	7.3
mean winter precipitation (%)	2070-2089	Low	-6	10	26
mean winter precipitation (%)	2070-2089	High	-3	23	52
mean summer precipitation (%)	2070-2089	Low	-39	-18	5
mean summer precipitation (%)	2070-2089	High	-68	-34	0

Likely impacts of a changing climate on biodiversity

3.5 While there is uncertainty around the predicted ecological impacts of the changing climate, the general meteorological trends are clear, and the rate of climate change is rapid. It is bringing profound changes to wildlife. While there are likely to be some positives, with new species arriving from continental Europe, most of the impacts are thought likely to be negative, particularly given the speed of climate change which leaves little time for natural adaptation.

3.6 In addition, it is thought that our weather will be more erratic, with an increased number of extreme weather events, such as excessive rainfall, drought and storms. Seasonal timings are altering - the composition of ecological communities is likely to change, and invasive species and disease are likely to increase. For example,

- swallows are arriving 15 days earlier than they did in the 1960s
- great tits lay their eggs on average 11 days earlier than they did in the 1968 (State of Nature 2019).
- Defra has identified 19 tree pests and 25 tree diseases that have arrived in the UK or are expected; their survival and dispersal is being aided by climate change.
- Species that cannot adapt quickly, or which cannot disperse are likely to suffer significant and increasing declines or even local or complete extinction.

ii) Development – housing and infrastructure

Population growth and new development

3.7 The population in Buckinghamshire has increased by about 9% from 502,820 in 2010 to over 550,00 today[27]. Between 2016 and 2026, the population of Buckinghamshire is expected to increase by 7.5% to over 573,000; a rate of growth that is above national and regional rates, and with around 60% of the growth accounted for by migration with people moving in from elsewhere.[28] Further growth to around 600,000 residents is expected by 2036. The increasing population is matched with expanding urbanisation as local authorities plan to accommodate new homes and infrastructure.

Likely impacts of new development on biodiversity

3.8 New development does not always result in biodiversity loss; some intensively managed agricultural land is so depleted of wildlife that a housing estate with green infrastructure (such as a pond and meadow area) can lead to an increase in the number and diversity of species using the site.

[27] From http://population.city/united-kingdom/buckinghamshire
[28] Demographic Change in Buckinghamshire, Bucks Business First, 2018) Available at: bbf.uk.com/news/demographic-change-in-Buckinghamshire (Accessed 21.08.20)

3.9 However, development does pose a risk, as all too often semi-natural habitats are lost to the built environment. Some species are affected more than others; for example, farmland birds don't adapt to urbanisation and are displaced as are rarer species of bats and invertebrates that rely on certain food plants or habitats.

3.10 A recent study for the Natural Environment Partnership[29] based on a sample of 59 recent development applications across Buckinghamshire and Milton Keynes showed that the impact on biodiversity as a result of development is site-specific rather than related to the type of development. The net impact reported for all development within each category assessed (commercial, householder, major and minor) was a loss of biodiversity, with the largest habitat losses per ha relating to major development proposals, followed by minor proposals; hedgerow loss was greatest with major development, followed by commercial development.

3.11 As well as the risk of direct loss to natural habitats on the development site, there are other, multiple negative pressures and risks on nearby habitats, sites, species and wildlife arising from the indirect impacts of development, including:

- Loss of habitat connectivity
- increases in recreational pressure
- increases in visitor pressure - which could risk negative impacts in sensitive habitats and sites (but also provides opportunities for increased involvement with nature and provision of health and wellbeing benefits)
- changes in hydrology
- addition of pollution (particulates, light and sound)
- the introduction of cats and dogs which predate native species
- the introduction of garden plant species which are problematic if allowed to escape into native habitats
- increased risk of anti-social behaviour affecting wildlife –such as fly-tipping, vandalism and wildlife crime.
- Changes in the overall balance of animal and plant diversity due to human activity (direct and indirect)

iii) Changes in land- and water-management; and changes in land use

What has changed? What are the impacts?

River profiles and structure – disconnection of rivers and flood plains; change in flows

3.12 Our rivers have been engineered, including widening, deepening, and, at times, straightening, often to improve land drainage, accommodate floodplain development or reduce flood risk, or to improve navigability (e.g. the Thames) - so that they often no longer exhibit natural flow characteristics or flood naturally. Where rivers have been deepened, through dredging and re-profiling, in order to get

[29] Warwickshire County Council (2019) Buckinghamshire and Milton Keynes Biodiversity Accounting Feasibility Report, *internal document*.

water off the land as quickly as possible, the dredged material has often been deposited on the banks, further reducing connectivity with the floodplain.

3.13 As a result, many rivers are disconnected from their floodplains and we have lost natural areas of wetland and reedbed as well as significantly reducing the area of lowland wet meadows. Nationally, 97% of wildflower meadows and species-rich grasslands have been lost in the past century[30].

3.14 Land drainage, dredged channels, and straightened and embanked watercourses (raised bank height) have resulted in high flows being conveyed within river channels rather than flowing into the floodplain, potentially increasing flood risk downstream. This has led to the drying out of some habitats and a change in water regimes for others. Straightening also reduces the meander plan, form and diversity within the river channel – affecting channel structure, deposition and substrate, and the habitats that form and rely on those. Engineered channels also require maintenance to conserve capacity and are less self-sustaining.

3.15 Traditional floodplain meadows rely on seasonal water inundation to maintain conditions for characteristic plants and animals. When the water is prevented from flowing onto the land, or groundwater levels are lowered, the site conditions can become unfavourable resulting in a complete change in species composition. The drying out of floodplain habitats in some areas has led to a decline in wading birds.

3.16 In addition, the increase in volume of water within a river channel can result in an increase in erosion power causing banks to become undermined and collapse. The collapse of the bank will increase the amount of sediment in the river and can lead landowners to 'protect' their banks by installing a hard revetment, which fragments natural marginal and bank habitat.

3.17 There is also often a poor understanding of river management and maintenance from riparian owners in respect of how best to manage for wildlife. For example, too much vegetation management taking place along the watercourse could affect sediments and pollutants reaching a water-course, habitat structure. Sometimes, not enough management could result in excessive shading, although mostly a problem on narrow streams and/or where woody vegetation is uniform. The timing of any mowing should be out of breeding bird season and sensitive to diversity of species, habitat structure and the food and shelter needs of invertebrates; the timing and intensity of any grazing must also be sensitive to breeding birds and invertebrates; and management of trees should be sensitive to their role in riverbank support.[31]

3.18 For a multitude of natural reasons and man-made and exacerbated pressures, fluvial flood risk is a particular concern in Marlow (but now more protected with a scheme), Buckingham, Denham, Bourne End and Medmenham. Groundwater flood risk is highest in Chesham, Chalfonts, Amersham old town, valleys leading into Wycombe – Hughenden, Saunderton/Bradenham and Hambleden.

[30] . Fuller RM (1987). The changing extent and conservation interest of lowland grasslands in England and Wales: a review of grassland surveys 1930–1984. Biological Conservation, 40: 281–300

[31] Further guidance is available from the Environment Agency; also a leaflet summary from Bucks Council available here: https://old.buckscc.gov.uk/media/2700591/Guidance-for-Riparian-Owners.pdf

Woodlands

3.19 Our woodlands have lost the larger animals; wolves, bears, beavers, wild cattle and boar which historically would have controlled deer or created open spaces, dams and shallow scrapes and influenced rivers and wetland habitats.

3.20 Changes and a decline in woodland management, and division of woodlands into smaller plots (particularly in the Chilterns), along with many introduced species and diseases (see below) have put excessive pressure on the functioning ecology of our native woods.

3.21 Development also threatens woodlands in the area. At the national infrastructure scale, for example, the construction of HS2 is causing the direct loss of nationally-important and locally-valued ancient woodland. Individual developments also threaten to disconnect woodland areas – so-called "annexing" – where connections are lost directly due to development, or because the buffers around development are not sufficient to keep woodland connected from a species and habitat point of view. Where this happens, new species and pets associated with development can change the functioning of surrounding woodland.

Sustainable land management

3.22 Policy change also threatens managing the land sustainably for wildlife. There has been a recent trend in landowners not renewing or taking up stewardship, or waiting until the policy uncertainty surrounding ELM is resolved.

Grassland and heathland

- Our grassland and heathlands have suffered declines from changes of use (e.g. from cattle to horse/pony grazing). Many important grassland sites have been under-grazed leading them to scrub over, reducing the overall biological value. Elsewhere, overgrazing by horses risks creating a uniform sward with little structure – which degrades the habitat for invertebrates – as does tightly-grazed sheep pasture.

Hedgerows

3.23 Changes in farming practice since 1945 has seen a decline in a number of groups including farmland birds and arable weed species. Many kilometres of hedgerows have been removed to enlarge fields or left unmanaged leading to their gradual loss or reduced value through poorer structure or connectivity.

iv) Pollution – diffuse and non-diffuse

Water - sources of pollution and impacts

3.24 Pollution of waterbodies from isolated incidents, agricultural run-off, soil erosion from fields, poor water treatment, or unconsented discharges from sewage treatment works (often due to aging equipment higher demand as a result of increased development pressure) high and rapid runoff from roads and hard surfaces, with lack of infiltration and absorption, or direct-source pollution from industry, directly impacts the watercourses themselves and connected habitats. The in-channel effects can be wide ranging - from catastrophic fish kills, sedimentation of gravels and an increase in

nutrients which can cause eutrophication. The flow of water means that the impact of pollution can sometimes be seen for kilometres downstream.

3.25 On flood meadows, for example, such nutrient-enrichment, for example where nutrients bound in silt are deposited, can have the effect of giving competitive advantage to coarse grasses and other plants which displace a more diverse flora. But the bulk of flood meadow habitat loss is a direct result of agricultural intensification and resulting nutrient enrichment.

3.26 In Buckinghamshire, one of the main reasons for waterbodies not reaching 'good ecological status' under the Water Framework Directive[32] (WFD) has been identified as high phosphate levels and the legacy of historic river engineering and land drainage affecting habitat quality, including barriers to fish passage – e.g. by weirs. Along some reaches this is seen in the growth of certain algae, sometimes algae blooms and loss of in-channel plant species diversity.

3.27 The effects of pollution can be heightened when combined with poor habitat quality management; where watercourses have been over-dredged or artificially straightened, this results in loss of habitat diversity, good quality gravels and natural processes of erosion and deposition. Damage as a result of historic dredging can also increase the risk of downstream flooding due to the increase in conveyance.

3.28 Additional pressure points within Buckinghamshire include urban areas through surface water runoff with particular hotspots at High Wycombe, Chesham, Aylesbury, Marlow and Amersham Old Town.

Sound – sources of pollution and impacts

3.29 Sound pollution comes from a range of human activities; roads, railways, aircraft, construction sites and factories. It can have a detrimental impact on wildlife in a number of ways; it can deter them from living in certain areas, interrupt their communication and hinder them in finding food. For example noise can reduce the ability of bats to hunt via echolocation as they fail to hear insects, resulting in them spending more time and energy to feed than in a quiet environment.

3.30 Whilst it is known that noise can affect a wide range of species[33] in a number of different ways, there is little knowledge about the resulting effects on our ecosystems, or the exact tolerances different species have to different noises.

Light – pollution and impacts

3.31 Light pollution affects wildlife as well as humans. Artificial lighting affects many of our nocturnal wildlife species. For example, some species of bats will avoid well-lit areas, and lighting affects their foraging and commuting areas.

[32] The latest Water Framework Directive legislation applicable to the UK is available here (Accessed October 2020): https://www.legislation.gov.uk/uksi/2017/407/contents

[33] Kunc, H. P. & Schmidt, R. (2019) *The effects of anthropogenic noise on animals: a meta-analysis.* Biology Letters; Research Articles. 20 November 2019.

3.32 In Buckinghamshire, night light is particularly bright in Milton Keynes, Aylesbury and High Wycombe as well as along the M40 corridor. Overall, Buckinghamshire ranks 33 out of 41 counties for darkness[34] with rural areas being relatively dark.

Chemicals, dust and particulates – sources of pollution and impacts

3.33 Nitrogen and phosphates are added to farmland to improve agricultural productivity, but have a negative impact on natural habitats. When applied (intentionally or not) to a grassland meadow they change the soil composition and create an environment where course grasses can out-compete native meadow flowers. This in turn reduces the food and resources available to invertebrates such as bees and butterflies - which then affects birds and mammals - resulting in a much less diverse environment.

3.34 Particulates are emitted from vehicles and road surfaces, which can pollute habitats next to the road, changing the composition of the vegetation. This is especially noticeable along motorways and busy A-roads.

3.35 Dust is often created during construction activities and as a result of quarrying and cement works. When this drifts and lands on nearby vegetation it can negatively affect the ecosystem.

v) Changes in policy and resourcing

3.36 A less obvious pressure is that faced as a result of changes in policy and funding, or inability to influence.

- At the time of writing, as negotiations are still under way, it is not yet clear how Brexit will affect the stringency or alignment with the EU of future environmental policy in England, or how that might affect Buckinghamshire & Milton Keynes in particular.

- At the time of writing also, The Environment Bill is on its passage through Parliament, promising mandatory net biodiversity gains as a result of development and a requirement for Local Nature Recovery Strategies to set the statutory footing for steering local biodiversity priorities with broader environmental benefits to achieve nature's recovery across the country; and there are plans afoot in relation to a new Environmental Land Management System to pay land owners and land managers to incentivise managing the land for wildlife.

- Elsewhere, tree-planting targets became a political party differentiator in the 2019 as a simplified link to tackling climate change; however political pressure for tree planting should not negate the need to assess which type of habitat best belongs where for the appropriate benefits, and ensuring any trees planted are the right ones in the right places, with suitable long-term management secured.

[34] CPRE (2020) England's Light Pollution and Dark Skies, https://www.nightblight.cpre.org.uk/maps/ accessed 10/08/2020

- Since 2010, the National Planning Policy has undergone a reform with several policy updates in subsequent years. In summer 2020 another Planning White Paper was released, setting out aspirations for major changes to the planning process. Desires by some to speed up the planning process and remove delays risk reducing environmental protection - and could result in less sustainable development.
- The Government is proposing to back the Oxford-Cambridge Arc which will cross Buckinghamshire and attract large-scale development. There is a potentially serious risk from this scale of development pressure to the local natural environment and numerous designated sites for nature conservation that sit within the identified arc.

- There has been a reduction in the number of local authorities with in-house Ecologists or ecological resources. Where this is the case, local authorities are less equipped to identify potential impacts on the natural environment and to suitable factor the natural environment into decision making.

- Resource pressures can also have a detrimental effect on the ability to monitor and survey biodiversity and so understand progress , challenges and priorities.

vi) Non-native species, diseases and pests – and their impacts

3.37 There are now believed to be over 3000 species of non-native plants and animals established in the wild in Britain and these species can establish in a way that poses a threat to our native wildlife[35]. It is these problem species that are referred to as "invasive non-native species" (INNS). For example:

- Introduced Signal Crayfish carry a fungal disease that is fatal to our native White-Clawed Crayfish, and has caused a massive decline in this species; the signal crayfish has probably also had a significant impact on freshwater invertebrates and fish populations, although this is hard to measure;
- In Buckinghamshire & MK, American Mink are also widely established and have decimated our water vole population;
- Other mammalian aliens such as Grey Squirrel and Muntjac deer are long established.
- More recently, edible dormice have been found to be expanding their range - which could have a detrimental effect on our ecosystems.
- Box moth blight
- Tree diseases – for example, Ash Dieback, Oak Processionary moth, and other existing diseases affecting specific species - although new diseases are also expected.[36] Losses of key tree species will affect the lichens, invertebrates, birds and animals which rely on them in some way; gaps in woodland canopies can also alter the woodland ecosystem.

[35] RSPB (2020) Invasive non-native species, *https://www.rspb.org.uk/our-work/our-positions-and-casework/our-positions/species/invasive-non-native-species/* accessed 03/08/2020.

[36] Further details about pests and diseases affecting specific trees species and woodland are described at this Forest Research site (accessed Oct 2020): https://www.forestresearch.gov.uk/tools-and-resources/pest-and-disease-resources/

- Many expected fungal diseases are affecting major tree species – with upward trends expected, the frequency of outbreaks increasing, to a larger extent and with less recovery time between. We risk losing substantial species, such as junipers.

3.38 Among the invasive plant species are New Zealand pygmyweed – a serious pest in freshwater habitats, Japanese knotweed, Himalayan balsam and Giant Hogweed. In many cases, the long term effects of these species on our native flora and fauna are as yet unknown but clearly the ever increasing number of INNS is of great concern as so many of them directly impact on natives. And some species, such as Oak Processionary Moth, can damage not only other species but also change whole landscapes.

3.39 Of the tree diseases, Ash Dieback is currently posing a significant threat in Buckinghamshire and MK. For example, BBOWT estimates that around 95% of the ash trees in their Bucks reserves are currently showing signs of Ash Dieback. The level of canopy dieback / loss is also increasing. When this reaches c.50%, the tree is in danger of falling – many trees are currently at around 25-50% canopy dieback. Major and expensive tree-works are needed to reduce the tree-fall risk onto roads, railways and footpaths; or, where trees provide great value to wildlife, permissive paths may need to be diverted to allow trees to be left and remove the risk to people.

Impacts can also act in combination or cumulatively

3.40 The impacts of individual pressures on our habitats and wildlife are highlighted above. However, many of these pressures act in combination, or cumulatively, with further consequences that could be detrimental to our natural environment, the wildlife that live in it and the services it provides our communities.

3.41 A non-exhaustive but illustrative list of such cumulative impacts are highlighted below:

i) Loss of habitat connectivity

3.42 This is the division of a single habitat parcel into multiple smaller fragments, creating more isolated ecological communities that are increasingly disconnected from each other and less resilient to deterministic processes like climate change and stochastic events such as pollution.

3.43 Land use changes and loss of natural habitat mean that remaining habitats become fragmented; with smaller areas of habitat scattered across the landscape and isolated from other areas of similar habitat. Isolated habitats are at much greater risk of species extinctions and less able to adapt to environmental and other pressures.

3.44 Habitats are at multiple risks of fragmentation and loss of connectivity, including:

- Land use changes – e.g. due to development and population growth or changes in land management - continue to further fragment our natural and semi-natural habitats. Examples include agricultural fields being made larger and squarer by removing hedgerows, grassland corners and wooded copses; and the subdivision of woodland into smaller plots, making

woodland-management at scale and consistently, difficult. Changes to habitats (e.g. woodlands, hedgerows, etc) can affect, for example, the availability of pollinators, or the local air quality – not just for humans, but for wildlife, as well as habitat connectivity and overall resilience.

- Major, as well as minor, developments and infrastructure projects threaten to compound habitat fragmentation within Buckinghamshire by causing habitat loss and becoming obstacles to successful species dispersal.

ii) Pollination – decline in pollinators

3.45 The transfer of pollen from one flower to another is essential for plant sexual reproduction. Honey, social and solitary bees are key pollinators. However, the process is also carried out by hoverflies, beetles, butterflies and moths during their feeding activities. A number of crop species e.g. oilseed rape, rely on insect pollination (some are wind-pollinated) as do many wild plants, which in turn support a complex network of animal and plant life.

3.46 However, pollinating insects face a multitude of threats. These include

- Pests, disease, invasive species
- Land-use intensification
- Changes to habitats and habitat loss (e.g. hedgerow removal) and fragmentation, and
- Climate change

3.47 In the last 40 years we have seen a significant decline in honeybee abundance (most estimates are above 50%). The National Pollinator Strategy (DEFRA 2014) recognises the critical importance of the enhancement of urban biodiversity in supporting pollinators and sets out a strategy to address pollinator declines[37].

iii) River channels and hydrology

3.48 Water hydrology, flow and quality are under multiple and cumulative pressures including:

- Increased water demand and abstraction rates due to population growth and development can affect river flows. In some parts of the Chilterns, unsustainable levels of abstraction from the chalk aquifer can lead to chronic low flows and premature drying of sections of river channel. This is likely to lead to water quality decline, general degradation of chalk streams, premature or extended drying of rivers and streams, failure to reach WFD status, a loss of key landscape features and impacts on ecology and the loss of associated wildlife.

- Changes in land use, and historic changes to river structure and management, can affect river channel morphology, connectivity of rivers with their flood plain, levels of pollution, runoff rates, etc; high levels of water usage can affects flow; past river engineering can lead

[37] National Pollinator Strategy, 2014-2024, Defra (2014) ; and the Implementation Plan are both available at: https://www.gov.uk/government/publications/national-pollinator-strategy-2014-to-2024-implementation-plan (Accessed October 2020),.

to lack of connectivity with the flood plain, and unnatural erosion and deposition problems, leading to unsustainable management and maintenance practices – and losses of habitat; development and subsequent increases in hard surfaces increased runoff rates;

- In riparian zones: poor vegetation management and maintenance can affect habitat bank stability, the diversity and structure of habitats, the availability of food and shelter for invertebrates and breeding birds and the extent to which sediments are intercepted before they reach water courses. Soil erosion leads to poorer soils and excess sediment through drainage systems and overland flow to rivers.

- Pollution –diffuse and non-diffuse

- Losses or changes in management of surrounding habitats – can affect channel structure and water quality.

4. Broad opportunities previously identified for the local areas of Buckinghamshire

2.161 The Buckinghamshire and Milton Keynes Natural Environment Partnership Biodiversity Action Plan working group recently reviewed the Natural England NCA descriptions for the local areas in Buckinghamshire and, combined with expertise and local knowledge, suggested the following broad opportunities, priorities and area-based actions needed to achieve them, for the local areas of Buckinghamshire.

2.162 The NEP's Biodiversity Action Plan working group intended for all of the localised opportunities listed below, to be *in addition to* a set of broad opportunities to recover and enhance biodiversity right across the NEP area, which together aimed to reverse biodiversity decline and contribute to nature's recovery by together creating better, more , bigger and more joined habitats.

- Targets to retain, enhance and improve **priority habitats;**
- To protect, retain, create, improve, expand and manage **other habitats**, for example wildflower-rich meadows, wildflower verges, native semi-natural woodland, species-rich grasslands, scrub and edge habitats;
- **Increase investment in identifying and managing** Local Wildlife Sites, SSSIs and Nature Reserves;
- **Buffer**s around core and high quality habitat and biodiversity sites;
- **Link habitats within and across landscapes** – e.g. within and between the Biodiversity Opportunity Areas; into the wider landscape when creating new habitats; manage and enhance landscapes with mosaics of goo quality, diverse habitats, support catchment-based principles and aim to consider management plans to improve water quality and flow; promote cooperative management across an area; work towards achieving the NEP's GI Vision and Principles; ensure actions and objectives are linked across borders;
- **Increase the area of land in positive management for wildlife** (e.g. public open spaces, land management schemes, best practice for wildlife, farmer and landowner collaborations, engaging the public in managing land for wildlife);
- **Use nature-based solutions to reduce resource-use, improve biodiversity and adapt to climate change** (e.g. soil-sensitive management, sensitive water usage, more sympathetic land management, reduce runoff from hard surfaces); and develop further adaptation plans to tackle climate change risks;
- **Ensure biodiversity is a key principle in the design of new developments and urban areas** – for example by following good practice design, taking cures for existing wildlife, habitats and landscape; ensure design and infrastructure aim to reduce water run-off, protect and restore

habitats and improve the quality of rivers and groundwater - e.g. through the use of sustainable urban drainage systems to reduce flood risk; and water conservation measures to support water resources and manage demand;

- **Maintain existing greenspace and plan for good, connected green infrastructure,** including tree planting, as a result of development, e.g. to help link developed areas to natural recreation areas, and help to reduce noise and air pollution, buffer noise, reduce the impact of urban fringe development, benefit climate regulation, reduce soil erosion, improve water quality, enhance perceptions of tranquillity and reduce flooding issues:

- E**ncourage good practice with development incorporating features of biodiversity and well-designed green infrastructure**; also to incorporate sustainable urban drainage systems to reduce flood risk, and water conservation measures to support water resources and manage demand.

Northern Bucks

1. **Promote sustainable and water-friendly agricultural practices.** Maintain and manage a sustainable and productive claylands arable landscape, while managing, expanding and linking woodlands, hedgerows and other semi-natural habitats to benefit biodiversity, improve soil and water quality, and ameliorate climate change by promoting good agricultural practice. This is likely to include working with local farmers, landowners and managers to promote best practice - including reducing herbicide and pesticide use to minimise runoff containing chemicals, buffering field margins, woodland edges and water courses, linking areas of semi-natural habitat, reducing soil compaction, managing vegetation to bind the soil, using local water sources sustainably and improve water quality for aquatic biodiversity, and managing soils to keep them on the field and to sequester CO2, preparing, implementing plans to control new pests and diseases, retaining winder stubble to support farmland birds and pollinators and promoting woodland management. Work to reduce surface and groundwater pollution under the principles established by Catchment Sensitive Farming[38].

2. **Protect aquifers and enhance the quality, state and structure of the River Great Ouse**, its valley and tributaries, habitats, waterbodies and flood plain by seeking to enhance their ecological and recreational importance while taking into account their contribution to sense of place and regulating water flow, quality and availability. This is likely to involve encouraging sustainable land management in farming areas and along water courses, and the use of sustainable urban drainage systems such as permeable surfacing within urban areas to help reduce run-off. Actions may also include: reinstating flood meadow pasture to allow for seasonal high water levels and summer grazing, and to support its associated species and assemblages; Enhancing and expanding suitable conditions for wetland species including natterjack toad, sedges, lower plants

[38] Catchment Sensitive Farming is a partnership between Defra, the Environment Agency and Natural England. It works with farmers and a range of other partners to improve water and air quality in high priority areas. CSF offers farmers free training, advice and support for grant applications. Further info available here: https://www.gov.uk/guidance/catchment-sensitive-farming-reduce-agricultural-water-pollution

including liverworts, and fungi; enhancing river corridors by planting wet woodland, including native willow, poplar and alder; and preventing the introduction and spread of non-native invasive species (plants and animals) that have an adverse impact on river life biodiversity and ecological status.

3. **Manage, enhance, extend, link and encourage native woodland** – through the conservation and management of existing woodlands and the replacing of introduced species with native species, such as indigenous broadleaves, as well as undertaking new tree and woodland planting to link existing sites and ancient and veteran trees, to enhance biodiversity.

4. **Encourage the appropriate management and expansion of traditional orchards**, bringing them back into active management to conserve their genetic diversity, biodiversity value and cultural heritage; and promoting and encouraging local markets for locally grown orchard produce

5. **Management, extension and linkage of semi-natural habitats and green infrastructure.** Plan and create high-quality green infrastructure to help accommodate growth and expansion, linking and enhancing existing semi-natural habitats and helping to improve biodiversity – with positive impacts on soil and water quality, climate regulation and recreation. This could include through targeted environmental enhancements, including ponds, hedgerows, hedgerow trees including conserving and planning for the replacement of ancient and veteran trees, and species-rich grasslands (such as areas found along road verges, green lanes and field margins) as well as conserving, strengthening, restoring and creating links between native woodlands, hedgerows, orchards and historic parkland to support biodiversity.

6. **Regenerate towns and major urban areas and build biodiversity into planning -** to improve and create new opportunities for biodiversity, recreation, timber and biomass provision while strengthening sense of place, tranquillity, resilience to climate change, and people's health and wellbeing. Actions could include creating new woodland on urban fringes, managing sites experiencing visitor pressure, conserving and managing traditional orchards, hedgerows, parkland, ancient and veteran trees from inappropriate development and land use and design green infrastructure early and strategically in line with the NEP's Vision and Principles for the Improvement of Green Infrastructure in Buckinghamshire & Milton Keynes.[39]

Aylesbury Vale Area

Broad objectives for the "Upper Thames Clay Vales"

1. **Restore and create wetland habitats.** As hydrological conditions sustainably allow, providing for a range of wildlife and contributing positively to the wider mosaic of habitats in the landscape including wet grassland, ponds and fens. Conserve wetland habitat in the flood plains which support breeding birds including waders.

[39] NEP (2016), Vision and Principles for the Improvement of Green Infrastructure in Buckinghamshire & Milton Keynes. Available here: https://bucksmknep.co.uk/projects/vision-and-principles-for-the-improvement-of-green-infrastructure/ . See also the accompanying map and explanatory document – available here: https://bucksmknep.co.uk/projects/gi-opportunities-mapping/

2. **Maintain and enhance hedgerows and field/hedgerow trees.** Conserve veteran trees in fields, hedgerows and woods. Ensure there are successor trees and retain deadwood where possible. Maintain characteristic native black poplars in the Aylesbury Vale and increase hedgerow planting within the landscape.

3. **Encourage green development and access to nature.** Meet access to Natural Greenspace Targets and integrate biodiversity features within proposed developments. Opportunity for creation of new traditional orchards using varieties of local provenance.

Broad objectives for the 'Midvale Ridge'

1. **Protect and manage complex of calcareous habitats**. Promote awareness of and provide advice to landowners on managing these calcareous habitats of biodiversity interest. Increase the connectivity of fragmented calcareous grassland and flushes, and where possible seek to link and extend them to strengthen their resilience

2. **Encourage and restore diverse arable habitats.** Encourage management of arable land for farmland bird communities by less intensive management and active restoration where necessary. Promote awareness amongst landowners of the location of particularly important uncommon arable weed communities and their management requirements.

3. **Restore and connect ancient and semi-natural woodlands.** Restore coppice management and conifer Plantations on Ancient Woodland Sites (PAWS) back to native broad-leaved woodlands where appropriate. Develop a co-ordinated approach to deer management with landowners. Encourage the restoration of hedgerows where these will link patches of woodland. Encourage management and landscape planting for Bechstein's Bat and black hairstreak butterflies.

Chilterns

1. **Promote and support landowner and farmer-led initiatives** that prioritise nature and deliver wildlife conservation, aquifer recharge, soil health and carbon storage at a landscape/ catchment scale.

2. **Improve the condition of existing wildlife habitats**, including chalk grassland, ancient woodland, beech woodland, chalk streams and riparian habitats, arable field margins, hedgerows and traditional orchards.

3. **Manage woodlands to create habitat mosaics and increase diversity of specie**s mix and age. Restore plantations on ancient woodland sites through a mix of natural regeneration and appropriate planting**.**

4. **Encourage livestock grazing of chalk grassland and the creation of habitat mosaics** including small areas of scrub and longer grassland as well as short turf.

5. **Create large, more joined up habitat networks**, reconnecting surviving pockets of habitat and working at landscape scale.

6. **Restore and manage native hedgerows and hedgerow trees to enhance connectivity.**
7. **End environmentally unsustainable abstraction from Chilterns chalk streams.**
8. **Promote opportunities to restore natural processes** - for example introduction of natural flood management, extensive grazing or reintroduction of key species such as pine marten to help the Chilterns achieve better ecological balance.

Thames Valley

1. **Protect and manage the area's historic parklands** (including veteran trees), wood pastures, ancient woodland, commons, orchards and distinctive ancient pollards, and restore and increase woodland for carbon sequestration, noise and pollution reduction, woodfuel and protection from soil erosion, while also enhancing biodiversity
2. **Enhance the area's rivers** – restoring their natural geomorphology to bring benefits to biodiversity – re-establishing and reconnecting to their flood plains and wetland habitats, or providing compensatory flood plains, aiding the regulation of water flow, improving water quality and benefitting biodiversity. This should include improving the maintenance of rivers and watercourses feeding into the Thames.

3. **Restore other areas for biodiversity** – e.g. Colne Valley Gravel Pits and Reservoirs.

4. **Protect and sustainably manage the area's historic parklands, wood pastures, ancient woodland, commons, orchards and distinctive ancient pollards, and restore and increase hedgerows, woodland** for carbon sequestration, noise and pollution reduction, woodfuel and protection from soil erosion, while also enhancing biodiversity, sense of place and history.

5. Ensuring that **access to the ancient woodland, veteran trees and other environmentally sensitive sites** provides equality of opportunity and a connection with nature and history, without causing damage or degradation to these unique assets.

6. **Form ecological corridors along restored rivers** to link sites that benefit wildlife.

7. **Woodlands and scrub** – maintenance and restoration

8. **Encouraging the dispersal of visitor pressures** through investment in high-quality infrastructure designed to meet the different needs and levels of use of all visitors, including local communities, recreational day-trippers and tourists.

9. **Encouraging sensitivity in development, particularly along the river**, to avoid causing any detriment to the character of the historic features and landscape.

Urban areas

The NEP's Biodiversity Action Plan working group, has also recently suggested a number of broad opportunities to recover and enhance biodiversity in urban areas, including:

1. **Engage the whole community**, increase knowledge and encourage participation to enhance biodiversity;

2. Challenge the norms of landscape maintenance to **create more biodiverse spaces**, both in the public and private realm;

3. **Encourage green development and access to nature**. Meet access to Natural Greenspace Targets and integrate biodiversity features within proposed developments. Extend the linear park system into new developments[40]; and

4. **Maintain and enhance ponds and hedgerows; conserve veteran trees, hedgerows and woods**. Ensure a diversity of new trees are planted and the correct species for the location is chosen.

[40] Milton Keynes continues to grow, and the original principles need to grow with it, this is encapsulated in the aspiration to be the greenest city[40]. The linear parks, for example, will continue to extend, blending with the surrounding countryside creating a wider green network providing multiple benefits both to the local and wider environment as well as to our economy.

5. National steer – outcomes: creating or improving habitats - areas to consider in selection

Policy area	Indicative steer for discussion with policy team
Climate Change Mitigation/Adaptation	**Want you to identify opportunities to mitigate climate change through land use and management change e.g. nature-based solutions** • Consider the climate impact of measures and outcomes that they identify in the policy areas below e.g. through woodland or peatland creation.
National biodiversity – habitats, inc protected sites	• In developing local priorities we want you to consider the nature goals in the 25YEP to; o restore 75% of our protected sites to favourable condition by 2042; o create or restore 500,000 hectares of wildlife-rich habitat outside protected sites as part of a Nature Recovery Network (broadly defined as the habitats of principle importance listed under section 41 of the NERC Act 2006); • You should consider habitats of high biodiversity value which exist locally, and NNRs, the threats and pressures that exist, and the opportunities to restore, expand, create and connect habitats. • In doing so, you could also take into account - o What is special or unique about the area o What are the main threats and pressures, or risks o Other habitats of high biodiversity value or particular local value/scarcity o Opportunities for "buffer zones" around, or links between, existing protected sites or other areas of existing high value for biodiversity to increase their resilience and connectivity across the landscape. o Opportunities for larger scale habitat recreation projects to create substantial new areas of interconnected habitat(s) at a landscape scale (nature recovery areas) • Opportunities for creating or improving habitat on nationally or locally designated protected sites should be considered, providing these opportunities do not impact negatively on the features for which the site was designated.
National biodiversity – species	**Want you to consider provision of sufficient habitat to support robust populations of nationally rare and declining species (see resources in the next bullet point for such species)** • Should give particular consideration to species that are protected on schedule 5? of the Wildlife & Countryside Act and schedule 2? of the Conservation of Habs & Species Regs, section 41 NERC Act species, Birds of Conservation Concern (red and amber on this list) plus any other species associated with habitats in your area that are nationally scarce or which have particular local significance

	• Should ideally seek to set ambitious but realistic targets for populations rather proposing prohibitions on activities per se • Consider reintroductions and translocations to boost local populations to support overall programme
Air quality	**Want you to consider opportunities for reducing ammonia emissions from agriculture near people or sensitive environmental receptors through changes in land use or management**
Water quality	**Want you to identify opportunities to reduce levels of nitrogen, phosphorus, sediment and faecal indicator organisms entering water bodies.** • Should focus particularly on areas around and upstream of water bodies with poor water quality, and on the issues these water bodies are facing • Should focus particularly on buffer strips and similar measures to reduce livestock access to water courses and to reduce over-land flow during periods of heavy rainfall. • Should also focus areas of steep gradient or current heavy soil erosion. • Look to draw on existing River Basin Management Plans and the Catchment Based Approach assessments. • You should involve CaBA partnerships and Water Companies in the step 3 process wherever possible
Flood and Coastal Erosion risk	**Identify opportunities to implement natural flood management.** • This includes considering: measures to slow flow into and through water bodies; creating space for excess water (e.g, through storage areas, river restoration or coastal realignment); as well as water level management and sustainable drainage solutions. • Target the measures based on flood risk mapping and the number of properties at high or medium risk that may benefit from the intervention. Information was provided as part of the data submission showing priority catchments where "slow the flow" measures are likely to provide greatest flood risk benefits for properties. [Note that this mapping does not cover all types of NFM measures – just slow the flow. We are working on something similar for other types, but meantime there are publicly available flood risk maps and the strategies/plans mentioned below.] • Draw on existing Local Flood Risk Management Strategies (talking to the LA's flood team), Flood Risk Management Plans (talk to EA and, where applicable, Internal Drainage Boards) and Shoreline Management Plans (EA).
Woodland creation	**Want you to identify opportunities to increase area of woodland planting** • Should consider both native species and mixed planting of non-native species where appropriate and designed to enhance biodiversity (consistent with UK Forestry Standard).

	• Should also consider risks posed by current & emerging tree diseases when selecting species for planting. • Should consider use of hedgerow planting to connect existing areas of woodland • Should avoid proposing planting in existing S41 habitats
Woodland management	**Want you to identify opportunities to increase area of woodland in active management** • Should look to provide diversity in age and structure of woodland, including retention of standing deadwood as appropriate, and ensure conservation and restoration of biodiversity is a management goal.
Soil management	**Want you to identify opportunities to protect and restore peatland (this can include shallow peat)** • Should try to target 1) stabilising of active peat erosion and 2) to restore suitable hydrological conditions to enable drained peat to rewet and begin gradual accumulation 3) Repopulate with appropriate flora such as sphagnum
Public access/engagement	**Want you to consider the benefits to increasing public access and engagement with nature when identifying opportunities for creating or improving habitat.** • Particular interest should be paid to proposals near areas of social deprivation • Where significant human disturbance is likely, proposals should consider how an overall benefit to biodiversity can still be achieved.
Heritage/historic environment	**Want you to consider impacts on landscape and heritage features when identifying opportunities for creating or improving habitat**. • Negative impacts should be avoided where possible, and opportunities for positive impacts considered where the intervention would have a wider environmental benefit.