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The contribution of designated heritage assets to biodiversity and natural capital in England:

An approach to integrated conservation

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Discovery, Innovation and Science in the Historic Environment

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Summary

This report sets out the approach, methodology and key findings relating to Project 8238 for Historic England, 'The contribution of Designated Heritage Assets to Biodiversity and Natural Capital in England'.

The project looks at how heritage assets can support biodiversity conservation, and at the relationships between wildlife, geodiversity, heritage and natural capital through a series of case studies: 6 National Character Areas (NCA) and 10 designated heritage assets. The project provides recommendations at the site, landscape and national scales for practitioners, including current and emerging funding and enhancement schemes, in the context of the statutory duty on public bodies to further biodiversity conservation, as well as considering opportunities for gains for heritage from integrated management.

Key relationships between biodiversity, heritage and natural capital were described for each case study site and NCA, including quantitative and qualitative data. These findings were collated and assessed for recurring themes, to help identify and describe the relationships most encountered.

Key findings regarding the relationships between heritage, biodiversity and natural capital included:

- Heritage has a strong influence on the biodiversity of an area. Many habitats and features of importance to wildlife and geodiversity have significant heritage elements. This includes the use by wildlife of heritage features, and the 'timeline' contribution of long-term management to the biodiversity value of a site. Heritage breeds and skills are also important for the specialist management of many sites of high biodiversity value and may also provide natural capital benefits.

- The sectors involved in the management of heritage and biodiversity may benefit from working more closely together to maximise the wildlife and heritage benefits that can be gained from integrated approaches at a variety of geographical scales.

- Natural capital benefits including wellbeing gains from sites and areas are often derived from a combination of the heritage, biodiversity and geodiversity aspects. Joint working in this regard is common at the site level and within Protected Landscapes, but there are further opportunities for the sectors to work closely together.

- Climate change is among many pressures having adverse impacts on both heritage and biodiversity. Both sectors may benefit from joint working for more resilient adaptation to change and to gain influence and resources to address common issues.

These findings led to recommendations that include specific actions relating to:

- Training, utilising expertise and carrying out further reviews of specific areas
- Policy and governance
- Site management
- Data and information

Specific guidance relating to themes integrating heritage and biodiversity was also produced.

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It must be emphasised that any errors or omissions are the responsibility of Geckoella and the contents and finding of this report do not necessarily reflect organisations or individuals consulted for information.

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1.1 Project overview

1.1.1 Historic England project 8238 evaluates the contribution of designated heritage assets to biodiversity and natural capital in England and explores how best to achieve long term integrated conservation benefits at the site, landscape and national scale. It has built on previous work by Historic England to:

- evaluate biodiversity gain through heritage asset conservation.
- explore the natural capital of designated heritage assets.
- explore synergies and opportunities, as well as potential issues with integrated cultural and natural heritage management, enhancement and conservation.
- provide practical tools and advice for site managers to assist them with mechanisms such as the Environmental Land Management Scheme and Conservation Covenants.
- help the heritage sector identify and access additional funds and support for site management.
- assist Historic England to fulfil their public body responsibilities under the Natural Environment and Rural Communities (NERC) Act 2006 and the Environment Act 2021 to further the conservation and enhancement of biodiversity. Historic England must:
    - consider from time-to-time what action it can take, consistent with the proper exercise of its functions, to further the general biodiversity objective,
    - determine policies and specific objectives it considers appropriate for taking action to further the general biodiversity objective,
    - take such action as it considers appropriate, in the light of those policies and objectives, to further the objective.

1.1.2 This project evaluates existing and potential biodiversity delivery through heritage asset conservation at a variety of geographical scales, including Priority Habitats and species and designated nature conservation sites. It studies the relationships between designated heritage assets, biodiversity and natural capital, including practical management.

1.1.3 The project looks at heritage, biodiversity and geodiversity datasets and wider information relating to 6 National Character Areas and 10 designated heritage assets. An overview of each is provided, as well as the broad natural capital values associated. Relationships between these aspects are explored, in addition to management challenges, opportunities and funding and other sources of support, including through interviews with site managers. Key findings are drawn from each of these with recurring themes explored and described to produce recommendations for action.

1.2 Biodiversity

1.2.1 Biodiversity is the variety of life found on earth. Biodiversity encompasses variation in the characteristics in the genetic makeup of a species, through to organism diversity and taxonomic hierarchy such as individuals, species and genera. On a larger scale there is ecological diversity such as the diversity in populations, habitats and biomes such as forests, tundra and marine reefs. The 1992 Convention of Biological Diversity (CBD) at Rio de Janeiro agreed that:

"Biological diversity means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems."

1.2.2 Biodiversity is not evenly distributed. More important sites and species are often identified and conserved through statutory and non-statutory mechanisms and attract the most funding for management as well as legal protection. However, it is also important to understand and measure biodiversity on the smaller scale such as in urban settings and parks and gardens. This is particularly in relation to values and benefits for local communities, including ecosystem services, wellbeing benefits relating to health, recreation, education, culture and science – derived from 'natural capital' assets.

1.2.3 Valuing and assessing biodiversity are essential in decision making in nature conservation. Knowing what species and habitats are found and where, is critical to understanding the structure and function of an ecosystem. Measuring and quantifying how biodiversity has changed through time allows us to better understand how it can

be conserved and to predict future changes. Effective assessments of biodiversity lead to better informed and effective strategies and decision making for nature conservation. This helps to ensure that policies and actions are in place where they are needed.

1.2.4 Measuring biodiversity value in England is achieved through condition assessments of protected sites, and the gathering of species and habitat data through a variety of formal and informal mechanisms. State of Nature Reports for England set out the current status of habitats and species of biodiversity significance. Current data is compared with historic data from the 1970s to determine trends and the health of biodiversity in England. Where suitable data is present, there is a decrease in biodiversity (Hayhow et al., 2019).

1.2.5 Biodiversity in England is conserved and enhanced through a variety of different legislative, statutory controls and incentives, funding regimes, organisations and individuals. In addition, significant new opportunities from the Environment Act 2021 and the Agriculture Act 2020 will be important to success. These bills form the cornerstone for the government's 25 Year Environment Plan and ambition of being 'the first generation to leave the natural environment in a better state than we found it' (HMSO, 2018).

1.3 Heritage

1.3.1 Heritage is a very broad concept that can cover both the natural as well as the cultural environment, including cultural and natural sites, historic places, biodiversity, built environments, heritage breeds, traditional skills/ techniques/ crafts and landscapes at a wide range of scales. Heritage for the purpose of this study comprises historical and cultural sites, cultural practices, knowledge, lived experiences and collections.

Historic environment

1.3.2 The National Planning Policy Framework defines the historic environment as:

"All aspects of the environment resulting from the interaction between people and places through time, including all surviving physical remains of past human activity, whether visible, buried or submerged, and landscaped and planted or managed flora." (NPPF, 2019).

Value

1.3.3 To identify the cultural and natural heritage values of a place, its history, fabric and character needs to be understood; its origins, how and why it has changed over time (and will continue to change if undisturbed), the form and condition of its constituent elements and materials, the technology of its construction, any habitats it provides, and comparison with similar places. Its history of ownership may be relevant, not only to its heritage values, but also to its current state.

1.3.4 A range of heritage values may be attached to places. These include the following conservation principles taken from the English Heritage, Conservation Principles Policies and Guidance (2008):

- Evidential value: the potential of a place to yield evidence about past human activity.
- Historical value: the ways in which past people, events and aspects of life can be connected through a place to the present – it tends to be illustrative or associative.
- Aesthetic value: the ways in which people draw sensory and intellectual stimulation from a place.
- Communal value: the meanings of a place for the people who relate to it, or for whom it figures in their collective experience or memory.

Significance

1.3.5 The significance of a place embraces all the diverse cultural and natural heritage values that people associate with it, or which prompt them to respond to it. Such values tend to grow in strength and complexity over time, as understanding deepens, and people's perceptions of a place evolve. Significance is defined as:

"The sum of the cultural and natural heritage values of a place, often set out in a statement of significance." (English Heritage, 2008).

And as:

"The value of a heritage asset to this and future generations because of its heritage interest. That interest may be archaeological, architectural, artistic or historic. Significance derives not only from a heritage asset's physical presence, but also from its setting." (NPPF, 2019).

1.3.6 The Guidance sets out a process for assessing the heritage significance of a place. It is important to understand:

- its fabric, and how and why it has changed over time,
- who values the place and why they do so,
- how those values relate to its fabric,
- their relative importance,
- whether associated objects and collections contribute to them,
- the contribution made by the setting and context of the place, and
- how the place compares with others sharing similar values.

Principles, policy and guidance

1.3.7 The Conservation Principles Policies and Guidance for The Sustainable Management of The Historic Environment (English Heritage, 2008) provide a comprehensive framework for considering management objectives of the historic environment, under six headlines:

- Principle 1: The historic environment is a shared resource
- Principle 2: Everyone should be able to participate in sustaining the historic environment
- Principle 3: Understanding the significance of places is vital
- Principle 4: Significant places should be managed to sustain their values
- Principle 5: Decisions about change must be reasonable, transparent and consistent
- Principle 6: Documenting and learning from decisions is essential

1.3.8 The principles reflect the World Heritage Convention and are consistent with the Granada Convention on the protection of the architectural heritage, the Valletta Convention on the protection of the archaeological heritage and the European Landscape Convention. All have been ratified by the United Kingdom.

Designated heritage assets

1.3.9 The National Heritage List for England is a register of heritage assets recognised by the Secretary of State for Digital, Media, Culture and Sport as of national significance. They are a material consideration in the planning process, and some have additional legal protection. Such assets range in scale from trace physical remains of past human activity and environments, whether visible, buried or submerged, to entire landscapes. The range of asset types includes Scheduled Monuments, Battlefields, Listed Buildings and Registered Parks and Gardens.

1.3.10 Whilst the report focuses on designated heritage assets, which comprises those that are recognised as being of sufficiently significant heritage value to be given formal status under law and/or policy, a wider range of heritage assets have been considered as the project has evolved. This follows the International Commission on Monuments and Site's definition of a heritage site:

"A Cultural Heritage Site refers to a place, locality, natural landscape, settlement area, architectural complex, archaeological site, or standing structure that is recognized and often legally protected as a place of historical and cultural significance." (ICOMOS, 2008).

Setting

1.3.11 Often it is not only the asset itself that contributes, or could potentially contribute, to biodiversity and natural capital, it is also the setting of the asset. All heritage assets have a setting which is defined in the National Planning Policy Framework (NPPF) as 'the surroundings in which the asset is experienced' (Historic England, 2017). The extent of a setting is not fixed and may change as the asset and its surroundings evolve. The setting contributes to the significance of the heritage asset or allows its significance to be appreciated.

1.3.12 The biodiversity found within the surroundings of a heritage asset can play an important role in the overall composition of the asset's setting. In practice the setting of assets, such as a Listed Building or Scheduled Monument often include the field, garden, park or public space in which it is located, as well as the surrounding land. The species found in these areas, as well as the management of these species can have a direct impact on the asset's setting. Therefore, the contribution of such areas to biodiversity and natural capital has been considered in this study.

1.3.13 Extensive heritage assets, such as historic parks and gardens, landscapes and townscapes have a setting of their own. However, such large areas often include many heritage assets, the historic associations between them and their nested and overlapping settings. For example, a Conservation Area will include the settings of many

Listed Buildings and have its own setting, as will the hamlet, village or urban area in which it is situated. A Conservation Area will potentially be visible from a wide area of its setting in the landscape or wider settlement. The biodiversity, natural capital and quality of the settings of such extensive heritage assets are often intimately related.

Places and their sustainable management

1.3.14 The term ‘place’ is used as a proxy for any part of the historic environment, including under the ground or sea, that people perceive as having a distinct identity. The term Place includes all the characteristics that can contribute to a ‘sense of place’. It embraces the idea that places, of any size from a bollard to a building, an historic area, a town, landscape or a region, need to be understood and managed at different levels for different purposes. A particular geographical location can form part of several overlapping ‘places’ defined by different characteristics.

1.3.15 Sustainable management of a place requires an understanding and definition of how, why, and to what extent it has cultural and natural heritage values: together these define its significance.

1.3.16 Conservation decisions need to be based on an understanding of their likely impact on the significance of the place concerned. Only through understanding the significance of a place is it possible to assess how the qualities that people value are vulnerable to harm or loss. Such understanding provides the basis for developing and implementing management strategies that best sustain the heritage values of the place in its setting.

Conservation

1.3.17 Natural processes, use and people’s responses to social, economic and technological change lead inevitable change in the environment and places. Conservation is the process of managing change to a significant place in its setting in ways that will best sustain its heritage values, while recognising opportunities to reveal or reinforce those values for present and future generations.

1.3.18 The conservation of a significant place can be achieved by sharing an understanding of its significance, and using that understanding to:

- judge how its heritage values are vulnerable to change,
- take the actions and impose the constraints necessary to sustain, reveal and reinforce those values,

- mediate between conservation options, if action to sustain one heritage value could conflict with action to sustain another,

- ensure that the place retains its authenticity – those attributes and elements which most truthfully reflect and embody the heritage values attached to it.

Heritage at risk

1.3.19 The Heritage at Risk programme was set up in 2008 by Historic England, to follow the national Buildings at Risk project which had been running since 1998. The aim is to identify the heritage assets in England that are at risk of loss through neglect, decay or development, or are vulnerable to becoming so, to help assess priorities for action and funding decisions.

1.3.20 The assessments cover assets on the National Heritage List for England (NHLE), which are judged by the Secretary of State for Digital, Media, Culture and Sport to have national significance, and allocate risk as high, vulnerable, or low, relating to factors such as arable ploughing, coastal erosion and unmanaged trees and scrub. The condition of the asset is assessed, and a priority accorded for action (Historic England, 2021a).

Cultural heritage protection

1.3.21 The National Planning Policy Framework (NPPF) sets out the Government's objectives and policies for the historic environment. The legislation that offers protection for heritage assets has developed in a piecemeal fashion.

1.3.22 There are a number of different designation regimes that identify different categories of heritage asset. Some assets have been given more than one designation. Designations at the national and international scale include:

- World Heritage Sites - The UK government is a signatory to the World Heritage Convention which was established in 1972 by UNESCO. World Heritage Sites are 'inscribed' by UNESCO for their Outstanding Universal Value. They include sites inscribed for their Natural Heritage

- Scheduled Monuments - buildings, structures, earthworks, buried remains scheduled as monuments by the Secretary of State (DCMS) if they are of national importance for their historic, architectural, traditional, artistic or archaeological interest. The regime for scheduling is set out in the Ancient Monuments and Archaeological Areas Act 1979.

- Listed Buildings - buildings and other structures listed by the Secretary of State (DCMS) that are of special architectural or historic interest. The special interest of the building is judged against published Principles of Selection and Historic England's selection guides. Buildings are graded I, II* or II. Objects, structures and buildings fixed to a Listed Building or within its curtilage may also be protected by listing. The designation regime is set out in the Planning (Listed Buildings and Conservation Areas) Act 1990. Government has set out the criteria for selection in Principles of Selection for Listed Buildings (October 2013).

- Registered Parks and Gardens - are, or were originally the grounds of private houses, but public parks and cemeteries are also categories. Under the Historic Buildings and Ancient Monuments Act 1953, Historic England compiles a register of "gardens and other land" situated in England that appear to be of special historic interest. The Register was established in 1984. Sites are graded I, II* or II. Registered parks or gardens are not protected by a separate consent regime, but applications for planning permission will give great weight to their conservation.

- Registered Battlefields - Historic England maintains a Register of Historic Battlefields. Registered battlefields are not subject to a separate consent regime, but they are considered designated heritage assets under the NPPF.

1.3.23 Ten designated heritage assets and sites are considered in this report:

- Campbell Park, Milton Keynes (Registered Park and Garden)

- Canterbury, Kent (World Heritage Site)

- Daw's Castle, Somerset (Scheduled Monument)

- The Wrecks of Goodwin Sands, Kent (Maritime Wrecks)

- Great Dixter, East Sussex (Registered Park and Garden)

- Hatfield Forest, Essex (includes Scheduled Monuments, Listed Buildings)

- Tewkesbury Battlefield, Gloucestershire (Registered Battlefield)

- Wessex Hillforts and Habitats, Dorset and Wiltshire (Scheduled Monuments)

- Sea Mills, Bristol (Conservation Area)

- Geevor Mine, Cornwall (Scheduled Monument)

1.3.24 Local planning authorities are under a positive legal duty to assess their area and review it from time to time to consider whether areas are suitable for designation, or to remain designated. Local designations include:

- Conservation Areas, designated under the Planning (Listed Buildings and Conservation Areas) Act 1990. Under the National Planning Policy Framework (NPPF) Conservation Areas are designated heritage assets and are a material consideration in planning permission decisions. The designation gives broader protection than the listing of individual buildings. All the features, listed or otherwise within the area are recognised as part of its character, including landscape and public spaces, and

- Locally listed buildings and sites. These may be offered some level of protection by a Local Planning Authority identifying them on a formally adopted list of local heritage assets. The NPPF requires that heritage assets are conserved in a manner appropriate to their significance. Local listing can provide a consistent and accountable means of identifying local heritage assets.

1.3.25 National Parks, the Broads and Areas of Outstanding Natural Beauty are designated and protected under the National Parks and Access to Countryside Act 1949. National Park authorities are the strategic and local planning authorities for their areas. The Environment Act 1995 defines the role of National Parks as being to:

- conserve and enhance the natural beauty, wildlife and cultural heritage of the National Park, and

- promote opportunities for the understanding and enjoyment of the special qualities of the National Parks by the public.

1.3.26 Areas of Outstanding Natural Beauty (AONB) are primarily designated to conserve and enhance the natural beauty of their area. Unlike National Parks they do not have their own planning powers. AONBs in general remain the responsibility of their Local Authorities by means of special committees. Only very limited statutory duties were imposed on Local Authorities within an AONB by the original 1949 Act. However, further regulation and protection of AONBs in England and Wales was added by the

Countryside and Rights of Way (CRoW) Act 2000. In the National Planning Policy Framework (March 2012) AONBs and National Parks have equal status when it comes to planning decisions on landscape issues.

Stakeholder engagement and support

1.3.27 The historic environment is a shared resource. Our environment contains a unique and dynamic record of human activity. It has been shaped by people responding to the surroundings they inherit, and embodies the aspirations, skills and investment of successive generations.

1.3.28 Public awareness of the value of and threats to our heritage is critical to long-term support. A nurturing of public interest in and engagement with the historic environment is important, including engagement with stakeholders at all levels through effective consultation.

1.4 Landscape

1.4.1 All landscapes are historic and are of heritage interest and value. Landscapes embrace a wide and complex range of interrelated natural and cultural features that are the result of the interaction between people and places through time. They include buildings, monuments, sites, places, areas, biodiversity, and both historic designed landscapes and what can be termed vernacular landscapes. The latter constitute most of the landscapes of the UK. They can be managed appropriately to the benefit of both biodiversity and heritage.

1.4.2 Landscapes have evolved over millennia as a result of both natural and cultural processes and continue to change and develop. Natural processes give rise to the physical structure of the landscape, the geology, landform and soils, and support its ecosystems and species, including humanity. Cultural processes over time have given rise to varying and ever-changing patterns and types of land use, tree cover, field boundaries and settlement. The landscapes we see today are a snapshot in time, reflecting generations of endeavour by people who have and continue to live on and from the land. Many historic landscape features, landforms and soils remain clearly visible, whilst others are now altered, their remnants buried, or have been destroyed leaving only traces. They range in scale from a single heritage feature, through properties such as an individual farm, a landed estate, rural villages, industrial complexes, large urban settlements to landforms such as quarries, to entire landscapes and landforms, comprising natural features often modified by agricultural practices, landscaping or engineering from prehistory onwards. Designated protected landscapes include Areas of Outstanding Natural Beauty (AONB), National Parks and some World Heritage Sites.

1.4.3 Landscape character is defined as a distinct and recognisable pattern of elements that make one landscape different from another. Landscape character assessment seeks to identify and explain the unique combination of elements including physical, environmental and socio-economic factors and the interrelationships between that make landscapes distinctive. The study has followed the landscape character assessment described in Natural England's National Character Area (NCA) profiles. Six NCAs were selected at random for study for the project:

- South Purbeck
- Cotswolds
- High Weald
- Orton Fells
- Bedfordshire and Greensands Ridge
- Exmoor

1.4.4 Whilst the NCA profiles include a consideration of heritage assets and features and the development of landscapes, more detailed information on the development of landscapes through time is available through Historic Landscape Characterisation (HLC). HLCs map the predominant historic landscape character of discrete patches of land, whether that character is still based on the products of prehistoric and medieval activity or is of much more recent origin. Identified landscape character areas can range from prehistoric field patterns, through medieval deer parks, woodland, fields and common land, 18th and 19th century enclosures to the large-scale urban development of the 19th century that has continued to the present day. HLCs are an important resource and have been used where available to inform the study and its understanding of the historic environment and its interrelationships with biodiversity, particularly with Priority Habitats.

1.5 Geodiversity

1.5.1 Geodiversity can be defined as "The natural range (diversity) of geological (rocks, minerals, fossils), geomorphological (landforms, topography, physical processes), soil and hydrological features. It includes their assemblages, structures, systems and contributions to landscapes" (Gray, 2004).

1.5.2 1.5.2 Geological and geomorphological conservation is related to the identification of features that reflect the full diversity and importance of geodiversity throughout England. These features are protected through statutory designations such

as Sites of Special Scientific Interest (SSSIs) and non-statutory designations such as Regionally Important Geological and Geomorphological Sites (RIGS) and Local Geological Sites (LGS). Geodiversity is also recognised as part of statutory nature conservation through key legislation such as The National Parks and Access to the Countryside Act 1949 and all subsequent nature conservation legislation in the UK, including the Wildlife and Countryside Act 1981, the Countryside and Rights of Way Act 2000 and the Natural Environment and Rural Communities (NERC) Act 2006, all of which define nature as relating to 'flora, fauna, or geological or physiographical (now referred to as geomorphological) features' (Natural England, 2015)

1.5.3 Geodiversity plays a major role in shaping the landscapes, habitats and land use. It has a fundamental influence on biodiversity, as well as on communities and heritage, as humans have influenced and exploited the varied natural capital arising from the rich diversity of landscapes and geology present in England in different ways.

1.5.4 There is a strong heritage element to geodiversity also arising from the role that UK scientists played in the early development of geology. Many of the fundamental principles and divisions of geological time were first defined in England, and many English sites and areas comprise internationally important reference sites. The science and early findings relating to geology contributed to developing ideas of evolution in the 19th century, and hence is also linked to the heritage associated with biological sciences. The value and condition of a geological Site of Special Scientific Interest is assessed according to the scientific and educational information that has previously been gained from the site, as well as the value of the features for ongoing scientific study and research (JNCC, 2004).

1.5.5 Geodiversity is important in providing and underpinning a wide range of ecosystem services of value to society, including soils for growing food, water supplies, coastal and river flood buffering, shaping landscapes and sites that contribute to our wellbeing. Geodiversity, together with biodiversity, comprises natural capital.

1.6 Mechanisms for nature conservation as relevant to heritage assets

Protected and important sites, species and habitats

1.6.1 Legislation, such as the Wildlife and Countryside Act 1981 (as amended) and the Conservation of Natural Habitats and Species Regulations 2017 (as amended) enable the designation and heritage conservation of statutory sites and species, set out a consent and licensing regime for some activities and ensure consideration of protected sites in the development control regime; as well as enabling financial and other support for positive management, enhancements, and monitoring.

1.6.2 Statutory protected sites represent the very best core areas for wildlife and their nature conservation and enhancement will be important to the success of the national and local nature networks.

1.6.3 Species Conservation Strategies are a development control mechanism now included in the Environment Act 2021. They are designed to address 'up-front' the adverse impacts likely to arise from development. The aim is to conserve local populations whilst also reducing the need for reactive, site-based assessments. The initiative builds on the experience of district level licensing for Great crested newt *Triturus cristatus*, which is now in place in many counties.

1.6.4 Protected Sites Strategies are also included in the Environment Act 2021 and are expected to operate in a similar way to Species Conservation Strategies. They may, for example, be developed to address multiple impacts on protected sites that arise from off-site impacts and a Nature Recovery Plan may help to focus and direct action and resources. An example of their use would be resourcing action for landscape connectivity that will help to ensure favourable conditions for bat populations from Special Areas of Conservation (SAC) across the southwest of England.

Public duty

1.6.5 Public bodies have a statutory duty to further the conservation and enhancement of biodiversity (Natural Environment and Rural Communities Act 2006; Environment Act 2021). Each body, including statutory heritage agencies, will be required to:

- consider from time-to-time what action it can take, consistent with the proper exercise of its functions to further the general biodiversity objective,
- determine policies and specific objectives it considers appropriate for taking action to further the general biodiversity objective,
- take such action as it considers appropriate, in the light of those policies and objectives, to further the objective.

1.6.6 This report can aid Historic England in the first of these requirements.

Government funding for environmental land management

1.6.7 The government increasingly focuses support on land management that delivers public benefits, including biodiversity, access and natural capital enhancements. The most significant support, in terms of areas covered and impacts on biodiversity, comprises agri-environmental funding. Three new schemes are in development:

- Sustainable Farming Incentive (SFI)
- Local Nature Recovery Strategies (LNRS)
- Landscape Recovery Scheme

1.6.8 These schemes are the latest in a series of agri-environmental support schemes, which are moving away from 'income foregone' to 'payments for public goods', as an ecosystem services approach is embedded within government processes. Landowners are paid for the public benefits arising from their conservation and management of natural capital assets. The schemes together form a cornerstone of how the government expects to meet its targets for the UK government's 25-year Environment plan, as well as contributing to the commitment to 'net zero' emissions by 2050 (made under an amendment to the Climate Change Act). The schemes mean that farmers and other land managers are likely to be paid for delivering the following public goods:

- Clean air
- Clean and plentiful water
- Thriving plants and wildlife
- Protection from environmental hazards
- Reduced risk of harm from environmental hazards, such as flooding and drought
- Enhanced beauty, heritage and engagement with the environment
- Mitigating and adapting to climate change

1.6.9 The three schemes comprise:

- The Sustainable Farming Incentive (SFI) will provide support for individual farmers, as a successor to schemes, such as Countryside Stewardship. SFI pilots are in development, and the scheme is expected to roll-out in late 2024. Nature Recovery Plans are expected to help target SFI scheme actions and investment.

- A Local Nature Recovery Scheme will offer government funding for collaborative projects that deliver environmental benefits.

- A Landscape Recovery Scheme will support large-scale, long-term changes in land use that would contribute to biodiversity networks and deliver natural capital enhancements, such as contributions to the national carbon net zero target. Projects may include tree-planting over significant areas or peatland conservation projects (Defra, 2021).

Local Nature Recovery Strategies

1.6.10 Local Nature Recovery Strategies (LNRS) have a statutory basis under the Environment Act 2021 and will be a key mechanism for the delivery of the national Nature Recovery Network. Spatial mapping and planning tools to inform nature recovery will be required to be developed.

1.6.11 The Environment Act sets out the required content for statutory LNRS. They will together cover the whole of England, with each individual LNRS being led by an appropriate 'responsible authority'. They must include:

- a statement of biodiversity priorities for the area,

- a local habitat map that shows the most valuable existing habitat for nature and that maps specific proposals for creating or improving habitat for nature as well as wider environment goals,

- LNRS are expected to inform a collective action for nature conservation for a variety of sectors, including development control. For example, through targeting Biodiversity Net Gain and the National Planning Policy Framework requirement to plan strategically for nature (NPPF, 2019), agriculture (e.g. through the Environmental Land Management Scheme) and climate action (e.g. through highlighting the best areas for tree planting and nature-based flood management works).

Direct management and ownership

1.6.12 Direct management and ownership of sites for biodiversity by government and non-governmental organisations (nature reserves) remains a crucial element of nature conservation in England and elsewhere, particularly where these represent ‘core nature’ areas of high biodiversity value.

1.6.13 Management of sites for other or multi-purposes can also help to deliver biodiversity targets. This includes where management protects a site from pressures relating to agricultural intensification or development. Other or additional site management objectives can include heritage, landscape, recreation and the use of land for military purposes.

Biodiversity Net Gain

1.6.14 Biodiversity Net Gain (BNG) is mandated by the Environment Act 2021. This will place a requirement on local planning authorities to achieve benefits for biodiversity through development control mechanisms. Many Local Authorities already include BNG policies within their local plan policies. BNG is one of a suite of public benefits, under the umbrella of ‘Environmental Net Gain’, that are increasingly expected to be delivered through state support and development control (HMSO, 2018).

1.6.15 Biodiversity Net Gain is ‘development that leaves biodiversity in a better state than before’ (Baker et al., 2019). This compares habitat condition, type and area, once a project has completed, as compared to the baseline at the start of the project. A standardised metric is used to calculate the ‘net gain’ figure (Crosher et al., 2019). Areas put forward will need to achieve a gain of at least 10% and be actively managed for biodiversity for a minimum of 30 years (Baker et al., 2019).

1.6.16 The ‘mitigation hierarchy’ still applies, so that developers are required to demonstrate how they first avoid, second mitigate and finally compensate for adverse effects arising from a proposal. BNG is only applied after all reasonable options under avoidance and mitigation have been explored.

1.6.17 It is unclear yet how heritage would best fit into the Environmental Net Gain scheme. Heritage assets are likely to be referenced in two of the 18 services comprising Natural England’s eco-metric (Warburton C. pers. comm. 2021). These are:

- Sense of place around locally determined important places and habitats, which includes cultural and heritage assets
- Recreation – special areas of access including heritage coast

1.6.18 The recent ‘Planning for the Future’ white paper set out how national and local level environmental, heritage, landscape and other data should be made available to authorities, communities and applicants in digital form in order to make it easier to re-use and update information and reduce the need for site-specific surveys (NPPF, 2020). This will require significant investment in the quality data, most likely by public bodies.

Nature conservation covenants

1.6.19 The security of long-term favourable land management can be crucial to the success of conservation initiatives. The Environment Act 2021 includes provision for ‘conservation covenants’, enabling obligations for positive management to be passed on to successors or purchasers of land. This will be important for many nature recovery actions and projects, for example, within the Mendip Hills AONB.

Stakeholder engagement and support

1.6.20 For all activities for nature conservation, public awareness of the value of, and threats to, biodiversity is critical to long-term support. A nurturing of public interest in and engagement with nature and biodiversity is important, including engagement with stakeholders at all levels through effective consultation.

1.7 Natural capital

1.7.1 Natural capital is related to, but distinct from biodiversity and geodiversity in terms of how it is described, evaluated and managed. Natural capital is defined as the stock of living and non-living natural assets, including geology, soils, water and all living organisms. The benefits of natural capital to us can be measured in terms of ecosystem services, which are the vital processes that derive from ecosystems that make our planet habitable to humans, such as clean air and food provision, as well as the aesthetic values and mental wellbeing. A healthy and balanced ecosystem is more resilient to stresses, such as climate change, and will have an increased ability to provide the ecosystem services and maintain the natural capital that we require to thrive on this planet.

1.7.2 The need for long term policies and action to assist with increasing and maintaining natural capital through biodiversity and environmental action is well recognised. Monetary and other values can be assigned to selected ecosystem services so that we can better understand and monitor the contribution made by natural capital assets from an economic perspective. This approach to valuation can be useful for influencing decision making. Although it is no substitute for the effective articulation of the need to protect biodiversity and geodiversity based on intrinsic values and ethics,

natural capital and ecosystem service calculations can convey some key additional benefits derived from nature conservation. Since many decisions are made at least partly based on economic consideration, looking at biodiversity and geodiversity in terms of natural capital enables environmental decisions to also be discussed in financial and asset management terms (e.g. Dasgupta, 2021).

1.7.3 1.7.3 Economic techniques for measuring the value individuals and communities place on natural resources are rapidly evolving. However, describing the relationship between biodiversity and natural capital remains complex and challenging. Natural capital can include a wide range of assets, and measuring the benefits associated with public goods can be problematic. Values can be easier to measure for 'tangible and transferable' stocks, such as wood, compared to, for example pollinators, views from a locality or climatic buffering (Dasgupta, 2021).

1.7.4 Natural stocks may be used to derive benefits in a sustainable manner or can be depleted. Use can be extractive or non-extractive (Lovell et al., 2018). Agriculture is one industry that both relies upon and impacts on the natural environment for production. Conservation grazing can be crucial for the management and maintenance of natural stocks relating to soil conservation and biodiversity. Decline in the condition and resilience of the natural environment (for example, loss of soil or access to water), including biodiversity (pollinators) can pose a risk to agriculture. Sometimes the relationship is complex, for example, wildlife can eat crops, but can also contribute to pest control.

1.7.5 Natural capital is not the only stock used by people. There is also produced capital (e.g. roads, buildings, machines, ports) and human capital (e.g. health, education, skills). Heritage includes produced capital, in that some assets of heritage value have cultural capital (for example, you can live in a Listed Building). As well as studies into the values and benefits of heritage (HLF, 2016), researchers have increasingly explored the relationships between heritage, ecosystem services and natural capital (e.g. Powell et al. (2019), RPA and LUC (2019), Fluck and Holyoak (2017), Youngs and Horner (2019)).

1.7.6 There is a rapidly growing body of evidence related to the wellbeing benefits derived from living in, visiting or otherwise having access to (whether direct or indirect) a high-quality environment (e.g. Natural England (2009), Fujiwara et al. (2014)). Many landscapes and sites have significant heritage, biodiversity and geodiversity values.

2 Methodology

2.1 Selection of sites and areas

2.1.1 Case study sites were selected to illustrate a wide range of different types of designated heritage assets, with a variety of biodiversity species, habitats and inter-relationships, under a selection of different ownership and management arrangements. The project team and steering group developed a long list of options, from which a short list of 16 were drawn up to give a variety of types of sites, quality and type of biodiversity likely to be associated, as well as geographical spread. Some sites were then excluded due to lack of data or costs of analysis, resulting in a final list of 10 heritage assets.

2.1.2 The ten heritage assets studied in this report are listed in the table below along with their heritage and/or biodiversity designation.

Heritage Asset	Heritage Designation	Date listed/ Registered	Biodiversity Designation	Date of Notification
Campbell Park, Milton Keynes	Grade II Registered Park and Garden	18 Aug 2020	None	N/A
Canterbury World Heritage Site (WHS), Kent	UNESCO World Heritage Site	17 Dec 1975	St Augustine's Abbey (Local Wildlife Site)	Not available
Daw's Castle, Somerset	Scheduled Monument	17 Jan 1969	Cleeve Hill (Site of Special Scientific Interest) Local Wildlife Site	07 July 1989 Not available
The Wrecks of Goodwin Sands, Kent	HMS Stirling Castle (Protected Wreck) HMS Restoration (Protected Wreck) HMS Northumberland (Protected Wreck) Admiral Gardner (Protected Wreck) Rooswijk (Protected Wreck) GAD 8 (Protected Wreck) GAD 23 (Scheduled Monument)	07 May 1980 08 Jun 1981 08 Jun 1981 02 May 1985 13 Jan 2007 03 Aug 2012 18 Jan 2021	Marine Conservation Zone	31 May 2019

Heritage Asset	Heritage Designation	Date listed/ Registered	Biodiversity Designation	Date of Notification
Great Dixter, East Sussex	Grade I Park and Garden	25 Mar 1987	High Weald (Area of Outstanding Natural Beauty)	Oct 1983
Hatfield Forest, Essex	Forest Lodge (Grade II Listed Building) Shell House (Grade II Listed Building) Portingbury Hills (Scheduled Monument) Bronze Age Barrow (Scheduled Monument)	07 Mar 1983 08 Aug 1985 Not available* Not available*	National Nature Reserve Site of Special Scientific Interest	Not available 09 Aug 1985
Tewkesbury Battlefield, Gloucestershire	Registered Battlefield	06 Jun 1995	None	N/A
Wessex Hillforts and Habitats Project sites, Dorset and Wiltshire	Badbury Rings (Scheduled Monument) Coney's Castle (Scheduled Monument) Figsbury Ring (Scheduled Monument) Hod Hill (Scheduled Monument) Lewesdon (Scheduled Monument) Pilsdon Pen (Scheduled Monument) Wick Ball Camp (Scheduled Monument) Cley Hill (Scheduled Monument) Eggardon Hill (Scheduled Monument) Hambledon Hill (Scheduled Monument) Lambert's Castle (Scheduled Monument) Park Hill Camp (Scheduled Monument) White Sheet Hill (Scheduled Monument)	15 Oct 1924 13 Dec 1929 28 Nov 1934 Not available* 18 May 1960 12 Sep 1936 19 Nov 1928 03 Mar 1927 26 Mar 1958 Not available* 26 Aug 1924 19 Aug 1954 17 Sep 1955	Dorset (Area of Outstanding Natural Beauty) Cranborne Chase and West Wiltshire Downs (Area of Outstanding Natural Beauty) Hambledon Hill (National Nature Reserve) Various Site of Special Scientific Interest Ancient Woodland Site of Nature Conservation Interest	1962 1982 Not available N/A Not available Not available

Heritage Asset	Heritage Designation	Date listed/ Registered	Biodiversity Designation	Date of Notification
Sea Mills Conservation Area, Bristol	Conservation Area	18 Feb 1981	Avon Gorge (Site of Special Scientific Interest) Avon Gorge (Site of Nature Conservation interest)	11 Mar 1988 01 Apr 2005
Geevor Mine, Cornwall	Cornish Mining World Heritage Site Scheduled Monument	13 July 2006 30 Jun 2005	Cornwall (Area of Outstanding Natural Beauty) Aire Point to Carrick Du (Site of Special Scientific Interest) County Geology Site	1959 26 May 1995 Not available

* Heritage designation listed dates obtained from the Historic England website. Where the date is unavailable the record was generated from an “old county number” (OCN) scheduling record, which are the oldest designation records, as such they do not yet have the full description available.

Table 1: Heritage and biodiversity designations for 10 case study sites

2.1.3 The project also wished to examine relationships between heritage, biodiversity and natural capital at the landscape scale. Natural England has subdivided England into areas of similar character, based on a combination of landscape characteristics, biodiversity, geodiversity and economics. Six National Character Areas (NCAs) were selected by random and comprised Bedfordshire and Greensands Ridge, Cotswolds, Exmoor, High Weald, Orton Fells and South Purbeck.

2.1.4 The scope of the study related to the delivery of biodiversity gains by designated heritage assets. The datasets selected were substation, but inevitably limited by availability and budget. This study does not seek to explain or explore the delivery of heritage conservation through action for biodiversity. However, key themes relating to integrated management and the multiple benefits to be gained through join working come though regularly in the analysis.

2.2 Project team

2.2.1 The Geckoella Ltd. Project Team includes Kate Jeffreys (Director and Lead Author), Brendan Cooper (Coordinator), Simon Ford (research and text), Phil Collins (heritage), and Alex Woolcock (statistics and mapping) and Andy King (geodiversity) with contributions by other team members relating to specialist groups and interest features. The Project Managers for Historic England are Hannah Fluck and Matt Canti. A Steering Group for the project including representatives from Historic England, Natural England and Forestry England provided significant input and guidance as to the priorities for the project as well as valuable information. Additional input from stakeholders including through questionnaires (Appendix 1) helped to define the most significant gaps in existing knowledge and advice for practitioners, as well as important relationships between biodiversity, geodiversity and heritage.

2.3 Heritage assessment

2.3.1 Designated heritage assets used in the assessment are listed below. They were described or mapped for each case study asset and National Character Area, depending on the availability of data.

- Scheduled Monuments
- Listed Buildings
- Registered Battlefields
- World Heritage Sites
- Protected Wrecks
- Registered Parks and Gardens
- Conservation Areas
- Heritage Coasts

2.3.2 A heritage assessment was carried out for case study sites and NCAs by desk study. Open-source data was obtained from MAGIC (Natural England, 2021) and other sources. Historic Environment Records (HER) centres were contacted. Most HER managers supplied free of charge, comprising heritage data including observations from sites, events and collections. On occasion, significant additional site-specific data was available, for example relating to Hatfield Forest.

2.3.3 Interviews with site managers, where practicable, were used to gain further information about the heritage on site, its management, and any issues (appendix 1). The interviews were also an important opportunity to explore the cultural capital and wellbeing associated with a site, including how the heritage asset is perceived, used and appreciated by different communities.

2.3.4 NCAs were also described using the National Historic Landscape Characterisation (NHLC) classification derived by Historic England. We were interested in how useful the NHLC would be for informing the integrated management of biodiversity and heritage at the landscape scale (for example, for Nature Recovery Mapping). Historic Landscape Characterisations when available at the county level also contributed to the analysis.

2.3.5 Protected Landscapes with integrated interests and objectives including heritage, such as Areas of Outstanding Natural Beauty and National Parks, were also included in the study but were not included in the statistical analysis.

2.4 Biodiversity assessment

2.4.1 A biodiversity desktop assessment looked at data relating to case study sites and NCAs. This included open-source data available for each site and NCA from MAGIC (Natural England, 2021) and Natural England as well as Historic England. This data included, Priority Habitats and designated sites (SSSI, SAC, SPA, Ramsar sites, National Nature Reserves). For the purposes of the study ancient woodland is considered a non-statutory wildlife designation.

2.4.2 Data was also obtained where practicable from Local Record Centres (LRC) comprising local wildlife sites and protected and notable species, as well as a check that LRC data was consistent with open-source information in relation to Priority Habitats and designated sites. Where quotes from LRCs were too large for the project budget then case studies / NCA areas unfortunately had to be dropped from the study (some quotes from LRCs seemed to be surprisingly high in comparison to others).

2.4.3 The study of the 10 case study sites and the 6 NCA areas looked at the biodiversity present within the site using QGIS for desk-based analysis.

2.5 Geodiversity assessment

2.5.1 The geodiversity assessment for case study heritage assets and National Character Areas was based upon the presence of statutory and non-statutory designated sites for geological and geomorphological features, together with a general, brief appraisal of the geology, soils and landforms of the area.

2.6 Natural capital assessment

2.6.1 The natural capital assessment for case study assets was based on the desktop analysis of each site which drew out the key environmental qualities of the area and the likely ecosystem services delivered by areas designated as heritage assets.

2.6.2 The natural capital assessment for National Character Areas was drawn from the NCA descriptions that set out the primary elements of natural capital in each area.

2.7 Fieldwork

2.7.1 Fieldwork was carried out to ground-truth the desktop assessment for four case study heritage assets (Geevor Mine, Daw's Castle, Sea Mills, Tewkesbury Battlefield). The Project Team also has between them recent professional knowledge from visits of most of the other sites and NCA areas. Site visits were also helpful to experience the asset from the perspective of a member of the public, looking at how places are displayed, and any interpretation and other materials.

2.7.2 Fieldwork visits were carried out as below:

- Sea Mills, visited by Kate Jeffreys on 26th November 2020
- Daw's Castle, visited by Kate Jeffreys on 24th November 2020
- Exmoor National Park visited by Kate Jeffreys on 25th November 2020
- Tewkesbury Battlefield visited by Brendan Cooper on 16th February 2021
- Geevor Mine visited by Kate Jeffreys on 17th December 2020
- Wessex Hillforts and Habitats Project sites, visited on a variety of dates in 2020 by Simon Ford

2.8 Assessment of relationships between heritage, biodiversity, geodiversity and natural capital

2.8.1 Key relationships between biodiversity, heritage and natural capital were described for each case study site and NCA, including quantitative as well as qualitative data. These findings were collated and assessed for recurring themes, to help identify and describe those relationships most encountered. Finally, recommendations were developed relating to how best to achieve biodiversity conservation through making the most of heritage assets; opportunities for mutual heritage, and biodiversity enhancement and benefits, at the site, landscape and national scales, have also been explored.

2.8.2 Advice Notes were produced for Heritage Asset Managers to help with site management and joint working between sectors. These advice notes are included in Appendix 2 and include heritage and biodiversity at a site scale and landscape scale, and for heritage and natural capital.

2.9 Statistical analysis

2.9.1 National Character Areas were subject to detailed statistical analysis where data was available to explore the relationships between the various designations (Appendix 3). A chi squared test was implemented which tests for associations between two or more categorical variables. For example, heritage designations (i.e. Scheduled Monuments and parks and gardens) and biodiversity designations (statutory and non-statutory). If biodiversity designations have no effect, we would expect the same area by proportion of heritage designations in statutory and non-statutory designated areas. Our hypothesis was that there is no statistically significant association between heritage designations and biodiversity designations.

2.9.2 In order to compare designations by area, the polygons were converted into a point-based dataset, where points were randomised within each designation. Total point counts within each designation were based on their total area size. Total number of points were generated for every 100m2, with no randomised points spaced within 1m of another. Separate chi squared goodness of fit tests were used to determine whether there were statistically significant differences between the number of sample points created for heritage designations found within biodiversity designations. Biodiversity designations were either statutory or non-statutory.

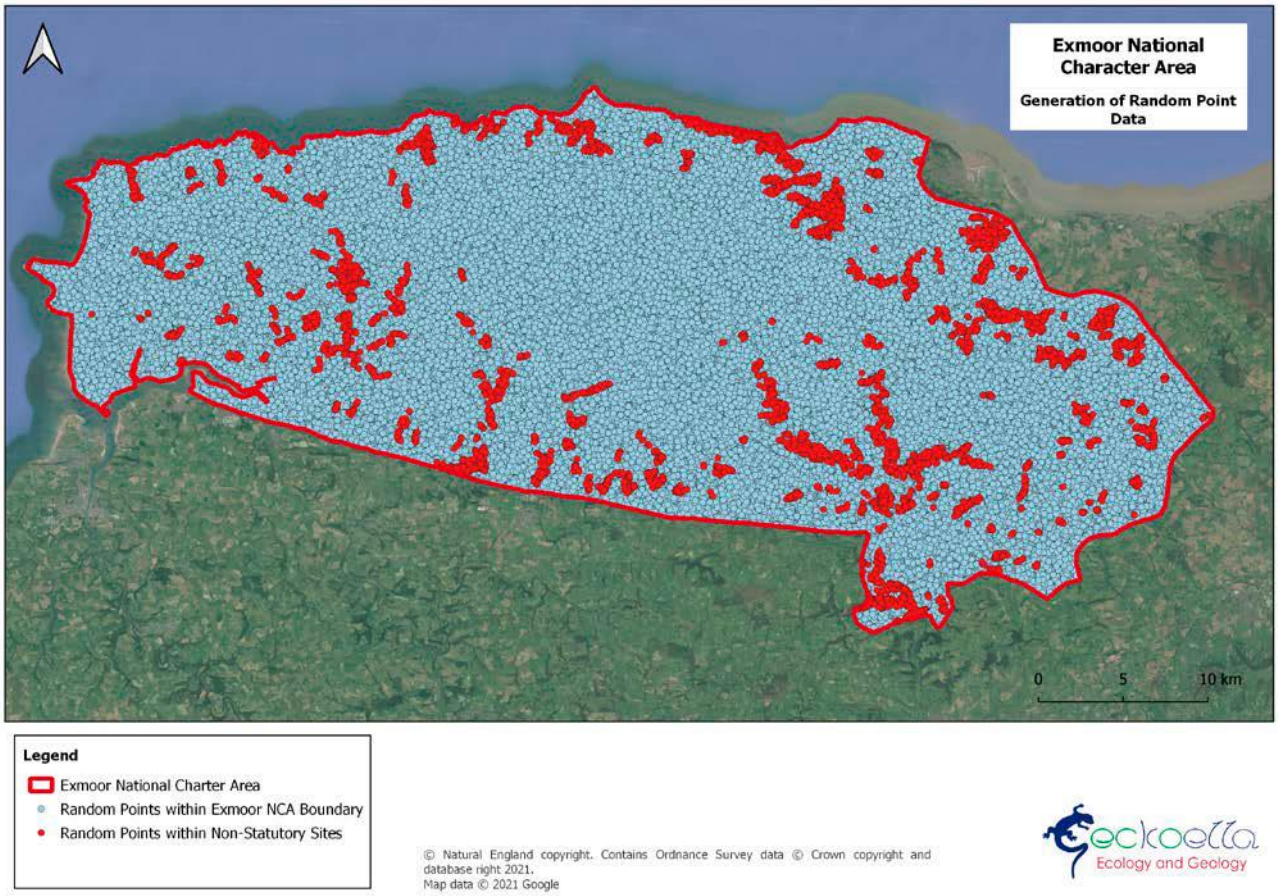

Figure 1: Map shows the generation of random point data for Exmoor National Character Area

2.9.3 A p-value that is less than, or equal to the significance level (P <0.05) indicates that there is sufficient evidence that the observed distribution of points within designations is not the same as the expected distribution. You can therefore conclude that they are not independent, and a relationship exists between heritage designations and Non-Statutory or Statutory Sites, or heritage designations and biodiversity designations or areas outside biodiversity Designations. When comparing the different designations within the different areas, the size of the chi square value provides a reliable guide to the strength of the relationship.

2.9.4 Where statistically significant relationships were found, the percentage of points found within biodiversity designations was compared to the percentage of points found outside. This additional test was carried out to determine the nature of the relationship, since the chi squared test only indicates that a statistically significant association exists – it does not indicate the character of the relationship.

2.9.5 The datasets tested for all NCAs included those set out in table 2 below where available. Local Wildlife Site data was only available in polygon format, which was a significant limitation to the statistical analysis.

Statutory biodiversity/geodiversity	Non-statutory biodiversity/geodiversity	Heritage
Site of Special Scientific Interest	Local Wildlife Site*	Scheduled Monument
Marine Conservation Zone	Local Geological Site*	Registered Battlefields
National Nature Reserve	Ancient Woodland Inventory	World Heritage Sites
Special Area of Conservation	Wood Pasture and Parkland Inventory	Protected Wrecks
Special Protection Area	Country Park	Registered Parks and Gardens
Ramsar Site		Conservation Areas
Local Nature Reserve		Heritage Coasts
		Listed Buildings

* Including local name variations such as County Wildlife Site (CWS), Site of Nature Conservation Interest (SNCI), Site of Importance for Nature Conservation (SINC) and Regionally Important Geological Site (RIGS)

Table 2: Datasets included in statistical tests for NCAs

2.10 Guidance for practitioners

2.10.1 Using lessons and key findings drawn from the case studies, brief advice notes for heritage asset managers was produced relating to the following and can be found in Appendix 2.

2.11 Study limitations

2.11.1 Study limitations arose from variations between and lack of desk study data. Although the content of data from different local biological record centres and Historic Environment Record (HER) centres tended to be relatively consistent, the format for delivery varied considerably.

2.11.2 The character and content of biological records and heritage records varied. Whilst biological datasets readily indicated relative priority and value of features present, HER records tended to comprise lists of all heritage in an area, that required additional analysis and interpretation in order to describe the heritage of an area.

2.11.3 The costs of obtaining data from local biological record centres varied and in some cases was prohibitive. This was a significant limitation to the statistical analysis for NCAs since we only had ready access to the boundaries of statutory and non-statutory biodiversity and geodiversity boundaries that were open source – Local Wildlife Site data would have been helpful.

2.11.4 Conservation Areas were not included in the list of types of heritage designated area considered for the NCAs due to the lack of readily accessibility of datasets. This is a limitation to the study, although Sea Mills was studied in detail to explore relationships between Conservation Areas and biodiversity.

2.11.5 Covid-19 affected the study through restricting travel. This resulted in a southerly bias to the example case study assets reflecting the geographical location of the researchers. However, the range of assets studied reflects heritage sites across England. (The NCAs were selected at random – Covid-19 or the location of the researchers had no influence on which were studied.)

2.11.6 For the statistical analysis, the chi squared statistic is sensitive to sample size. When calculating the number of individuals for each class, the sample size should be greater than 5 for each class for the most appropriate use of chi squared. Number of points refers to the number of random points allocated within each designation. However, all samples were greater than 6 for this project.

3 Heritage Asset Case Studies

3.1 Campbell Park, Milton Keynes

General description of Campbell Park

3.1.1 Campbell Park is a Grade II Registered Park and Garden comprising a key element of the significant green infrastructure in the heart of Milton Keynes (Figure 2). Pevsner and Williamson (1994) states, “Campbell Park; the city park, links central Milton Keynes to a vast swathe of parkland down the Ouse valley, in all, the largest and most imaginative park to be laid out in the 20th century”.

3.1.2 There is innovative governance through the creation of an independent charity, known as The Milton Keynes Parks Trust (MKPT), separating the management of many of the green spaces in Milton Keynes from the Local Authority.

3.1.3 Campbell Park lies adjacent the main shopping and cultural areas within the city centre of Milton Keynes town centre and was part of the vision for the new town. It was created using the natural topography as well as spoil from the development. It includes parkland, woodland, ponds and grassland as well as formal gardens, playground, a cricket pitch and other sports activities. It links to a series of other green spaces, using the flood plain and canal, including lakes, woods, other parks, nature reserves and flood plain managed by MKPT.

3.1.4 Thousands of trees were planted as part of the park’s creation, starting in 1984. The gardens include flower beds, extensive bulb planting, conifer hedges (together with established older hedgerows), ponds, designed vistas and hanging gardens. There are extensive surfaced paths throughout Campbell Park.

3.1.5 Milton Keynes Parks Trust has been awarded successive Green Flag awards for its parks and green spaces in Milton Keynes.

Figure 2: Location of Campbell Park, Milton Keynes

Campbell Park, Milton Keynes			
Site owner / manager: Milton Keynes Parks Trust **Type**: 20th century, Grade II Registered Park in the centre of Milton Keynes **Location:** Centre of Milton Keynes, Buckinghamshire **OS grid ref:** SP 862395 A**rea:** 48 hectares (part of around 2,500ha of linked greenspace in Milton Keynes)			
Priority Habitat	**Statutory Designated sites**	**Non-Statutory Designated Sites**	**Heritage Designations**
Deciduous Woodland	None	None	Parks and Gardens

Percentage Coverage Statutory Designated Sites		
Statutory Designated Sites	**Percentage Cover**	**Hectare**
None	0%	0 ha

Percentage Cover of Non-Statutory Designated Sites		
Non-Statutory Designated Sites	**Percentage Cover**	**Hectare**
None	0%	0 ha

Percentage Cover of Heritage Designations		
Designations	**Percentage Cover**	**Hectare**
Parks and Gardens	100%	48 ha

Percentage Cover of Priority Habitat		
Priority Habitat	**Percentage Cover**	**Hectare**
Deciduous Woodland	16.2%	8 ha
Lowland Meadows*		
Hedgerows*		

* not reflected in 'Magic' NE datasets but present on site (PB, pers. comm. Sep23)

Table 3: Overview of Campbell Park

Heritage of Campbell Park

3.1.6 Campbell Park is recognised as one of the most imaginative people's parks to have been laid out in the 20th century. In August 2020 Historic England recognised it as being of national importance and added it to the Register of Parks and Gardens as a Grade II Registered Park and Garden. Its designation followed a campaign by the Gardens Trust to gain recognition and protection for significant post-war gardens and landscapes.

Design interest

3.1.7 The 48-ha park was created between 1977 and 1984 based on a design of 1973-1975 by Derek Walker, Stuart Mosscrop and Andrew Mahaddie, revised by Neil Higson Milton Keynes Development Corporation. It was influenced by 18th and 19th century park design but fused with contemporary design. Inspiration was taken from the grand Victorian parks at Birkenhead on the Mersey and New York Central Park in USA. It was underpinned by the belief that landscape can have a fundamental influence on the health and quality of life of all citizens, and therefore on the success of the new city.

3.1.8 Very few large public parks were created during the late 20th century and certainly not on the scale of those in Milton Keynes. Campbell Park is particularly significant because it was incorporated into the plan for the commercial area of Central Milton Keynes. It is a key part of the planned cityscape linking the urban centre through naturalistic parkland to the Ouse Valley. The park lies on an axis with the shopping centre to the west. In the east it rises to a mound offering exhilarating panoramic views to Willen Lakes, the Newlands Tree Cathedral and beyond to Bedfordshire.

3.1.9 Generally, public parks in the UK's inner cities have tended to evolve historically, with the land often gifted or sold by wealthy property owners to Local Authorities. The incorporation of planting and planning to encourage biodiversity on this scale, from this date, and in the centre of a developing city, is notable. The park has group value with the Shopping Building, Midsummer Boulevard, which shares its sense of scale and generous use of space, and the Central Library, Silbury Boulevard (both Grade II).

3.1.10 The park was also intended as an international sculpture park. Eleven significant sculptures created by internationally renowned artists are situated in the park and work together with the design and planting, and the natural and artificial topography, to produce an outstanding, unified design. More could be done with investment.

Architectural / archaeological interest

3.1.11 The design respects the natural landscape and the industrial archaeology of the Grand Union Canal, but also forms a point of transfer between the city centre built on a grid pattern and the wide, natural landscape beyond. Its strong geometric forms are offset by a central pastoral landscape and the park is 'magnificently generous and on the right scale for the city' according to Pevsner and Williamson (1994).

3.1.12 The Grand Union Canal runs through the site with its industrial archaeology. During construction, archaeological surveys found evidence of Neolithic, Bronze Age and Saxon settlements, with Roman remains found locally. 19th century brick kilns and the remains of ridge and furrow agriculture were also recorded. There are no Listed Buildings in Campbell Park.

Biodiversity of Campbell Park

3.1.13 One of the Park Trust's aims is "To create an important environment to maximise the biodiversity of our parks and green spaces". Milton Keynes Parks Trust employs three Biodiversity Officers who work across the whole portfolio of properties in Milton Keynes.

3.1.14 Campbell Park was created in 1984 from intensively managed farmland and so will take some time to become a valuable site for wildlife, unlike more established nature reserves, lakes and woodlands that are also managed by MKPT. There are no SSSIs or County Wildlife Sites at Campbell Park. However, great strides have been made, especially in the creation of a large wildflower meadow and a series of ten ponds, interconnected by rills. A further biodiversity achievement in the park is the creation of a new area of deciduous plantation woodland on the southern ridge that runs through the park; ground flora is enhanced with a diverse species-mix.

3.1.15 A Biodiversity Action Plan (BAP) has been written for the Park Trust's land in Milton Keynes (including Campbell Park) and this includes 10 Habitat Action Plans (HAPS) and 15 Species Action Plans (SAPS), including for the great crested newt *Triturus cristatus* at Campbell Park. Reports for 300 surveys are held by MKPT going back to 1974, when the new town was first planned. However, no formal Biological Survey or Management plan has been written for Campbell Park in particular, there are still a good range of species records, both from staff as well as local people. Biodiversity planning should be considered and integrated with heritage to inform any future management, and vice versa.

3.1.16 Wildlife includes European protected great crested newt in some ponds as well as common frog, smooth newt and galingale on the fringes of water bodies.

3.1.17 Bird records are diverse and must include those on passage, such as turtle dove, nightingale, red kite, cuckoo, hobby, lesser redpoll, ring ouzel, as well as bullfinch, firecrest, fieldfare, redstart, yellowhammer, wood warbler and willow warbler.

3.1.18 Wildflowers and invertebrates recorded are sparse but include yellow rattle in the hay meadow, primrose, cowslip, ox-eye daisy and the rare corn buttercup. While butterflies include small heath, red admiral and wall.

3.1.19 None of Campbell Park is yet Priority Habitat, although there are areas which in time will become Lowland Deciduous Woodland and Lowland Meadow. In addition, there are some remnants of the original hedges which existed before the park was created. Due to a lack of veteran and ancient trees, the site is unlikely to become Wood Pasture and Parkland Priority Habitat. At the edge of Campbell Park is the Grand Union Canal, which is not designated, but links to Coastal and Floodplain Grazing Marsh along the River Ouse, close to the park.

Figure 3: Grassland with trees at Campbell Park, Milton Keynes

Geodiversity of Campbell Park

3.1.20 The topography of Campbell Park is partly natural, but also reflects spoil and tipped material created by the construction of the new town of Milton Keynes. The dominant bedrock geology comprises clays belonging to the Jurassic Oxford Clay Formation, with patches of superficial glacial gravels. The area is cut through by the River Ouzel, a tributary of the River Ouse and additionally, the Grand Union Canal, connecting London to the Midlands. The site has relatively low geodiversity interest.

Relationships between heritage, biodiversity and geodiversity

3.1.21 The designation of Campbell Park as a Registered Park was made in August 2020. Although recent, the designation is already having a significant influence on the future of the park and the surrounding area within Milton Keynes:

- The heritage designation helps to protect the biodiversity present on the site and secure long-term positive management. This is of value since the site lacks biodiversity designations that might offer a similar level of protection and consistency;

- With regard to Development Control, the Park is surrounded on three sides by land allocated for development in the Local Plan. There are several impending planning applications for developments that now have to take the designation of the Park into account in their environmental assessments;

- Consultees, including MKPT, in their responses to these applications and the related consultations, have made several references to the Park's designated status and the need for the applicant's to fully assess and avoid or mitigate the potential effects of their proposals on the Park; and

- MKPT and many others have celebrated the inclusion of the Park on the Register of Historic Parks and the designation has added significantly to the awareness and appreciation of the Park and the quality of its design and layout.

3.1.22 The presence of the park and garden in the centre of Milton Keynes, with its 250,000 population, offers an important wildlife habitat in an urban area, as well as a place for fresh air and recreation.

3.1.23 Previously mown grass has been reverted to wildflower meadows, by the spreading of green hay and introduction of grazing. This has created significant benefits for wildlife as well as saving money and carbon in mowing large areas. Grazing by

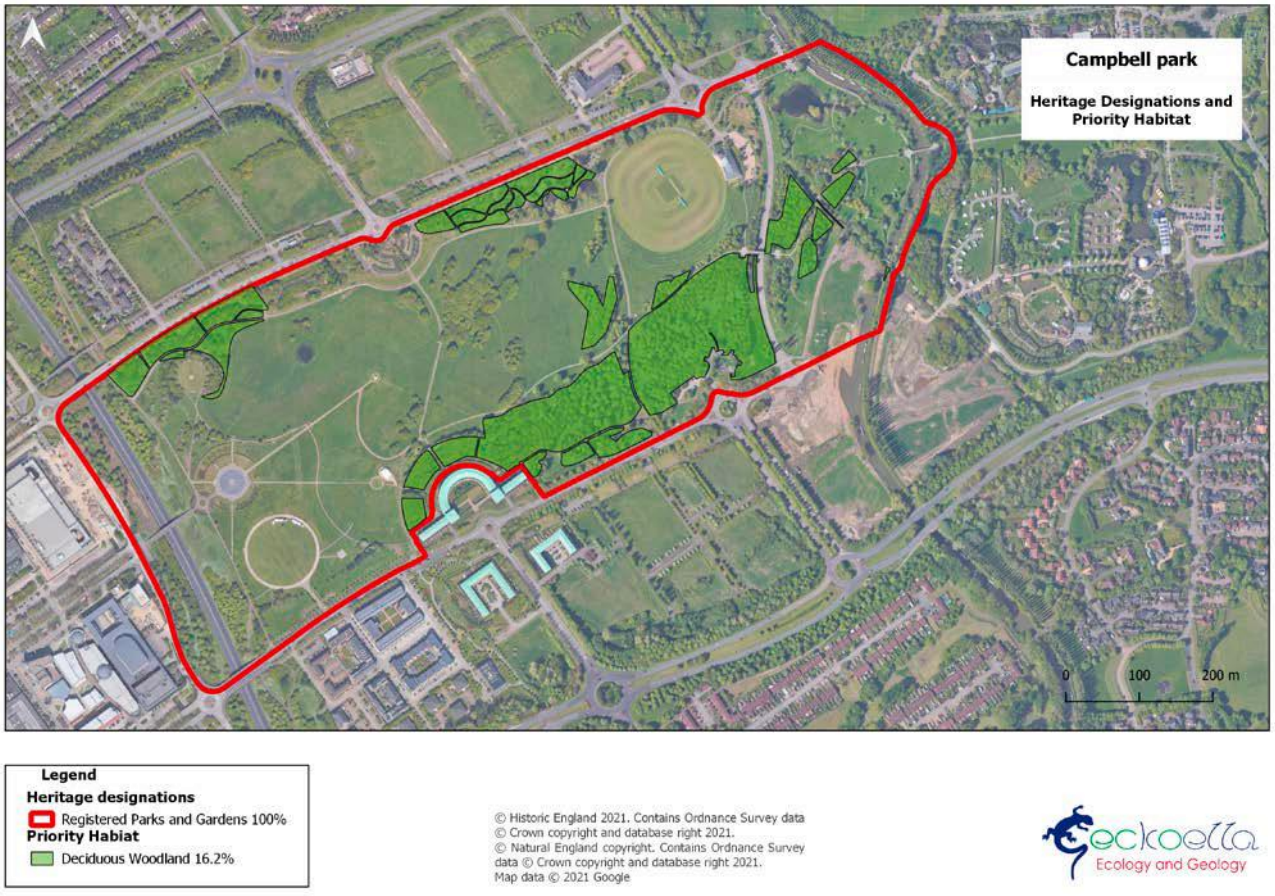

Figure 4: Heritage and Biodiversity of Campbell Park

sheep also provides a connection to the farming heritage. Milton Keynes was largely fields used for farming, so having sheep present helps to maintain the cultural heritage, understanding and connection to animals and farming.

3.1.24 *The mechanism of securing the long term management and maintenance of the Park through an endowed independent charity* is something many Local Authorities could investigate as a way of looking after their green spaces in a more financially sustainable manner.

Natural capital of Campbell Park

Cultural services

3.1.25 Many of the green corridors of Milton Keynes include important transport links, comprising walking and cycle paths for residents. These in turn reduce traffic and road use. These green corridors also provide a place for recreation and enjoyment.

3.1.26 There is ambition for the sculpture park to be “one of the world’s best arts parks”. Inspirational pieces include 11 significant works by leading artists and ‘the MK Rose’, which is a circular feature dominating the plateau and designed for “commemoration, celebration and contemplation”.

3.1.27 The Events Plateau and the Amphitheatre in the park are frequently used as venues for cultural and sporting activities. These include both professional events (such as the Milton Keynes International Festival), and those organised either by MKPT or by other groups from the local community (such as the Parks Trust’s annual Play Day and those organised, with the Parks Trust’s support, by the diverse community of Milton Keynes such as the India Day and African Diaspora festivals). With the Park located within the city centre, it is in high demand as a location for events and activities that are significant in the cultural and community life in Milton Keynes.

3.1.28 Community engagement is a key part of the Park’s ethos and there are many volunteers and events, as well as educational and outreach staff employed by MKPT. There is the potential for green social prescribing activities in future, which could have a financial benefit to the NHS, as well as improve community wellbeing.

3.1.29 Milton Keynes Parks Trust have worked hard to integrate with the local population, by employing Community Engagement and Learning staff. About 200 people volunteer in a variety of roles and there are many activities from Easter egg hunts, litter picks, guided walks and talks, park runs, group dog walks and young explorers’ clubs.

3.1.30 Activities include jogging, mountain biking, orienteering, yoga, kite flying, sledging and cricket. There is a free car park, but at present, no public lavatories. There are no significant conflicts and Campbell Park is appreciated by the community for a place for fresh air, exercise and recreation, particularly during the Covid-19 lockdown.

Supporting services

3.1.31 From its inception, there was an aspiration to plant at scale to encourage biodiversity. In recent years, the management has moved from large areas of species-poor mown grass to the creation of flower and insect rich meadows. These has resulted in more insects and a more abundant food source for birds, bats and amphibians.

3.1.32 The ponds provide habitat to European protected Great crested newts, as well as other amphibians and insects, and a water source for a range of other animals.

Regulating services

3.1.33 Campbell Park is linked to an extensive green corridor along the River Ouse floodplain and comprises part of the green infrastructure network embedded in the forward-thinking design of Milton Keynes. This network of green spaces has regulating effects on climate, noise and air pollution.

3.1.34 There are a series of 10 ponds across Campbell Park, which as well as being important landscape features and providing a habitat for wildlife, will store water which would otherwise enter the catchment.

3.1.35 The park has been planted with many trees and shrubs, which will be storing carbon, while the permanent grassland will also have a beneficial impact on sequestration.

3.1.36 The increase in insects resulting from the species rich meadows provide an ecosystem service in the form of pollinators.

Management challenges

3.1.37 Campbell Park is a large green space adjacent to the town centre of Milton Keynes. Although it may appear to not be as heavily used as might be expected, the capacity takes into account likely future nearby developments. According to the Milton Keynes Local Plan, in the period 2019-2030 an additional 3,500 dwellings could be built in Central Milton Keynes, and with Campbell Park being the only significant sized green

space in the city centre, this will mean the park inevitably become busier as it is used by more local residents as well as those from further afield traveling to it as a destination park. The challenge is to ensure new developments are well connected to the park, and the park is embedded in the cultural and recreational life of Milton Keynes as the city grows and evolves.

3.1.38 There are some areas of anti-social behaviour and drug taking in quieter parts of the park to the north. These may decline once the planned new development is completed.

3.1.39 Litter and illegal fly-tipping can be an issue at the edges of the park. MKPT now employs its own in-house Parks Cleansing Team, who patrol all of the Trust's parks but especially in known littering hotspots. Therefore, while littering is a constant problem, the Trust works hard and has employed dedicated resources to collect and dispose of the litter (as much of this is recycled as possible).

3.1.40 Whilst the extensive paved path network reduces the problem of pedestrian erosion in the park, busier zones of ground can become eroded/worn through use and require remedial works such as repairs/overseeding of worn grass areas in the appropriate season (Autumn or Spring).

3.1.41 Despite plentiful signage, sheep worrying can be a problem, as it makes management challenging. Dogs can also deter ground nesting birds.

3.1.42 Finding suitable stock and skills to graze the site was an issue. MKPT now owns its own sheep and cattle to graze its wider estate and *has a long term contracting agreement with a local farmer who manages the Trust's livestock on its behalf, bringing sheep into the park to graze the meadow area during the periods specified* by the Trust's operational team. By managing the stock in hand, it is easier to meet the necessary nature conservation objectives. There is the potential for added natural capital via supporting succession and training in these heritage skills.

3.1.43 Most trees are still relatively young, being planted since 1984 and as such are not of an age where they create any safety issues. With regard to managing expectations, some members of the public have asked why the whole of the park is not planted with trees to meet the government's carbon targets which has required the response of highlighting the value of other habitats such as grassland, the need to retain open spaces for events and recreational activities, plus the fact that Campbell Park was designed as with a range of character areas and heritage value that includes open spaces as well as zones of trees and woodland.

3.1.44 Invasive species are of concern, with the tree disease ash dieback *Hymenoscyphus fraxineus* presenting significant challenges to manage risk associated with limb fall. The approach taken is to remove or reduce ash trees in highly trafficked areas and to plant a diverse range of species where replacements are necessary.

Opportunities for funding and support

3.1.45 Placing the ownership of and management responsibility for Campbell Park with an independent charitable trust, which is self-financing through the investment of endowment funds, is rarely encountered. MKPT was established in 1992 by the Milton Keynes Development Corporation as a single purpose vehicle to take on the strategic green spaces in Milton Keynes, including Campbell Park. The Development Corporation then handed the green spaces to the Trust by granting 999-year leases. The freehold of the land was then transferred to the local authority, Milton Keynes Council. This put the city's parks under the care and management of a specialist independent charitable organisation, with the land's use as parkland secured by the terms of the 999-year leases.

3.1.46 The way that the Parks Trust is funded through the investment of its endowment assets is a model that could be adopted by other new and old settlements and developments. The Trust's original endowment, provided by the Milton Keynes Development Corporation, was in the form of income generating assets that produced a level of income that equalled the liability cost of maintaining the parks each year. This same principle of has been applied each time the Trust has taken on a new area of parkland or green space – the endowment being calculated as the capital sum necessary to provide, when invested, the annual income necessary to meet the annual costs of maintenance of the green space. Since 1992, most of the endowments the Trust has received when taking on new parkland have come through S106 agreements, the funds ultimately being derived from the uplift in the value of the land when planning permission is granted and development takes place. As well as S106 planning obligation funds for public open space provision, other funding streams that may be available towards funding endowments of commuted sums include Biodiversity Net Gain contributions. Environmental Net Gain may also evolve in the future and may include heritage as part of a 'bundle' of benefits that can help to secure future multi-benefit management.

3.1.47 Milton Keynes Parks Trust was endowed with a series of properties and investments to allow it to be self-financing. This included freehold pubs, petrol stations, a garden centre, youth hostel, shopping centre and a canal marina. These investments can be sold, and other assets bought, in Milton Keynes and elsewhere in the UK if appropriate. MKPT headquarters is in Campbell Park and is jointly a cricket pavilion.

3.1.48 MKPT will be seeking to engage with developers and the local planning authority to secure resources to upgrade the range of facilities in Campbell Park, so that the Park can serve the increased catchment population whilst also conserving its special character and status as a historic park. For example, ambitions to build a new café and toilets, which would also be a council office and community resource could help be realised through funding from development.

3.1.49 Basic Payment Scheme (BPS) payments are received for grazing sheep in the wildflower meadow but will be phased out by 2027. MKPT will be looking for other grant schemes under the new Environmental Land Management grant (ELMS) to support positive management for biodiversity and other benefits.

3.1.50 There are significant opportunities to bid for funds through the Section 106 development levy to carry out nature conservation work at Campbell Park. This could include the building of a café and community resource as well as a project to investigate the hydrology of the park and to remedy the ponds and rills drying up.

Key points from Campbell Park

3.1.51 Campbell Park has been created from farmland in less than 40 years and is a much-loved green space and place for fresh air and recreation in the middle of Milton Keynes.

3.1.52 Its scale and design have resulted in it becoming Grade II registered by Historic England in 2020.

3.1.53 Having an in-hand herd of cattle and sheep to help manage many of the Park Trust's sites, means that the timing and intensity of grazing can be fine-tuned to ensure the best management, rather than relying on farm tenants with different objectives.

3.1.54 Housing development beside the canal and on the northern boundary offers potential opportunities and challenges. The quality of the developments in terms of design and connectivity with the Park will be crucial in terms of encouraging positive interactions, managing anti-social behaviour and ensuring the landscape character of the park is enhanced and not adversely affected. The increased demands on the park as the area becomes busier will need to be recognised and planned for, and funding opportunities through mechanisms such as Biodiversity Net Gain and other development-linked funding to help pay for nature conservation and other enhancement work will need to be maximised.

3.1.55 There are further opportunities to integrate and celebrate heritage, nature and culture as part of the visitor experience, increasing understanding of the range of features present and values of the park for different users. The Park is also already a very significant venue for cultural events and activities, helping to connect communities with the park and maximising its value for visitors. In addition, the community could be engaged in developing skills such as traditional woodland and other habitat management, and in activities such as folklore and natural history walks.

3.1.56 MKPT's work in enhancing the meadows, including through use of stock, is significant given the urban context of the site. In addition, the woodland is managed and enhanced, and ponds that support populations of great crested newts and other wildlife are also valuable biodiversity assets to the area. Although the Biodiversity Action Plan for MKPT assets does not greatly feature Campbell Park and instead focuses on the more obvious nature reserves, flood plain and woodlands of the wider area, the proximity of the site to the city centre provides good opportunities to focus on access to nature and heritage, working with the local community and volunteers; there are already activities such as hedge laying and bat walks taking place.

3.1.57 A biological survey would be beneficial, to include community engagement opportunities, to help inform the Site Management Plan and ensure an integrated approach to the Park's management.

3.2 Hatfield Forest, Essex

General description of Hatfield Forest

3.2.1 Hatfield Forest is situated adjacent to Stansted Airport and the M11 in Essex, England (Figure 5).

3.2.2 In 1988, Oliver Rackham described Hatfield Forest as the “best preserved forest landscape in England and possibly Europe. It is a rare surviving example of a medieval hunting forest. The complex mosaic of traditional management regimes and perpetuation of archaic techniques on a uniquely extensive scale is of great note”. As well as its heritage interest, it is also of significant biodiversity value, comprising one of the best examples of Wood Pasture and Parklands Priority Habitat in the United Kingdom, with associated coppice, deciduous woodland, fen and grassland.

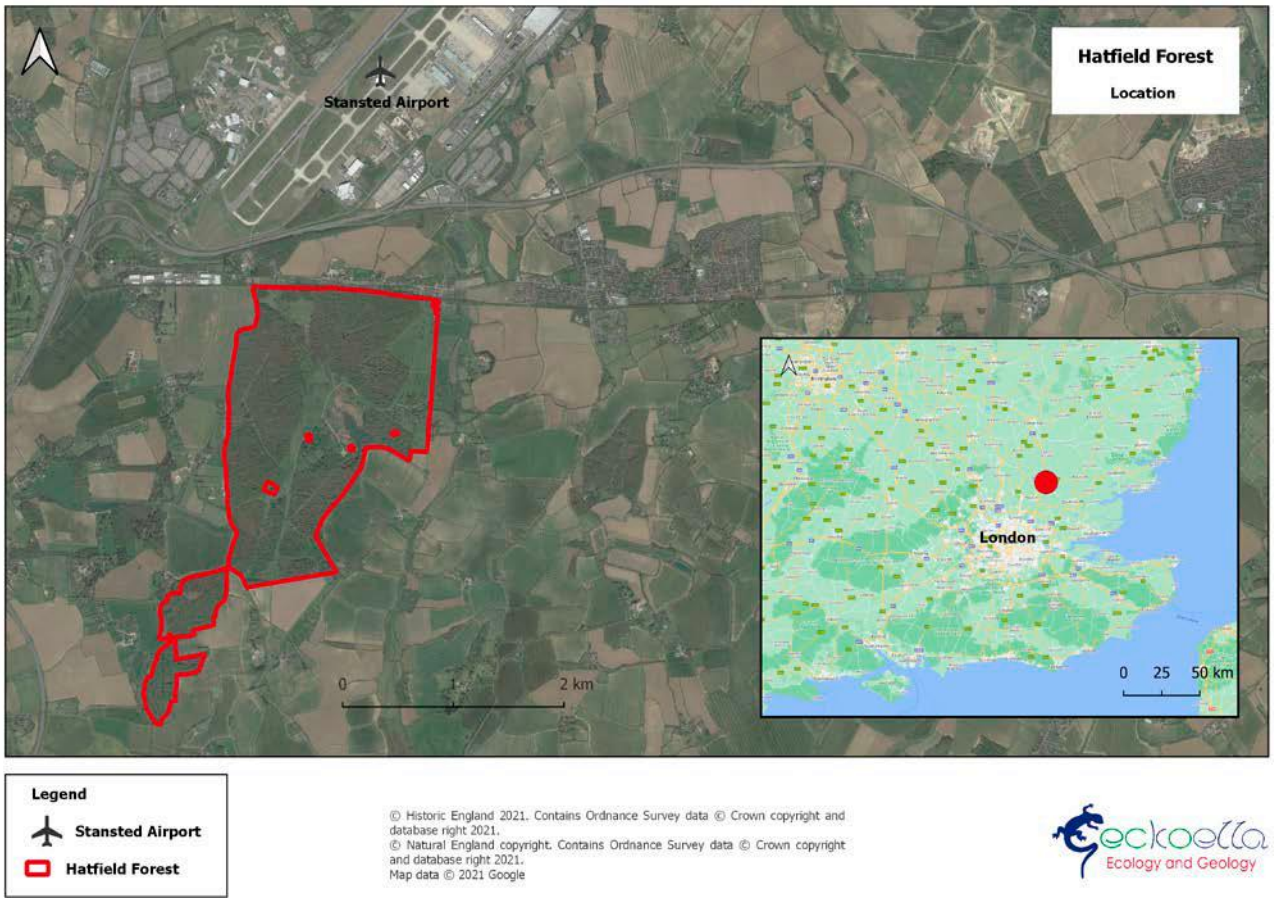

Figure 5: Location of Hatfield Forest

Hatfield Forest			
Site owner / manager: National Trust **Type**: Wood Pasture and Parkland **Location:** Essex **OS grid ref:** TL5230 A**rea:** 411 hectares			
Priority Habitat	**Statutory Biodiversity / geodiversity sites**	**Non-statutory Biodiversity / geodiversity Sites**	**Heritage Designations**
Deciduous Woodland Lowland Fen Lowland pasture Wood Pasture and Parkland No main habitat but additional habitats present	National Nature Reserve Site of Special Scientific Interest	Ancient Woodland	Scheduled Monument Listed Buildings

Percentage Coverage Statutory Biodiversity / geodiversity Designated Sites		
Statutory Designated Sites	**Percentage Cover**	**Hectare**
National Nature Reserve	95.6%	392 ha
SSSI	100%	411 ha

Percentage Cover of Non-Statutory Biodiversity / geodiversity Designated Sites		
Non-Statutory Designated Sites	**Percentage Cover**	**Hectare**
Ancient Woodland	66.5%	273 ha

Percentage Cover of Heritage Designations		
Designations	**Percentage Cover**	**Hectare**
Scheduled Monument	1.7%	6 ha

Percentage Cover of Priority Habitat		
Priority Habitat	**Percentage Cover**	**Hectare**
Wood Pasture and Parkland	95.6%	392 ha
Deciduous Woodland	100%	411 ha
Lowland Fen	0.6%	3 ha
Lowland Meadows	15.8%	65 ha
No main habitat but additional habitats present	1.4%	5 ha
Total	98%	402 ha

Table 4: Overview of Hatfield Forest

3.2.3 Hatfield Forest is an excellent example of a site where the traditional management techniques are of great interest to those in both the cultural and the natural environment. Despite being surrounded by 21st century activity such as an international airport, motorway and urban development, as well as intensive agriculture, Hatfield Forest has survived many of these changes. Additionally, it has been used as a site to trial innovative management of arboriculture and specifically pollarding techniques and the management of rare deadwood invertebrates (Harris, 2018).

Heritage of Hatfield Forest

3.2.4 Hatfield Forest is of great historic interest, comprising a rare surviving example of a medieval royal hunting Forest, with over 1000 acres of coppices and wood pasture (Figure 6). It has a rich and varied history stretching back over 2000 years through to the present day. Hatfield Forest was a Royal Hunting Forest owned by the King prior to the Norman Conquest in 1066 and is recorded in the Domesday Book. It remained as a Royal Forest until 1446, when it was transferred to Robert the Bruce, then the Duke of Buckingham and then the Riches, Turnors and Houblon families. The area was used extensively for rabbit breeding and there are several historic 'pillow mounds' evident.

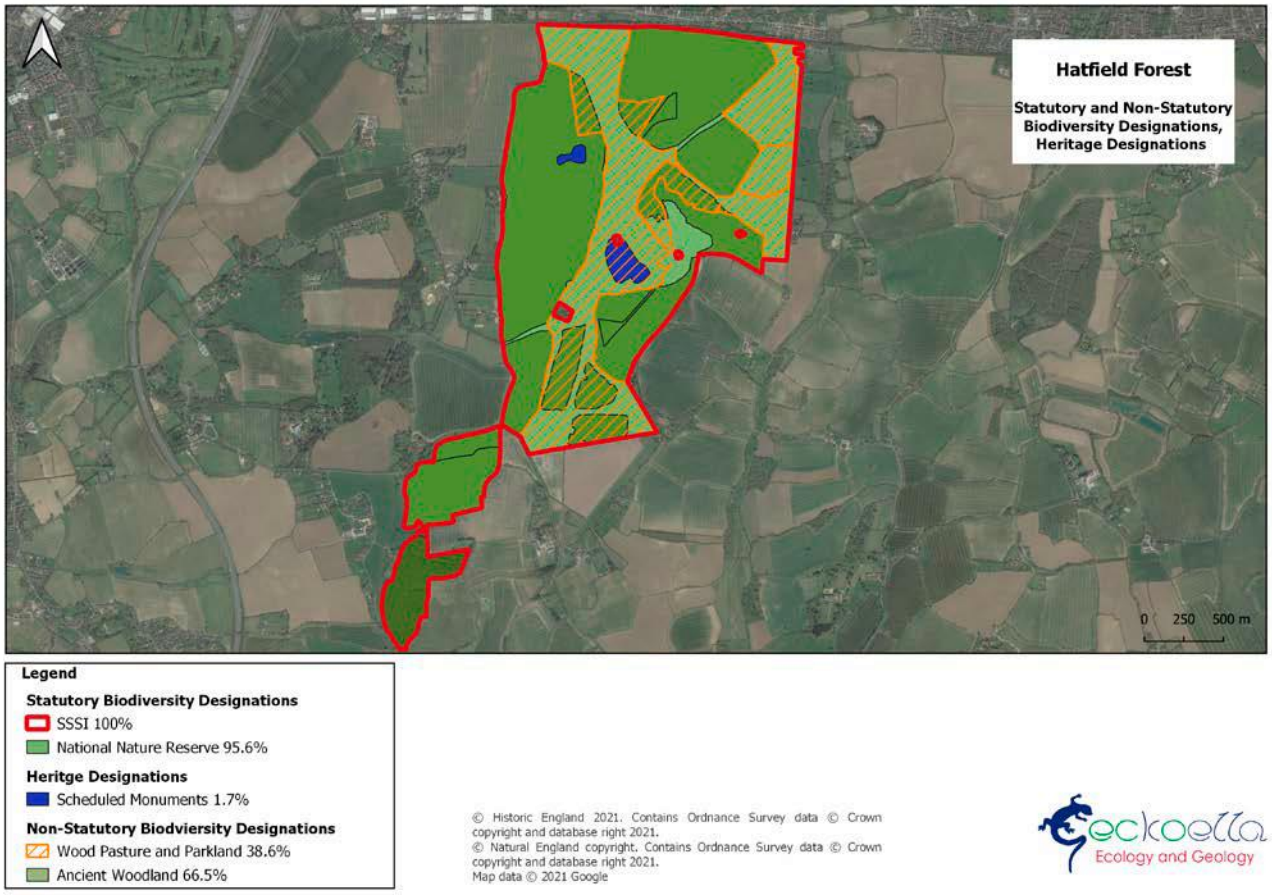

Figure 6: Hatfield Forest Biodiversity and Heritage Designations

3.2.5 Cultural management of the woodland including of veteran trees comprises a key heritage characteristic as well as contributing to the biodiversity value of Hatfield Forest. This management combines practical heritage skills and knowledge of the forest, and the internationally important population of veteran trees present with scientific research and the development of new techniques, as the research and woodland management communities share their findings and expertise, and work with others, who manage similar heritage and biodiversity rich woodlands across the UK and beyond (e.g. Sisitka, 1991).

3.2.6 A small percentage of the forest is covered by heritage designations (1.7% is a Scheduled Monument, plus Listed Buildings). The significance of the historic designed landscape is understated. It is one of the conservation challenges that this important 18C development is overlooked. The Houblons, a banking family, bought the Hallingbury Park estate, including the 400-hectare (1,000-acre) ancient royal forest of Hatfield in 1729. As part of the improvements to the property, Jacob Houblon III developed the forest as a “detached pleasure ground”, about 1.5 kilometres from the house. In 1757 Capability Brown proposed the extension of the lake in Hatfield Forest at both ends and the replanting of Cottage Coppice. Brown’s additions were intended to make the lake appear more serpentine and river-like. The Houblons family laid out a pleasure ground and lake under the guidance of Capability Brown, planting exotic trees and building the Shell House. Brown’s plan survives. The main changes implemented were the introduction of a curving arm at southwest corner / end of the barrage, with a small island at the far end and a bridge near the main lake. Only part of Brown’s plan for modifying the lake was carried out, perhaps because of the cost. Only an extension to the lake and an island at the southern end by the end of the dam were constructed. The extension was cut off from the main lake when the barrage was heightened in the 1970s. It now forms the Decoy Lake.

3.2.7 Brown’s scheme also included improvements to the grounds around the cottage and Shell House (listed Grade II*). The cottage was demolished in the 1920s, but the shell and flint encrusted Shell House survives. Brown’s plan shows new, more exotic trees were to be planted along the connecting rides in this part of the forest. They were to include Cedar of Lebanon and Plane trees, two of Brown’s signature trees. A Plane and an Oak tree still stand near the Shell House and another Plane survives at the end of Brown’s extension to the lake. There are also several large Yew trees and Scots Pine along the bank.

3.2.8 Other aspects of the heritage interest of the site are reflected in the Historic Environment Record relating to the site, primarily through scattered point features reflecting historical management over the years. Although this record is of undeniable value, the fragmented nature of the designated assets and wider historic record makes a holistic understanding and description of the basic heritage value of the forest as a coherent whole dependent upon the individual expertise of heritage experts and extrapolation of results. Aspects such as the cultural heritage and knowledge of traditional management techniques are also not clearly represented in this record.

3.2.9 In 1923, Hatfield Forest was sold to a timber merchant who began felling the oak trees, before it was purchased by the pioneering conservationist, Edward North-Buxton, whose family handed it to the National Trust after his death.

3.2.10 In the 2nd World War, Hatfield Forest was used for ammunition storage for the adjacent Stansted airfield and there are remains of various buildings and structures still evident.

3.2.11 There are two Scheduled Monuments within Hatfield Forest. Portingbury Hill was considered to be an Iron Age settlement and ditched enclosure, although recent research suggests it may be medieval. The Warren in Collins Coppice includes 22 pillow mounds within an area of circa 4ha. It survives well and includes at least two phases of construction and alteration and two types of mound. It is the most complete surviving example of a large-scale warren in Essex. Unusually the 17th century warrener's house (listed Grade II) at the north edge of the warren also still stands, but is excluded from the scheduling, although the ground is included.

3.2.12 The Roman Road known as Stane Street, which linked Braughing (Hertfordshire) and Colchester (Essex), runs along the boundary of the site.

Architectural interest

3.2.13 The listed Grade II Forest Lodge and Grade II* Shell Lodge are both located within the Forest. The former is a C16th timber framed house, the latter a rare garden house/folly of *c*.1757 constructed of knapped and boulder flints, shells, glass fragments and brickwork with a low-pitched pantile pediment gabled roof. It was built by the Houblon family. The shell decorations designed by the 17-year-old Laetitia Houblon.

Biodiversity of Hatfield Forest

3.2.14 Hatfield Forest is a designated Site of Special Scientific Interest (SSSI) and National Nature Reserve (NNR).

3.2.15 It is considered one of the best examples of Wood Pasture and Parklands in Britain, with abundant veteran pollard oak, hornbeam (Figure 7), beech, ash, field maple and hawthorn standards, totalling 884 trees of 8 species, second only to Borrowdale in Cumbria in the UK. In addition, there are large areas of coppice and broadleaved deciduous ash/maple and oak/hornbeam woodland.

Figure 7: Veteran hornbeams in Hatfield Forest Wood Pasture (Jason Boldero)

3.2.16 The continuity of woodland cover has resulted in an exceptionally rich saproxylic (deadwood) interest, such as lesser stag, rhinoceros, click, soldier and longhorn beetles. In addition, it is of national importance for its rich fungi flora and epiphytic lichens and has a good assemblage of birds including nightingale, marsh tit and goldcrest.

3.2.17 Fallow deer were originally imported from Sicily for hunting and there are still wild fallow deer as well as more recent escapees of muntjac deer.

3.2.18 Hound's-tongue, burnet saxifrage, dwarf thistle, common restharrow, common gromwell, fairy flax, harebell, flat sedge, greater butterfly, southern marsh and common spotted orchids, twayblade, cowslip and oxlip have been recorded. The purple hairstreak, silver-washed fritillary butterflies and southern hawker dragonfly are also noted from Hatfield Forest.

3.2.19 On the lake, great crested grebe, reed warbler and grasshopper warbler can be seen, while green woodpecker are commonly seen on the yellow meadow ant hills and yellowhammer and goldcrest in the scrub.

3.2.20 The key Priority Habitats are Wood Pasture and Parkland, Broadleaved Woodland, Wet Woodland, Fen, Coastal and Floodplain Grazing Marsh, Lowland Meadow and Hay Meadow (Figure 8). In total, over 4,000 species of fauna and flora have been recorded at Hatfield Forest.

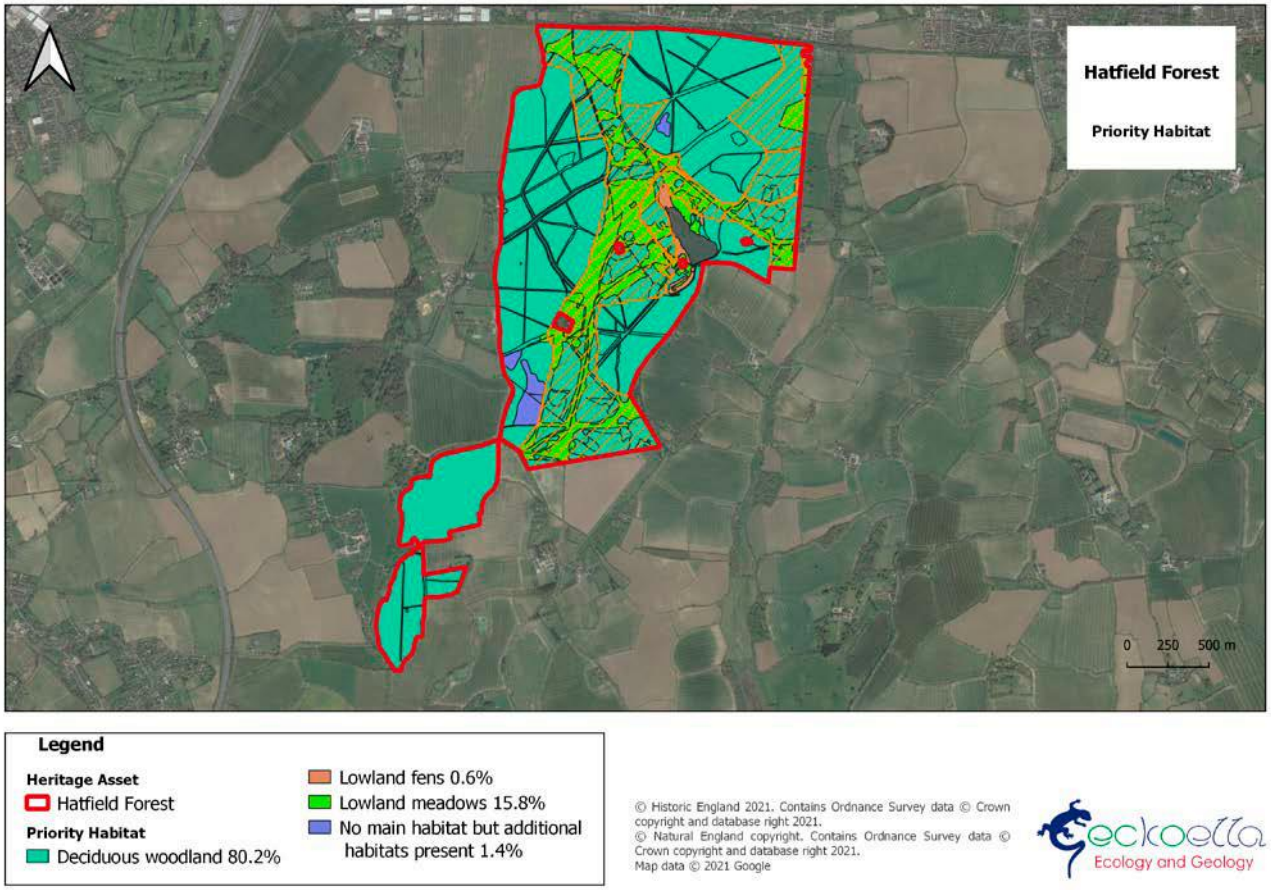

Figure 8: Priority Habitats within Hatfield Forest

Geodiversity of Hatfield Forest

3.2.21 The underlying geology and soils of Hatfield Forest comprise a mix of Cretaceous chalks overlain by Eocene London Clay Formation; the flora indicates a calcareous to neutral pH. The topography is relatively flat and low lying, rising from 70 to 90 metres above sea level. The geodiversity interests are relatively limited.

Relationships between heritage, biodiversity and geodiversity

3.2.22 Hatfield Forest is recognised as an excellent site for biodiversity, and one of the best-preserved medieval hunting forests in Europe. The nature conservation designations reflect and refer to both the wildlife and the heritage value of the site

and cover the whole site to the boundaries. However, in terms of formal heritage designations, only point or relatively small-scale features within the landscape are recognised.

3.2.23 The significance of the historic designed landscape is understated. It is one of the conservation challenges of the site that the important 18th century development of the landscape by Capability Brown is overlooked. Although this was not completed as intended, features and some of the plantings do remain.

3.2.24 Since the forest has both significant biodiversity and heritage value, conservation relating to the health of the forest in terms of structure and recruitment will benefit both aspects. This includes tree management, grazing and deer control as well as the management of visitor pressure. Management solutions need to address the requirements of ecology and heritage. The interests are usually compatible and often harmonious, although trade-offs are sometimes required. In particular, the management of the 18th century landscape features needs to be taken more into account in the management of the Forest.

3.2.25 The management and conservation of veteran standards and pollards as well as grazing animals is of considerable benefit to both the biodiversity and heritage character of Hatfield Forest. Pollarding is a heritage skill that stretches back centuries and contributed to the overall biodiversity and structure of the ecosystem. It is also of significant scientific value.

Figure 9: Restoring Capability Brown's vision – management in Hatfield Forest (Jason Boldero)

Natural capital of Hatfield Forest

Cultural services

3.2.26 Hatfield Forest is a significant destination for recreation in a densely populated area otherwise lacking accessible high quality natural greenspace. One measure of this is the Outdoor Recreation Valuation Tool, which indicates there are 182,387 visits to Hatfield Forest per year (LEEP, 2022).

3.2.27 Hatfield Forest also offers activities such as nature walks and practical conservation and heritage skills, such as coppicing. This offers important recreation and wellbeing benefits for visitors and the local community. There are many intangible benefits, such as wellbeing benefits, as being outdoors in nature is proven to improve mental health (NHS, 2022).

3.2.28 The heritage and natural history present within the site provide many opportunities for education and learning, and the development of a sense of place. This includes folklore and heritage events and publications.

3.2.29 Hatfield Forest has scientific and knowledge value also relating to heritage and biodiversity. The site comprises an exemplar for the management of large numbers of ancient trees and pollards, and this information has been shared across the UK and abroad.

Supporting services

3.2.30 Hatfield forest supports a wide range of important habitats and species, including deadwood habitat for invertebrates, and the site is of national importance for its rich fungi flora and epiphytic lichens.

3.2.31 The lake, scrub and woodland offer habitat to fauna including some rare and notable birds.

Regulating services

3.2.32 Large woodlands have value in relation to flood attenuation. Natural habitats tend to ‘hold the flow’ on water courses, reducing peaks of flow further downstream (Birkinsham et al., 2014; Cooper et al., 2021).

3.2.33 Woodland and undisturbed soils are one of the most effective ways to store carbon. The continuity of tree and species rich grassland cover at Hatfield Forest offers these values.

Provisioning services

3.2.34 Large woodlands, if managed appropriately, have the potential for providing provisioning services such as wood for fuel and building materials. Coppicing trees can also provide wood for traditional woodwork such as basket weaving, or as canes for gardening. Traditional heritage skills associated with woodwork also provide a heritage benefit.

Management challenges

3.2.35 There are challenges associated with being so popular and accessible in areas close to large urban conurbations. Many of the issues at Hatfield Forest are typical of other similar sites, such as Epping Forest, Burnham Beeches and Windsor Great Park. Common issues include path erosion and compaction around veteran trees. As well as management issues relating to visitor pressure, there are problems associated with diffuse pollution into water courses, air pollution from neighbouring Stansted Airport and noise pollution from the neighbouring M11.

3.2.36 The surrounding area is subject to intense development pressure and indirect and direct impacts are a risk. The potential dual effects on both heritage and biodiversity require continued explanation to Local Planning Authorities. Collaboration by heritage and biodiversity specialists in this regard may be helpful, both to evaluate in full the integrated as well as individual potential adverse impacts, and to explore potential measures that developers may be obliged to carry out to avoid, mitigate and compensate for effects.

Opportunities and funding

3.2.37 The key funding mechanism for managing Hatfield Forest are agri-environment grants, as well as the Woodland Grant Scheme.

3.2.38 The National Trust spends a great deal of operational funds on managing the historic and natural environment. Funding is partly derived from visitor income from car parking charges (currently £8.00 per vehicle), as well as from expenditure in the shop and café.

3.2.39 There are opportunities, through various initiatives such as Biodiversity Net Gain, Section 106 and Green Infrastructure levy to help manage the site.

Key points from Hatfield Forest

3.2.40 The management of Hatfield Forest through utilising heritage skills draws together the cultural and natural environment and manages the friction that can sometimes be observed on sites with significant biodiversity and heritage value. It is a classic example of a wildlife-rich site steeped in history and to try and separate out these values makes no sense. Nature conservation designations and citations (e.g. SSSI, NNR) refer to the heritage value of the site as an integral part of its character.

3.2.41 The heritage value of the wider forest area is not clearly described in the heritage designations that apply to the site.

3.2.42 Managing the site for wildlife also conserves the heritage value. This includes measures to reduce negative impacts from visitors, deer management, grazing and scrub management. Veteran trees have a high cultural, historical and wildlife value; Hatfield Forest is an international exemplar site relating to their conservation.

3.2.43 The wellbeing value of Hatfield Forest as accessible greenspace with high quality nature and heritage features is a significant element of the site's natural capital; carbon budgets associated with semi-natural habitats are an additional benefit.

3.3 Canterbury World Heritage Site, Kent

General description of Canterbury WHS

3.3.1 Canterbury UNESCO World Heritage Site comprises three separate structures of Canterbury Cathedral, St Augustine's Abbey and St Martin's Church (Figure 10). While they are internationally recognised for their architecture and cultural importance as the birthplace of Christianity in Great Britain, they also show how historic buildings can provide important habitats for a variety of wildlife, from bats to great crested newts and herb rich grassland to birds.

3.3.2 All three buildings are directly and tangibly associated with the history and introduction of Christianity to the Anglo-Saxon kingdoms. The WHS was designated in 1988 and a Management Plan was written in 2002. The Queen Bertha walk was created to link the three elements of the WHS, with brass plaques embedded in the pavement.

3.3.3 Canterbury regularly suffers flooding and there are a series of flood defence measures in the city, from raised banks (levees), sluices, to flood channels. The River Stour and a series of feeder streams, mill leats and other channels bisect the city.

There is little opportunity to carry out natural flood management within the WHS, although organisations such as Kent Wildlife Trust and the Rivers Trust, as well as the Environment Agency are carrying out work in the catchment.

3.3.4 Although in a built-up area, wildlife, some rare and protected, is found within and associated with Canterbury WHS; St Augustine's Abbey is a Local Wildlife Site.

Figure 10: Canterbury World Heritage Site Location

Canterbury World Heritage Sites			
Site owner / manager: Church of England (Canterbury Cathedral and St Martin's Church) St Augustine's Abbey is owned by English Heritage **Type**: Historic buildings and structures **Location:** Canterbury, Kent **OS grid ref:** TL15325771 A**rea:** 48 hectares			
Priority Habitat	**Statutory Biodiversity / geodiversity sites**	**Non-Statutory Biodiversity / geodiversity Sites**	**Heritage Designations**
Traditional Orchard Lowland meadows	None	Local Wildlife Site	World Heritage Site Scheduled Monument

Percentage Coverage Statutory Biodiversity / geodiversity Designated Sites		
Statutory Designated Sites	**Percentage Cover**	**Hectare**
None	0%	0 ha

Percentage Cover of Non-Statutory Biodiversity / geodiversity Designated Sites		
Non-Statutory Designated Sites	**Percentage Cover**	**Hectare**
Local Wildlife Site	3.4%	1.3 ha

Percentage Cover of Priority Habitat		
Priority Habitat	**Percentage Cover**	**Hectare**
Traditional Orchard	0.6%	0.3 ha
Lowland Meadows	2.8%	1 ha

Percentage Cover of Heritage Designations		
Heritage Designations	**Percentage Cover**	**Hectare**
World Heritage Site	100%	48 ha
Scheduled Monument	27.9%	6 ha

Table 5: Overview of Canterbury World Heritage Site

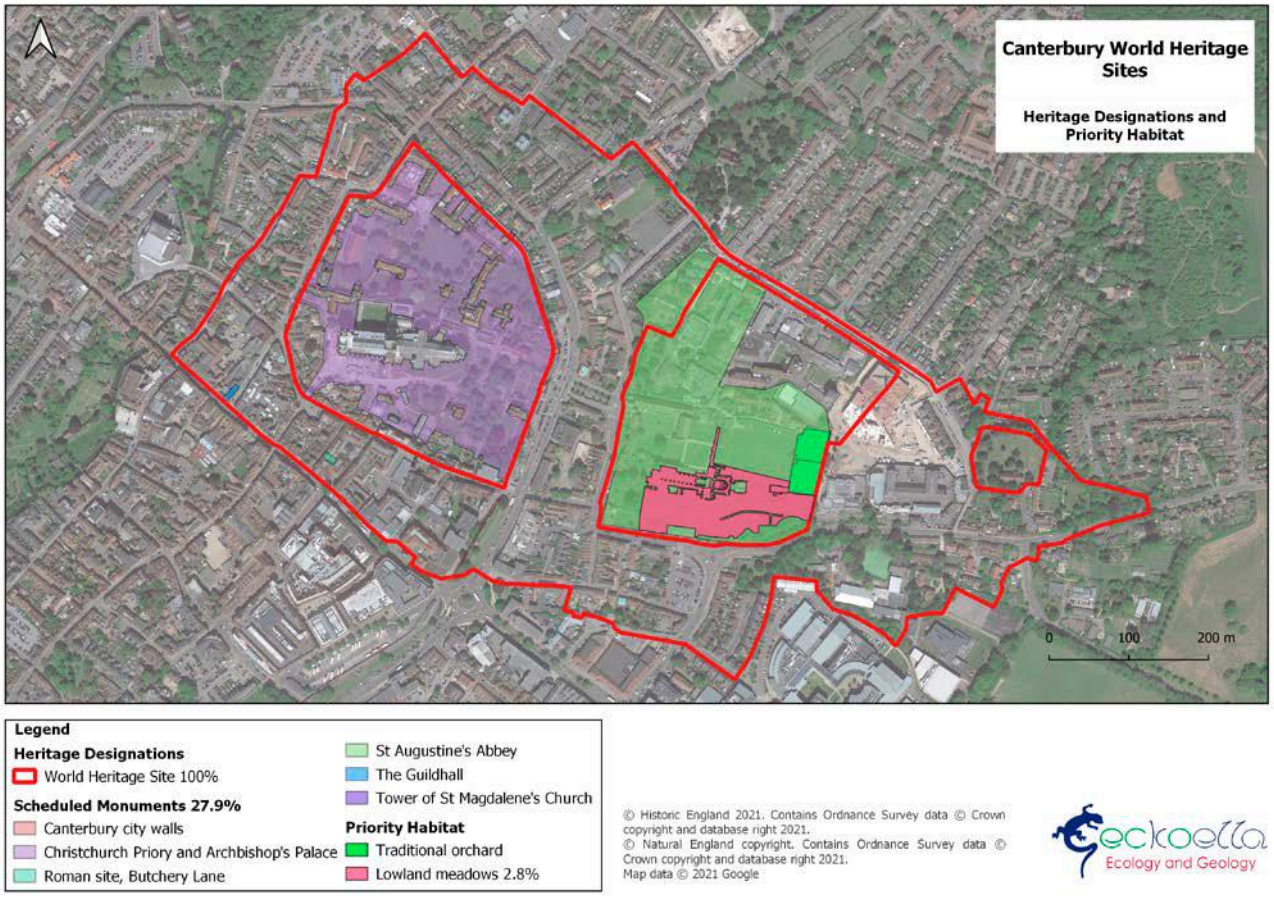

Figure 11: Canterbury World Heritage Site heritage and biodiversity

Heritage of Canterbury WHS

3.3.5 Canterbury Cathedral: a stunning mix of Romanesque and Perpendicular architecture, built in AD 597. Headquarters of Church of England and shrine to Thomas Beckett who was murdered in the cathedral in 1170.

3.3.6 St Martin's Church: the oldest church in the English-speaking world and the private chapel of Queen Bertha, wife of King Ethelred, who worshipped in the church that was already in existence in the late Roman period.

3.3.7 St Augustine's Abbey: one of the most significant religious houses in northern Europe and the burial place of Anglo-Saxon kings. It may have been the birthplace of the Bayeux tapestry. It was dissolved by Henry VIII and later was a royal palace, poor house, gaol and school. The Abbey is designated as a Scheduled Monument.

3.3.8 The Canterbury WHS archaeological, historic and architectural interest extends to neighbouring parts of the city. The earliest remains are a Neolithic polished flint axe head

3.3.9 Additional heritage associated with the site comprises:

- An Iron Age hillfort was constructed in the 1st century BC on neighbouring Bigbury to the west. The hillfort was overrun during the Roman invasion in 54/55 AD. The Romans then found a city on the route between the ports of Richborough and Dover and London. The city was named Durovernum Cantiacorum and was fortified. Roman bricks and tiles were later re-used in building houses in the city.

- In the 6th century, Canterbury became the capital of the Anglo-Saxon Kings of Kent.

- During the Middle Ages, walls and gatehouses were constructed, roughly along the lines of the Roman fortifications.

- Canterbury became a garrison town in the 19th century and a large jail was built.

- Sadly, there was significant damage to the city in the WWII Baedeker raids in 1942, although luckily the Cathedral only suffered minor damage. Post war rebuilding saw lots of redevelopment, some more sympathetic to heritage than others.

3.3.10 Much of the centre of Canterbury is within a Conservation Area, including all the WHS. The precinct is additionally designated a Protected Open Space.

3.3.11 There are 333 Listed Buildings of Grade I, II* and II status located within the boundary that encompasses all three World Heritage Sites

3.3.12 The Cathedral holds an extensive collection, including early illuminated manuscripts, maps and books as well as a large historic collection of chattels. Unfortunately, the cathedral library received a direct hit in the war, and much was lost. Other historic items relating to the Abbey and other parts of the WHS are held in Canterbury Museum.

Biodiversity of Canterbury WHS

3.3.13 There are two small areas of Priority Habitat within the WHS, both at St Augustine's Abbey. These are Traditional Orchard and Lowland Meadow, and this area has also been registered as a Local Wildlife Site (LWS) for its "range and variety of flora". In addition, there is a small area of Broad-Leaved Deciduous Woodland and an area of Open Water close to the Abbey as well as more extensive, linear Coastal and Floodplain Grazing Marsh along the River Stour.

3.3.14 There are extensive gardens linked to the Cathedral and private houses within the precinct. There is ambition to plant flowers which attract pollinators such as salvia and aquilegia, as well as a focus on spring flowers for nectar and the creation of log piles and compost. The Cathedral stated that they, “aspired to carry out an environmental audit” (pers. com. 2020).

3.3.15 The Kent and Medway Biological Records Centre records of flora and fauna from within the WHS including some notable and protected species, such as the great crested newt, and other species, such as slow worms, common frog and hedgehog. A ‘BioBlitz’ was planned for Canterbury Cathedral and the precinct in May 2019. Bats recorded in the Church and Cathedral include noctule, serotine, whiskered, common and soprano pipistrelle, brown long eared and Daubenton’s. It is not known if these roost in the buildings or were foraging in the area. Peregrine falcon nested on the cathedral in 2014 and 2016 and reared young. Webcam footage is available on YouTube. Stag beetles in rotten logs in the precinct were mentioned in a press release in 2019.

3.3.16 The height and complex turreted and crenelated towers of churches provide the equivalent to a cliff face for nesting birds. Perhaps the most well-known are peregrine falcons (often feeding on plentiful feral pigeons), but also jackdaws, starlings and house sparrows. Overhanging masonry provides an ideal site for swifts, swallows and house martins. Barn owls and sometimes kestrels will often nest in old buildings where there are suitable openings.

Figure 12: Peregrine falcon on Norwich Cathedral

3.3.17 Mammals such as badgers, brown rats and foxes often burrow under structures such as garden sheds, where they are protected and have plentiful food sources nearby.

3.3.18 The stonework of buildings and structures, as well as gravestones, provide superb opportunities for a variety of lichens, particularly where there is a range of stone used in the construction of the building. It also has geodiversity value.

3.3.19 The soft lime pointing is ideal for masonry bees and solitary wasps, while colonies of native black bees can be found in voids. Stonework will often heat up and be attractive to a variety of warmth loving invertebrates, such as wall brown and grayling butterflies. Common lizards and non-native wall lizards can be found on exposed stone where there are suitable voids (as at Corfe Castle in Dorset).

3.3.20 Lime mortar is attractive to a variety of molluscs, but also several plants such as wall rue, rusty-back fern, ivy-leaved toadflax, pellitory of the wall and maidenhair spleenwort, as well as less desirable destructive plants such as red valerian and buddleia. Damp and shady areas at the base of buildings are sometimes colonised by ferns such as shield, scaly male, hart's tongue and lady fern.

3.3.21 There are several parks and gardens within the boundary, the immediate vicinity and within the cathedral precinct. Where green infrastructure comprises the 'setting' to designated heritage features this confers additional protection under development control policies.

Geodiversity of Canterbury WHS

3.3.22 Canterbury is situated in a low-lying area on the River Stour with its feeder channels. As such, much of the city lies on alluvium, while there are areas of river gravel (Thanet Beds), as well as London Clay Formation underlying other parts of the city. The Upper Chalk of the Kent Downs is situated close by, to the south.

3.3.23 Like many urban locations, the main geodiversity value of the site is reflected in the building stone used. Structures within Canterbury WHS are built from a variety of materials, including brick made from local clay (dating back to the Roman period) to flint from the local Chalk Downs and cob (clay mixed with horsehair and bracken, smothered on hazel laths and placed within a timber structure). Canterbury Cathedral is built of Caen Stone, a form of Jurassic limestone from northern France and forms part of its intangible heritage. There are also a variety of sandstones, limestones and marbles/ granites seen on shop fronts and civic buildings, along with clap boarded buildings which are typical of this part of Kent (Historic England, 2023a).

Figure 13: Mature trees, greenspace, and buildings with potential for bats at Canterbury Cathedral

Relationships between heritage, biodiversity and geodiversity

3.3.24 Canterbury WHS illustrates relationships between biodiversity and heritage that are relevant to many built heritage sites across the UK.

3.3.25 Wood sourced from Hatfield Forest for timber contributed to the areas rich heritage of ancient timber framed buildings and is an important historic landscape character.

3.3.26 Ecclesiastic as well as other historic buildings provide opportunities for several species of wildlife, from bats to birds and plants to invertebrates. This is often due to the construction of historic buildings. There are plentiful voids and gaps which nature can take advantage of, which are often not available in modern buildings. It is also because many of the natural places where they would live, such as ancient trees with hollows, rock faces and bare ground are no longer available due to modern farming practices, development or disturbance.

3.3.27 The Cathedral gardens aim to carry out work that will benefit pollinators, as well as retaining wildlife features such as log piles. There are additional opportunities to manage the site to enhance the wildlife value. The species rich sward at St Augustine's Abbey could be mown less rigorously, providing additional opportunities for flowering and seeding. Additionally, food sources available close to buildings, such as nectar and food plants in gardens for bees, ponds for reptiles, waste food for mammals or prey species for raptors can be enhanced. Works can be carried out in sympathy, for example to avoid inadvertent impacts such as repointing stonework where reptiles or invertebrates live.

3.3.28 Actions relating to engaging visitors with the wildlife of the site include a popular peregrine webcam on Canterbury Cathedral, and a planned BioBlitz for the area.

3.3.29 Reading the World Heritage Site Management Plan and the English Heritage Guide on St Augustine's Abbey as well as the Cathedral's information, they are understandably detailed on the historic environment, but there is no mention of the natural environment. They could celebrate this as one of the valuable aspects of the site, including the Local Wildlife Site designation, enhancing the experience for the visitor.

3.3.30 It is helpful to consider sites in the round and ensure skills and knowledge from both the historic and natural environment are involved in the management planning process before works are carried out. Better wildlife may also enhance the experience for their visitors.

3.3.31 Heritage plays an important role in the introduction of many non-native species in the UK. It is an important interrelationship between heritage and biodiversity, one which is evident in Canterbury WHS with the presence of ivy-leaved toadflax. It is believed that the plant was originally introduced into England via seeds having been brought in some marble sculptures from Italy to Oxford. The small, purple and yellow Snapdragon, which easily colonises walls vertically, became a very popular ornamental plant between the 17th and 19th century when many walled gardens were created (Plantlife, 2022). This plant is now considered naturalised in the UK.

Natural capital of Canterbury WHS

Cultural services

3.3.32 Canterbury has been a religious pilgrimage site for centuries – this is a key part of its heritage. Many are connected to the WHS by their faith. Visitors to the site, whether direct or indirect through books, online or film, gain wellbeing benefits. Irrespective of their faith the site is a magnificent heritage location of global significance. The green infrastructure associated with the site in the form of gardens and greenspace will also enhance their visit.

Supporting services

3.3.33 Historic sites such as Canterbury WHS play a very important part in providing a habitat for a variety of wildlife in an urban setting. The range of niches and crevices often found in the historic fabric provide opportunities which are often not available in modern hermetically sealed buildings. Whilst the garden and green space settings for historical assets can offer valuable habitat in an otherwise built-up environment. Many of these green spaces and buildings will have been unchanged for many years (sometimes centuries) offering a stable environment for urban wildlife.

Regulating services

3.3.34 Green spaces in cities and towns, particularly those green spaces that include trees, can improve the air quality within the urban area (Barwise and Kumar, 2020).

3.3.35 Gardens linked to Canterbury Cathedral have been shown not only to be recognised as important settings for the designated heritage assets and being attractive in their own right; they also act as a draw to butterflies, bees, birds and other species. Pollinator insects provide an important ecosystem service to society and the environment.

Provisioning services

3.3.36 A traditional orchard present on the site provides a potential food source to landowners, visitors and locals in the area.

Management challenges

3.3.37 Balancing the care of the ancient buildings and wildlife is sometimes difficult, especially where there are protected species such as bats involved. Most bats in churches will be undetected or causing negligible impact. However, if found in significant numbers then their droppings and urine can affect the fabric of the building, as well as sometimes being seen as a health and safety risk. There is however a significant body of evidence to help resolve any problems (Howard and Richardson, 2009). Organisations such as Bat Conservation Trust and Natural England have invested a lot of effort in providing advice and the Bats in Churches Project (part funded by the aforementioned organisations as well as Historic England, Church of England, Churches Conservation Trust), is working hard to help churches where there might be issues (Bats in Churches Project, 2018).

Opportunities and funding

3.3.38 Funding for works within the Canterbury WHS come from a variety of sources. UNESCO does not directly fund works within the WHS but ensures that they are compatible with the objectives of the designation. English Heritage raises income through membership and entry, as well as commercial outlets and events.

3.3.39 Canterbury Cathedral helps to pay for the very expensive repairs to its fabric through a variety of means. This includes a charge not only to enter the building, but also the precinct around the cathedral (unless people are going to worship). There are also shops, restaurants and charges to see some of the collection.

3.3.40 St Martin's Church has fewer opportunities to raise funds and is similar to most other churches, where fundraising activities are ongoing and requests for donations made. Grants are applied for when required.

Key points from Canterbury WHS

3.3.41 Heritage managers in urban settings can make a significant contribution to the conservation of local wildlife, often through small or subtle changes to management – their sites may be the best for nature in the area.

3.3.42 While the WHS was designated specifically for its "direct and tangible association with the history of the introduction of Christianity to the Anglo-Saxon kingdom", there is scope to do more for wildlife, both in action and in the information/ interpretation relating to the site.

3.3.43 Survey and environmental audit information can be usefully enhanced for many heritage sites through both formal surveys as well as involving volunteers, to help guide management.

3.4 Great Dixter Garden, East Sussex

General description of Great Dixter

3.4.1 Great Dixter Garden (Figure 14) is an exceptional Grade I garden, surrounding a Grade I listed 15th century medieval hall house, sympathetically managed for its biodiversity. It is one of the most well-known and admired gardens in the United Kingdom and is intimately linked to a medieval hall house and associated historic buildings. Although there is a wider estate with significant interest, this case study focuses on the garden. The site is within a special and unique part of the historic High Weald Area of Outstanding Natural Beauty on the Sussex/Kent border.

3.4.2 Through its long-established sensitive management, Great Dixter has a successfully maintained garden offering the very highest horticultural standards, whilst protecting and enhancing the wildlife and historic fabric.

Figure 14: Topiary lawn orchids at Great Dixter Gardens (Julie Weiss – reproduced with permission)

Great Dixter Garden			
Site owner / manager: Great Dixter Charitable Trust **Type**: Grade I garden, surrounding a Grade I listed 15th century medieval hall house **Location:** Northiam, East Sussex **OS grid ref:** TQ81992505 A**rea:** 3 hectares			
Priority Habitat	**Statutory Designated Sites**	**Non-Statutory Designated Sites**	**Heritage Designations**
None	AONB	None	Parks and Gardens

Percentage Coverage Statutory Designated Sites		
Statutory Designated Sites	Percentage Cover	Hectare
Area of Outsrtanding Natural Beauty	100%	3 ha

Percentage Cover of Non-Statutory Designated Sites		
Non-Statutory Designated Sites	Percentage Cover	Hectare
None	0%	0 ha

Percentage Cover of Priority Habitat		
Priority Habitat	Percentage Cover	Hectare
None	0%	0 ha

Percentage Cover of Heritage Designations		
Heritage Designations	Percentage Cover	Hectare
Parks and Gardens	100%	3 ha

Table 6: Overview of Great Dixter Garden

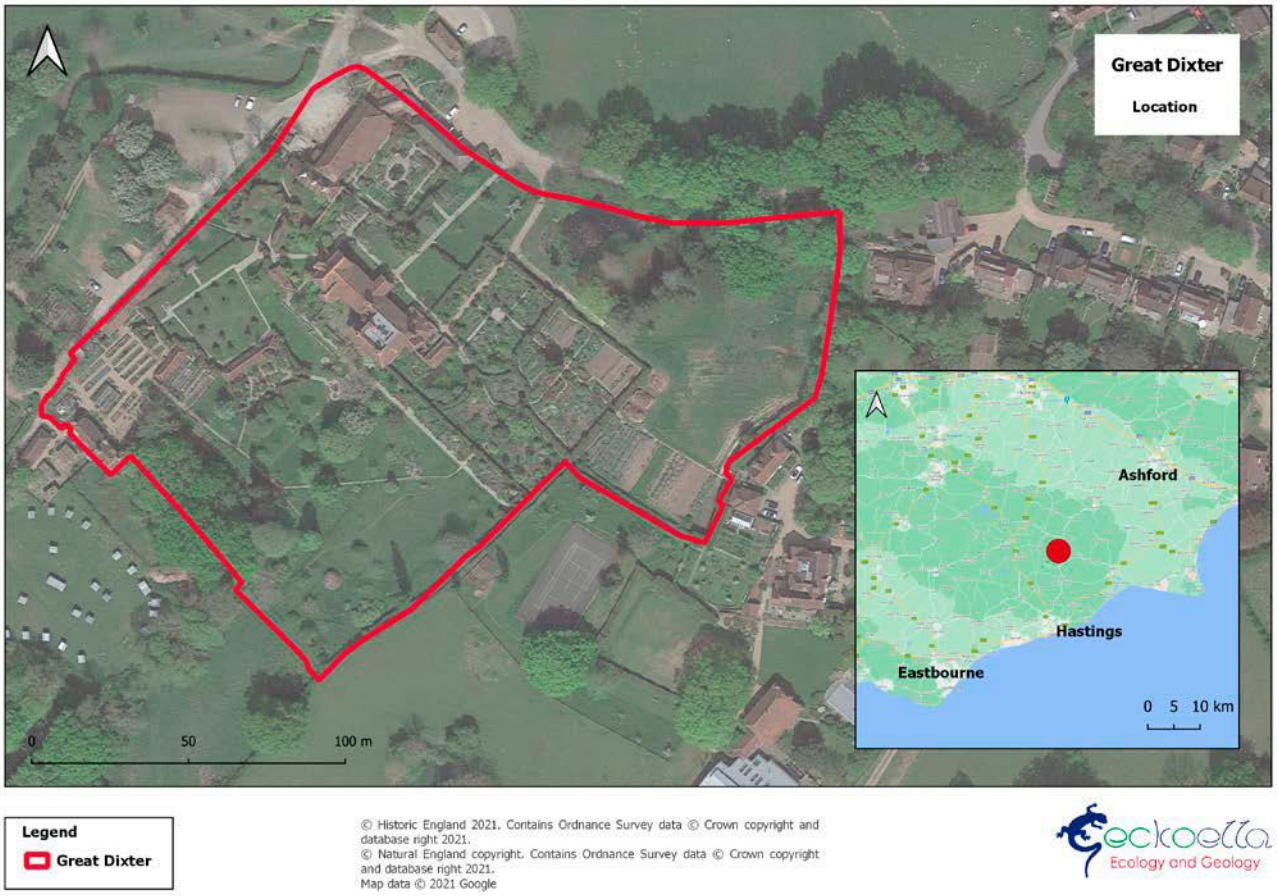

Figure 15: Location of Great Dixter Garden

Heritage of Great Dixter

3.4.3 Great Dixter is a Grade I Registered Garden, established by Nathaniel and Daisy Lloyd in 1910 and then managed by their youngest son, Christopher Lloyd for over 40 years, until his death in 2006. The original Lutyens' framework was designed to be enjoyed as a series of contrasting compartments linked by steps and archways. The varied arrangement includes yew hedges, meadow gardens, water features, mixed borders and walled gardens spread over 2 ha around the main house, and the garden has a famous tradition of bold and experimental approaches to plantsmanship.

3.4.4 The Grade I listed 15th century medieval hall house was restored and extended by Sir Edwyn Lutyens. The great hall is one of the largest surviving timber framed halls in Britain. There is also an extensive indigenous collection.

3.4.5 There is a Grade II listed great barn, which is one of the largest surviving medieval timber frame barns in the southeast and 19th century brick-built oast houses.

3.4.6 Other heritage includes nearby Roman iron workings, for which coppicing was carried out on the estate to provide wood for smelting. In WWI, Great Dixter was used as an auxiliary military hospital.

Biodiversity of Great Dixter

3.4.7 Wildlife has been seen as a fundamental element of Great Dixter Garden from the mid-20th century, when Christopher Lloyd understood the importance of pollinators and the need to respect the natural world. It has been described as a 'garden nature reserve'. The complexity of the garden arrangement, comprising formal herbaceous borders and lawns together with water features, offers a range of micro-climates and conditions favouring a diversity of invertebrate fauna.

3.4.8 In 2017, a Heritage Lottery Fund (HLF) grant and private donors helped fund some ecological surveys and habitat assessments, significantly adding to the knowledge of the site. In addition, a series of historic environment and landscape surveys were commissioned.

3.4.9 2,029 species of plant and animal were recorded, including local and rare species. Some records were from within the garden, while others were just outside on the wider estate.

3.4.10 Although Great Dixter garden is not designated for its ecology, there are Priority Habitats present on the estate. These include Traditional Orchards, Ponds, Lowland Meadows and Ancient Woodland. The heritage designations can play an important role in protecting these habitats and ensuring management occurs. For example, management to achieve appropriate pond maintenance to prevent silting and loss of the pond habitat.

3.4.11 17 species of dragonfly and damselfly were noted including the red-eyed and small red damselfly. European protected great crested newts were observed in good numbers along with common toad, smooth newt and common frog. These are mostly associated with the three main water bodies in the garden: horse pond, lower moat and the sunken garden pond.

3.4.12 There is a good population of more common bat species including common and soprano pipistrelle, brown long-eared and Daubenton's bat. Bird records include swift, house martin, swallow, linnet, marsh tit, lesser spotted woodpecker, nightingale and cuckoo. Bats and some bird species will use the Listed Buildings for shelter and breeding spaces, and the invertebrate-rich gardens for foraging. The heritage designations protect these Listed Buildings and surrounding gardens, and therefore protect the wildlife breeding spaces, foraging sites and shelter.

Figure 16: Swallows nesting in the Great Barn at Great Dixter Gardens (reproduced with permission of the Great Dixter Garden Trust)

3.4.13 Bees and invertebrates are well represented and include the rare white-bellied bee, oak mining bee and long-horned bee, as well as brown argus, marbled white, green hairstreak and small heath butterflies. There are also two notable species, outside the garden, the white admiral and purple emperor. Roesel's bush cricket was seen in good numbers in the long grass. Forest tubic, festoon and yellow-legged clearwing moths have been recorded.

3.4.14 The natural flora within the grassland meadows is rich and varied and includes good populations of the neutral grassland specialists of corky-fruited water dropwort and green winged Orchid as well as adder's tongue fern, common spotted orchid and Dyer's greenweed.

3.4.15 Gardening approaches at Great Dixter actively encourage wildlife including the creation of dead wood piles, 'bug hotels', leaf piles and the creation of wildflower meadows, which actively benefit pollinators. Great care is taken in managing the garden, including the cessation of the use of pesticides and herbicides and the creation of large amounts of compost.

Geodiversity of Great Dixter

3.4.16 Situated in the high weald of East Sussex, Great Dixter is underlain by sedimentary Cretaceous mudstones and siltstones of the Wadhurst Clay Formation, while parts of the wider estate have Ashdown and Tunbridge Wells Formation sandstone outliers.

3.4.17 Ironstone is commonly found in this part of the Weald and has been mined as far back as the Roman period.

3.4.18 The soils are generally of neutral to slightly acidic chemistry, making the site suitable for many species of cultivated plants and shrubs.

Relationships between heritage, biodiversity and geodiversity

3.4.19 The philosophy at Great Dixter is very much to work with nature and to avoid unnecessary impacts on the environment. Respect for and understanding of biodiversity and the relationship with horticulture is embedded as part of the cultural heritage and ethos of the site. This is in addition to the features and practical actions that benefit on-site biodiversity alongside the heritage and horticultural value of the site.

3.4.20 In recent years, emphasis on reducing environmental impacts has included the reduction of use of chemicals, invested in on-site composting and stopping the use of peat as a growing medium. This will have additional benefits for off-site wildlife and natural capital.

3.4.21 Great skill is needed in balancing the plantsmanship, established by Christopher Lloyd, with the historic structure of Great Dixter, while enhancing the ecological value of the estate. The designations of the cultural and historic landscape need to be adhered to and this can sometimes restrict some ambitions regarding wildlife. It is not always possible to achieve some of the 'nature' opportunities as they can conflict with the need for the highest level of presentation and curatorship.

3.4.22 Great Dixter garden, could showcase exemplary management, integrating first class horticultural expertise with the protection of the natural and historic environment to its many visitors.

Natural capital of Great Dixter

Cultural services

3.4.23 There is an increasing awareness of the importance of gardens and the natural environment for wellbeing, exemplified in the Covid-19 crisis. Research by bodies such as the Royal Horticultural Society and the National Trust indicates that people greatly value gardens and nature and the number of people visiting gardens continues to rise. The wellbeing of visitors to Great Dixter will be enhanced by the combination of heritage and semi-natural features present.

3.4.24 As part of Great Dixter's research and education programme, opportunities will be developed to promote the knowledge to other bodies and individuals.

Supporting services

3.4.25 The Great Dixter Trust states they "want gardens and horticulture to play a part in addressing the loss of biodiversity by enhancing the environment in which wildlife can flourish and by promoting the essential cooperation between man and nature". In

addition, they aim “to set an example for other gardens to follow”. The heritage skills and knowledge of wildlife-friendly gardening promoted by Great Dixter has influence on gardening practices far beyond the boundaries of the site.

3.4.26 The network of ponds and water bodies will be maintained both as important garden features, but also with wildlife in mind (in particular, rare and protected species such as the Great crested newt and various damselflies).

Regulating services

3.4.27 Great Dixter illustrates how gardens with significant heritage interest can support a wide diversity of pollinating insects.

3.4.28 On-site composting and wildlife friendly gardening can improve the soil quality and fertility. Good quality soil retains and stores carbon more effectively.

Provisioning services

3.4.29 The gardens include an extensive nursery, which provides plants that are sold to the public.

3.4.30 The gardens and orchard can provide food that can be either sold or utilised by the small refreshment outlet that is present at the site.

3.4.31 The compost produced on site is a product and an example of a provisioning service, which can be used in the garden or sold/ shared with locals and visitors.

Management challenges

3.4.32 Over 50,000 people visit Great Dixter garden each year, which can bring about its own challenges in managing foot fall, preventing erosion of the turf and accommodating the necessary infrastructure of car parks, lavatories, tearoom and shop.

Opportunities and funding

3.4.33 Great Dixter is managed under a charitable trust and receives income from visitors and sales. This was seriously curtailed in 2020 due to Covid-19. Some help was however received through the government Covid-19 support fund.

3.4.34 The house and garden are funded through a variety of means. Visitor tickets (£14.30 with gift aid for the house and garden and £12.10 for the garden alone in 2020). Approximately 50,000 people visit each year. There is an extensive nursery and plant sales, as well as a shop and a small refreshments outlet.

3.4.35 The Great Dixter Trust runs a series of lectures, talks and courses throughout the year, which brings in income and is an opportunity to promote the work.

3.4.36 There are several volunteers who help and supplement the work of the paid staff.

3.4.37 The audit of the natural and historic environment was funded through a Heritage Lottery grant as well as private donations.

Key points from Great Dixter

3.4.38 Great Dixter is a showcase garden and highly influential in both the professional and amateur garden community. It provides inspiration for others and shows practical ways to integrate the management of a world class garden with its extremely important historic fabric while not only protecting, but significantly enhancing wildlife.

3.4.39 It has pioneered management for pollinating insects for many decades, helping the plants flourish while providing a home for many rare and declining species.

3.4.40 The 2017 Biodiversity Survey has provided an excellent baseline for the wildlife of the Great Dixter estate. This now needs monitoring to determine trends and a Biodiversity Strategy needs writing by skilled ecologists to provide future direction for the team.

3.4.41 The Great Dixter Trust aims to apply for County Wildlife Site status, helping to promote the sensitive management of the estate for wildlife.

3.4.42 All archaeological features will be protected, and training will be given to all staff to understand the natural and historic resource at Great Dixter.

3.4.43 There are opportunities to further enhance the wildflower meadows and orchards as well as some of the less biodiverse areas of the estate. Examples include replanting lost hedges and gapping up sections as well as maintaining areas of scrub and creating a mosaic of woodland edge and tall grassland margins. The hay-meadows require sensitive management, including late cutting and removing the aftermath, followed by chain harrowing to open up the sward and spreading of herb rich green hay to encourage diversity.

3.5 Daw's Castle Scheduled Monument, Somerset

General description of Daw's Castle

3.5.1 Daw's Castle Scheduled Monument comprises a grassy field of approximately 2 ha that includes buried earth banks and ditches. The site is located high on the Somerset coast overlooking the Bristol channel, just west of Watchet, and the eroding sea cliff to the north has incurred into the site since notification. Damaging agricultural management in 1982 prompted purchase by English Heritage to help save the remaining interest. The site has a footpath running through the site, and an English Heritage interpretation board at the entrance to the site.

Figure 17: Location of Daw's Castle Scheduled Monument

Daws Castle Scheduled Monument			
Site owner / manager: English Heritage **Type**: Cliffside Hillfort **Location:** Watchet, Somerset **OS grid ref:** ST06154314 A**rea:** 3 hectares			
Priority Habitat	**Statutory Biodiversity / geodiversity sites**	**Non-Statutory Biodiversity / geodiversity Sites**	**Heritage Designations**
Lowland Calcareous Grassland	SSSI	Local Wildlife Site	Scheduled Monument

Percentage Coverage Statutory Biodiversity/ geodiversity Designated Sites		
Statutory Designated Sites	**Percentage Cover**	**Hectare**
SSSI	11.6%	0.3 ha

Percentage Cover of Non-Statutory Biodiversity/ geodiversity Sites		
Non-Statutory Designated Sites	**Percentage Cover**	**Hectare**
Local Wildlife Site	100%	3 ha

Percentage Cover of Priority Habitat		
Priority Habitat	**Percentage Cover**	**Hectare**
Lowland Calcareous Grassland	11.3%	0.3 ha

Percentage Cover of Heritage Designations		
Heritage Designations	**Percentage Cover**	**Hectare**
Scheduled Monument	100%	3 ha

Table 7: Overview of Daw's Castle Scheduled Monument

Figure 18: Daw's Castle – grassland over buried heritage Cliffside Hillfort

Heritage of Daw's Castle

3.5.2 The remaining main earthworks of the Scheduled Monument (SM) comprise a 255m long bank to the south and comprise part of a once more extensive set of banks and walls. The fort may be of Iron Age origin but was rebuilt and fortified as a 'burh' or coastal fort, by Alfred the Great (reigned 871-99). This would have been created as a string of coastal forts or 'burhs' along a 'herepath', a military coastal road to protect the kingdom from invasion by sea. The heritage associated with battles against Vikings and other raiders peppers the local area and community history, extending to the name of the local secondary school – Danesfield.

3.5.3 A Saxon mint was established at Watchet in 1035, and this was probably within the fort, or adjacent, rather than in the town below. Researchers carried out excavations in 1982 and a survey in 2004. The site may have also been used for defence during the Iron Age. Additional heritage interest for the site includes stone kilns on the northeast boundary to the site, associated with the processing of the limestone foreshore rock, and the later use of the adjacent coastal road as a turnpike road.

Biodiversity of Daw's Castle

3.5.4 The biodiversity interest of the fort area of Daw's Castle comprises semi-improved lowland grassland. Although generally dominated by rank grasses such as cock's foot, species such as salad burnet and pale flax are found in some of the species-rich areas, particularly on some of the steeper slopes to the south of the site and suggests a slight and patchy calcareous influence. The dense thick bordering hedgerows of blackthorn and English elm offer scrub to be used by migratory birds travelling the coast, including

whitethroat and ring ouzel (seen in November 2020). The site is designated as a Local Wildlife Site due to the grassland interest. Like the heritage interest, the botanical interest was likely adversely affected by agricultural works carried out in 1982.

3.5.5 The soft eroding maritime cliff along the north boundary of the grassland habitat comprises valuable habitat for specialist pioneer plant species such as Coltsfoot, as well as for a range of invertebrates including mining bees, solitary wasps, and beetles. Because the cliff is eroding, the edge of the cliff is moving south, together with the associated maritime cliff habitat. However, the boundary of the SAM is fixed where the edge of the cliff used to be. This means that the cliff habitat is now mapped coincident with areas comprising the Scheduled Monument.

Geodiversity of Daw's Castle

3.5.6 Daw's Castle is perched on a cliff of national importance for geodiversity. The fossil-rich Jurassic mudstone and limestone cliffs, and the foreshore extending into the Severn Estuary, are recognised as of national importance as part of the Blue Anchor to Lilstock Site of Special Scientific Interest. The castle site also sits atop of the coastal terminus of the Watchet-Cothelstone Fault, a major structural lineament in the geology of Southwest England and Wales.

3.5.7 The erosion of terrestrial habitat by the sea does potentially result in an overall increase in overall area of a fossil-rich, rocky shore platform, as well as comprising the main process by which fossil faunas are exposed and discovered. The overall area of soft maritime cliff habitat in the area will not however have changed with time. The seaward boundary will also have shifted inland in favour of a rocky foreshore at sea level.

3.5.8 Geologists welcome the action of, and erosion by, the sea at many sites as the main process by which the cliff and foreshore exposures are maintained and continue to reveal their geological information. The Blue Anchor to Lilstock SSSI comprises one of these coastal 'exposure' type sites and the extent of the geological resource is very considerable. The geological features of exposure sites may be large scale and comprise sea cliffs can often offer access for researchers to important structural features, including faults and views of the various strata and components of local geology. Geological features may also comprise individual, smaller-scale features scattered throughout the strata. Although individual specimens (e.g. a fossil or a mineral) may be small, it is usually possible for the contextual information relating to the surrounding strata to still be deduced, even after the fossils and surrounding materials have fallen from high up the cliff and onto the foreshore. Erosion therefore helps otherwise inaccessible geological and fossil features to be accessed. Fossiliferous sea cliffs are often visited by geologists after stormy conditions - although health and safety aspects need to be carefully considered.

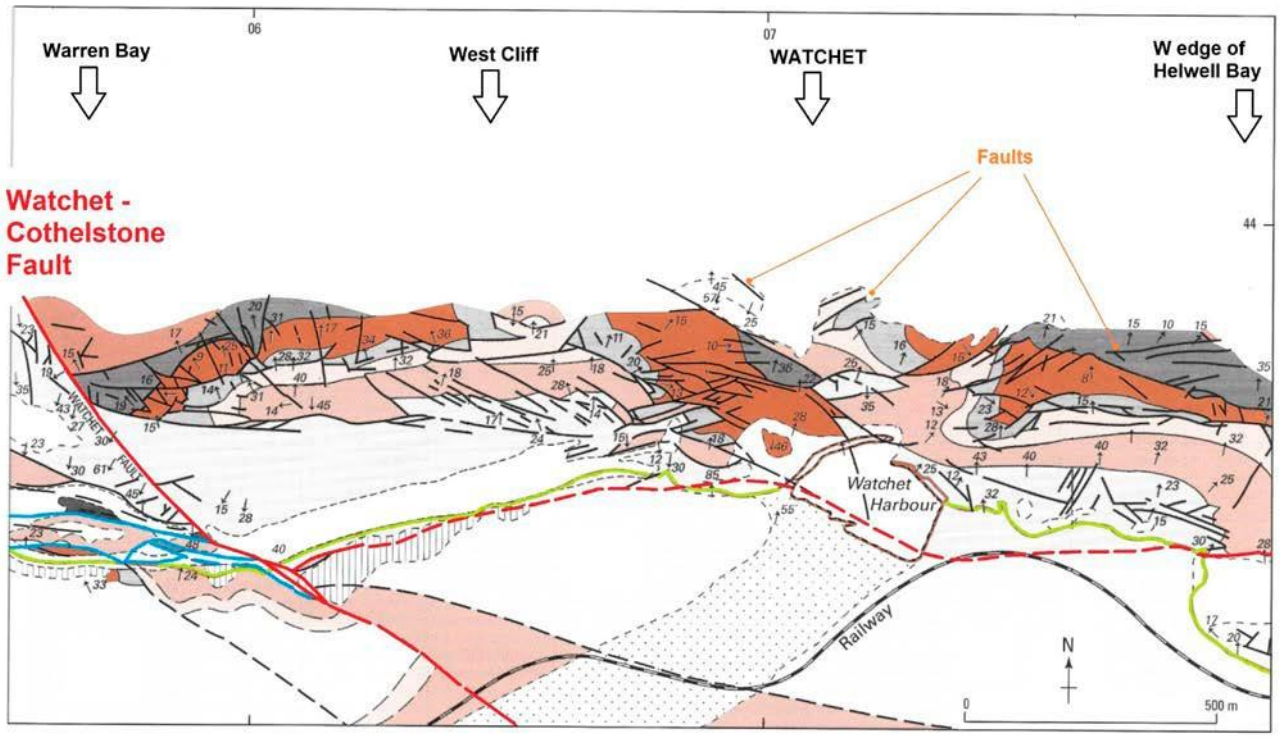

Figure 19: The complex geology in the Daw's Castle area which is being eroded by the sea

Relationships between heritage, biodiversity and geodiversity

3.5.9 The current management of the grassland areas is appropriate to the maintenance of the buried heritage interest. However, the Local Wildlife Site botanical sward would likely benefit substantially from enhanced grazing, helping to switch the balance from coarse grasses to the species-rich flora which should then (re)emerge. As the longer light grazing continues, the more the topsoil will build up an enriched nutrient base that favours coarse grasses and common species. This will likely lead to those scarcer species adapted to a low nutrient environment, further reducing in number across the site.

3.5.10 In common with many heritage assets, whether on the coast or elsewhere, Daw's Castle is subject to natural processes that impact on the site. In this case, coastal erosion is resulting in a reduction in the overall area of the site on the ground. The Intergovernmental Panel on Climate Change (IPCC) has found that locations currently experiencing coastal erosion will continue to do so due to increasing sea levels. The IPCC states:

"While such actions to protect the coast are effective in the short term, in the long term, investing to 'hold the line' may diminish capital resources for other adaptations and hence reduce adaptive capacity to future sea level rise. Thus, dealing with specific risks without a full accounting of the nature of system resilience can lead to responses that can potentially undermine long-term resilience." (IPCC, 2012).

3.5.11 The management of dynamic sites like Daw's Castle needs to adapt to change, with measures ranging from technical interventions to mitigation for unavoidable damage, depending on the sustainability, long-term feasibility and cost-effectiveness of the proposal (Desilvey et al., 2022). At Daw's Castle the management policy is to adapt to the change by moving fencing and paths inland as the coast erodes. Meanwhile the best of the heritage interest that is still safely accessible is conserved for research and enjoyment. This is in line with positive 'nature-based solutions', and physical interventions would not be justifiable due to the environmental and financial costs, as well as likely being impractical to maintain in the long term.

3.5.12 There are contrasts and similarities between the way geological, heritage and biodiversity specialists consider the impacts of coastal erosion upon assets. Part of this is due to the extent and accessibility of the interest.

3.5.13 Coastal change will not remove the site in its entirety over a timespan relevant to the designation and the unfettered natural processes leading to erosion comprise a requirement for favourable conditions for geological SSSIs. Nonetheless, when an interesting individual fossil specimen is revealed by the sea, there is often a race against time to both collect the specimen and record the context and geological research information associated before the sea erodes both and the opportunity for research (and part of the 'geological heritage') is lost.

3.5.14 At some sites, significant heritage finds can also be made on the foreshores below eroding cliffs, in a similar way to geological finds. However, heritage features and their context tend to be more delicate and subtle. The heritage interest of Daw's Castle is in soft soils at the very top of the cliff. The soft sediment and soils that form the important context of such finds tends to be more friable, and key information can be quickly lost on a foreshore amongst other cliff-fall rubble.

3.5.15 Preservation by record aims to mitigate against natural coastal erosion and the loss of the physical site, buried deposits and the knowledge and information that these contain through active gathering of heritage information while it is still accessible. Techniques include the use of LIDAR and geophysical survey to target excavation and evidence digital reconstruction, to enable long-term remote and digital access to areas no longer considered physically safe.

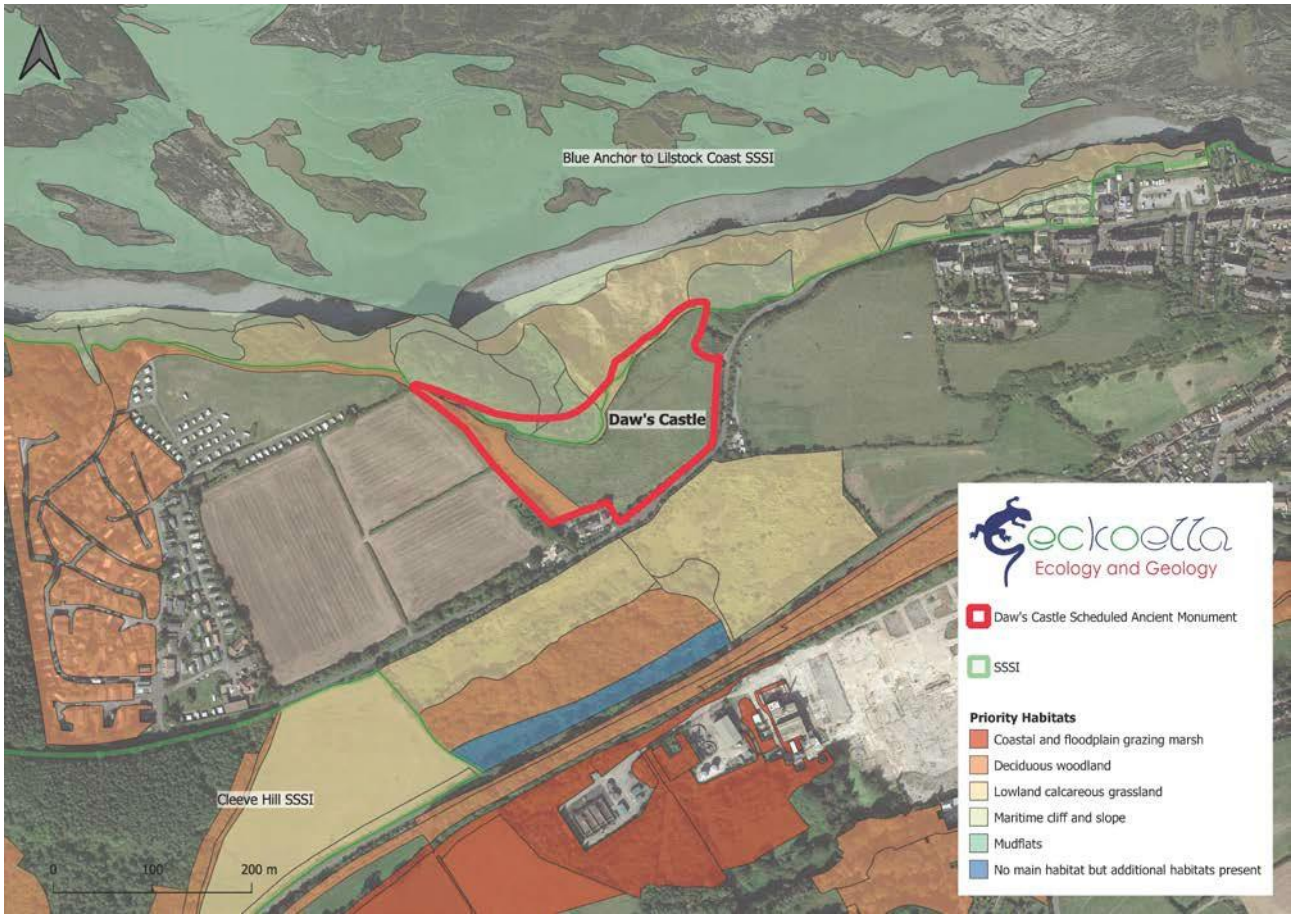

Figure 20: Coastal change at Daw's Castle Scheduled Monument

Figure 21: The eroding sea cliff at Daw's Castle, changing from heritage site to coastal cliff habitat (photo: Kate Jeffreys)

Natural capital of Daw's Castle

Cultural services

3.5.16 The landscape, biodiversity and heritage value of Daw's Castle is valued by visitors and the residents of Watchet, for whom the site comprises a valuable landmark feature.

Regulating services

3.5.17 The cliff along the north boundary of the grassland habitat comprises valuable habitat for specialist pioneer plant species and range of invertebrates including mining bees, solitary wasps and beetles. The site itself is a Local Wildlife Site for species-rich grassland.

Provisioning services

3.5.18 Erosion can aid exposure of fossils by bringing new material to where geologists can access.

Management challenges

3.5.19 Climate change is increasing the rate of erosion and frequency of coastal and fluvial flooding for many coastal and inland sites, adding a new dimension to these challenges. Sometimes adaptations to climate change proposed by others to address off-site issues raises new issues for site managers. A resilience framework outlining organisational adaptation to climate change and weather extremes, which sets out multiple capabilities and response approaches in response to changing extremes, may be beneficial in the long term (IPCC, 2012). This could incorporate an adaptive response (Desilvey et al., 2022).

3.5.20 At Daw's Castle, the old 'herepath' is now a coastal road linking Watchet and Blue Anchor, and is, in places, at the very edge of the eroding sea cliff. At the time of issuing this report (September 2023), the coastal road is currently closed immediately east of Daw's Castle due to the risk of coastal instability and landslip. Measures formerly considered by the local council to protect this road include a substantial (310m long) concrete revetment stretching from Watchet to around 60m east of Daw's Castle (WSP, 2020). Geologically, these cliffs are relatively soft and are in an area of landslip. Daw's

Castle is potentially at risk of exacerbated rates of erosion due to the ‘end effects’ of increased scour that typically arise from ‘hard defences’ (Pilkey and Cooper, 2014), should proposals for the construction of a concrete revetment proceed.

3.5.21 Although Daw’s Castle will eventually be lost to the sea (through natural erosion) in any case, the construction of ‘hard defence’ coastal structures in its vicinity may accelerate cliff erosion at the site which in turn could potentially deprive communities and researchers’ opportunities to enjoy and study this important site in the future. This highlights the finite irreplaceability of historic heritage, compared to being able to recreate natural habitats through Biodiversity Net Gain - ‘Heritage Net Gain’ is not possible. There may also be very significant, negative effects on biodiversity and geodiversity interests arising from inappropriate coastal defence works. Funding for surveying and recording the coastal loss could be beneficial to help monitor the rate of erosion.

3.5.22 Natural change leads to mapped ‘increase’ in the biodiversity value within the site, but this is not a true reflection of overall biodiversity gain because the cliff profile has simply shifted inland. GIS and other datasets should ‘move’ with cliffs rather than composing hard red line boundaries from, for example, the dates of notification.

Opportunities for funding and support

3.5.23 The site is currently managed by English Heritage. There may be scope for agri-environmental support for the site, particularly given the joint biodiversity and heritage interest. However, the small size may mean that the administrative costs are disproportionate.

3.5.24 There are development pressures in the area, including, not only the proposed sea defence works but housing estates. As well as the joint heritage and biodiversity designations strengthening the case for appropriate mitigation, there may be an opportunity for developer contributions to help fund future management and enhancements.

Key points from Daw’s Castle

3.5.25 The low-impact management of Daw’s Castle is conserving the heritage interest. However, the species-rich grassland may be declining in quality as rank grasses take precedence. This site illustrates the potential value of conservation grazing schemes which secure appropriate grazing and cutting management on a series of high priority sites across a particular area. Often, such schemes require heritage breeds and skills due to the challenging nature of the sites for modern farming methods.

3.5.26 Daw’s Castle comprises a coastal site under pressure, both directly from the sea and coastal erosion rates, and also from Local Authority responses to climate change. The construction of hard sea defences in the vicinity of Daw’s Castle may accelerate erosion rates and mean that Daw’s Castle is lost more quickly to the sea than would otherwise be the case. The integrated consideration of the heritage and biodiversity interest of the site, together with consideration of wider natural capital implications, may help to determine a better outcome.

3.6 Shipwrecks of Goodwin Sands, Kent

General description of Goodwin Sands

3.6.1 Goodwin Sands is a 10 mile long and 3-mile-wide marine sand bank that is located approximately 6 miles off the Kent coast where the English Channel meets the North Sea. 25m of fine sand sits on top of a chalk platform, the same feature that forms the White Cliffs of Dover. It is a constantly shifting area of subtidal sands and coarse sediment, affected by the tides and current. At low tide, the sand banks become exposed and are approximately 0.5m above the low water mark, with a series of channels between the sand banks.

3.6.2 The sand bank has been a hazard for shipping for hundreds of years and it is thought that over 2,000 shipwrecks are located within the site, as well as the remains of some wartime aeroplanes; some of these wrecks are designated. It remains a high risk to shipping and is marked by many warning buoys as well as a light- ship at East Goodwin Sands (there were originally five lightships). In addition, there are lighthouses at South and North Foreland on the Kent coast.

3.6.3 Goodwin Sands affords some shelter to ships in stormy weather where they shelter between Deal and the sandbank. The sandbank also provides coastal protection against erosion in the area of mainland, between Ramsgate, Deal and Kingsdown.

3.6.4 Goodwin Sands lies within a Marine Conservation Zone (MCZ), which has been used as the boundary for this project. The area is rich in wildlife and is additionally an important area for fishing.

Figure 22: Shipwreck at Goodwin Sands (reproduced with permission of the Goodwin Sands Conservation Trust)

Shipwrecks of Goodwin Sands			
Site owner / manager: Crown Estates **Type**: Sand bank with Protected Wrecks in a Marine Conservation Zone **Location:** Southern end of the North Sea, 6 miles off the coast of Deal in Kent **OS grid ref:** TR410560 A**rea:** 27,627 hectares			
Priority Habitat	**Statutory Biodiversity / geodiversity sites**	**Non-Statutory Biodiversity / geodiversity Sites**	**Heritage Designations**
None	Marine Conservation Zone	NONE	Protected Wrecks Scheduled Monument

Percentage Coverage Statutory Biodiversity/ geodiversity Designated Sites		
Statutory Designated Sites	**Percentage Cover**	**Hectare**
Marine Conservation Zone	100%	27,627 ha

Percentage Cover of Non-Statutory Biodiversity/ geodiversity Designated Sites		
Non-Statutory Designated Sites	**Percentage Cover**	**Hectare**
None	0%	0 ha

Percentage Cover of Heritage Designations		
Heritage Designations	**Percentage Cover**	**Number**
Protected Wrecks	N/A	6
Scheduled Monuments	N/A	861

Table 8: Overview of Shipwrecks of Goodwin Sands

Heritage of Goodwin Sands

3.6.5 The heritage assets associated with the Goodwin Sands are predominantly shipwrecks. Many thousands of people have perished on Goodwin Sands and in one storm alone in 1703, 1,200 people were known to have drowned on the sands. There are six Protected Wrecks on the sands, although there are believed to be over 2,000 shipwrecks associated with the site, along with the remains of some aeroplane wrecks, mostly from the 20th century. It is one of the most important wreck heritage sites in the UK.

3.6.6 Designated Protected Wrecks on site comprise:

- Admiral Gardner – remains of an English East Indiaman, stranded on Goodwin Sands in 1809. No part of the designated site lies above the high-water mark. Built in 1797. Wreck discovered in 1976 during dredging operations in the area.

- HMS Northumberland - believed to be the Third Rate 70 gun warship built in 1678. The ship was wrecked on Goodwin Sands in 1703 during the great storm of that year. It is periodically exposed and covered due to the shifting sand. Exposed timbers have been weakened by biological attack. This is a declining site. The ship was found in 1979 and became designated in 1981. No part of the wreck is above the high-water mark of ordinary spring tides. The site lies at a depth of 15 to 20m.

- HMS Restoration – No definitive evidence but believed to have sunk during the great storm of 1703. Built in 1678 in Harwich. 1,055 tons. Site discovered in 1980 and designated in 1981. No intrusive archaeological work has been carried out to identify the wreck. The site is located at a maximum depth of 20m.

- HMS Stirling Castle – A 70 Gun warship built in 1678 and sunk during the great storm of 1703. The site was found in 1979 and designated in 1980. Lies approx. in 15m of water.

- The Rooswijk – Wreck of a Dutch East Indiaman. Became grounded on the sands in late 1739. The ship is a rare survival of Dutch ‘retourschip’ in Northern European waters. The wreck and its component parts are vulnerable. The site was designated in 2018. Silver was found onboard in 2005 and handed over to the Netherlands Finance Minister. More than 1,000 artefacts have been recovered from the wreck during excavations that took place in 2017 and 2018. These have been transported to Historic England’s research facilities at Fort Cumberland, Portsmouth

- Unknown Wreck – Designated site. Ship unknown. It has survived remarkably well. It has the potential to enhance our understanding of merchant seafaring. Mid to late 19th century wooden sailing ship which was carrying cargo of coal. First discovered in 2005

- Other shipwrecks include HMS Mary, The Goodwin Sands lightship, HMS Mortar, the Radio Caroline (pirate radio) ship and SS Montrose.

3.6.7 There are also 861 wrecks listed as monuments on the Historic Environment Record. It is thought there are over 2,000 wrecks associated with the sand banks.

3.6.8 Goodwin Sands may have once been an island; it was named after Godwin, Earl of Wessex in the 11th century.

3.6.9 Goodwin Sands has been the location of several battles, including the Battle of Goodwin Sands in 1602 and 1652 and the Battle of Dover Straits in 1917. The site includes 27 WWII aircraft crash sites including a B52 bomber and Spitfire.

3.6.10 Goodwin Sands has also featured in literature for hundreds of years. Including William Shakespeare, Ian Fleming and James Bond and Herman Melville's Moby Dick.

3.6.11 Regarding cultural heritage and events, there was an annual cricket match played on the site from 1824 to 2003. An athletics match has also been a feature of Goodwin Sands. The Radio Caroline, ship MV Ross Revenge, ran aground on the Sands in 1991, bringing the end to Pirate Radio in Europe.

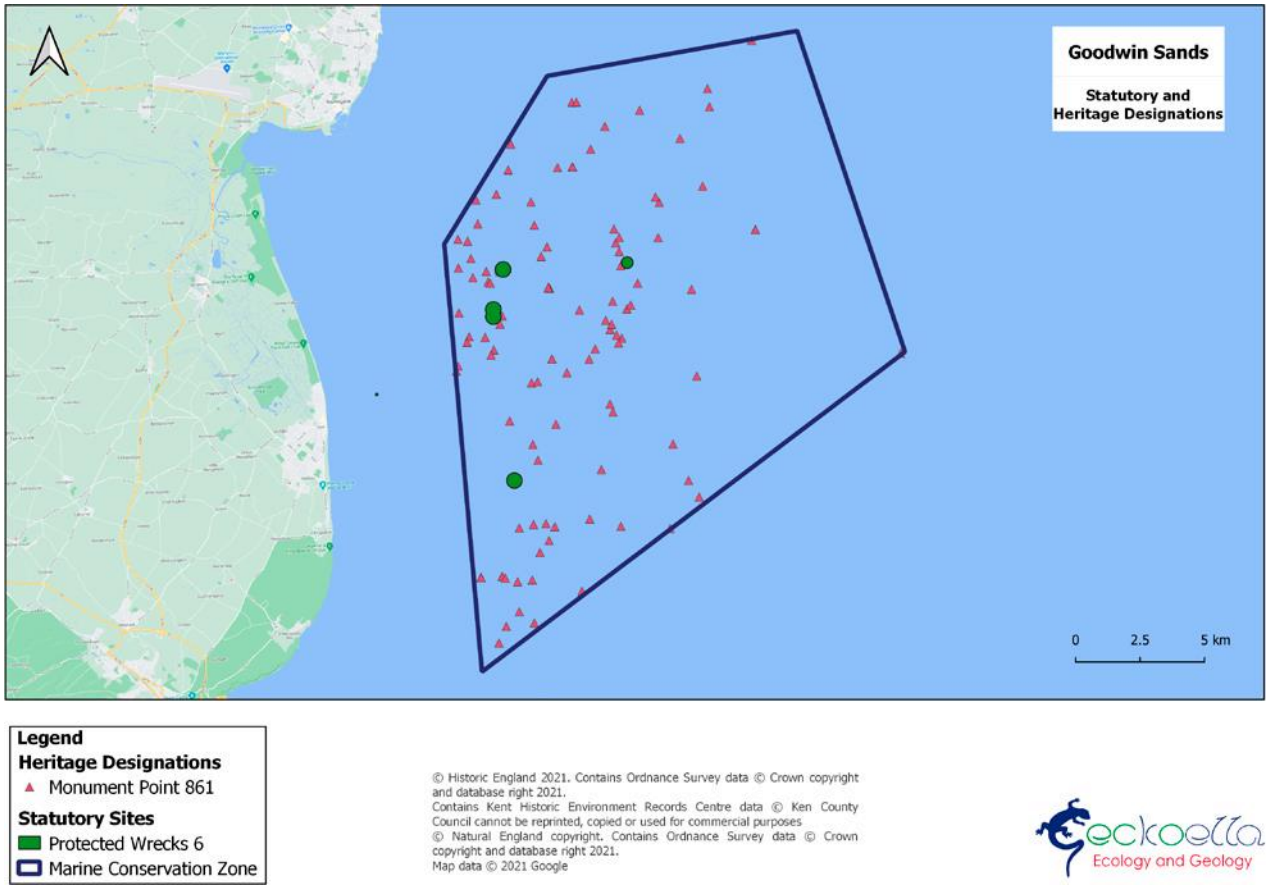

Figure 23: Heritage and Biodiversity Designations at Goodwin Sands

Biodiversity of Goodwin Sands

3.6.12 Goodwin Sands was declared a Marine Conservation Zone (MCZ) on 31 May 2019. These are designed to protect a range of nationally important habitats and species. The MCZs contribute to a wider network of Marine Protected Areas (MPAs) in the UK. They are designated so that biological communities within the zone remain in a healthy and non-deteriorating condition. Protected features include moderate energy circa-littoral rock; subtidal coarse sediment; subtidal sand, English Channel outburst flood feature; common mussel beds and ross worm reefs.

3.6.13 The area is also designated as part of the Thanet Coast and Sandwich Bay, Special Protection Area (SPA) and a Ramsar site for its bird interest, as it provides good foraging grounds for bird species.

3.6.14 Goodwin Sands form a productive habitat that supports a wide range of specialist sand dwelling species including amphipods, polychaete worms and hermit crabs and provides spawning and nursery grounds for benthic fish species such as herring, Dover sole, plaice, whiting, sea bass and cod. Whelks and scallops are an important resource. There are also biogenic reefs with large numbers of common mussel as well as shellfish including lobster and crab.

3.6.15 Wrecks provide hard substrate for species which cannot live on sandy sediment. These include sea squirts, strawberry and snake-lock anemones, barnacles, and tuberous worms. A large number of seaweeds and algae, such as bladderwrack, kelp and oar-weed also grow on wrecks. Wooden shipwrecks tend to have a more diverse fauna. Studies suggest worm casts are also much denser in the vicinity of wrecks. They can produce artificial reefs. (Evans and Davison, 2019).

3.6.16 A wide range of sea birds are found at Goodwin Sands, including internationally important populations of turnstone, as well as gannet, kittiwake, herring gull, black-headed Gull, fulmar, shag and cormorant.

3.6.17 Cetaceans such as bottlenose dolphin, harbour porpoise and pinnipeds also use the site throughout the year and there are also occasional sightings of sperm whales and fin whales.

3.6.18 Goodwin Sands is one of the most important sites for seals in the east of England, with the site likely comprising an important haul out site for seals travelling between mainland Europe and the UK. In 2019, 450 grey seals and 180 harbour seals were recorded, comprising 70% of the total population of grey seals in the southeast of England. Harbour seals also breed on the sands.

3.6.19 Non-native invasive species are an increasing issue and Goodwin Sands is particularly prone to this problem due to the extremely large number of shipping movements, often carrying species from other parts of the world in their ballast water or on their hulls. Pacific oyster is already established on Goodwin Sands as is Japanese wireweed, a form of brown seaweed which spreads rapidly.

Figure 24: Harbour seal – Goodwin Sands is one of the most important sites for seals in East England

Geodiversity of Goodwin Sands

3.6.20 Approximately 25 metres of sand covers the underlying geology of the Cretaceous Upper Chalk at Goodwin Sands (the same geology as the White Cliffs of Dover). The Seascape character type is Inshore Sandbanks and Shoals Priority Habitat.

3.6.21 Goodwin Sands is bisected by several channels; most of the site is around only 0.5 metres above mean low water. The palaeo-channels were originally part of a series of tributaries of the Proto-Thames, Proto-Rhine and Proto-Solent rivers which separated Britain from the continent until the last Ice Age. During this period, it is highly likely that there would have been land at Goodwin Sands, although some references suggest that

there is a description in Roman literature of a “Low Island” in this area, while in the 11th century, there is a description of an island called Lomea, although this is disputed as there was no mention in the Domesday Book or other historic references.

Relationships between heritage, biodiversity and geodiversity

3.6.22 The conservation of historic and natural assets appears entirely compatible at Goodwin Sands. Indeed, wrecks comprise artificial reefs in the depauperate sandy environment, benefiting both wildlife and the fishing industry that depends on spawning grounds for their catch.

3.6.23 The heritage and biodiversity features of Goodwin Sands are under significant pressure, including the following issues:

- Dover harbour is proposing to dredge sand and aggregate from Goodwin Sands. Dover port wishes to dredge sand from Goodwin Sands for land reclamation and berth construction for the Dover Western Dock Revival scheme. It has been proposed that 2.5 million cubic metres of sand will be taken from the south of Goodwin Sands and transported to Dover harbour to be used as aggregate. This would be on top of the 6.3 million cubic metres of material which have previously been dredged between 1976 and 1998 for other projects in the area.

- Goodwin Sands may be subject to modification by increased storm surges. Goodwin Sands’ role as providing shelter to other parts of the area and coast could be at risk.

- An airport has been proposed for the site. It was first put forward in 2003 and then again in 2012. The aim was to create a UK hub airport with five runways at the cost of £39 billion. Another proposal was to create a new ‘freeport’ to attract international shipping. This was prior to the site becoming a Marine Protected Zone. It is not known if these proposals will be resurrected in the future.

- There is always a risk of illegal ‘bounty hunting’, from people trying to plunder the remains of the wrecks and their cargo, as has happened on many other wrecks around the world.

- Fishing can have a serious impact on the wildlife as well as the historic features, particularly where scallop dredging or bottom trawling (dragging heavy weighted nets along the seafloor) is carried out. Some fishermen would like to see a cull of seals which they see as competition for fish.

3.6.24 The Goodwin Sands Conservation Trust has brought together people from a variety of backgrounds, including archaeologists and naturalists. This and other bodies articulate the joint and varied interests of the site when proposing conservation measures or commenting on development proposals. For example, in relation to the dredging, a judicial review was called on the following grounds:

- Potential impact on known as well as unknown heritage assets such as wrecks and aeroplanes.
- Impact on fisheries and spawning grounds.
- Impact on wildlife such as seals and marine fauna.
- Potential to increase coastal erosion on the coast of Deal, Kingsdown and Ramsgate once the protective sand bank is diminished.
- Environmental impact on water quality and turbidity from the dredging.

3.6.25 This integrated response and approach illustrates how considering a site in terms of both its heritage and biodiversity can strengthen the case for conservation.

Natural capital of Goodwin Sands

Cultural services

3.6.26 Goodwin Sands features in literature from William Shakespeare to Herman Melville's, Moby Dick and this contributes to a sense of place and to the historical value of the site. There are also film and TV documentaries about Goodwin Sands.

3.6.27 The site provides sheltered anchorage in stormy weather for ships between the mainland and sandbank.

Supporting services

3.6.28 Wrecks, marine fauna, and flora. Shipwrecks on the sands give rise to ecosystem services and create artificial reefs. The sand is habitat for many marine organisms, such as a sand eel ecosystem.

3.6.29 The artificial reefs and sand banks provide an important spawning and nursery ground for many marine species supports commercial fisheries including herring, sea bass, whiting, cod, Dover Sole, and plaice.

Regulating services

3.6.30 Goodwin Sands performs an important function in protecting the low-lying land at Deal, Ramsgate and Kingsdown from coastal erosion and inundation in stormy weather. This could be reduced as sea levels rise or the sands are dredged for construction.

Provisioning services

3.6.31 Goodwin Sands is seen as a valuable resource for sand and aggregate by construction companies. In the past, it has been exploited by Dover Harbour Board, the Channel Tunnel, and others. 6.3 million cubic metres of sand and aggregate were removed from the sandbank in 1976, 1988 and 1998. There are proposals for a further phase of dredging for a second ferry terminal and marina in Dover, where another 2.5 million cubic metres would be dredged, although this has been resisted by various bodies and has resulted in the creation of the Goodwin Sands Conservation Trust and a request for a judicial review.

3.6.32 There is a large offshore wind farm close to Goodwin Sands known as Thanet Offshore Windfarm, 7 miles off the coast, to the east of the study area. When commissioned, it was the largest wind farm in the world, with 100 turbines generating 300 MW of energy, sufficient to power 240,000 houses.

Management challenges

3.6.33 Climate change and increased storms as well as projected sea level rise is likely to have a significant impact on Goodwin Sands and may cause more mobility in the sediment.

3.6.34 Modern wrecks have the potential to create significant pollution, particularly from oil and anti-fouling chemicals, but also from their cargo. Oil and chemical spills following accidents as well as deliberate discharge of oil from shipping is an ongoing and very real risk. In recent years, there have been a number of collisions between ships close to Goodwin Sands, including a 38,000 ton oil tanker.

3.6.35 Pollution from shipping creates significant atmospheric pollution in certain conditions. The Dover Straits is the busiest channel in the world for both ferry movements as well as general international shipping. This is exacerbated by industry on the coast of France, Belgium and Britain.

3.6.36 With the constant shifting of the sand, it is likely that new wrecks and remains will become uncovered and that emergency excavations or surveys may be required by marine archaeologists to gather information and conserve the historic interest if practicable.

Opportunities for funding and support

3.6.37 Unlike the terrestrial environment, active habitat management of features is rarely required in the marine environment, whether for heritage or biodiversity. The main management activities comprise schemes where stakeholders are engaged in avoiding areas or activities likely to damage the special interest of the site.

3.6.38 Funding mechanisms for conservation in the marine environment are less well developed than in terrestrial sites. The Crown Estates, as owners of the seabed from mean low water, may contribute to projects and grant bodies such as Heritage Lottery Fund may also assist. European funds such as LIFE, Interreg and Erasmus which might have previously supported works are no longer available since Britain's withdrawal from the European Union.

Key points from Goodwin Sands

3.6.39 The conservation of heritage, biodiversity and natural capital at Goodwin Sands both depend on the absence of destructive activities such as dredging, the use of aggregate or bottom trawling fishing.

3.6.40 Conservation organisations have helped to protect the site through explaining and campaigning about the value of the area based on the integration of these interests.

3.6.41 There are practical integrations too, since some of the marine wildlife species present at Goodwin Sands use the wrecks as substrates and habitat.

3.7 Sea Mills Conservation Area, Bristol

General description of Sea Mills

3.7.1 Sea Mills is situated in an area adjacent to semi- natural habitat on the River Avon, Shirehampton Park and Crabtree Slipwood. Two areas of SSSI are close by on the Avon Gorge and Shirehampton, plus a Local Nature Reserve at Blaise Castle.

3.7.2 Sea Mills is an excellent example of the early 20th century garden city movement. Garden cities were focussed on helping people living in overcrowded cities and ill maintained houses find a more pleasant place to live. Other examples include Bournville, Port Sunlight, Letchworth, Welwyn Garden City and Hampstead Garden Suburb. (English Garden City report, English Heritage, 2010). The Sea Mills Conservation Area provides examples of the built heritage and the natural environment working in synergy.

3.7.3 Sea Mills is a post WWI garden suburb housing estate on the north bank of the river Avon that lies approximately 5km from Bristol city centre. The site sits between the higher ground of King Weston Ridge to the west and the lower Trym Valley in the east. Shirehampton Golf Course, owned by the National Trust (NT), is immediately to the west of the site and Crabtree Slipwood (NT) abuts the River Avon, providing important greenspace. The housing estate comprises 1,279 houses, with associated allotments, gardens and public open space. Sea Mills is a purpose-built garden suburb, constructed to house WWI veterans and was designed to be a self-sufficient community site with space for allotments, large gardens for growing vegetables as well as a library, shops, schools and churches.

3.7.4 Sea Mills is an intact example of Ebenezer Howard and Raymond Unwin's model of a planned detached garden suburb. It is Bristol's finest example of post WWI municipal housing. (BCC, 2015).

3.7.5 Sea Mills was planned as a "sustainable self-contained community, with its own shops, recreation grounds, libraries, schools and churches. Sea Mills is where the urban density of the city starts to open out into a more rural setting" (BCC, 2011).

Figure 25: Location of Sea Mills Conservation Area, Bristol

Sea Mills Conservation Area, Bristol			
Site owner / manager: Multiple owners. Conservation Area designated by Bristol City Council. **Type**: Conservation Area **Location:** Bristol **OS grid ref:** ST55076 A**rea:** 117.65 hectares			
Priority Habitat	**Statutory Biodiversity / geodiversity sites**	**Non-Statutory Biodiversity / geodiversity Sites**	**Heritage Designations**
Coastal Saltmarsh Deciduous Woodland Mudflats Wood Pasture and Parkland No main habitat but additional habitats Present	SAC SSSI	SNCI	Scheduled Monument

Percentage Coverage Statutory Biodiversity/ geodiversity Designated Sites		
Statutory Designated Sites	**Percentage Cover**	**Hectare**
SAC	0.2%	0.2 ha
SSSI	0.2%	0.2 ha

Percentage Cover of Non-Statutory Biodiversity/ geodiversity Designated Sites		
Non-Statutory Designated Sites	**Percentage Cover**	**Hectare**
SNCI	2.4%	19 ha

Percentage Cover of Priority Habitat		
Priority Habitat	**Percentage Cover**	**Hectare**
Coastal Saltmarsh	3.2%	4 ha
Deciduous Woodland	5.9%	8 ha
Mudflats	6.6%	8 ha
Wood Pasture and Parkland	2.6%	4 ha
No main habitat but additional habitats present	0.3%	0.4 ha
Total	18.5%	25 ha

Percentage Cover of Heritage Designations		
Heritage Designations	**Percentage Cover**	**Hectare**
Scheduled Monument	1.7%	2 ha

Table 9: Overview of Sea Mills Conservation Area

Heritage of Sea Mills

3.7.6 Sea Mills was designated as a Conservation Area in 1981 due to the architectural and historical interest associated with the site, especially the significance of the garden suburb layout, which is considered to be the finest example of post WWI municipal housing in Bristol. The Sea Mills Council Estate was one of the first to be designated a Conservation Area in the United Kingdom.

3.7.7 Construction of Sea Mills Garden City started in 1919 as a part of the garden city movement. A movement conceived in response to the unhealthy overcrowding and growth of cities and designed to give residents a better quality of life and access to open space. Although the individual buildings are unremarkable, it is the uniform and homogeneous design that is a defining characteristic of the area. Shared greenspace for recreation, allotments and private gardens were an important integral part of the original design, alongside the built infrastructure.

3.7.8 The site was largely uninhabited and mostly agricultural land prior to construction but does comprise several historic monuments. Remains of a Roman settlement to the southeastern corner of the site is now a Scheduled Monument and are visible to visitors. An 18th century dry dock, only the third to be constructed in Britain, was in use on the site up until the 1800s. The harbour walls are now listed. The 18th century Sea Mills Farmhouse is still standing on the site and acts as an indication of the area's agricultural roots prior to a garden suburb and Conservation Area.

3.7.9 Some of the houses have been built in the Arts and Crafts style, such as the alms-houses, in Haig Close, which were built for disabled WWI servicemen.

3.7.10 The 300-acre Kings Weston Park is a Registered Park and Garden and lies to the west of the site with part of the parkland extending into the recreational area of Sea Mills. It was given to the National Trust and Bristol City Council in 1923. The landscaped grounds around Kings Weston house developed during the 17th century following the purchase of the manor by Sir Robert Southwell in 1679. His son Edward commissioned Sir John Vanbrugh to design a replacement house that was begun in 1712. Vanbrugh and Southwell replanned the gardens and park to provide commanding views over the Bristol Channel to the west and the Avon Gorge to the south and southeast.

3.7.11 Shirehampton Park is part of the Kings Weston registered Park and Garden. Vanbrugh and Southwell extended King's Weston Home Park to the south as far as the River Avon in the 1720s. A large portion of Kings Weston Hill was removed to link the two area and create a viewing terrace. It is partially occupied by Shirehampton Golf Course, founded in 1904. The southern section of the Kings Weston landscape is notable for its spectacular views over Horseshoe Bend of the River Avon. Kings Weston became a nationally celebrated estate. The landscape is very much linked to the Sea Mills area though both are situated outside the Sea Mills boundary.

3.7.12 Blaise Castle Estate, a Registered Park and Garden (Bristol City Council), is located to the north of Sea Mills. Both are situated outside the Sea Mills boundary lines. Thomas Farr, a wealthy Bristol sugar-merchant commissioned Robert Mylne in 1766 to design Blaise Castle, a triangular prospect tower, designed to command views of the shipping in the Severn and the Avon. Farr created an elaborate pleasure garden. A subsequent owner John Scandrett Harford, in augmented the estate with further land purchases, including the east side of the gorge, and commissioned a design for a new house, Blaise Castle House in 1795 and advice from Humphrey Repton on the design of the park. In 1796 Repton completed a Red Book and the landscape park was laid out largely in accordance Repton's suggestions. In the early 19th century further additions and structures were made by John Nash and G S Repton. In 1926, the estate was purchased by the Bristol Corporation, excluding Blaise Hamlet which was bought by the National Trust in 1943.

3.7.13 Leigh Court on the other side of the River Avon, was monastic property until the Dissolution. Philip Miles commissioned the current house by Thomas Hopper between 1814 and 1818. Humphry Repton advised on the landscape and a Red Book was produced in 1814. There are commanding views over the Avon Gorge. The house functioned as a mental hospital from 1917 to 1969. The estate then became government property and was split up from 1952 onwards culminating in the park being split up into several ownerships in 1988.

3.7.14 Historic Environment Records including finds of heritage interest are clustered around the Roman Settlement, possibly reflecting search effort.

3.7.15 A Scheduled Monument (SM) near the river comprises Roman walls and remains that belong to a first to fourth century AD Roman town port. The town was known as Abona.

Biodiversity of Sea Mills

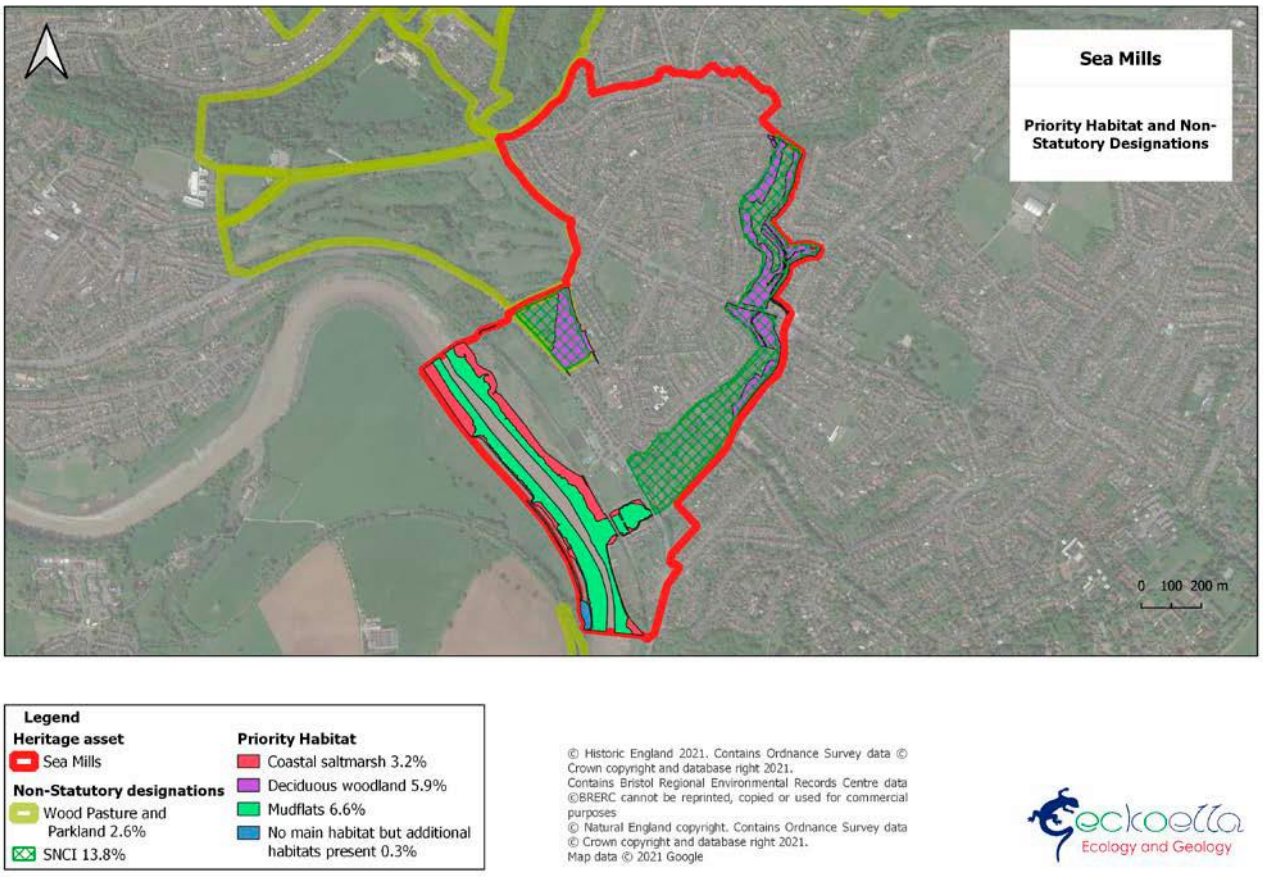

Figure 26: Biodiversity Sites and Priority Habitats of Sea Mills Conservation Area

3.7.16 The biodiversity interest of the Sea Mills Conservation Areas includes three Sites of Nature Conservation Interest (SNCI) as listed below:

- The Trym Valley comprises Deciduous Woodland Priority Habitat (PH). It forms an important green buffer to the garden suburb.

- Three Acre Covert and Portway gardens has both woodland and grassland with some calcareous influence on the grassland species Priority Habitat as well as veteran trees and Wood Pasture and Parkland.

- The River Avon SNCI comprises Priority Habitat which includes coastal marsh land and mudflats. These areas are also Bristol Wildlife Network Sites, meaning that they have been identified by Bristol City Council as important for habitat connectivity across the city.

3.7.17 Avon Gorge Woodlands Site of Special Scientific Interest (SSSI) /Special Area of Conservation (SAC) to the south of the site and across the river from the main Conservation Area, also forms part of the biodiversity interest of the general area. There is also a small SSSI at Shirehampton, including a river bluff that supports the true service tree *Sorbus domestica*.

3.7.18 While there has not been a biological survey specifically of Sea Mills, there are several notable species, recorded within neighbouring SSSIs and on the National Trust land at Shirehampton Park and Crabtree Slipwood. These include endemic Bristol rockcress, the largest population of true service tree in Britain, a number of very rare and endemic whitebeams, round-headed leek, little robin and nit grass. Peregrine and raven nest on the gorge side, and are likely found in the parks, gardens and gorge areas adjacent to the Conservation Area.

3.7.19 Sea Mills was designed to have gardens large enough for growing vegetables and fruits as well as to keep animals and chickens. The green space is higher than in other similar housing developments and will undoubtedly be beneficial for wildlife.

3.7.20 Parks and recreational areas. The Conservation Area forms part of Bristol's Green Corridor. Mature trees, tree lined streets, Sea Mills Square, the combination of trees, verges and gardens add to the green corridor effect of the Conservation Area. Two further green corridors completely enclose the Conservation Area; Shirehampton Park and King Weston Park to the north and the Trym valley to the south.

Geodiversity of Sea Mills

3.7.21 Sea Mills is situated on Triassic Dolomitic Conglomerate, with areas of Carboniferous Limestone located close to the river. The conglomerate was historically quarried as a local building stone for buildings such as Bristol Temple Meads railway station.

3.7.22 The area is also of geological interest as part of Blaise Castle Regionally Important Geological and Geomorphological Site (RIGS), comprising a periglacial landscape with associated gorges.

Relationships between heritage, biodiversity and geodiversity

3.7.23 Sea Mills is an urban site; biodiversity and natural capital generally comprise shared green and blue infrastructure as well as private gardens. Sea Mills has more green space (gardens, allotments, parks, hedgerows and tree lined verges), than comparable suburbs. Some of these areas pre-date the estate and include small remnants of old woodland and farmland. These green spaces exist due to the founding principles of the development – the wildlife and environmental value of the site is intimately related to the heritage of the site.

3.7.24 The Conservation Area design guide includes reference to these green spaces and features, helping to ensure that development is appropriate. This helps to slow, for example, the rate of losses of trees from streets and changes of front gardens to driveways. The heritage designation also benefits local wildlife.

3.7.25 Sea Mills has not changed dramatically for 100 years; this continuity can be helpful for wildlife.

3.7.26 The sense of place associated with heritage is significant at Sea Mills and conservation action helped to protect local wildlife as well. The Garden Suburb history is celebrated by residents, such as in 2019, with a birthday party for the Adison Oak, planted to celebrate the Addison Act of 1919 that provided council housing. This local support helped to get the Conservation Area designated in 1981. Community engagement at Sea Mills showed how formally designated heritage assets are only part of the story of the cultural value of an area; being open minded to including what resonates with the community can yield added benefits and uncover hidden values for an area.

3.7.27 Research into urban pollinators and nectar recently done by Bristol University found that allotments have the highest diversity of nectar, which results in very biodiverse habitats scattered throughout urban environments, particularly in those

neighbourhoods like Sea Mills, where there is a high density of allotments (Tew et al., 2021). Whilst allotments have the highest diversity of nectar, gardens make up the highest density of nectar, and have the highest potential to provide both more nectar in quantity and in diversity. This is largely due to lots of people having mown lawns, rather than flower beds (Tew et al., 2021). Promoting wildlife friendly gardening could be beneficial to biodiversity and in improving pollinator corridors particularly in urban environments. It was the garden city movement and the 'Dig for Victory' campaign that led to the abundance of allotments and the large gardens in Sea Mills. This heritage aspect of Sea Mills has had a positive impact on both the current and potential biodiversity as well as the natural capital values within the neighbourhood.

3.7.28 The Romans introduced many kinds of plants to England, many of which are now found in allotments, gardens and farms. Many of these plants provide a source of food, and include plants such as apple, cherry, plum, damson, cucumber, celery, walnut, dill, fennel and coriander. These plants have contributed to the diversity of nectar found in green spaces, particularly allotments, and thus has contributed to the biodiversity found within these areas.

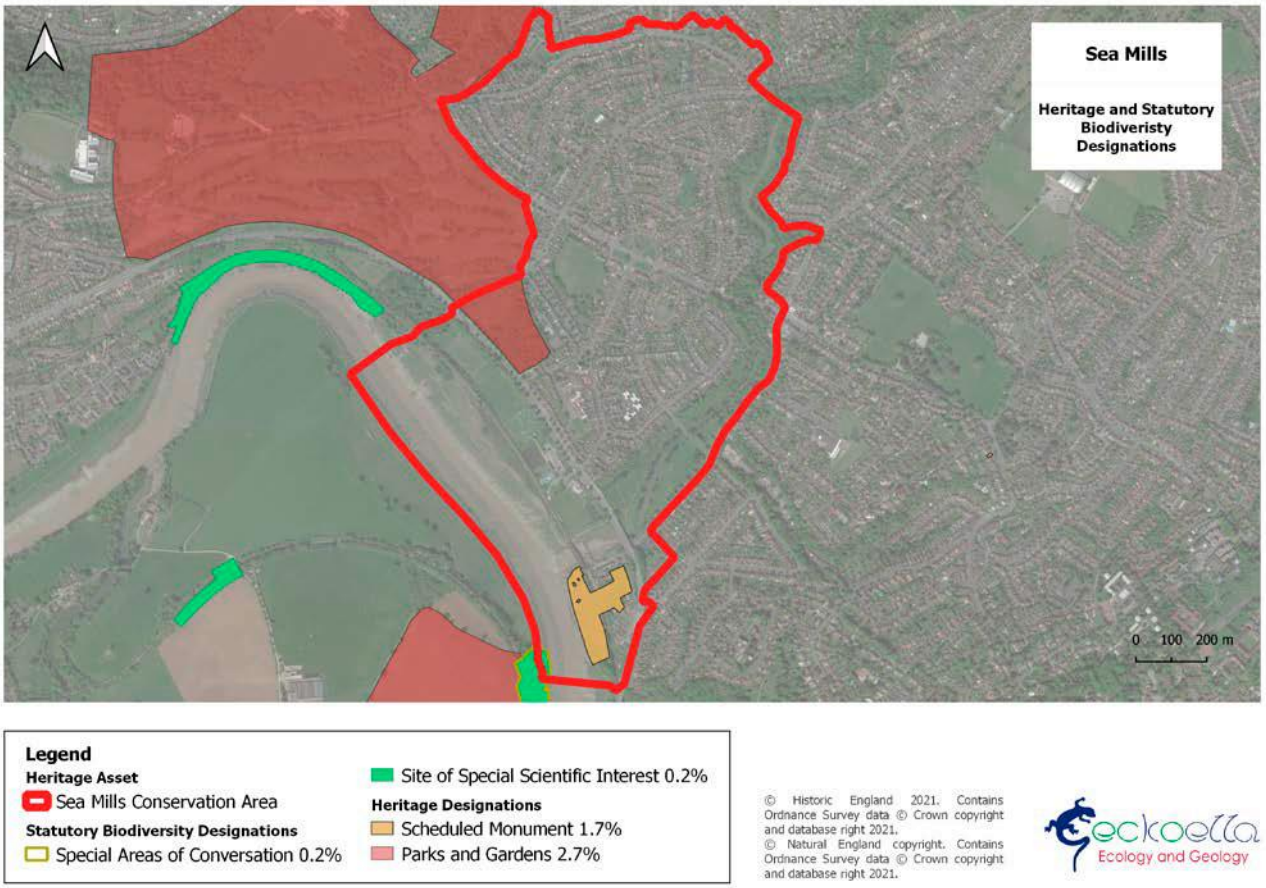

Figure 27: Biodiversity, Geodiversity and Heritage Designations in and around Sea Mills Conservation Area

Natural capital of Sea Mills

Cultural services

3.7.29 Allotments provide social interactions, mental wellbeing, physical exercise and fresh air. This was their original intention and is still very relevant today.

3.7.30 Green spaces and large gardens provide recreational areas for the community, which can improve wellbeing and mental health.

3.7.31 Green social prescribing is a new concept and one that has already started to be implemented across Bristol. These activities often utilise existing green spaces within urban areas, and include allotments, community/ city farms, local nature reserves, parks and gardens. Activities can include, food growing projects, community gardening, local walks and conservation work. Some examples of green social prescribing in Bristol can be seen at Lawrence Weston Community Farm (http://lwfarm.org.uk/) and Heart of BS13 allotment (https://heartofbs13.org.uk/). Other organisations such as TCV run green social prescribing projects, such as Green Gym (https://www.tcv.org.uk/greengym/).

3.7.32 The NHS recognises that there is an importance of being outdoors to people's mental and physical health (NHS, 2022). Schemes such as, green social prescribing have a potential intangible benefit of improving quality of life and a tangible benefit in the potential long term financial savings to services, such as the NHS. Green social prescribing is also less likely to have a long waiting list, like counselling sessions currently do. This means patients are likely to receive treatment quicker (NHS, 2022).

3.7.33 Forest schools can take place in local nature reserves and local woodlands. These schools provide a natural capital in the form of education for children, and as a tool to assist vulnerable children, children with mental health issues and children with behavioural issues. If used effectively, forest schools have the potential to help reduce the pressure on both the health system and education system. It can also be used to connect children to the natural environment and heritage (FSA, 2022).

Supporting services

3.7.34 The River Trym Corridor is an important element of the local green and blue infrastructure and provides a nature corridors and habitats within the urban environment.

Regulating services

3.7.35 Allotments have a high diversity of nectar, and gardens have the highest density of nectar in urban environments. This provides an important food source to urban insects, which in turn provide a food source to the bats, amphibians and birds that are also commonly found in urban areas.

3.7.36 Many of the streets are tree-lined, which provides an air regulating service, by reducing air pollutions. Trees and hedges can also to an extent reduce noise, air and light pollution within urban areas.

3.7.37 Green spaces within urban areas can help reduce surface run off by infiltrating water, compared to hard surfaces which can contribute to flooding in heavy rain.

3.7.38 Urban cultivation in allotments maintains soil qualities and has a higher soil organic carbon (SOC) than conventional agriculture (Edmondson et al., 2014). High quality soil plays an important regulating role in food growing and food security. Soil of high SOC also has a greater ability of carbon sequestration – an important consideration for climate change management and mitigation (Deluz et al., 2020).

Provisioning services

3.7.39 Allotments provide food and large gardens have the potential to provide a space for food growing.

Figure 28: An example of an allotment at Sea Mills – Sea Mills is fortunate to have many allotments for food growing, as well as large gardens and access to green spaces

Management challenges

3.7.40 Pressures from housing developers means that some green spaces are at risk of being lost. Nearby developments can also have an impact on the effectiveness of green and blue corridors within the urban area.

3.7.41 Allotment biodiversity – changes since 1931 mean some allotments have been lost and infilled with other developments. This is a loss to the original design as well as green space.

Opportunities for funding and support

3.7.42 Bristol City Council is including Sea Mills as one of several sites for potential enhancements under developer contributions. A biodiversity audit was carried out in 2020, looking at the type and quality of habitats present, and setting out recommendations for enhancement.

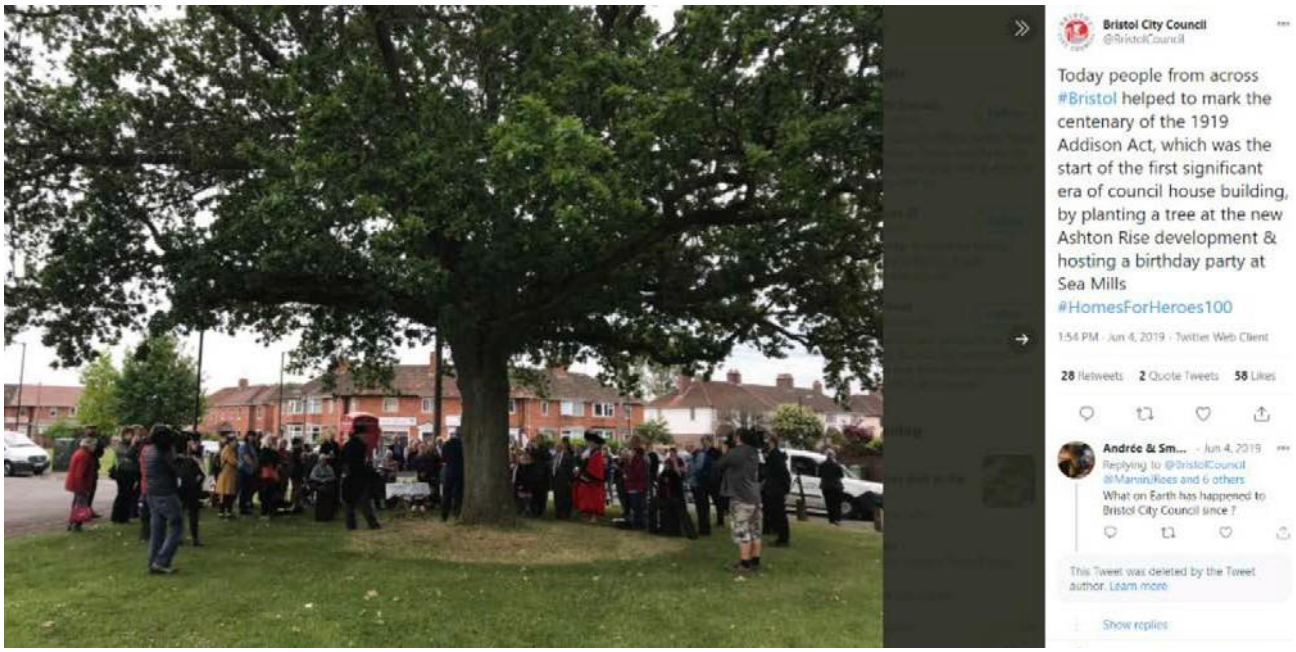

Figure 29: Social media report about the Addison Oak Birthday Party (reproduced with permission of Bristol City Council)

Key points from Sea Mills Conservation Area

3.7.43 The aims of the original development at Sea Mills are still very relevant today, in terms of what contributes to a high-quality environment, including the integration of green space alongside residential and other buildings. Wildlife is most often found

in these areas; looking after the Conservation Area will therefore help to conserve biodiversity and natural capital.

3.7.44 It is important to identify what is important to residents in terms of heritage, biodiversity and geodiversity, as well as having a technical understanding of conservation value against national and regional criteria. The value of the garden suburb's history to residents at Sea Mills helped to achieve Conservation Area status for the area, providing security for the integrated greenspace and hence aiding the ongoing conservation of biodiversity. Being open minded to features and stories that resonate with the community can yield added benefits and uncover hidden values for an area.

3.7.45 Conservation of heritage can lend stability of land use that can be helpful for wildlife including protection from inappropriate development.

3.7.46 Sea Mills shows how development today can be tomorrow's heritage, if carried out with thought and planning. Bristol City Council are now looking to enhance the biodiversity, heritage and other interest of the publicly owned spaces within Sea Mills, potentially creating a new chapter in the history of the site.

3.8 Geevor Mine, St Just, Cornwall

General description of Geevor Mine

3.8.1 Geevor Mine is a Scheduled Monument located on the north coast of Cornwall near the town of St Just and represents a well-preserved 20th century tin mine. The site is situated in a small valley that slopes down to the northwest, towards the sea and the steep maritime cliffs, and includes both above and below ground mine workings.

3.8.2 The site includes a mix of 20th century industrial buildings and mine spoil as well as evidence of earlier mine workings within the scheduled area. Most buildings are of concrete, timber and steel construction, however older granite walled buildings are also present. Most buildings are located at the head of the small valley, furthest from the sea. The middle section of the scheduled area includes raw mining material, ore, spoils, and gravel. The remains of 18th and 19th century mine buildings, and possibly medieval remains, are located at the bottom of the valley nearest the sea on the cliff edge. Further historical mine remains survive underneath the debris in the valley bottom.

3.8.3 The mine ceased operation in 1990 due to the crash in tin prices in 1985. It was then purchased by Cornwall Council in 1992 to be run as a mining heritage centre. Geevor Mine is now open to visitors.

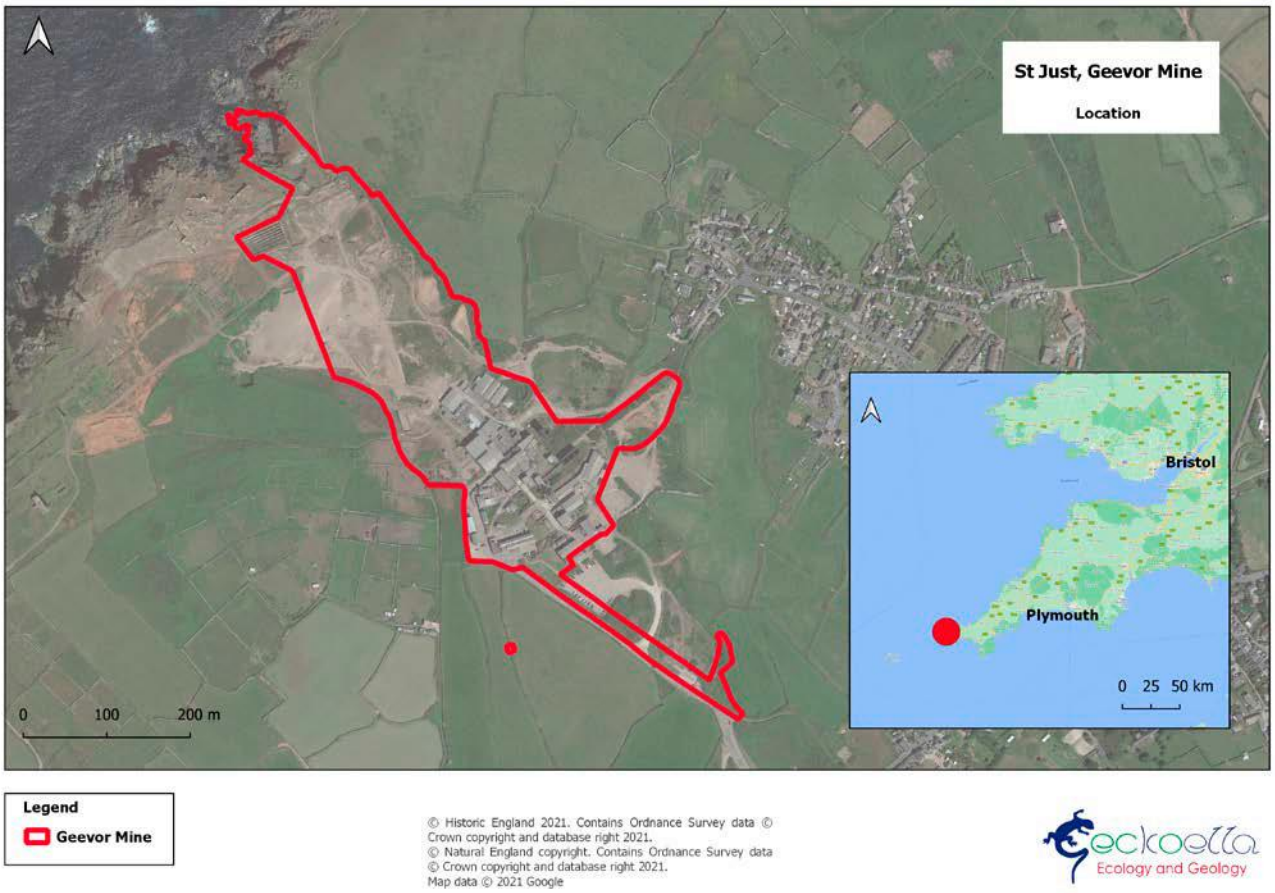

Figure 30: Location of Geevor Mine, St. Just, Cornwall

Figure 31: Geevor Mine. Ex-industrial site in Cornwall; influencing surrounding habitat

Geevor Mine Scheduled Monument			
Site owner / manager: Cornwall Council (National Trust own adjacent land) **Type**: Scheduled Monument reflecting industrial heritage **Location:** St Just, Cornwall **OS grid ref:** SW37593480 A**rea:** 10 hectares			
Priority Habitat	**Statutory Biodiversity / geodiversity sites**	**Non-Statutory Biodiversity / geodiversity Sites**	**Heritage Designations**
Maritime Cliff and Slope	AONB SSSI	County Geology Site	World Heritage Site Scheduled Monument

Percentage Coverage Statutory Biodiversity/ geodiversity Designated Sites		
Statutory Designated Sites	**Percentage Cover**	**Hectare**
AONB	100%	10 ha
SSSI	6.3%	0.6 ha

Percentage Cover of Non-Statutory Biodiversity/ geodiversity Designated Sites		
Non-Statutory Designated Sites	**Percentage Cover**	**Hectare**
County Geology Site	5.9%	0.6 ha

Percentage Cover of Priority Habitat		
Priority Habitat	**Percentage Cover**	**Hectare**
Maritime Cliff and Slope	6%	0.6 ha
TOTAL	6%	0.6 ha

Percentage Cover of Heritage Designations		
Heritage Designations	**Percentage Cover**	**Hectare**
World Heritage Site	100%	10 ha
Scheduled Monument	100%	10 ha

Heritage Asset Information	
Area of Heritage Asset	10 ha
OS grid Reference	SW37593480
Listed Buildings	0

Table 10: Overview of Geevor Mine Scheduled Monument

Heritage of Geevor Mine

3.8.4 Geevor is located within the Cornwall Area of Outstanding Natural Beauty which was designated in 1959 and includes 12 separate areas of the County. The West Penwith section of the AONB includes the most westerly part of the Cornwall peninsula including St Just and Geevor Mine and extends across 14,000 hectares. The distinctive character relates to the ancient landscape and granite geology as well as its geographic position at the end of a peninsula. The small pasture fields located in this AONB are enclosed with granite walls, some of which are pre-historic in origin making them some of the oldest man-made structures in continuous use. Archaeological interests within the AONB include Neolithic quoits, Romano-British settlements, standing stones and Iron Age castles as well as many engine houses and associated mining structures.

3.8.5 Geevor Mine first became a Scheduled Monument in 2005 and is in an area of Cornwall that has been mined for non-ferrous metals for millennia. The site at Geevor, highlights the technological and chronological advances in Cornish mining exceptionally well. It is for this reason that the Geevor Mine received its scheduled status. The remains at Geevor are well preserved and demonstrate the technology, systems, and organisation of a 20th century mine layout. There are also earlier mining remains located within the site, further chronicling Cornwall's mining heritage.

3.8.6 Geevor Mine is located within the Cornwall and West Devon Mining Landscape World Heritage Site. The area became a World Heritage Site in 2006 due to its contribution to the industrial revolution through mining. The area was responsible for supplying two thirds of the world's copper at its peak. The landscape was transformed in the 18th and 19th century with the construction of mines, engine houses, new towns, foundries, ports, and smallholdings as well as associated industries to sustain the mining efforts. The substantial remains that still exist are testimony to the influence the area had on mining at a global scale. Mining technologies developed in Cornwall have been exported around the world.

3.8.7 There are no Listed Buildings within the Geevor Mine Scheduled Monument site. However, there are Listed Buildings within proximity associated with the mine. These are the 1911 Geevor Mine Wethered Shaft Headgear, the 1840s Skip Shaft Headframe, Geevor Mine (Levant Section) and the 1960s Levant engine house. All three are listed for their historical and architectural interests and are historical buildings associated with the Geevor mining.

3.8.8 Historic Environment Record data reveals further features including Stennack and Mexico Mines.

3.8.9 The Historic Landscape Character description of the area lists Geevor Mine as being in “an Industrial, disused landscape, bordered by Farmland”: Prehistoric, Post Medieval Enclosed Land and Coastal Rough Ground are all associated with the site. Various significant historical events and surveys have taken place at Geevor Mine including a contamination survey, the mining deposits survey, and the Geevor biodiversity tail survey.

Biodiversity of Geevor Mine

3.8.10 Geevor mine extends to the cliffs to the northwest of the site, where it is bordered by the Lands’ End to Cape Back Special Area of Conservation (SAC). The SAC is designated due to the offshore rocky reefs which provides a complex and biodiverse habitat for marine species. Manx shearwater, guillemot, razorbill, fulmar, kittiwake, shag and gannet are regularly seen and some breed on the cliff face. Atlantic grey seal are resident in the area. Occasionally cetaceans such as orca (killer whale), pilot whale, harbour porpoise and bottlenose dolphin are observed.

3.8.11 The northwestern section of the Geevor Mine site stretches into the Aire Point to Carrick Du SSSI. This SSSI predominantly covers the vertical maritime cliffs which are formed by the Lands’ End granite mass. The SSSI was first notified in 1971. The SSSI was designated for its unique geology and biodiversity.

3.8.12 The biodiversity in the SSSI is dominated by Maritime and Sub maritime communities, including maritime cliff and slope. Characteristic plant species include thrift, sea campion, buckshorn plantain, kidney vetch and spring squill. Lowland Fen and Lowland Heath Priority Habitats are also found close to Geevor. Notable plant species include hairy bird’s-foot trefoil, rare eyebrights and Cornish moneywort.

3.8.13 Peregrines breed nearby, while chough have recently returned to West Cornwall. Stonechats are commonly seen on patches of gorse, and wheatears are seen on the heath and bare mineral soil.

3.8.14 Reptiles and amphibians found within or near to the site include adder, slow worm, common lizard, toad and frog. Rare pearl bordered fritillary, silver studded blue and grayling butterflies are recorded in the vicinity, as are the Red Data Book invertebrates the mud snail and scarce jewel beetle.

3.8.15 Although most of the biodiversity within and near to Geevor is associated with natural rather than man-made features or works, there are some specialist invertebrates present, as well as a suite of lichens and bryophytes such as *Tortula solsii*, which have adapted to survive on metalliferous and contaminated soils which are found at ex-industrial sites such as Geevor.

3.8.16 Open disturbed areas are an important ecological asset within a maritime cliff context, as are open water and temporary pools associated with works sites. These can favour specialist invertebrates as well as amphibians and provide ecological niches otherwise rare in areas unaffected by the mining heritage.

3.8.17 West Penwith mines provide extremely important roost sites for a series of bat species, including greater and lesser horseshoe bats. Daubenton's bats are also recorded. Bats forage across wide areas of coastline and valleys, but with few buildings and less trees, the mines and associated heritage structures provide important shelter in an otherwise sparse landscape.

Figure 32: Post-mining microhabitats near to Geevor, including mineral tips and mine shafts

Geodiversity of Geevor Mine

3.8.18 West Cornwall has a very complex geology and is famed for its minerals, which have been exploited by man for millennia. The geology is formed primarily of igneous granite and adjacent metamorphic Devonian slates and basalts. Pillow lavas are found in places, showing areas of volcanic material which emerged from under the ocean. The granite mass (batholith) of Lands' End is linked to the Scillies and Bodmin Moor and was formed during the Variscan orogeny.

3.8.19 Extensive tin and copper vein mineralization as well as mine spoils and dumps illustrate the very significant mineral interest. There is an old mine tunnel at Geevor with managed public access enabling views of the granites and associated mineralisation. This enables good public engagement to both the heritage of the site as well as its geodiversity. Part of the site is designated as a County Geological Site.

3.8.20 The exposed coastal rocks exhibit a wide range of SSSI geological features that are associated with igneous activity and the mining heritage interest. There are extensive tin and copper veins found within the geological features. The unique geological features were mined because they were unusually rich in uranium, tin, copper, and beryllium. This geology is the underlying reason for the subsequent mining and therefore historic environmental interest and importance.

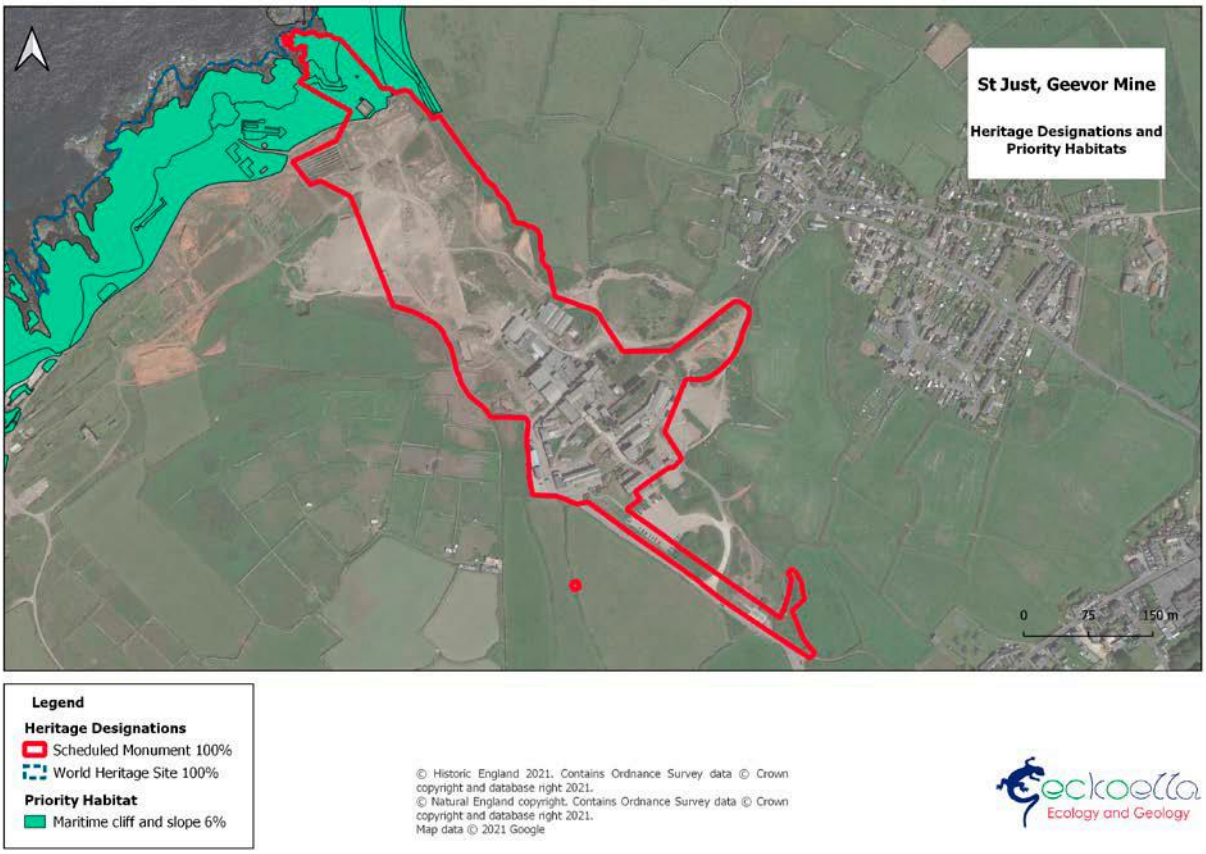

Figure 33: Heritage designations and Priority Habitats at Geevor Scheduled Monument

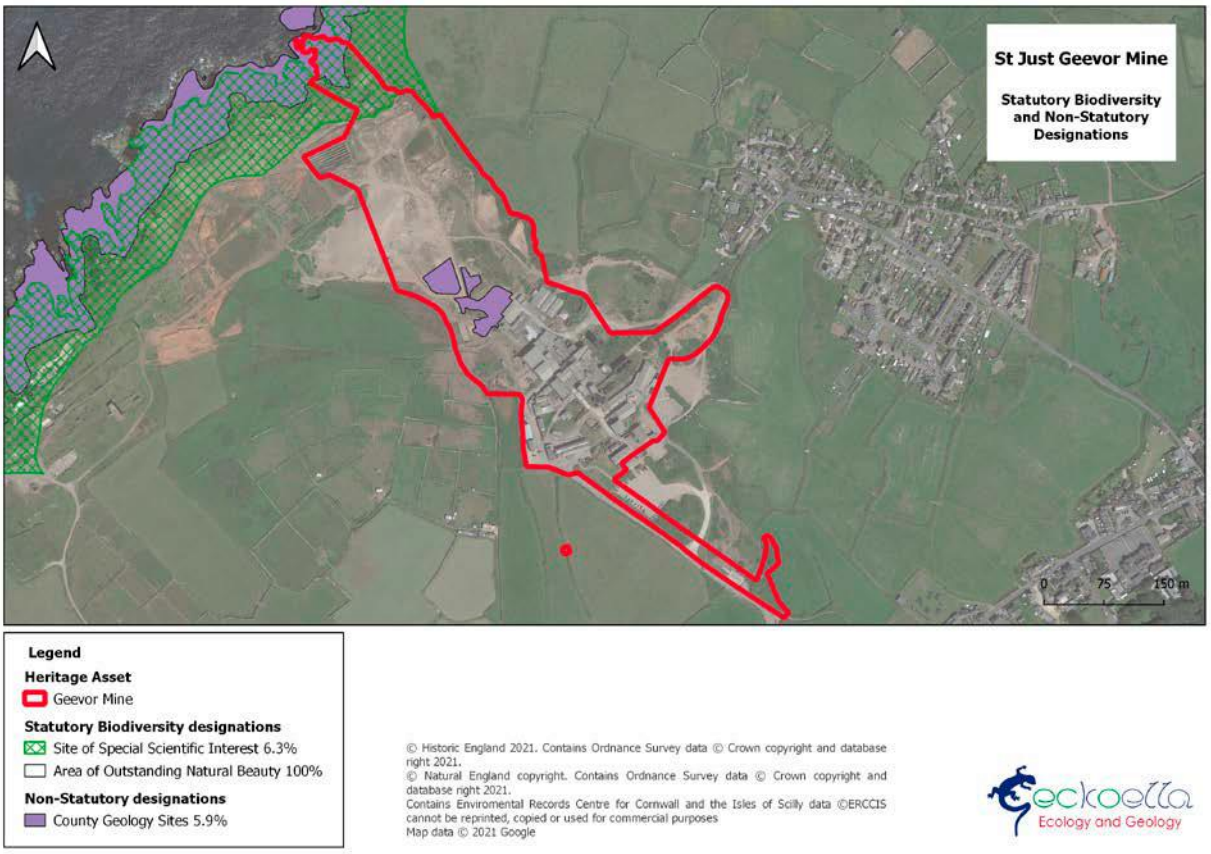

Figure 34: Biodiversity and Geodiversity Sites and Features at Geevor Scheduled Monument

Relationships between heritage, biodiversity and geodiversity

3.8.21 The World Heritage Site designation is explicitly linked to humanity's exploitation of the minerals which comprises part of the geodiversity of the area.

3.8.22 Maritime cliff and marine habitats are the most important nature conservation features on the site and form part of the site's context and setting. These features are broadly unaffected by the heritage interest of the site, with the harsh environmental conditions having the most impact on species composition.

3.8.23 However, the heritage features of the site do offer point features of value within the maritime cliff context. These include water bodies, structures and specialist micro-habitats associated with open and disturbed ground.

3.8.24 Spoil tips from the mines create very specialist opportunities for several species to live in niche habitats, with specialist assemblages of lichens, mosses and liverworts, invertebrates, butterflies and some heathland species. This is an example of how the

industrial landscape has aided in the biodiversity of the site. Cornwall mining heritage in West Penwith forms an important substrate for metalliferous bryophytes of national significance (Pilkington, 2013).

3.8.25 Abandoned buildings and mines on the site offers roosting habitat for bats and nesting features birds in an area that otherwise lacks suitable areas.

Natural capital of Geevor Mine

Cultural services

3.8.26 Geevor Mine is one of the most popular visitor attractions in Cornwall, offering significant learning opportunities. The site is used extensively as an educational resource. Interpretation tends to focus on the mining heritage but could be extended more to the geology and biodiversity of the site, including the relationships between these.

3.8.27 Media, film and TV includes short documentaries about Geevor Mine, and the site is used as a setting for these.

3.8.28 Peat soils have palaeoecological and archaeological value, as they help with preservation of below ground, historic artefacts (Gearey et al., 2010).

3.8.29 The South West Coast Path runs through the site and the coastal area is stunningly attractive, offering significant wellbeing benefits associated with recreation and landscape.

3.8.30 The Geevor Mine is extremely important culturally to the local community as well as to Cornwall as a whole, being the last working mine. The community remains very involved in the site and many ex-miners now volunteer at Geevor and are very proud of the heritage. This is an important example of intangible heritage, where traditional skills and knowledge are maintained and shared within the community.

Supporting services

3.8.31 The site provides habitats for specialist species such as mosses and lichens which can tolerate highly contaminated soils, early coloniser plants and rare invertebrates. Over 25% of Cornwall's mosses and liverworts have been found on sites of metalliferous mines. In addition, abandoned mines and buildings can provide suitable habitat for rare bats and birds.

Regulating services

3.8.32 Peat soils are a highly important store of carbon, and it is important to retain them in situ, with a vegetative cover.

Provisioning services

3.8.33 The economic, social and environmental impacts of mining in Cornwall during the 18th and 19th centuries was transformational for Cornwall and had global significance; the legacy and heritage is profoundly influential to the present day, shaping society, economy and the environment as well as the built heritage and landscape. These impacts include those derived from the 'boom/bust' character of the industry. In the 21st century, it is possible that mining for lithium in Cornwall will once again be economically viable, as demand for batteries outstrips supply in the shift to a carbon neutral economy. The future impacts of the mining industry may therefore be profound.

Management challenges

3.8.34 Mining sites can potentially cause significant pollution from both the waste tips, as well as contaminated water from adits and mine shafts. They are also potentially hazardous, comprising aging structures in a harsh environment, as well as below-ground hazards. Their location close to a sea cliff adds to the challenges of ensuring large numbers of visitors have a safe visit.

3.8.35 The Management plan associated with the Cornwall and West Devon Mining Landscape World Heritage Site, highlights the need to understand the biodiversity of the site. This is proposed to take place within the lifetime of the 2020-2025 management plan.

Opportunities and funding

3.8.36 Geevor Mine is one of the most popular visitor attractions in Cornwall. There is a charge to visit (£16.10 Adults and £9.00 Child in 2021). In addition, the site has a shop and café. This brings important revenue to help manage the site, although during the Covid-19 pandemic, the site has been closed and has had to draw on the government 'Culture Recovery Fund'.

3.8.37 The WHS draws visitors to this deprived part of Cornwall, bringing in money to the area.

3.8.38 In the past, West Cornwall has benefited significantly from European funding through ‘Objective 1’, as it has been identified as one of the poorest parts of Europe. Other grants have been drawn down, although there is uncertainty about the future for such funding at present.

3.8.39 Geevor Mine works closely with the National Trust who owns the adjacent Levant Mine; it is possible to purchase a joint ticket at a discount. This could be expanded to joint work programmes to benefit wider conservation and interpretation of both heritage and biodiversity.

3.8.40 Agri-environment grants are a key funding mechanism for cultural and biodiversity conservation, although it is unclear whether these would be targeted at Geevor.

Key points from Geevor Mine

3.8.41 Old industrial sites often have specialist heritage, geodiversity, and biodiversity interest. The geodiversity of Geevor Mine is inextricably linked to the heritage value of the site, comprising the reason why the world-famous mining industry developed in Cornwall

3.8.42 Regarding biodiversity, the exposed sea cliff habitat comprises the main determinant for species and assemblages found on the site. However, the heritage assets of Geevor Mine and other mining sites do provide a specialist substrate for rare bryophytes and lichens, as well as point features suitable for bats and birds.

3.8.43 Significant investment in conservation can be achieved through designations, in this case relating to both heritage and geodiversity. Collaboration at the site, county and wider scales can help to bring in significant resources and funding.

3.9 Tewkesbury Battlefield, Gloucestershire

General description of Tewkesbury Battlefield

3.9.1 The Registered Battlefield in Tewkesbury is a historically significant site, having played an extremely important role in the War of the Roses and was where the House of York defeated the House of Lancaster. The battle held on the site on 4th May 1471 ended the second phase of the War of Roses and restored some stability to the country until Edward IV's death in 1483.

3.9.2 The site lies southwest of the town of Tewkesbury. Despite the encroachment of the town into the area, the battlefield remains largely undeveloped by housing. The topography is undulating and includes the hill in Tewkesbury Park known as Gober Hill as well as Margaret's Camp (an earlier earthwork), and the area known as Bloody Meadow where large numbers of men were cut down during the battle.

Figure 35: Tewkesbury Battlefield re-enactment

Tewkesbury Registered Battlefield			
Site owner / manager: Privately owned by a variety of landowners and Tewkesbury Golf Club **Type**: Registered Battlefield **Location:** North of Gloucester close to the town of Tewkesbury on the River Severn and south of Tewkesbury Abbey **OS grid ref:** SO89603174 A**rea:** 10 hectares			
Priority Habitat	**Statutory Biodiversity / geodiversity sites**	**Non-Statutory Biodiversity / geodiversity Sites**	**Heritage Designations**
Coastal Floodplain and Grazing Marsh Deciduous Woodland Traditional Orchard Wood Pasture and Parkland	None	None	Registered Battlefield Parks and Gardens Scheduled Monument

Percentage Coverage Statutory Biodiversity/ geodiversity Designated Sites		
Statutory Designated Sites	**Percentage Cover**	**Hectare**
None	0%	0 ha

Percentage Cover of Non-Statutory Biodiversity/ geodiversity Designated Sites		
Non-Statutory Designated Sites	**Percentage Cover**	**Hectare**
None	0%	0 ha

Percentage Cover of Priority Habitat		
Priority Habitat	**Percentage Cover**	**Hectare**
Coastal Floodplain and Grazing Marsh	6%	0.6 ha
Deciduous Woodland	11.8%	17 ha
Traditional Orchard	3.5%	5 ha
No main habitat but additional habitats present	0.2%	0.3 ha
Wood Pasture and Parkland	2.5%	4 ha
Total	6%	0.6 ha

Percentage Cover of Heritage Designations		
Heritage Designation	**Percentage Cover**	**Area**
Registered Battlefield	100%	148 ha
Scheduled Monument	1.3%	1 ha
Parks and Gardens	2.4%	3 ha

Table 11: Overview of Tewkesbury Registered Battlefield

3.9.3 The fields within the site largely follow an ancient pattern and include mature hedgerows and large mature oak trees. There is a golf course that extends into a large part of the western section of the site. Most of the site is made up of farmland and associated field systems. There are some building developments in the northern section of the original battlefield site. The area contains residential properties as well as a sewage treatment plant, golf clubhouse, hotel and associated car park. There are also recreational grounds and a community centre within the boundary.

3.9.4 Tewkesbury Battlefield has great significance for the place it played in the history of Great Britain, as well as providing a strong contribution to local culture and green infrastructure. Its position on the Severn floodplain, with its series of ancient field boundaries and veteran trees, provides important habitat for several species, within and adjacent to an urban area.

Heritage of Tewkesbury Battlefield

3.9.5 The site is a Registered Battlefield and was designated due to the historical importance of the battle that took place in 1471. It is also designated for archaeological interest. The Registered Battlefield has the potential to still hold archaeological remains associated with the battle. These are likely to include firearms, cannon shot as well as personal effects. The town's museum houses some of the artefacts which have been recovered from the area. There is a battlefield trail that people can follow with information boards.

3.9.6 There is one Scheduled Monument within the site boundary. This is Margaret's Camp, a medieval moated site with associated remains. The land around the site has been heavily developed for housing. The site comprises a central square platform around 30 metres across and surrounded by a moat which is about 8m wide. There is also evidence of an elaborate network of water management features associated with Margaret's Camp.

3.9.7 There are five Listed Buildings within the site. These are: Webber House and gate house, a chapel, Gupshill Manor Inn and Lincoln Green Farmhouse and attached outbuildings. Parts of Gupshill manor date back to 1438. Tewkesbury cemetery, a mid-19th century cemetery is a Registered Park and Garden.

3.9.8 Some of the old field systems appear to be relatively intact from the time of the original enclosures, except where the golf course development has created fairways. Ridge and Furrow are evidence of medieval farming within the site. There have also been Roman finds found on the site, indicating its long-standing use by man.

Biodiversity of Tewkesbury Battlefield

3.9.9 With the exception of a small area to the east, Tewkesbury Battlefield is not designated for its wildlife, although there are some Priority Habitats present and some protected species.

3.9.10 Tewkesbury Nature Reserve covers 108 acres in total, of which a portion overlaps with the battlefield site to the east. It has been identified for is potential as an amphibian breeding ground and has extensive wetland features, including rivers and ponds and lies within a floodplain of the River Swilgate, a tributary of the Severn. 68 species of bird have been recorded as well as 87 species of invertebrate. It also has potential as a Local Wildlife Site but appears to not yet be designated. Tewkesbury Nature Reserve is an independent, community nature reserve and a registered charity. There is a green corridor through housing that links the nature reserve to the farmland and the rest of the battlefield.

3.9.11 There is Coastal and Floodplain Grazing Marsh Priority Habitat located within the site both to the east and the northwest, on the River Severn, Swilgate and Colnbrook. There are also pockets of Deciduous Woodland Priority Habitat within the site. A Traditional Orchard is in the centre of the site. Wood Pasture and Parkland Priority Habitat extends into the site to the south and southwest. The Priority Habitat does not overlap with the Registered Battlefield designation, however.

3.9.12 Although ridge and furrow are often associated with species-rich swards, it does not appear to be the case at Tewkesbury, perhaps due to agricultural activity as well as the inherent fertility of the soil due to seasonal inundation.

3.9.13 There are mature hedgerows and areas of scrub associated with the farmland. The low-lying areas flood during rain and there are drainage systems that border many of the fields. Ancient willow pollards are a feature of the water courses.

3.9.14 Lesser Horseshoe bats have been reported from Southwick Park from 1999, as well as noctule and soprano pipistrelle. In addition, protected great crested newts have been recorded in the moat at St Margaret's Camp. They favour old established farmed landscapes.

3.9.15 Other priority species found within the site include bullfinch, (which is linked to Traditional Orchards) and yellowhammer (on established hedges). Other records include cuckoo, curlew, dunnock, house sparrow, lapwing and lesser spotted woodpecker, linnet, reed bunting, song thrush, spotted flycatcher and starling.

3.9.16 European hedgehog has also been recorded on the site along with small heath butterflies. Rare black poplar and greater dodder have been noted on the verge of Lower Lode Lane.

3.9.17 European eel, brown trout and otter have been recorded along the rivers.

Geodiversity of Tewkesbury Battlefield

3.9.18 The geodiversity of Tewkesbury Battlefield is limited. The bedrock geology comprises Triassic sedimentary rocks of the Branscombe Mudstone Formation. There are no surface exposures of strata.

Relationships between heritage, biodiversity and geodiversity

3.9.19 Tewkesbury Battlefield comprises both an important cultural area and a key part of the local green infrastructure in an otherwise built-up area. It has significant recreation and wellbeing values.

3.9.20 Old field systems associated with the farming heritage established hedges, which are important for species such as yellowhammer, linnet and grasshopper warbler, as well as offering suitable foraging habitats for species such as the lesser horseshoe bat. These features include mature standards that provide potential roosts for bats. Similarly, great crested newts prefer long-established water bodies and old farmed landscapes. The stability of landscape character and content allows populations time to build and species richness time to develop. They also provide wildlife corridors through the arable land, providing protection, habitat and a food source for many species.

3.9.21 The Traditional Orchard is an example of how heritage and traditional skills have shaped the biodiversity of the site. These types of Priority Habitats often contain fruit trees introduced to the UK during the Roman times and include varieties of sweet apple and pear. The flower blossom of these trees provides an important source of nectar for many insects and aids biodiversity within the ecosystem. The skills associated with orchards, such as planting, grafting and pruning have a rich heritage, with the cultural associations still present today, with orchards acting as centres for songs, recipes, cider and festive gathering, such as the Wassail.

3.9.22 Limited biodiversity designations within the site means there is little protection for the habitats and species at Tewkesbury. This potentially makes the designation of the area as a Registered Battlefield a key tool to protect the site's biodiversity.

3.9.23 The designation of the area as a Registered Battlefield helps to protect the location from development. In this case the old field systems are part of the Registered Battlefield designations, offering added protection to these landscape features of value to biodiversity and preventing further degradation.

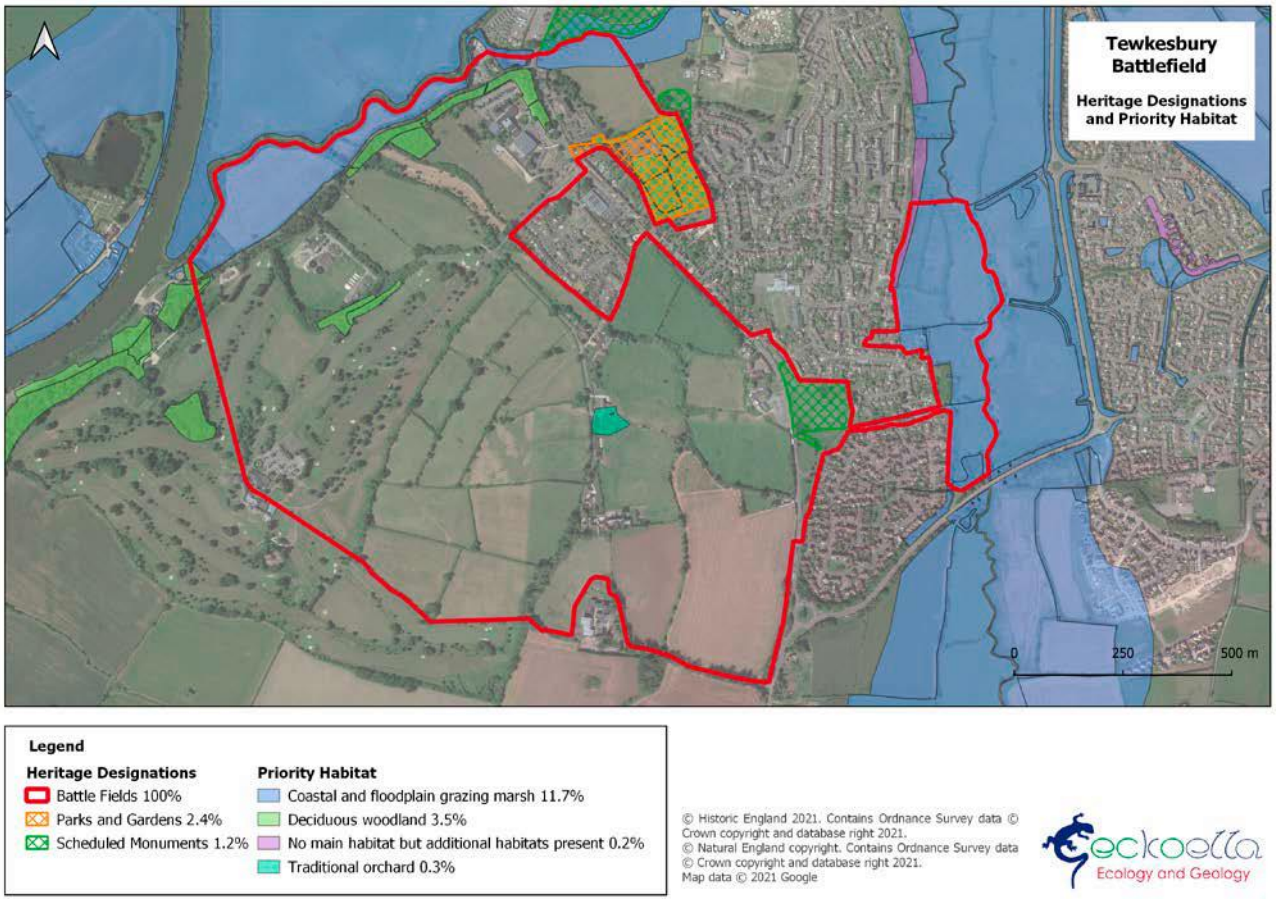

Figure 36: Heritage Designations and Priority Habitat of Tewkesbury Battlefield

Natural capital of Tewkesbury Battlefield

Cultural services

3.9.24 Tewkesbury Battlefield is very important culturally to local people. There are battlefield walks and an annual medieval festival which further establishes the connection between people and place.

3.9.25 The site also contributes accessible, attractive green spaces for recreation and enjoyment, providing significant wellbeing benefits.

Supporting services

3.9.26 Listed and old buildings offer potential habitat for bats, as well as swallows, house martins, swifts and barn owls.

3.9.27 Hedgerows established due to traditional farming practices, have provided a wildlife corridor, habitat for many birds and small mammals, and foraging potential for bats.

Regulating services

3.9.28 Areas of the site perform an important function as storage for flood water and reducing flood risk downstream, particularly in Tewkesbury Nature Reserve to the east.

3.9.29 The soils at Tewkesbury are a mixture of river gravels and silts and are mostly under permanent grassland, protecting the carbon which is stored in the soil. However, there are some areas of arable cultivation within the site, where this is not the case.

Provisioning services

3.9.30 The farmland, and potentially the orchard, support food provision.

Figure 37: Tewkesbury Battlefield after winter inundation (Brendan Cooper)

Management challenges

3.9.31 Much of the site is in private ownership and has multiple owners, making it difficult to manage and protect.

3.9.32 A significant percentage of the Battlefield is now managed as a golf course and the management will sometimes have differing objectives to the natural and historic environment.

3.9.33 The immediate environs are very prone to winter flooding, extending up to the town of Tewkesbury. While floods are a natural process and they have limited direct impact on the designated area, the ground is left prone to erosion when people return to visit. Climate change is creating more regular and greater flooding.

3.9.34 Agricultural activity can impact the site, including poaching by stock, ring barking of trees, vehicular erosion and impacts on wildlife. Arable farming within the floodplain can be very detrimental to water quality and can result in soil loss, as well as pollution. In addition, it can impact the archaeology of the site. There are aligned biodiversity, heritage and natural capital interests in promoting conservation-minded farming approaches.

3.9.35 Visitor pressure can require management. Large events such as re-enactments can cause compaction and damage to sward, particularly in wet years. There have been several issues with dogs chasing stock as well as wildlife such as swans at Tewkesbury Battlefield and on the nature reserve and people are now asked to keep dogs on leads. These impacts may be more significant for the biodiversity than the heritage of the area.

3.9.36 Development pressure close to the Battlefield has had effects. Although the Scheduled Monuments are protected from development, there has been development on the site, including a golf course, hotel, clubhouse and car park, sewage works and housing. In 2004, there were attempts to build over part of the site at Gaston’s Field. As a result of this, the Tewkesbury Battlefield Society was set up to preserve and promote and interpret the history, archaeology and natural history of the site.

Opportunities and funding

3.9.37 There may be opportunities to access grants such as the Landfill Tax Credit and Heritage Lottery Fund (HLF) for specific projects.

3.9.38 The site has free open access, although there are guided battlefield tours, where a small charge is made. There is a waymarked trail which takes about 45 minutes which goes around the site.

3.9.39 Agri-environment grants have offered funding for positive conservation projects for both the natural and historic environment, and likely will do in the future through the forthcoming Environmental Land Management schemes (ELM).

Key points from Tewkesbury Battlefield

3.9.40 designation of the Registered Battlefield has protected green open space accessible to the people of Tewkesbury since 1995 and contributes to their local sense of place. As part of this, the remaining heritage elements of the landscape including old field systems support a range of species and habitats including the lesser horseshoe bat and great crested newt.

3.9.41 In 2004, there was an application to build a large housing development at Gaston's Field, which resulted in the formation of the Tewkesbury Battlefield Society to help protect and promote the site. It is possible that there may be further plans for development in the future.

3.9.42 Flooding is increasing due to climate change and areas of the battlefield are seasonally inundated. However, the low-lying areas can perform a useful function in acting as a reservoir for flood water, reducing flooding downstream.

3.9.43 Farming activities can be detrimental to the desired wildlife management of the site, such as agriculturally improved grassland or arable management. At present, the farmland has limited biodiversity value, but could be significantly improved with ecological advice.

3.10 Wessex Hillforts and Habitats Project

General description of Wessex Hillforts included in the project

3.10.1 The Wessex Hillfort and Habitats Project, led by the National Trust, looked to enhance the condition of the archaeological and biological interest across 13 Iron Age hillforts located across Dorset and South Wiltshire (National Trust, 2022). These comprise:

- Badbury Rings
- Coneys castle
- Figsbury Ring
- Hod Hill
- Lewesdon
- Pilsdon Pen
- Wick Ball Camp
- Cley Hill
- Eggardon Hill
- Hambledon Hill
- Lambert's Castle
- Park Hill Camp
- White Sheet Hill

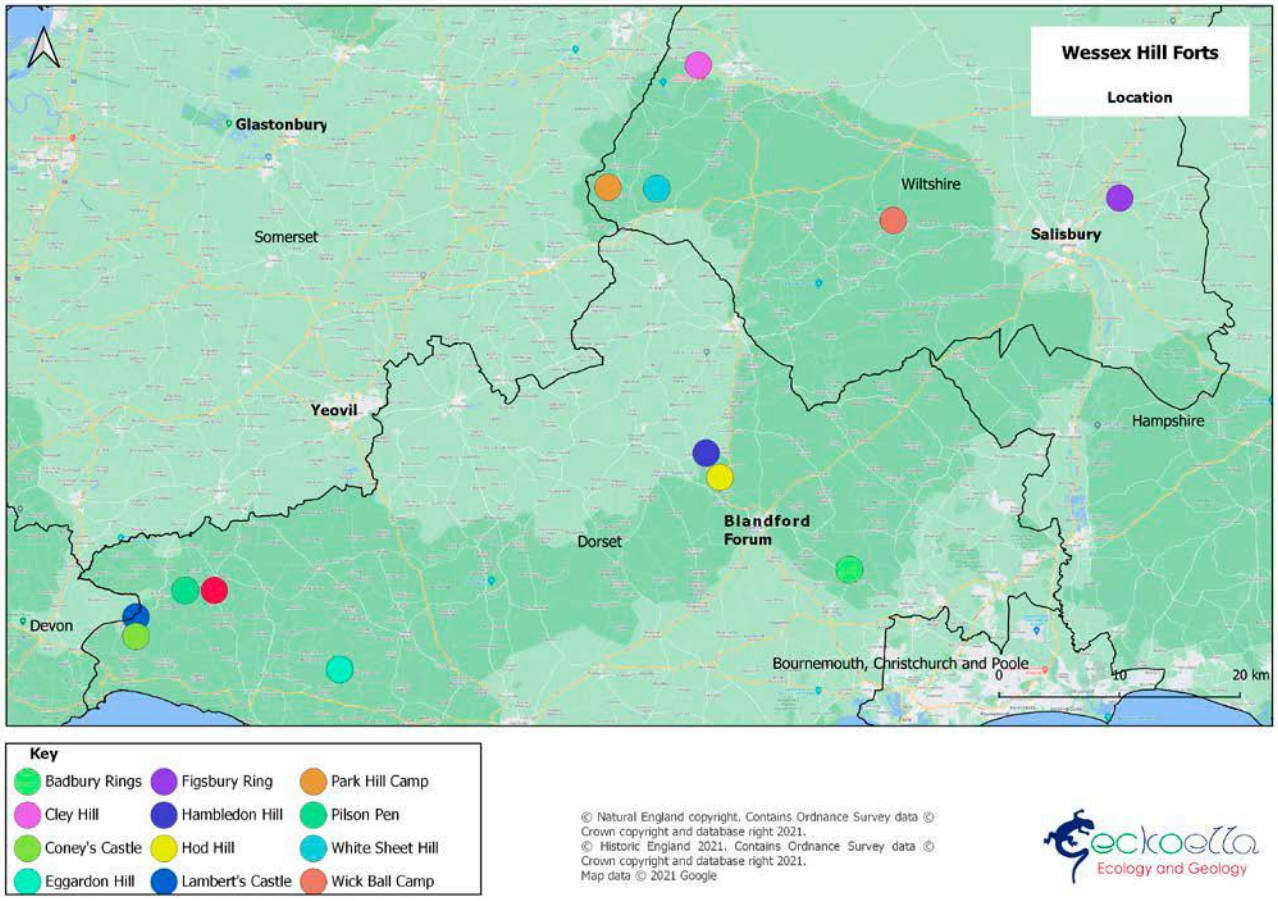

Figure 38: Locations of Wessex Hillforts

3.10.2 All the hillforts are designated Scheduled Monuments, while the majority are also SSSI. Hambledon Hill is additionally a National Nature Reserve (NNR).

3.10.3 All 13 hillforts sites are managed by the National Trust (three partially) and have public access. Land ownership is primarily within the National Trust, with Whitesheet Hill partly owned by the Duchy of Cornwall. Eggardon Hill and Wick Ball Camp are part privately owned.

3.10.4 The majority of the Wessex Hillforts are located within the North Wessex Downs AONB, which encompasses an area of 670 square mi (1,730 sq km).

3.10.5 The aim of the Wessex Hillforts and Habitats project was to explore ways to promote integrated management of the historic and natural environment and to engage people in their monitoring and protection. A secondary objective is to increase the understanding of the wealth of interest of the sites and to create information booklets for those interested. The project was part funded by the National Trust, Historic England and People's Postcode Lottery.

Figure 39: Hambledon Hill – a Scheduled Monument Hillfort and National Nature Reserve

Wessex Hillforts Scheduled Monuments*			
Site owner / manager: primarily National Trust, part owned by Duchy of Cornwall and other landowners **Type**: Iron Age Hillforts **Location:** various across Dorset and Wiltshire **OS grid ref:** various A**rea:** 129 hectares in total across 13 sites			
Priority Habitat	**Statutory Biodiversity / geodiversity sites**	**Non-Statutory Biodiversity / geodiversity Sites**	**Heritage Designations**
Deciduous Woodland Good Quality Semi-improved Grassland Lowland Calcareous Grassland Lowland Dry Acid Grassland Lowland Fens Lowland Heathland Wood Pasture and Parkland	Area of Outstanding Natural Beauty National Nature Reserve Site of Special Scientific Interest	Ancient Woodland Site of Nature Conservation Interest	Parks and Gardens Scheduled Monument

Percentage Coverage of Statutory Biodiversity/ geodiversity Designated Sites		
Statutory Designated Sites	**Percentage Cover**	**Hectare**
AONB	96%	124 ha
NNR	19.7%	25 ha
SSSI	65.7%	84 ha

Percentage Cover of Non-Statutory Biodiversity/ geodiversity Designated Sites		
Non-Statutory Designated Sites	**Percentage Cover**	**Hectare**
Ancient Woodland	3.4%	4 ha
SNCI	22.8%	29 ha

Percentage Cover of Priority Habitat		
Priority Habitat	**Percentage Cover**	**Hectare**
Deciduous Woodland	9.4%	12 ha
Good Quality Semi-improved Grassland	0.1%	0.1 ha
Lowland Calcareous Grassland	70.6%	91 ha
Lowland Dry Acid Grassland	2.5%	3 ha
Lowland Fens	8.9%	11 ha
Lowland Heathland	0.2%	0.2 ha
Wood Pasture and Parkland	4.6%	6 ha
No main habitat but additional habitats present.	1.2%	1 ha
Total	96 %	125 ha

Percentage Cover of Heritage Designations		
Heritage Designation	**Percentage Cover**	**Area**
Parks and Gardens	6.9%	9 ha
Scheduled Monument	100%	128 ha

*Detailed figures for Wessex Hillforts and Habitats Project sites can be found in Appendix 4.

Table 12: Overview of Wessex Hillforts Scheduled Monuments

Heritage of the Wessex Hillforts

3.10.6 Each of the hillforts are Scheduled Monuments for their Iron Age fort interest. These were massive earthworks constructed between around 2,500 to 2000 years ago, reflecting engineering skill and the coordination of large numbers of people. Some had a single bank, whilst others had more complex fortifications.

3.10.7 There have been multiple finds of pottery, flint shards, coins and grave goods within these hillforts, particularly in ones which have had archaeological excavations such as Pilsdon Pen (Gelling, 1977) and Hambledon Hill (Healy and Mercer, 2008).

3.10.8 There is evidence of human occupation and use of these sites prior to and after the Iron Age. Extensive Neolithic remains are found at Hambledon Hill, along with a well-preserved long barrow. Hod Hill has one of the best-preserved Roman forts in the UK on the summit. Lambert's Castle has the remains of a variety of buildings and structures associated with the annual fair that was held there in the 18th and 19th century. Rabbit warrens (pillow mounds) are found at various sites, such as Pilsdon Pen.

Figure 40: Reconstruction of Eggardon Hill during the Iron Age (Reproduced with the permission of the National Trust)

Biodiversity of the Wessex Hillforts

3.10.9 The classic SSSI and Priority Habitat interest of Wessex Hillforts comprises Unimproved Grassland, especially species-rich Calcareous Grassland on chalk. Key flora includes early gentian, autumn gentian and small scabious, as well as squinancywort, chalk milkwort, bastard toadflax, wild thyme, bird's foot trefoil and common rockrose. Orchid flora can be dramatic as well as rare, with frog, early purple, bee, autumn ladies' tresses, greater butterfly, fragrant and common spotted orchid all found on these sites.

3.10.10 However, some forts have woodland, heathland and acid grassland habitats, and a diversity and gradation between these can add significantly to the biodiversity interest of the sites.

3.10.11 Acid flora may typically include bell heather, common heather and cross leaved heath, whilst species such as dwarf and western gorse, dodder, heath milkwort, betony and heath spotted orchid may also be present.

3.10.12 There are several notable insect species present including chalkhill blue, Adonis blue, green hairstreak, marsh and dark green fritillary butterflies and other insects, such as glow worms. Birds such as skylark and Dartford warbler may also be found together with reptiles such as slow worm and adder.

Geodiversity of the Wessex Hillforts

3.10.13 The geodiversity of the hillforts varies according to location, but they all have landforms in common – perched on the top of a hill. Many are located on Cretaceous calcareous or chalk substrates, providing conditions and soils suitable to support rich biodiversity. Some will have fossils occasionally exposed where the chalk is close to the surface.

Relationships between heritage, biodiversity and geodiversity

3.10.14 There are significant synergies between heritage and biodiversity associated with hillforts. The 360-degree nature of hillforts create the perfect environment for many species of insect, with various aspects and always providing shelter or sunshine in the ramparts.

3.10.15 The historic nature of the site has protected it from the plough in most cases, leaving one of the few areas of ‘unimproved grassland’, often surrounded by intensive arable farming such as at Cley Hill and Badbury Rings.

3.10.16 Except for Wick Ball Camp, which is within a woodland all the hillforts need to be sensitively grazed to ensure that the sward remains in the best condition for both the ecological and archaeological interest. In most cases, this is done through farm tenants, although Park Hill Camp has ‘in hand’ stock, due to difficulties with access.

3.10.17 One of the recurring needs for management is to control woody vegetation, which can cause significant damage to the archaeology as well as to the grassland wildlife. Large trees not only cause disturbance by their roots but can also be levered out in gales and create shelter for burrowing animals. On chalk and limestone sites, hawthorn, ash, field rose, and wild clematis are most commonly seeding, while on acid geology, it is more commonly European gorse, birch, bramble and blackthorn.

3.10.18 At Wick Ball Camp, the issue is *Rhododendron ponticum*, an invasive non-native species, which was introduced into the UK for its ornamental value and was especially popular during the Victorian times. Although it has heritage value in some contexts, Rhododendron impacts biodiversity by outcompeting with native species, and even when removed the toxic humus layer on the soil remains, making it difficult for other plants to establish, often leaving barren ground. The Rhododendron present at Wick Ball Camp, has spread from neighbouring land.

Natural capital of the Wessex Hillforts

Cultural services

3.10.19 Wessex Hillforts are iconic features within the landscape, and enhance wellbeing, through landscape, recreational and educational benefits to visitors, local communities and researchers.

Supporting services

3.10.20 There are numerous protected as well as S41 Priority species that these sites provide habitat for.

3.10.21 The grasslands provide habitat for a variety of orchids including some rare species.

Regulating services

3.10.22 The permanent grassland present of many sites contrasts with the intensive arable surrounding – offering soil and carbon conservation services.

Provisioning services

3.10.23 Grasslands can provide hay and forage supporting livestock for meat production.

Management challenges

3.10.24 To protect the archaeology and to allow the hillforts to be viewed, heritage managers are generally keen to see scrub and trees removed. This is often also the prescription for grassland or heathland management, although can occasionally cause concern from for instance ornithologists or where a particular tree is host to a rare insect.

3.10.25 The ideal grazing is with hardy traditional breeds of cattle from May to October and winter sheep from November to February, to avoid poaching (damaging) the soil. Regular checks need to be made both for stock welfare as well as to ensure they are not causing damage to the sites. Sheep worrying is a common problem due to the presence of dog walkers. This can make management challenging.

3.10.26 Scrub management is time consuming and often difficult on steep ramparts and once cut, will swiftly regenerate without stump treatment, (although appropriate grazing will hold it in check in some cases). On organically registered sites, herbicides may not be used. The disposal of often large amounts of woody vegetation can be problematic, with fires potentially impacting on both the natural and historic environment, while chipping the arisings results in significant noise and debris to dispose of. Tree removal can also be sensitive with visitors who may see it as damaging to wildlife and releasing carbon.

3.10.27 At Park Hill Camp, Lambert's Castle and Hod Hill, trees have been planted in the part of the slope beneath the hillfort and these now obscure the views in and out, as well as creating shade to the grassland and a source of seeds to create unwanted ash and Douglas fir saplings.

3.10.28 Burrowing animals: The ramparts of hillforts, afford excellent opportunities for rabbits and badgers (and to a lesser extent foxes), to create burrows, which can create significant sub-surface damage as they excavate. The disturbance also creates an ideal environment for ruderal species such as ragwort, spear thistle and bramble. While rabbit and foxes can be legally exterminated, badgers are protected by law and a licence will be needed to disturb them (and sometimes the costly creation of a replacement sett and fences with one-way gates required). Moles are sometimes considered an issue, with their tunnels and resultant molehills, bringing artefacts to the surface.

3.10.29 Visitor pressure: By their nature, hillforts are very popular with visitors, usually on foot, but in some cases on horseback and mountain bike. Commonly, people will walk along the top of the ramparts and sometimes will climb or slide down the embankments. This can cause erosion to the turf, which is then exacerbated by water run-off. In some cases, grazing stock can also excavate small platforms to shelter and to take minerals from the soil.

3.10.30 Close to Cley Hill, there is a large housing development being built less than 1km from the hillfort and at Badbury Rings near Wimborne, there are a series of new estates being built. This is already causing a noticeable increase in people, particularly with dogs, which is creating damaging nutrient enrichment to the grassland and an increase in sheep worrying incidents as well as more erosion. Ground nesting birds such as skylarks are being disturbed and surveys suggest they are vacating sites.

3.10.31 Metal detecting: All the hillforts in the study area are Scheduled Monuments and have National Trust bylaws, and as such, it is illegal to use metal detectors or to dig into the sites. This does not stop occasional illegal metal detectors coming, often at night. On some sites such as Badbury Rings, the problem was so severe, that an area of the surface was netted to make it impossible to use detectors.

3.10.32 Land ownership: While most of the hillforts are owned in the entirety by the National Trust, some are only part owned, resulting in different management from one side of the hillfort to the other. An example is Whitesheet, where there the northern half (NT) is grazed by a mix of summer cattle and winter sheep, while the southern half is solely sheep grazed, resulting in an impoverished sward. At Wick Ball Camp, non-native invasive *Rhododendron ponticum* is spreading on to the cleared area from the privately owned part and additionally, visitors are not permitted to view the hillfort.

Opportunities and funding

3.10.33 Due to the significant archaeological and wildlife value of these sites, as well as their public access value, they tend to score highly when submissions for funding are made. Many benefits from agri-environment funding (Countryside Stewardship, HLS and ELMS), which help with management costs.

3.10.34 The Wessex Hillforts and Habitats Project has benefitted from several grants, particularly from Historic England, as well as the People's Postcode Lottery, Postcode Earth Trust, and the South Dorset Leader fund. The recent acquisition by the National Trust of Hambledon Hill resulted in bequests to help purchase and manage the site.

3.10.35 Hillforts provide excellent media opportunities, being so iconic in the landscape. An example was BBC Breakfast News being hosted at Hambledon Hill and stories in most national and many local newspapers.

3.10.36 The emblematic nature of hillforts has allowed the National Trust to recruit a team of volunteers. This is made up of people who are keen to do archaeological monitoring and surveying, under the guidance of the Regional Archaeologist, another group is carrying out Priority Habitat monitoring as well as species monitoring, butterfly transects and common bird Census. Finally, there are several people who wish to do practical conservation work, from scrub clearance, erosion repair and fencing.

Key Points from Wessex Hillforts and Habitats Project

3.10.37 The Wessex Hillforts and Habitats Project is a classic example of how biodiversity and heritage can coincide in a broadly compatible manner. In this case, species-rich grassland and buried interest features share common management objectives. On some of the sites, woodland biodiversity interest required active management, but this could often be targeted to achieve the conservation of the heritage features because the biodiversity interest operated at a wider geographical scale – felling some trees on the fort did not impact on the wildlife interest of the woodland.

3.10.38 Wessex Hillforts also shows how similar sites that are dispersed across a landscape can share a common character and management challenges, and how resources and knowledge can be pooled and targeted to achieve benefits.

3.10.39 Multiple landowners and stakeholders can make management of the sites and landscape challenging. However, having so many invested parties also mean a wider scope of knowledge and the potential for more joined-up working.

3.10.40 The Wessex Hillforts and Habitats Project has been successful in securing grants and funding, and has a widely distributed volunteer base, allowing work to be carried out on different sites across the Hillforts project. It is an example of where joint-interest sites can attract more income from funders and a wider support base of volunteers. This helped the more to be achieved in terms of positive management and community engagement than would have been the case had the project focussed on either biodiversity or heritage.

4 National Character Area Case Studies

4.1 South Purbeck National Character Area

General description of South Purbeck National Character Area

4.1.1 The South Purbeck National Character Area (NCA 136) is situated to the south and southwest of Poole in Dorset and extends from Ringstead Bay, east of Weymouth to Old Harry Rocks near Studland. It covers 11,850 ha and includes 42 kilometres of coastline and the small seaside resort of Swanage and the attractive villages of Corfe Castle, Worth Matravers, Kimmeridge and Lulworth. It is bounded by the sea to the south and the Purbeck Heaths NCA to the north.

Figure 41: Location of South Purbeck National Character Area

4.1.2 Purbeck NCA covers one of the most diverse areas of Great Britain, both from an ecological and historical perspective. Much of the area is designated of national or international importance for nature conservation, including offshore areas.

4.1.3 Parts of NCA are included in the Jurassic Coast World Heritage Site (the only natural WHS in England) and geodiversity is a key aspect of South Purbeck. The area is also within the Dorset Area of Outstanding Natural Beauty (AONB) as well as the Dorset Heritage Coast. Additionally, there are calls from some to designate parts of South Purbeck and other areas of Dorset as a National Park in due course.

4.1.4 Perhaps the most well-known Scheduled Monument in South Purbeck is spectacular Corfe Castle, but there are many other features such as Iron Age hillforts, bowl barrows, well defined strip lynchets and the abandoned village of Tyneham. Listed Buildings, ranging from Grade I through II* and II.

4.1.5 Both areas of importance for biodiversity, and Scheduled Monuments are spread across the NCA, but focussed on the chalk ridge and the coastal landscape.

Figure 42: Old Harry and Ballard Down, Purbeck

4.1.6 Purbeck NCA is unusual in having a small number of very large estates, including Lulworth (which leases a high proportion of its land to the MOD as a firing range), Encombe, Creech and the National Trust. Except for Swanage, most of the coastline is undeveloped and there are large areas of semi-natural habitat, compared to most areas of lowland England.

4.1.7 In the past, industry was more prevalent and was especially focussed on quarrying the high-quality Purbeck and Portland stone as well as Purbeck marble. In addition, the Kimmeridge shales hold one of the largest quantities of oil in terrestrial UK and there is still ‘nodding donkeys’, extracting it at Kimmeridge (as well as in neighbouring Poole Harbour). Swanage still has a small harbour and shell fishery, and small boats also go out from Kimmeridge and Lulworth.

4.1.8 The land management of the South Purbeck NCA is predominantly pastoral, with only very small areas of the valley running to Swanage in cultivation, plus a more extensive area at Chaldon Down and Encombe in the west.

4.1.9 Beef cattle and sheep grazing are the main forms of farming and additionally, cattle, sheep and a small number of ponies are used in conservation grazing of the semi natural habitats on the cliff slope and heathland. Outdoor pigs are bred at Chaldon, and these can dig deeply into the ground, damaging archaeology.

4.1.10 Overall, agriculture has diminished as a key industry, with a reduction in people working in the industry. It is concentrated on beef cattle and sheep grazing, with a small amount of dairy, as well as outdoor bred pigs in the west. Arable farming is less prevalent except on the chalk plateau and on the coast near Kimmeridge.

4.1.11 Farming operations are reducing in number and intensity in the NCA, with less stock and less workers on the land. Some of this land has changed from traditional farmland to wildlife habitats.

4.1.12 There are a small number of predominantly deciduous woodlands in the NCA, and these are mostly managed in a low-key manner or for conservation.

4.1.13 A small amount of land has been developed for housing, tourism (such as campsites), quarrying and small-scale industrial use. The area of land used by the MOD as a firing range and tank training has remained static.

4.1.14 Significant transport is restricted to the A351 from Wareham to Swanage. Running parallel to this is the heritage steam railway from Norden to Swanage, although historically this would have connected to the main line. It is hoped that this could be resurrected in due course, helping to alleviate traffic congestion. All other routes follow minor roads or the B3021 and are very narrow.

South Purbeck National Character Area*	
Heritage Designations	
Site	**Total**
Number of Scheduled Monument within Statutory Biodiversity Designations	24
Number of Scheduled Monument in Priority Habitat	42
Number of Scheduled Monuments in NCA	83
Number of Listed Buildings in NCA	663
Area of NCA (Hectares)	11,850

Percentage covered by Statutory Biodiversity Designations		
Statutory Designations	**Percentage Cover**	**Hectare**
AONB	99%	11,732 ha
SSSI	16%	1,896 ha
SAC	11.9%	1,410 ha
Ramsar	1.2%	142 ha
NNR	0.9%	107 ha
Total	99%	11,732 ha

Percentage covered by Non-Statutory Biodiversity Designated Sites		
Non-Statutory Designations	**Percentage Cover**	**Hectare**
SNCI	6.1%	723 ha
Ancient Woodland	3.2%	379 ha
Country Parks	1%	118 ha
Total	10.2%	1,213 ha

Percentage Covered by Priority Habitat		
Priority Habitat	**Percentage Cover**	**Hectare**
Lowland Calcareous grassland	12.1%	1,432 ha
Deciduous Woodland	5.3%	632 ha
Maritime Cliffs and Slopes	3.4%	404 ha
Wood Pasture and Parkland	3.1%	367 ha
Good Quality Semi-Improved Grassland	1.8%	217 ha
No main habitat but additional habitats present	1.4%	166 ha
Lowland Meadows	1.3%	152 ha

Lowland Dry Acid Grassland	0.7%	86 ha
Purple Moor Grass and Rush Pasture	0.4%	54 ha
Lowland Fens	0.12%	14 ha
Traditional Orchards	0.04%	5 ha
Lowland Heathland	0.02%	2 ha
Total	30.2%	3,478 ha

Percentage covered by Heritage Designations			
Heritage Designations	**Percentage Cover**	**Hectare**	**Percentage of which is Priority Habitat**
Heritage Coast	56.6%	6,707 ha	34.1%
Parks and Gardens	6.2%	735 ha	44.4%
Scheduled Monuments	2.9%	343 ha	44.4%
World Heritage Sites	2.4%	284 ha	98%
Total	59.2%	7,024 ha	

*Detailed figures for South Purbeck National Character Area can be found in Appendix 5

Table 13: Overview of South Purbeck National Character Area

Heritage of the South Purbeck NCA

Historic landscape character of South Purbeck NCA

4.1.15 The distinctive character of the coastal landscape on the limestone cliffs is composed of small fields bounded by dry stone walls constructed from local Purbeck stone, in the local vernacular style.

4.1.16 Impressive lynchets at East Man near Worth Matravers are cut into the hillside, indicating historical cultivation, while at Middle Halves at Corfe, old strip fields are still evident.

4.1.17 The vale is guarded by Corfe Castle, where the road and railway cuts through the chalk ridge. This area is underlain by greensand and chalk and is where much of the agricultural activity is found, as well as a series of small woods and copses.

4.1.18 At the western end of the NCA, chalk downland meets the sea, with distinctive open landscapes, some of which have been ploughed on the more level ground at Chaldon.

Figure 43: Corfe Castle and the Chalk Ridge

4.1.19 The Lulworth Ranges display a mixture of military paraphernalia, from a large camp at West Lulworth, to tank tracks, abandoned vehicles and signage. This is also where the village of Tyneham, with its church, abandoned schoolhouse, manor and cottages is located.

4.1.20 Quarries (some still active) and adits are a feature of this area and on the cliffs, include extensive systems of caverns where stone has been extracted and associated platforms where it has been worked and loaded on to waiting ships.

4.1.21 At Swanage, there is the classic feel of a seaside resort, with its hotels, campsites and beach and modern development inland.

Heritage assets of South Purbeck NCA

4.1.22 Heritage assets range from Neolithic flint finds to Second World War defensive structures.

4.1.23 There are 95 Scheduled Monuments within the NCA and 57 Listed Buildings. There are also Registered Historic Parks at Lulworth Castle and Creech Grange.

4.1.24 The most distinctive historical feature is the stone, which has been utilised by people for millennia. Stone quarries are still active at Acton and Kingston, providing building stone from the Purbeck and Portland formations. No longer working, but once a significant industry, were the stone quarries on the sea cliffs at places such as Seacombe and Dancing Ledge, where large caverns have been excavated and cranes once winched stone into waiting boats. There are also several adits in the Langton Matravers area, which are now home to rare greater horseshoe bats. There are small outcrops of what is known as Purbeck Marble (a form of limestone), which were utilised by the Romans and is found in local churches. Many houses in the area are made of local limestone, while many boundaries are made in the local vernacular style from inferior quality stone.

4.1.25 Building stone from the South Purbeck NCA is of national heritage significance and has been exported outside of Dorset and used for important buildings across the country and even internationally. Portland Stone, for example, has been used since Roman times in England and since the Middle Ages in the construction of major historic buildings including St. Paul's Cathedral, the British Museum and the Bank of England in London. It was also the preferred building stone of Sir Christopher Wren, one of England's most famous architects. The international use of Portland Stone during the 20th century includes the United Nations building in New York City and the war graves of British Commonwealth soldiers. Furthermore, Portland Stone quarried from the Dorset and East Devon Coast World Heritage Site has been nominated as a 'Global Heritage Stone Resource' (Hughes et al., 2013) and was accepted as one of the first entries onto the GHSR list by the International Union of Geological Sciences (IUGS) in 2017. The GHSR designation provides international recognition of natural stone resources that have achieved widespread utilisation in human culture.

4.1.26 The ruins of Corfe Castle are undoubtedly the most iconic historic feature in the NCA. Lulworth Castle is also distinctive. The many domestic houses and structures are also of great importance. Barrows of various forms are of note along the two main ridges. There are superb examples of strip lynchets at East Man and medieval strip fields at Corfe as well as Romano-British field systems at Tyneham.

4.1.27 The extensive management of much of the NCA as well as the use of areas such as Tyneham, has protected many archaeological assets from modern agriculture, although deep ploughing in the Chaldon area to the west has damaged several barrows and these are now on the Heritage at Risk Register (Historic England, 2023b).

4.1.28 Heritage assets of NCA (including designated and non-designated) include:

- Stone quarries, adits and sea caves for Portland and Purbeck stone and Purbeck Marble. Shale tar excavations.
- Neolithic finds such as pottery and worked flints.
- Bronze Age barrows.
- Iron Age hillfort at Flower's Barrow.
- Roman quarries and quays.
- Norman Chapel of St Aldhelm's on St Aldhelm's Head.
- 11th century motte and bailey and castle at Corfe. Corfe Castle village houses, mills and other structures.
- Ancient trackway of Priest's Way.
- Lulworth Castle and Creech Grange, with associated Registered Parkland.
- Medieval strip lynchets at East Man and rare surviving strip fields at Middle Halves, Corfe. Dry stone walls on the limestone of South Purbeck.
- Common land at Corfe, Middle Halves and Ailwood Down.
- Clavell's Tower on a cliff at Kimmeridge.
- Abandoned village of Tyneham, within the military firing range.
- 19th century coastguard cottages and lookouts at Whitenothe Point, Kimmeridge and St Aldhelm's Head. Lifeboat station at Peveril Point.
- Conservation Area at Swanage.
- 663 Listed Buildings, ranging from Grade I to Grade II* and Grade II.

Biodiversity of Purbeck National Character Area

4.1.29 The South Purbeck NCA has one of the most diverse mixes of habitats and species in the UK. This has been recognised with the wealth of ecological designations and the area being part of the “most biodiverse 10km squares in the UK”.

4.1.30 The underlying geology as well as the local topography provides the basis for a number of different Priority Habitats, from Calcareous, Acid Grassland, Lowland Meadow, Ancient Broad Leaved Woodland, Lowland Heath, Traditional Orchard, Maritime Cliff and Slope, Fen and Offshore Reef.

4.1.31 There is a strong ecological link with the neighbouring NCAs such as the Purbeck Heaths, immediately to the north. Organisations such as National Trust, Natural England, RSPB and the Rempstone Estate are working together to create a Wild Purbeck Nature Improvement Area (NIA). A particular focus is on some innovative work to link the three National Nature Reserves on Purbeck (including Durlston Point), with other semi natural habitats, such as Brownsea Island and Arne, to work on a landscape scale.

4.1.32 The National Trust has an ambition to create 5,000 ha of new Priority Habitat in the southwest of England by 2025 (25,000 ha in Great Britain) as well as to improve the condition of its SSSIs and Priority Habitats. It is putting significant resources into identifying suitable sites and designing the methodology and then working with tenants to deliver these ambitions. There is a particular focus on Purbeck.

4.1.33 The marine environment is of international importance for its species both in the littoral (foreshore) environment as well as on the neighbouring reefs. It is of importance for marine life, including cetaceans such as harbour porpoise and bottlenose dolphins and sea birds, such as kittiwakes, puffins, guillemots and razorbills, and cliff nesting peregrine falcons. Three species of tern use this area as a key hunting ground. It has been designated as both an SPA and SAC (Portland to Studland and St Aldhelm’s Head to Durlston). Kimmeridge Bay has been designated as one of the first Marine Nature Reserves in Great Britain and is managed by Dorset Wildlife Trust as an educational and conservation resource. It is also a Marine Conservation Zone (MCZ).

4.1.34 The NCA is of great significance for bats, including a highly studied population of greater horseshoe bats which have been shown to migrate from their summer roosts and breeding sites in the Cotswolds to hibernate in the sea caves and adits of Purbeck, over 100 miles away.

4.1.35 The calcareous soils on limestone and chalk are particularly notable for rare plants such as early spider orchid and early gentian and butterflies such as Adonis blue and Lulworth skipper.

4.1.36 The arable areas to the west display some rare arable species including shepherd's needle, corn parsley and corn marigold as well as notable birds such as corn bunting.

4.1.37 Over 100 expert naturalists from all fields volunteer for a project known as the 'Cyril Diver bequest'. Cyril Diver and colleagues studied the ecology of Studland and other parts of Purbeck in the 1930s and eventually gave his collection to the Centre for Ecology and Hydrology (CEH), which was previously based at Furzebrook near Corfe and Winfrith. This in turn was handed to the National Trust (while the herbarium went to the Bodleian Library in Oxford). It has acted as a catalyst to study changes in species and habitats over the Purbeck area and brought together many specialists who have provided first rate monitoring and surveying skills to the area.

4.1.38 The Freshwater Biological Association (FBA) has a research station at East Stoke and has been carrying out studies on freshwater ecosystems since 1929.

Designated biodiversity sites of NCA

4.1.39 The high biodiversity value of South Purbeck NCA is reflected in a significant number and area of biodiversity designations.

4.1.40 South Purbeck is part of the UNESCO World Heritage Site, known as the Jurassic Coast, England's only natural WHS. It covers 96 miles of coast between Studland and Exmouth and displays 185 million years of geology. It was designated for its outstanding geology and geomorphology as well as its world class fossils. In addition, geology is a designated feature in many SSSI citations and there are several Regionally Important Geological and Geomorphological Sites (RIGS).

4.1.41 Large areas of the chalk and limestone cliffs and grasslands as well as lowland heath are designated SAC. There are several features cited, but the early spider orchid and early gentian are particularly notable, as well as Nottingham catchfly and "orchid rich sites".

4.1.42 There are a series of SSSIs covering a range of habitats from Calcareous Grassland (such as Ballard Down), Acid Grassland (Corfe Common), Lowland Heath, (Povington), Maritime Cliff and Slope (East Man), Ancient Broad Leaved Woodland, (Wilkswood) and Lowland Meadow at Langton Matravers.

4.1.43 Durlston Country Park is designated as a National Nature Reserve for its coastal flora and breeding seabirds and is managed by Dorset County Council.

4.1.44 There are many non-statutory Sites of Nature Conservation Interest, selected for a range of habitats and species of biodiversity importance.

4.1.45 The marine environment immediately offshore is of international importance, designated as a SAC as well as an SPA for its marine bird interest. Protected marine areas include limestone ledges and submerged sea caves. Key species and groups include brittle stars, sponges and sea fans. This area is also an important feeding area for little, common and sandwich terns. In addition, Kimmeridge Bay is one of the UK's first Marine Nature Reserves (MNR). The area has recently been declared a Marine Conservation Zone (MCZ), giving it some additional protection.

Geodiversity of Purbeck NCA

4.1.46 All the coastline of the South Purbeck NCA (42kms) is part of England's only natural UNESCO World Heritage Site (WHS). The Jurassic Coast, as it is known, has been designated as a WHS due to its exposure of strata spanning 185 million years of geological time through the Triassic, Jurassic and Cretaceous periods in the coastal cliffs and hinterland.

4.1.47 Several world-famous and classic sites for geodiversity occur within the NCA, including Lulworth Cove, Durdle Door, Stair Hole, Kimmeridge Bay and Old Harry.

4.1.48 The Purbeck monocline is a large-scale structural feature which many geologists study; this structure represents where the African and European tectonic plates that make up the Earth's crust collided, creating dramatic folds such as is seen at Stair Hole.

4.1.49 The geology of the NCA includes Cretaceous chalks, greensands and limestones as well as internationally famous Jurassic limestones (such as Blue Lias, Portland Stone) in addition to more recent deposits such as the Eocene Wealden Beds, siltstones, mudstones and clays.

4.1.50 Impressive dinosaur footprints have been discovered by quarrymen at Acton and fossil ammonites, belemnites, gastropods and other molluscs are often abundant in the marine limestones and mudstones.

4.1.51 The Kimmeridge clays have oil deposits which are being extracted by 'nodding donkeys', while tar shales were once mined at places such as Burning Cliff, near Ringstead, in the west of the NCA. Its name originates from the oil that naturally occurs in these rocks that may occasionally catch fire and burn for years, which is an example of the intangible heritage of place names and how they can be used to preserve stories about the natural history of a site.

4.1.52 In addition to geological SSSIs, there are 12 Regionally Important Geological and Geomorphological Sites (RIGS) designated within the NCA such as Corfe Castle and St. Aldhelm's Head Quarry, near Worth Matravers. The latter is active and supplies Portland Stone for building and restoration purposes.

4.1.53 A recent addition to help further promote geodiversity within the NCA is the Etches Collection Fossil Museum at Kimmeridge which was opened in 2016 and funded by the HLF.

4.1.54 The geology of South Purbeck has a significant influence on the biodiversity, natural capital and heritage of the area (Fig. A5.6). Many of the designated wildlife and archaeological sites are located along the chalk ridge to the north of the area.

Relationships between heritage, biodiversity and geodiversity

4.1.55 The extensive nature of much of the land management in the NCA also benefits the historic environment. Agri-environment grants have encouraged landowners to manage land sensitively, including Countryside Stewardship which has options related to both the conservation of biodiversity and the protection of heritage buildings and features.

4.1.56 Multiple designations have provided a protective umbrella for many sites for both biodiversity and heritage. The Jurassic Coast WHS is designated for its geological interest. However, the citation notes the value of the site in relation to the historical and scientific study of geology (UNESCO, 2001). This emphasises that natural heritage often also has historical and cultural value.

4.1.57 Designations in the coastal and marine environments include Marine Conservation Zones (MCZ), Marine Nature Reserves (MNR), SPAs and SACs, and offer some, but not comprehensive protection from damaging activities such as unsustainable fisheries.

4.1.58 Designations do not prevent benign neglect, and there is an increasing emphasis within nature conservation generally to looking to positive enhancement, rather than reactive protection. This includes the Colchester Declaration whereby Areas of Outstanding Natural Beauty (AONB), including the Dorset AONB of which South Purbeck is a part, have pledged to incorporate an ecosystem services approach into the management plans of all AONB by 2024, and that by 2030 at least 200,000 ha of SSSI in AONBs will be in a favourable condition along with enhancements to wildlife-rich habitat and new woodland planted (landscapesforlife.org.uk, 2019). Many wildlife sites, such as calcareous grassland, heathland and fen habitats. require active management and enhancement in order to conserve their nature conservation value (Dorset Environmental Records Centre, 2013). Similarly, Heritage at Risk in Purbeck and elsewhere is often subject to scrub and vegetation encroachment and requires active management (Historic England, 2023b).

4.1.59 Local Nature Recovery Strategies may offer new opportunities to secure engagement and funding for positive management and enhancement, including for sites that have both heritage and biodiversity significance. Biodiversity differs from heritage in that habitats and species populations can be restored to areas that were previously of low value; heritage can be enhanced, both through direct management to improve the condition, and through improvements to access and understanding for a wider range of communities, but ultimately heritage cannot be created.

4.1.60 The number of nature and heritage designations, while providing significant protection, particularly in the terrestrial environment, can cause confusion and duplication as well as a lot of bureaucracy in the development of positive enhancement projects such as Wild Purbeck, a project set up to enhance valuable habitats at the landscape. An early integration of heritage and biodiversity objectives can be helpful in resolving at least some of these issues as well as looking for opportunities for added benefits.

4.1.61 Where management practices are of concern in relation to biodiversity conservation, they are also often of concern in relation to heritage. For example, intensive mechanised agriculture is undoubtedly the biggest threat to both archaeological heritage and wildlife in the South Purbeck NCA. Ploughing has damaged archaeological assets such as barrows at Chaldon and Encombe (Historic England, 2023b), and this intensity of management is also of concern for farmland wildlife. On the Encombe Estate east of Clavell's Tower, arable fields are ploughed to within a few metres of the cliff edge. Polluting of water courses, through agricultural runoff of pesticides and nutrients, as well as soil erosion, is also a significant issue for both biodiversity and natural capital assets relating to water quality.

4.1.62 Quarrying has been carried out in South Purbeck for millennia and is part of the cultural heritage of the area. Heritage-related planning requirements relating to repairs and construction in the local vernacular style supports their creation. The quarries are generally small family run businesses (*c.* 0.25 – 1 ha at Acton) and have a relatively short life span of about 25 years before they are worked out.

4.1.63 In the past, planning conditions generally required the land to be put back to agricultural use, but more recently, with input from ecologists, some of these have been left open with bare cliff faces, offering potential geodiversity as well as biodiversity interest for pioneer communities. Ephemeral pools at the base offer habitat for wetland species such as great crested newts.

4.1.64 There remains conflict between those who would wish to generate offshore wind power to reduce our draw on carbon and those who are concerned about the ecological impact to wildlife as well as the effect on the seascape from Purbeck, Bournemouth and the Isle of Wight.

4.1.65 Development pressures from housing and infrastructure are perhaps less than many other NCAs, although there are proposals outlined at present by Dorset County Council for further housing and small industry development in Swanage. Some of these could impact sites of historical or nature importance as well as affecting the local environment. There is a particular threat to Corfe Castle as all vehicles to Swanage must go through the ancient village. (The reconnecting of the railway to the main line at Wareham would mean that more people could travel by public transport).

4.1.66 The historic use of Lulworth Range by the MOD, while seen as an anathema by some, due to the annexing of large areas of land and the village of Tyneham, has also brought some benefits to wildlife and heritage. Like Salisbury Plain, it has meant that modern farming, (which can be very damaging to wildlife and in some cases the historic environment), has not been able to take place. The land is managed extensively by grazing, without fertiliser or herbicide/pesticide application or indeed ploughing and this has allowed several rare species to coexist. Additionally, the prohibition of public access to large areas, means that species sensitive to disturbance such as ground nesting birds or brown hare can flourish.

4.1.67 Heritage provides a direct substrate for some of the biodiversity interest of the NCA. Purbeck limestone creates a superb environment for lichens and lower plants, including a number which are nationally rare. These include masonry walls, drystone walls, limestone tiles and gravestones. Species such as little owl and stoat have made their home in voids in field walls, while reptiles such as slow worms will hibernate in the base. At Corfe Castle, both common and the non- native wall lizard are resident in the large blocks of fallen masonry and peregrine falcon and kestrel are seen on the battlements.

Natural capital of South Purbeck NCA

Cultural services

4.1.68 The South West Coast Path (SWCP), runs along the southern fringe of the NCA and there is an inland section which bypasses the Lulworth Ranges when they are being used for firing practice and are closed. Tourism is now one of the largest employers in the area, with plentiful campsites, hotels, B & Bs and a heritage steam railway. Swanage and Corfe Castle are the main draw for visitors in the east and Lulworth Cove in the west.

4.1.69 Walking, cycling, hiking, birdwatching, and nature activities provide wellbeing benefits.

Regulating services

4.1.70 Much of the NCA is under permanent high-quality grassland and as such, this protects the soils underneath. Although there is some damage to the soils from the tank training on the Lulworth ranges, overall, there is likely to be benefits from the area remaining out of modern agriculture since the second world war.

4.1.71 Except for groynes and sea walls at Swanage, the coastline in the NCA is unprotected and allowed to naturally function. This provides an ample supply of beach sediment as well as helps to maintain exposures

Provisioning services

4.1.72 The extraction of natural stocks of building stone from the Purbeck and Portland formations has significant heritage as well as economic significance, through facilitating the repair and maintenance of historic buildings and structures and providing income and employment. Extraction can also create potential specialist niches for biodiversity (old quarries and adits), that may comprise 'net gain' as compared to the land use present prior to extraction. Provided it is managed well, through the minerals planning process, this gives an example of where the depletion of natural stocks (of building stone) can potentially lead to overall improvements in natural capital.

4.1.73 The South Purbeck NCA is underlain by a large aquifer in the chalk, which is extracted for drinking water. 59% of the NCA or 6,999 ha, is covered by a Nitrate Vulnerable Zone (NVZ).

Management challenges

Farming, agriculture and food growing

4.1.74 At Chaldon, arable farming is causing soil degradation and damaging barrows in addition to causing runoff from pesticides and fertilisers, as well as pig farming, which runs off into the catchment of the River Frome to the north.

Woodland management

4.1.75 Many woodlands are suffering from overgrazing by deer and an area wide deer management plan (or enclosures), will be needed to improve the understorey and to encourage regeneration.

4.1.76 In the ancient woodlands, large numbers of deer, notably non-native sika deer are heavily browsing the understorey and preventing regeneration or coppice growth.

Wildlife management

4.1.77 Burrowing animals and scrub are an issue on many archaeological features, such as Flower's Barrow and the East Man lynchets.

Habitat management

4.1.78 Many areas of grassland could be managed to enhance biodiversity with minor changes but need financial support (such as ELMS) and technical advice to achieve the desired habitats. There is a risk of abandonment of grazing of the sea cliffs in some areas and this would be undesirable both for wildlife and historic landscape reasons. Scrub growth is constantly regenerating on areas such as the sea cliffs at Dancing Ledge and Ailwood Down, as well as on the Lulworth Ranges. Gorse in particular is swamping features such as barrows and hillforts and also the herb rich grassland underneath.

4.1.79 Of the 95 Scheduled Monuments, a large number are Bronze Age barrows, such as on Ailwood Down and Povington. One of the biggest threats to these is scrub regeneration, but this is also detrimental to wildlife as they often have a fine flora of the short turf. There is therefore a double incentive to carry out management for both the archaeology as well as the wildlife.

4.1.80 Non-native invasive species (such as New Zealand pygmy-weed, Himalayan balsam and parrot's feather) are beginning to impact some sites in and near water bodies, which can both displace native flora and reduce the suitability of water bodies (such as at Horse Pond, Corfe) for protected species such as the great crested newt. Japanese knotweed is found in abandoned quarries, and *Rhododendron ponticum* may be invasive in some woodlands near East Lulworth.

Climate change

4.1.81 Climate change is undoubtedly already having an impact. Sea level rise is threatening flooding in low lying areas such as Swanage and has meant further defences have had to be created and beach replenishment carried out. Another related issue is the extremes of weather exacerbating the fire risk, particularly on heathland sites and there have been several significant fires on the neighbouring Purbeck Heaths NCA. Gorse is spreading at an alarming rate on the chalk scarp between Corfe and Swanage,

potentially due to atmospheric nitrogen deposition and this is swamping species rich grassland and archaeological features, such as historic boundaries and tumuli. Some new species are arriving from the continent, while conversely other species are finding conditions unsatisfactory and are being lost (Dorset Environmental Records Centre, 2013).

4.1.82 Flooding has historically been an issue at Swanage, although alleviation works has reduced this in recent years. However, sea level rise due to climate change is causing ever more stormy conditions at sea and higher sea levels, which can flood and erode areas such as Swanage.

4.1.83 Erosion has a negative impact on the historic environment, where features such as Flower's Barrow is collapsing into the sea. In recent years, Clavell's Tower at Kimmeridge had to be dismantled and rebuilt a little inland to prevent the same fate.

Water management

4.1.84 There are few water bodies on the chalk, but springs and streams run eastwards from Corfe Castle along with smaller ones at Tyneham and Kimmeridge. These suffer from agricultural, and sewage run off and this in turn can impact bathing water quality at places such as Swanage.

Development pressures

4.1.85 In recent years, there has been an application to create a large offshore wind farm, between Old Harry and The Needles on the Isle of Wight, called Navitus Bay. This split opinion, due to the environmental benefits of low carbon energy production versus the impact on a sensitive marine ecosystem as well as being highly visible on an area of Heritage Coast. The application was eventually withdrawn.

4.1.86 New development in the Swanage area is increasing surface runoff, which also has an impact on water quality.

Tourism and recreation

4.1.87 Bottlenecks on the A351 at Corfe Castle can lead to localised atmospheric pollution during the tourist season.

4.1.88 Car parks sometimes do not have the capacity to accommodate the number of vehicles that arrive, as was seen at Lulworth Cove and Durdle Door in the summer of 2020. This resulted in a great deal of damage to verges and illegal parking, as well as impacts to the sites that people visited.

4.1.89 Erosion from recreational activity is becoming an increasing issue, particularly on popular walks such as Durdle Door and Ballard Down. This has been exacerbated by Covid-19 when natural outdoor sites have had more visitors. Added to this has been a substantial increase in litter and disturbance to wildlife and livestock by uncontrolled dogs. Some barrows have been damaged by mountain bikes using them to ride over.

Other pressures

4.1.90 Military vehicles such as tanks and 4WD can damage turf and create scars in the landscape. Conversely, they create open areas for invertebrates such as mining bees and grayling butterfly as well as places for reptiles such as adders to bask. Care is needed to ensure these vehicles are excluded from sites of historic importance, but they are usually only marked by posts.

Opportunities for funding and support

4.1.91 The Nature Improvement Area known as Wild Purbeck, partially covers the NCA along with the Purbeck Heaths NCA. This brings capital funds to carry out works to conserve and enhance wildlife in the area (Dorset Environmental Records Centre, 2013).

4.1.92 There are many agri-environment grants covering the NCA. Some sites are in Countryside Stewardship (CS), some Higher Level Scheme (HLS) and others Woodland Grant Schemes (WGS). It is hoped that many of these will continue under the new Environmental Land Management Scheme (ELMS).

4.1.93 Landfill Tax Credits have been accessed on several occasions, as has Heritage Lottery Funding to carry out cultural and natural environment projects.

4.1.94 The National Trust and Lulworth Estate receive income from their visitor business, which includes car parking, entry to sites, shops and cafes and concessions. Encombe Estate charge to drive down the toll road and park at Kimmeridge. At Swanage, there are car parks operated by Dorset Council and the Town Council which bring income to the area. Durlston Country Park and Nature Reserve is managed by Dorset County Council and has a pay and display car park to help pay for the work on this 320 acre site.

4.1.95 At Kimmeridge, there is a new fossil museum, known as the Etches Collection, which brings visitors and generates employment as well as skills, education and knowledge. It also supports the collection of fossils, which, although natural, may be considered to have heritage value due to their cultural importance.

4.1.96 The South West Coast Path runs along the whole length of the NCA and this provides opportunities for establishments to create hotels, pubs, bed and breakfast and camp sites and to bring in much needed funds.

Key points from South Purbeck NCA

4.1.97 South Purbeck NCA is a phenomenally rich area both from a natural and cultural perspective. There must be very few places in the UK with as many designations, which is testament to the importance of the area.

4.1.98 The objectives for management of the historic and natural environment are broadly similar; conflicts are rare.

4.1.99 Pressures such as development are generally quite low and are focussed in defined areas such as Swanage.

4.1.100 Agriculture is generally extensive and sympathetic to both biodiversity and heritage interests, although there is still considerable scope for increased emphasis on enhancement, rather than simply avoiding harm. Existing significant issues relating to agriculture include deep ploughing in the archaeological rich landscape of Chaldon and right up to the cliff edge at Encombe.

4.1.101 The extraction of stone from the area impacts on the environment and heritage, but there is heritage and biodiversity interest in worked out quarries' adits and caverns.

4.1.102 Projects working at the landscape scale include South Purbeck within plans of a Nature Improvement Area (Dorset Environmental Records Centre, 2013), and would be likely to be incorporated within Local Nature Recovery Strategies in due course. These enhancement projects offer opportunities to achieve significant gains for nature conservation through bringing together multiple partners. Significant benefits would arise from the recognition and integration of heritage within these plans at the earliest opportunity, due to the synergies between the disciplines and the extra weight that a united approach brings when articulating to audiences the importance of an area.

4.2 Cotswolds National Character Area

General description of Cotswolds National Character Area

4.2.1 The Cotswolds NCA (107) is one of the largest of the 159 areas defined in England. It stretches along a roughly 60-mile-long escarpment with the Severn Valley and Evesham Vale below. The Cotswolds runs from Wiltshire and Somerset in the south, through Gloucestershire, to Worcestershire, Warwickshire, Oxfordshire and Northamptonshire in the northeast.

4.2.2 Just outside the NCA are the towns of Bristol, Cheltenham, Evesham, Banbury, Oxford, Swindon and Trowbridge, while Bath, Stroud, Cirencester, Stow-on-the-Wold and Moreton-in-Marsh are situated within the NCA. There are over 400,000 residents (Natural England, 2015).

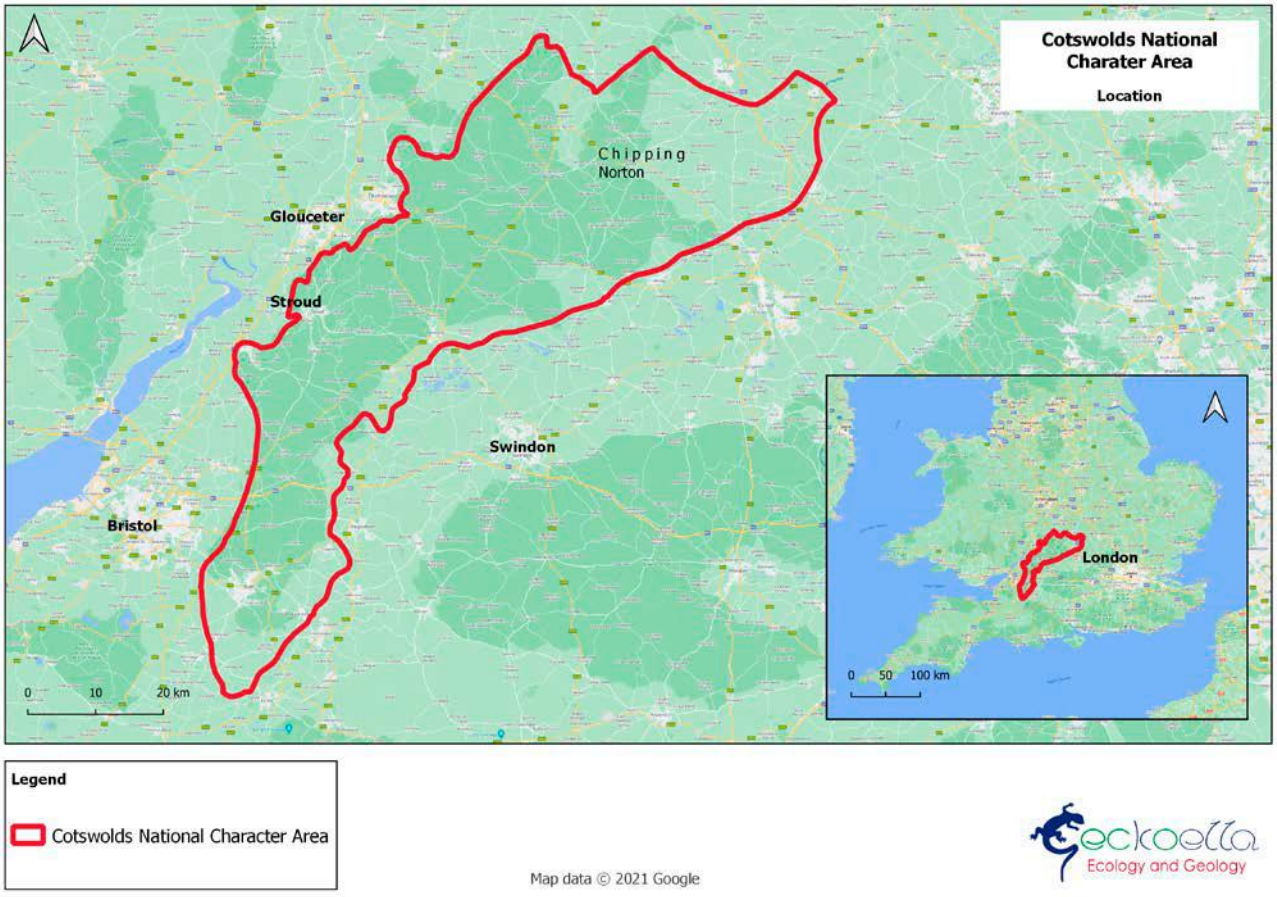

Figure 44: Location of the Cotswolds National Character Area

4.2.3 The Cotswolds NCA character is derived from its underlying geology of Jurassic oolitic limestone- part of a band of golden coloured limestone running from the Dorset coast to Yorkshire. This makes up a steep scarp slope running along the western edge of the area, comprising an elevated undulating plateau or wold, that gradually dips towards the Thames catchment in the east and Avon in the south.

4.2.4 Beef cattle and sheep grazing is much less common than it was previously, although it is found on the steeper areas which are less suited to arable farming as well as in some of the river valleys and floodplain. Sourcing suitable stock for conservation grazing of marginal farmland for conservation purposes can be challenging. Dairy farming is decreasing, partially due to market conditions and the move to large intensively managed herds.

4.2.5 Arable cultivation dominates the plateau, where once sheep would have grazed. This is primarily for wheat and barley, but there are increasingly large areas of oil seed rape and maize as well as occasional linseed, sunflower and fodder crops such as beet. Particularly in the area close to Evesham, horticulture and market gardening is practised, although the majority is outside the NCA on the neighbouring Severn Vale.

4.2.6 Woodland in the Cotswolds is rarely extensive, although there are some beech hangers on the western fringe, such as Cotswolds Beechwoods. More commonly on the plateau, woodlands are of secondary nature and have been planted as shelter belts, landscape features or as game coverts and are a mixture of conifers and beech or ash trees. In the deeper clay vales in the east, the woodlands are composed of oak/ash, and include Wychwood, an area of ancient woodland near Oxford. Only 3% of the woodland is defined as Ancient Woodland. There are, however, some very important veteran trees, particularly associated with the many large estates and parklands such as at Blenheim Palace and Stanton.

4.2.7 From an ecological perspective, the Cotswolds are most well known for their very species-rich calcareous grassland, mostly focussed on the steep scarp slope and valleys in the west and south of the NCA, such as Rodborough and Cleeve Commons. However, the cultivated land, where managed sensitively, is important for rare and declining farmland birds and arable plants.

4.2.8 Sites of Special Scientific Interest (SSSIs) cover 4,171 ha. There are three internationally important Special Areas of Conservation (SAC) within the NCA.

4.2.9 The Cotswolds geodiversity includes SSSIs and Regionally Important Geological and Geomorphological Sites (RIGS) that expose the Jurassic limestones that make up the main escarpment, and which are rich in marine fossils, for example at Leckhampton Hill and Charlton Kings Common SSSI and at Cleeve Hill SSSI. In total however, less than 1% of the area is designated as either statutory or non-statutory sites for its biodiversity or geodiversity.

4.2.10 Quarrying was also an important industry as seen in Bath, where Bath stone was not only used within the city but exported to build important buildings such as Buckingham Palace. The use of this stone is an example of the contribution to both local and wider heritage relating to the geology of the area. There are several smaller quarries across the Cotswolds which were used for constructing the houses and walls which are so iconic in the NCA.

4.2.11 The Cotswolds Way and the Thames Long Distance Path run through the NCA, while the Roman Fosse Way and Akeman Street also traverse it. The Kennet and Avon canal crosses to the south of the NCA while the Stroud canal runs to Stonehouse. Modern intrusion comes from the M4 and M40, while the M5 runs along the base of the Cotswolds scarp and the A417 trunk road runs from Gloucester to Swindon.

4.2.12 Agriculture remains a significant industry, making up 238,358 ha of the Cotswolds NCA, and having a large impact on the quality and character of the environment. However, it directly employs far fewer people than in the past. The number of full-time farm labourers has dropped by 17% between 2000 and 2009 (Natural England, 2015).

4.2.13 Organic farming is more common in the Cotswolds NCA than other areas, perhaps due to the relative affluence of some of the inhabitants of the area and the large number of farmers markets such as the well-known Stroud Farmers Market or Daylesford Farm Shop.

4.2.14 Large estates with associated parkland, gardens and pleasure grounds are a particular feature of the Cotswolds, with 88 Registered Parks and Gardens.

4.2.15 Open access land is relatively limited, particularly on the wolds, although there are some large commons covering 1,536 ha such as Cleeve, Selsley, Rodborough and Solsbury Hill. In addition, there are 932 ha of National Trust access land, plus some large estates such as Blenheim Palace and Cirencester Park allow extensive public access.

4.2.16 In the Cotswolds NCA, there tends to be a juxtaposition, between land which is managed extremely intensively and areas which are abandoned to coarse grasses and scrub. This can negatively impact the cultural and natural environment.

4.2.17 As a proportion of the NCA, only a small amount of land has been developed for housing, tourism (such as campsites and golf courses), quarrying and small-scale industrial use. There are however some exceptions, such as around the larger towns of Bath, Cirencester, Stroud and Bradford on Avon.

4.2.18 There are three large rivers bounding the Cotswolds. To the west there is the River Severn, east, River Thames and south, River Avon. However, within the NCA, there only tend to be small streams and water courses, with the Windrush, Coln and Evenlode being some of the more significant.

Figure 45: Selsley Common, Gloucestershire looking west across the Severn Vale from the Cotswold Escarpment (Photo: Brendan Cooper)

Cotswolds National Character Area*	
Heritage Designations	
Site	**Total**
Number of Scheduled Monuments within Areas Protected by Statutory Biodiversity Designations	491
Number of Scheduled Monuments in Priority Habitats	92
Number of Scheduled Monuments in NCA	524
Number of Listed Buildings in NCA	16,843
Total Area of NCA (Hectares)	288,170

Percentage covered by Statutory Biodiversity Designations		
Statutory Designations	**Percentage Cover**	**Hectare**
AONB	65%	188,089 ha
NNR	0.2%	677 ha
SAC	0.5%	1,552 ha
SSSI	1.5%	4,236 ha
Total	67.5%	194,554 ha

Percentage covered by Non-Statutory Biodiversity Designations		
Non-Statutory Designations	**Percentage Cover**	**Hectare**
Ancient Woodland	3.7%	10,521 ha
Country Parks	<0.1%	81 ha
Woodland Pasture Parkland	4.6%	13,125 ha
Total	3.3%	9,522 ha

Percentage Covered by Priority Habitat		
Priority Habitat	**Percentage Cover**	**Hectare**
Coastal and floodplain grazing marsh	0.4%	1,180 ha
Deciduous Woodland	7.5%	21,504 ha
Good Quality Semi-improved Grassland	0.8%	2,304 ha
Lowland Calcareous Grassland	1.5%	4,278 ha
Lowland Dry Acid Grassland	>0.1%	3 ha
Lowland Fens	>0.1%	96 ha
Lowland Heathland	>0.1%	6 ha
Lowland Meadows	0.2%	655 ha

No main habitat but additional habitats present	1%	2,780 ha
Purple Moor Grass and Rush Pasture	>0.1%	4 ha
Woodland Pasture and Parkland	4.6%	13,125 ha
Traditional Orchards	0.1%	396 ha
Total	16.6%	46,332 ha

Percentage covered by Heritage Designations			
Heritage Designations	**Percentage Cover**	**Hectare**	**Percentage of which is Priority Habitat**
Battlefields	0.1%	411 ha	13.2%
Parks and Gardens	3.2%	9,226 ha	0%
Scheduled Monuments	0.5%	1,552 ha	25.3%
World Heritage Sites	1.3%	3,619 ha	15.3%
Total	4.8%		

*Detailed figures for Cotswolds National Character Area can be found in Appendix 5

Table 14: Overview of Cotswolds National Character Area

Heritage of the Cotswolds NCA

4.2.19 The Cotswolds is rich in heritage stretching back over 6,000 years from Neolithic pottery shards and long barrows to Second World War airfields. There are 538 Scheduled Monuments spread across the ranging from Neolithic long barrows, Iron Age hillforts, Roman villas, deserted medieval villages, remains of water meadows and ridge and furrow farming to 2nd World War airfields. The area was famed for the quality of its sheep and wool from medieval times. Over 4,000 miles of characteristic dry-stone walls run across the Cotswold landscape, mostly built during the 18th and 19th centuries when large tracts of open fields and downland were enclosed to establish boundaries to land ownership and offer shelter for stock.

4.2.20 The wool and other trades brought wealth from medieval times, as can be seen from the size and quality of many churches and houses. Much of the area was once owned either by ecclesiastic or large feudal estates; there are 88 Registered Parks and Gardens, including Hidcote, Painswick House and Prior Park. Mill towns such as at Stroud and Wickwar also developed, as did honey-coloured villages built from the local limestone. These all contribute to the Cotswolds having one of the largest concentrations of Listed Buildings in Britain, with 15,968, ranging from Grade I, II* to II. There are also two UNESCO World Heritage Sites at Bath and Blenheim Palace. Lansdown Hill and Stow are Registered Civil War Battlefields (Natural England, 2015).

4.2.21 Together, the landscape, heritage and biodiversity are highly valued at the national level, and 65% of the NCA is designated as an Area of Outstanding Natural Beauty (AONB) to conserve the unifying limestone geology, drystone walls, dark skies, flower-rich grassland and distinctive settlements (Cotswolds Area of Outstanding Natural Beauty Management Plan 2018-2023, 2018).

4.2.22 There are two Registered Battlefield sites dating from 1643 and 1646 at Lansdown Hill near Bath and Stow respectively. Both Stow and Lansdown Hill Battlefields are sites of battles between the Royalist and Parliamentarians during the first English Civil War in the mid-17th century (English Heritage Battlefield Report: Lansdown 1643, 1995)

4.2.23 The city of Bath is designated a UNESCO World Heritage Site (WHS), as is Blenheim Palace at Woodstock. Bath was first inscribed as a WHS in 1987 due to its outstanding universal value in Roman Archaeology, its hot springs, Georgian Town planning, Georgian Architecture, its green setting and its Georgian architecture reflecting 18th century social ambitions (The City of Bath World Heritage Site Management Plan 2016-2022, 2016). Blenheim Palace built between 1705 and 1722 was also inscribed as a WHS in 1987 for its outstanding example of work by two of England's most notable architects John Vanbrugh and Nicholas Hawksmoore and is one of the finest and earliest examples of the English Romantic movement. Its landscapes were also laid out by Lancelot "Capability" Brown (Blenheim Palace World Heritage Site Revised Management Plan 2017, 2017).

4.2.24 The oolitic limestone that underlies the Cotswolds is the most used building stone in this area, while at Bath, the slightly paler Bath Stone is used throughout the city. Inferior Oolite limestone, often quarried on site, is used for the 4,000 miles of stone walls that are a feature of the landscape. Stone quarries are still active in places like Farmington, but they are quite small in nature and often now only supply crushed stone aggregate, which is also reconstituted into blocks for building. In the caverns where stone was extracted, such as Bradford on Avon, Minchinhampton Common and Sherborne Estate, large colonies of rare greater and lesser horseshoe bats as well as occasional Bechstein's bat are found.

4.2.25 Country estates with associated historic houses and structures which are often listed are a typical feature of the Cotswolds NCA. In addition, the area's churches reflect the area's past importance in broadcloth production and wealth derived from sheep farming and wool as well as their links with the medieval abbeys. Wychwood, the ancient broadleaf forest in Oxfordshire, was part of a once much larger royal hunting forest.

4.2.26 Two Roman roads cross the Cotswolds NCA- the Fosse Way from Exeter to Lincoln and Akeman Street, from St Albans to Cirencester. Roman features are relatively common on the Cotswolds and include Chedworth Roman villa, the Roman Baths and the town of Cirencester. Mosaics have been uncovered at Chalford and Woodchester.

4.2.27 There are remains of abandoned medieval villages as well as remnants of the early open field systems and ridge and furrow. In some river valleys such as the Windrush in Gloucestershire, there are examples of historic water meadows, sometimes with sluices and channels still evident.

4.2.28 The move away from extensive sheep walks prior to the war to intensive arable farming across much of the plateau has had a significant negative impact on the archaeology, with deep ploughing of some remains such as barrows, resulting in the damage to many and these are now on the Monuments at Risk Register. In addition, scrub and burrowing animals are causing damage to the archaeological stratigraphy in areas away from the arable.

4.2.29 Examples of the diverse range of heritage assets found within the Cotswolds NCA include:

- Neolithic finds such as pottery and worked flints
- Bronze Age chambered tomb at Belas Knap and Stone Circle at Rollright Stones.
- Bronze Age long barrows and bowl barrows.
- Iron Age hillfort including Solsbury Hill, Horton Camp and Crickley Hill (17 in total).
- Roman villas such as Chedworth, Roman mosaics at Woodchester, Baths at Bath, Roman roads- Fosse Way and Akeman Street. Romano-British Settlements.
- Fine early churches, manors and houses.
- Royal Hunting Forest at Wychwood.
- Medieval open field systems and ridge and furrow.
- Water meadows on Thames and Windrush.
- Deserted medieval villages.
- Civil War Battlefields at Stow and Lansdown
- Listed Buildings such as Blenheim Palace WHS, Sherborne Park Estate, Badminton, Cirencester Park, Dyrham Park, as well as many houses in Bath, Chipping Campden, Burford and others.

- 88 Registered Parks and Gardens including Westonbirt, Prior Park, Painswick, Hidcote and Barnsley.
- Common land at Cleeve, Selsley and Rodborough and Minchinhampton.
- Beckford, and Broadway Tower and Tyndale Monument.
- Cloth Mills at Stroud, Wickwar and Nailsworth.
- Canals at Stroud and Kennet and Avon. Second World War airfield at Windrush Camp.

4.2.30 The Historic Land Characterisation (HLC) of the NCA is complex due to the extensive area, covering many counties. A common focus however is very much on the relationship with the underlying geology and topography and the architecture of the buildings and structures.

Figure 46: Sheep grazing among apple trees on the farm featured in Laurie Lee's 'Cider with Rosie' in the Slad Valley (Photo: Brendan Cooper)

Biodiversity of the Cotswolds NCA

4.2.31 The wildlife of the Cotswolds NCA is synonymous with species rich limestone grassland as well as its 'beech hangers' woodlands. These habitats (Lowland Calcareous Grassland and Deciduous Woodland) would have been much more extensive, but since the second world war have retreated enormously, to the steep scarp slope and some dry valleys, where cultivation was not possible. Designated sites for wildlife, such as SSSI, SAC and NNR make up less than 1% of the NCA.

4.2.32 Although woodland cover is about 11%, (below the national average), much of the woods in the Cotswolds are planted as shelter belts or for game cover or as commercial plantations and as such are less attractive to wildlife. There are however some exceptionally important areas of woodland; the most notable being Wychwood near Oxford and the Cotswolds Beechwoods, although there are several other important sites such as Littleworth Wood at Snowshill, Boundary Court near Woodchester and Crickley Hill near Cheltenham. Many of the woods are classified as Plantation on Ancient Woodland Site (PAWS), while ancient woodlands cover only 3% of the NCA.

4.2.33 Of particular note are the large number of Wood Pasture and Parklands, often associated with historic estates such as Blenheim Palace, Lodge Park, Sherborne Park, Dyrham Park and Badminton Park. These often have significant veteran trees, with important deadwood communities and cavities suitable for bats and rare birds, as well as orchards.

4.2.34 In some of the river valleys, there are remnants of Coastal and Floodplain grazing marsh as is seen on the Windrush at Sherborne, Clattinger Farm near Malmesbury and at Rack Isle, Bibury. However, most fell under the plough and/or re-seeded. These were once famous for their snakes-head fritillaries as is still seen just outside the NCA at North Meadow NNR, Cricklade.

4.2.35 The NCA is of great significance for bats, including a highly studied population of greater horseshoe bats at Woodchester Park which have been shown to migrate from their summer roosts and breeding sites in the Cotswolds to hibernate in the sea caves and adits of Purbeck, over 100 miles away. Many of these bats use abandoned stone quarries as well as the roof space of houses, while other species use ancient trees.

4.2.36 Woodchester Park is also the site of a long-term research project into the population of badgers, having begun in 1976 and has been instrumental in our understanding of their ecology.

4.2.37 Priority Habitats in the Cotswolds are often quite small and isolated from each other. It is difficult for species to disperse between these patches across large areas of unsuitable habitat such as intensive arable. Table 12 and Appendix 5 illustrate the scattered distribution of Priority Habitats within the Cotswolds NCA.

4.2.38 Many of the most notable species are linked to the unimproved calcareous grassland at places like Rodborough Common near Stroud. They include pasque flower, Cotswolds pennycress, musk orchid, bastard toadflax, sword leaved helleborine, rock rose, Roman snail, Duke of Burgundy fritillary, chalkhill blue, Adonis blue and the recently reintroduced large blue butterfly. In the woodlands, bird's nest orchid, herb Paris, red helleborine and limestone fern are of note. There are some notable arable birds on some sites such as grey partridge, yellow wagtail, lapwing, tree sparrow, corn bunting, and yellowhammer, while arable plants include corn marigold, shepherd's needle and on the margins in the south, Bath asparagus.

4.2.39 The National Trust has an ambition to create 5,000 ha of new Priority Habitat in the South West of England by 2025 (25,000 ha in Great Britain) as well as improving the condition of its SSSIs and Priority Habitats. A lot of resources have been invested into identifying suitable sites, designing the methodology and working with tenants to deliver these ambitions. There is a particular focus on the Cotswolds estates such as Stroud Commons, Newark Park, Horton Court, Ebworth and Sherborne.

4.2.40 The Cotswolds NCA includes 118 relatively small SSSIs, 3 internationally important SACs plus two NNRs. What is evident however, is that they cover a small area and are very fragmented. However, those which are still intact often have extremely rich wildlife.

4.2.41 Bradford-on-Avon is a designated SAC for its exceptionally rich bat fauna, which are resident in the old Bath stone quarries. Over 15% of the UK population of horseshoe bats are found here. Cotswolds Commons and Beechwoods are the other SAC in the Cotswolds and it is designated for its species rich limestone grassland and beech hangers and this is also partially covered by the NNR designation.

4.2.42 Rodborough Common SAC is designated for its extensive area of semi-natural dry grassland.

4.2.43 The other NNR is at Wychwood, (which was once part of a much larger Royal Hunting Forest) and is mostly composed of oak with coppice.

4.2.44 There are a series of SSSIs covering a range of habitats from calcareous grassland (such as Haresfield Beacon), Broad Leaved Woodland, (Pope's Wood), Coastal and Floodplain Grazing Marsh (Clattinger Farm), Wood Pasture and Parklands at Blenheim Palace and Lowland Meadow at Ebworth.

4.2.45 There are many Sites of Nature Conservation Interest, notified by the local Wildlife Trusts, covering a plethora of habitats. There are also several RIGS sites, for palaeontology, geology and landforms.

Geodiversity of the Cotswolds NCA

4.2.46 The predominant geology of the Cotswolds NCA consists of Middle Jurassic oolitic limestones and calcareous clays approximately 165-170 million years old. These are broadly divided between the Inferior Oolite in the west of the Cotswolds and Great Oolite on much of the Wolds. This stone was created in warm tropical seas, reminiscent of the Caribbean today. The classic and best-preserved exposures of Inferior Oolite limestones are at Leckhampton Hill and Cleeve Hill.

4.2.47 The NCA includes areas in the Severn Vale which are only 10 metres above sea level and rise to 330 metres asl at Cleeve Hill. There is a steep scarp slope on the western aspect, with a gentle dip to the east.

4.2.48 The Great Oolite is part of a limestone and clay band running from Dorset to Yorkshire. It is paler grey/cream in the south at Bradford-on-Avon, Corsham and Bath, as is seen in the classic Georgian architecture of these towns, while the iconic golden hue caused by iron oxides is typical of the strata extending from Gloucestershire to Northamptonshire.

4.2.49 The underlying pale cream-coloured Inferior Oolite limestone has been used for millennia to construct the houses and churches and other structures of the region and is seen as an early building material in the Roman villas such as at Chedworth, as well as in the Rollright Stones and Belas Knap chambered tomb. The stone walls which cross the landscape are a distinctive landscape feature, although many are now in a very weathered, and sometimes dilapidated condition.

4.2.50 Stone has been quarried at many sites and some areas are pot marked with small dips where surface extraction has been made for local use. Most quarries have been worked out and closed many years ago and are often now covered in secondary woodland. There are also caverns such as at Bradford-on-Avon, Bath, Nailsworth and Sherborne, which are now home to rare bats such as the lesser and greater horseshoe bats.

4.2.51 The Cotswolds have supplied building stone for many famous buildings. Taynton Quarry at Burford provided material for many Oxford Colleges, Blenheim Palace, Windsor Castle and Eton. Bath Stone was used to build Buckingham Palace and of course the city of Bath, while stone employed in the construction of parts of the Houses of Parliament was quarried at Minchinhampton.

4.2.52 Also less well known, but instrumental in the area's economic importance, was the use of Fuller's Earth (laid down with the Great Oolite) in the woollen mills of the Middle Ages. In the 13th century it was discovered that Fuller's Earth was suitable for removing the oil and grease from fleeces, which contributed to the success of Cotswold wool sold in Europe. This brought wealth to the area, which was spent on the construction of many of the houses and churches still present in the Cotswolds today.

4.2.53 In the Vale of Moreton, there are periglacial drift deposits which have been quarried for aggregate. Jurassic Lias clay underlies the limestone and is often found at the spring line. There are more recent Quaternary deposits of alluvium, clays and gravels, and Oxford Clay occurs in some river valleys. The Cotswolds Water Park has been formed from dredging the gravels in this area.

4.2.54 Most of the arable land on the Cotswolds is on thin, free draining Cotswolds brash, creating a very stony substrate and one which requires large quantities of fertiliser adding to grow a crop successfully.

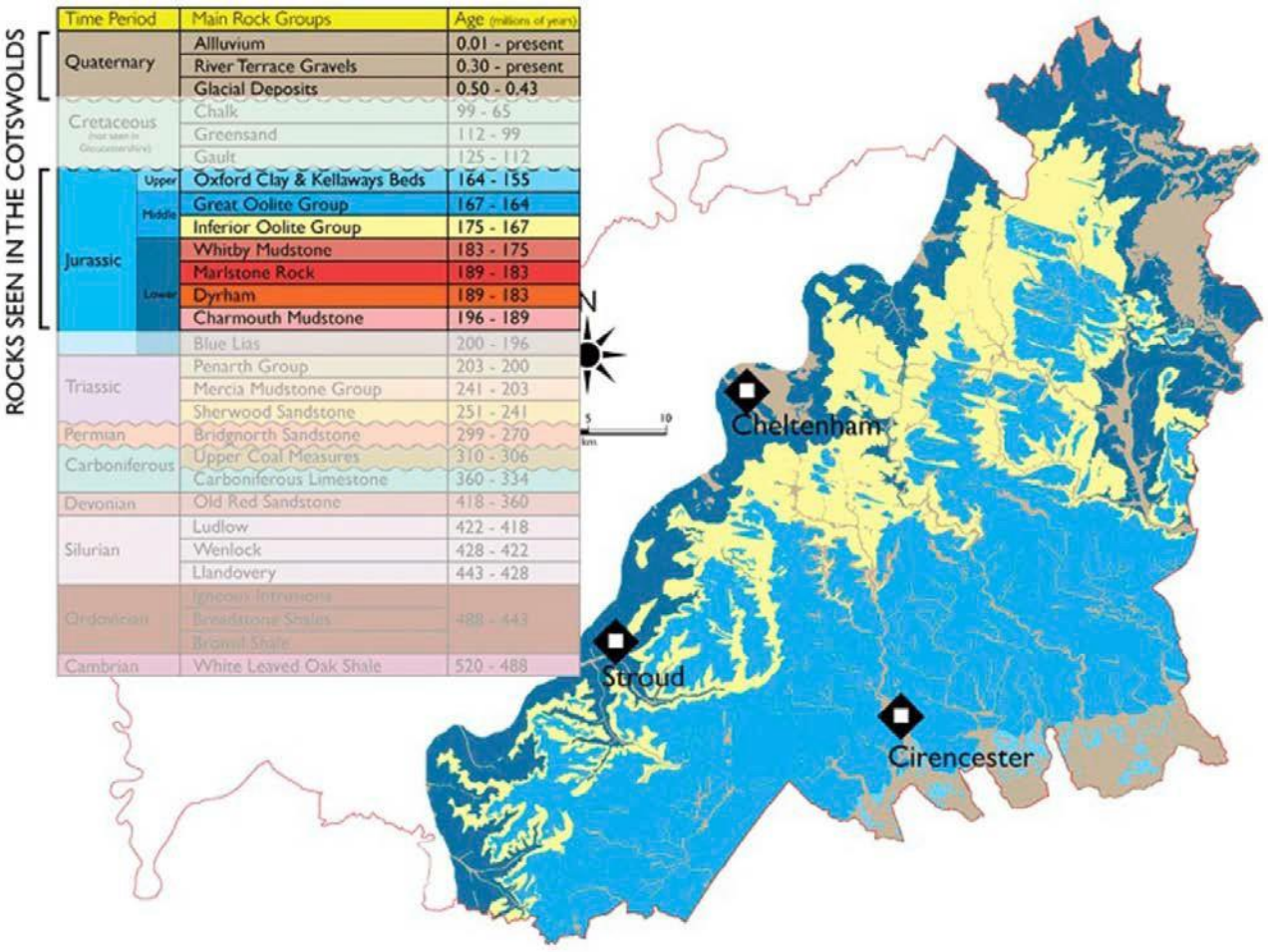

Figure 47: Overview of Cotswolds Geology (reproduced with the permission of Gloucester Geology Trust)

4.2.55 Fossils, especially brachiopods, bivalve and gastropod shells and echinoids (sea-urchins) are commonly found through much of the oolitic limestone sequence. There are 186 separate RIGS sites in the NCA as well as 37 SSSIs for which geology is a contributory factor within the citation.

4.2.56 There are concerns that since the closure of many of the quarries, and the reluctance to open new ones on planning grounds, that there will be a lack of suitable stone to carry out sympathetic repairs and construction to retain local distinctiveness. Most remaining quarries are producing crushed stone which is then reconstituted for building blocks or used as aggregate.

Relationships between heritage, biodiversity and geodiversity

4.2.57 Biodiversity, geodiversity and heritage conservation in the Cotswolds tend to have broadly similar objectives.

4.2.58 An example would be Leckhampton Hill which includes a Scheduled Monument hillfort and barrow, geological SSSI quarries designated for their oolitic limestone interest, and overlapping biological SSSI features comprising calcareous grassland, woodland and scrub. Ideal management of the grassland areas is through extensive grazing to create a short, fine sward which protects underlying heritage features as well as grassland species, such as meadow clary. The control of scrub is a key objective for all three elements.

4.2.59 Disused stone quarries have an important heritage value as both post-industrial sites and in terms of their contribution to heritage through local building stones. Underground quarries are also home to several bats such as lesser and greater horseshoe bats, with a significant proportion of the UK population of greater horseshoe bats using the stone caverns of Bradford-on-Avon Special Area of Conservation.

4.2.60 Limestone creates a superb environment for lichens and lower plants. These include quarry faces, masonry walls, drystone walls, limestone tiles and gravestones. Species such as little owl and stoat have made their home in voids in field walls, while reptiles such as slow worm and common lizard will hibernate in the base.

4.2.61 Barn owls are found in field barns at places like Windrush, and swallows and house martins' nest under the eaves, while swifts can bring up young in undisturbed roof spaces.

4.2.62 A fascinating link to the distant past is the Roman snail. This was brought over to Britain by the Romans and still survives at sites such as Chedworth Roman Villa, Cheltenham and Cirencester. In 2008 the Roman snail became a legally protected species.

4.2.63 Agriculture has a large influence on heritage and biodiversity. Getting the grazing and cutting regimes right on archaeological and wildlife-rich sites is important. This is however often challenging on marginal land or steep slopes. Heritage stock and skills aligned with modern techniques and equipment can help to meet these specialist requirements.

4.2.64 Intensive agriculture in the Cotswolds in the 20th century has had an adverse effect. Large tracts of grasslands and sheep walks have been converted to arable farming, leading to loss and fragmentation of habitats, and archaeological assets such as barrows and old field systems and their settings can be damaged by ploughing. Cultivation of thin limestone soils and then leaving them open to the elements in the winter is causing a significant degradation of soil by aerial and fluvial erosion and this in turn is causing damage to water courses and a loss of carbon to the atmosphere.

4.2.65 Stone walls which are such a characteristic feature of the NCA are being slowly lost and replaced by barbed wire fences, or in arable areas, removed or allowed to collapse.

4.2.66 Many traditional apple and pear orchards are being lost, either through neglect and old age or conversion to farmland or woodland. Other orchards are being replaced with modern commercial varieties. Traditional Orchards are home to rare historic varieties of fruit as well as important habitats for species such as mistletoe, noble chafer and bullfinch.

4.2.67 Many areas of ancient woodland have been replanted with conifers of non-native trees (Plantations on Ancient Woodland Sites (PAWS) and trees have been planted on limestone grassland and designed landscape, such as at Woodchester Park. Woodlands are seeing an increasing impact of deer browsing, both on the ground flora, but also the regeneration of the understorey. In addition, non-native grey squirrels can bark strip trees, causing them to become poor specimens and in some cases die. Tree diseases are having an increasing impact on historical and/or wildlife-rich wooded landscapes.

4.2.68 Agri-environment support and land management focussed on conservation can achieve significant benefits. Landowners on some of the large estates, (including the National Trust and Sir James Dyson at Beeswax Farm) have been repairing many miles of dry stone walls on their holdings.

4.2.69 Quarrying has been carried out in the Cotswolds for a very long time, but many old quarries have now been closed or reclaimed for farming, and the majority of those remaining produce aggregate or dust which is reconstituted as building blocks. There is still a need for Cotswolds or Bath stone to carry out repairs and construction in the local vernacular style and hence new quarries should be permitted to open (subject to standard controls on environmental and other impacts).

Natural capital of the Cotswolds NCA

Cultural services

4.2.70 Tourism is a key income stream for many businesses and employs many people in the Cotswolds. This includes country house hotels and bed and breakfast establishments, visitor attractions, car parking, shops and tearooms. There are many famous houses and gardens such as Hidcote, Kiftsgate, Iford Manor, Painswick Rococo Gardens, Chedworth Roman Villa, Blenheim Palace, Lodge Park and Newark Park. Towns and villages such as Bath, Bradford-on-Avon, Cirencester, Bourton-on-the-Water, Bibury, Woodstock, Burford, Chipping Campden and Broadway draw tourists from around the world, bringing funds to support local communities.

4.2.71 The Cotswolds AONB is a significant visitor destination and confers important wellbeing benefits to visitors and local communities, including access and recreation, and wellbeing. The 102-mile-long Cotswolds Way, runs along the length of the NCA and there is additionally the Thames Path which crosses part of the area.

4.2.72 Being predominantly on limestone, lakes are uncommon, although there are landscape features on some of the larger estates, such as at Blenheim Palace, Woodchester Park and Sherborne Estate. In the low-lying river valleys, particularly of the Thames and its tributaries, near Cirencester and Fairford, there are many worked out gravel quarries which have become recreational lakes, such as the Cotswolds Water Park.

Supporting services

4.2.73 Historic buildings with their many voids and places to roost are also extremely important for bats and other wildlife as is seen at Woodchester Mansion and Snowshill Manor. Underground quarries are also home to several bats such as lesser and greater horseshoe bats.

4.2.74 The unimproved calcareous grasslands present in the Cotswolds NCA provide habitat to rare insects, birds and plants.

Regulating services

4.2.75 The popularity of organic farming has led to a decrease in pesticide use and a greater abundance and quality of pollinator friendly plants and nectar, which aids pollinator populations. Unimproved grasslands also achieve the same.

4.2.76 Reducing the use of pesticides and herbicides improves mycorrhizal fungi present in soil, which improves soil quality, water retention and plant growth.

Provisioning services

4.2.77 Agriculture is a significant industry in the Cotswolds NCA; food production is big business. There are in addition to the larger-scale producers' niche high quality products, and organic producers. Farm shops such as the well-known Daylesford Farm and farmers markets such as Stroud are used by locals and visitors alike. Traditional Orchards can also provide a food source.

4.2.78 There is a large aquifer underlying the Cotswolds limestone and this is used for abstraction to supply water to the many large towns surrounding the NCA.

Management challenges

Farming, agriculture and grazing

4.2.79 Boundary trees on hedge-banks and walls are being lost and not replaced and, in many cases, those that were once part of a parkland are being ploughed so closely, that it damages the roots, and the tree dies. On sites such as Lodge Park, Sherborne, the historic Bridgman Landscape has virtually been denuded of the original trees.

4.2.80 On the Coastal and Floodplain Grazing Marsh at sites such as Cricklade and on other sections of the Thames, large areas of neutral grassland with important populations of snakes-head fritillary and greater burnet have been ploughed up or quarried for river gravels, leaving only a few areas such as North Meadow (just outside the NCA) and Clattinger Farm to indicate what these areas would have been like. Many of these landscapes will also have had heritage interest.

4.2.81 Another land management activity which is more prevalent in the NCA is horse grazing. Due to the popularity of horse riding, and the number of riding stables, relatively large areas of land are used to graze horses. This can be detrimental to the sward

and bridle paths can become heavily poached. In some areas, there is additionally a landscape impact with the need for additional fencing and infrastructure and ring barking of veteran trees.

4.2.82 The lack of suitable stock to graze sites sensitively is a particular problem in some areas, particularly in the east and north of the NCA. Conservation herds such as the National Trust/Natural England one seen at Ebworth to graze the commons of various landowners is worth investigating. This would also benefit archaeological features.

4.2.83 Intensive use of fertilisers and herbicides/pesticides is having a damaging impact on farmland birds and plants such as weasel's snout, corn marigold, turtle dove and lapwing. Water quality, including an important aquifer for many surrounding towns and cities, is being affected by the leaching of nitrates and other pollutants from agriculture and development. Additionally, over abstraction is causing low flows in areas such as the River Kennet.

Woodland management

4.2.84 Many woodlands, including ancient woodlands, are suffering from overgrazing by deer and an area wide deer management plan (or enclosures), will be needed to improve the understorey and to encourage regeneration. Management of grey squirrels will also be needed.

Wildlife management

4.2.85 Burrowing animals and scrub are an issue on many archaeological features, such as on the long barrows at Randwick and Newark and the hillfort at Crickley Hill. However, the burrowing animals are often badger or rabbit, both of which can be moved (with an appropriate licence), albeit at cost.

Climate change

4.2.86 Climate change is causing increasingly erratic weather, with strong gales in the winter causing wind blow, particularly in beech, excessive rain causing flooding and water ingress into historic buildings. Drought in the summer is causing the decline and loss of sensitive species.

Water management

4.2.87 Lines of springs discharge under the limestone where it meets impermeable clay, particularly along the ridge at places such as Snowshill, Bath Skyline and Horton Court. These areas can be quite unstable and are prone to slumping such as Beechen Cliff, Bath.

Development pressures

4.2.88 There are development pressures from housing and infrastructure, particularly near the larger towns and this can affect both historical and natural features if not carefully planned. There are also major infrastructure projects such as the dual carriageway proposals on the A417 at Crickley Hill which will affect highly significant sites on both sides of the road. In other areas, recreational development such as golf courses, horse riding and tourism is influencing the NCA.

Community pressures

4.2.89 Theft of historic stone tiles and flag stones from vernacular buildings such as barns in isolated places, as well as churches is an increasing problem. In addition, stone walls are dismantled illegally to make rockeries and the like. Redundant farm buildings in the local vernacular style are being neglected, or conversely are being converted to dwellings, with ancillary infrastructure.

Opportunities for funding and support

4.2.90 There are many agri-environment grants covering the Cotswolds NCA. Some sites are in Countryside Stewardship (CS), some Higher Level Scheme (HLS) and others Woodland Grant Schemes (WGS). It is hoped that many of these will continue under the new Environmental Land Management Scheme (ELMS) and that further support for land management for public goods, including biodiversity, heritage and natural capital will be made available.

4.2.91 Landfill Tax Credits have been accessed on several occasions, as has Heritage Lottery Funding to carry out cultural and natural environment projects.

4.2.92 The Cotswolds AONB are signatories to the Cotswolds Declaration and hence have committed to significant nature recovery and enhancement targets. AONB partnerships across the country are instigating Nature Recovery Plans and looking for landscape-scale changes.

4.2.93 Developer contributions relating to ‘Biodiversity Net Gain’ may be another source of support for conservation in the future.

Key points from the Cotswolds NCA

4.2.94 The Cotswolds NCA is one which is instantly recognised by most people, but it is usually the built environment; the honey-coloured cottages and churches, the grand estates and picturesque villages which first come to mind, rather than the natural environment.

4.2.95 While superficially, the area looks little changed, there has been an enormous amount of damage and fragmentation due to modern agriculture to biodiversity and archaeology. Protected sites for wildlife now cover less than 1% of the land mass and tend to be focussed along the western and southern scarp. Mixed farms are now quite unusual in the NCA and the vast majority are arable farms.

4.2.96 The objectives for management of the historic and natural environment are broadly similar and rarely are their conflicts. Disused quarries, caverns and adits frequently have significant wildlife, geological and heritage value, both above and below ground.

4.2.97 The loss of stone field barns and walls is having a negative impact on the landscape as well as to those species like barn owls which reside there.

4.2.98 Similarly, the conservation and restoration of field boundaries, including the iconic networks of stone walls as well as hedgerows typical of historic landscapes, offers heritage and biodiversity benefits. The conservation of standard and in particular veteran trees along boundaries, within fields and in parkland also comprises a heritage and biodiversity enhancement.

4.3 High Weald National Character Area

General description of the High Weald NCA

4.3.1 The High Weald NCA 122 is situated primarily in East Sussex, with smaller sections in Kent and West Sussex. The towns of Tunbridge Wells, Crowborough and Hastings are within the National Character Area (NCA), and it is bounded by the towns of Horsham, Crawley, East Grinstead, Haywards Heath and Uckfield.

4.3.2 The NCA covers 174,500 ha of which 78% is within the High Weald AONB. There is a population of 873,000 people living either in the NCA or within 5 kms of its boundaries.

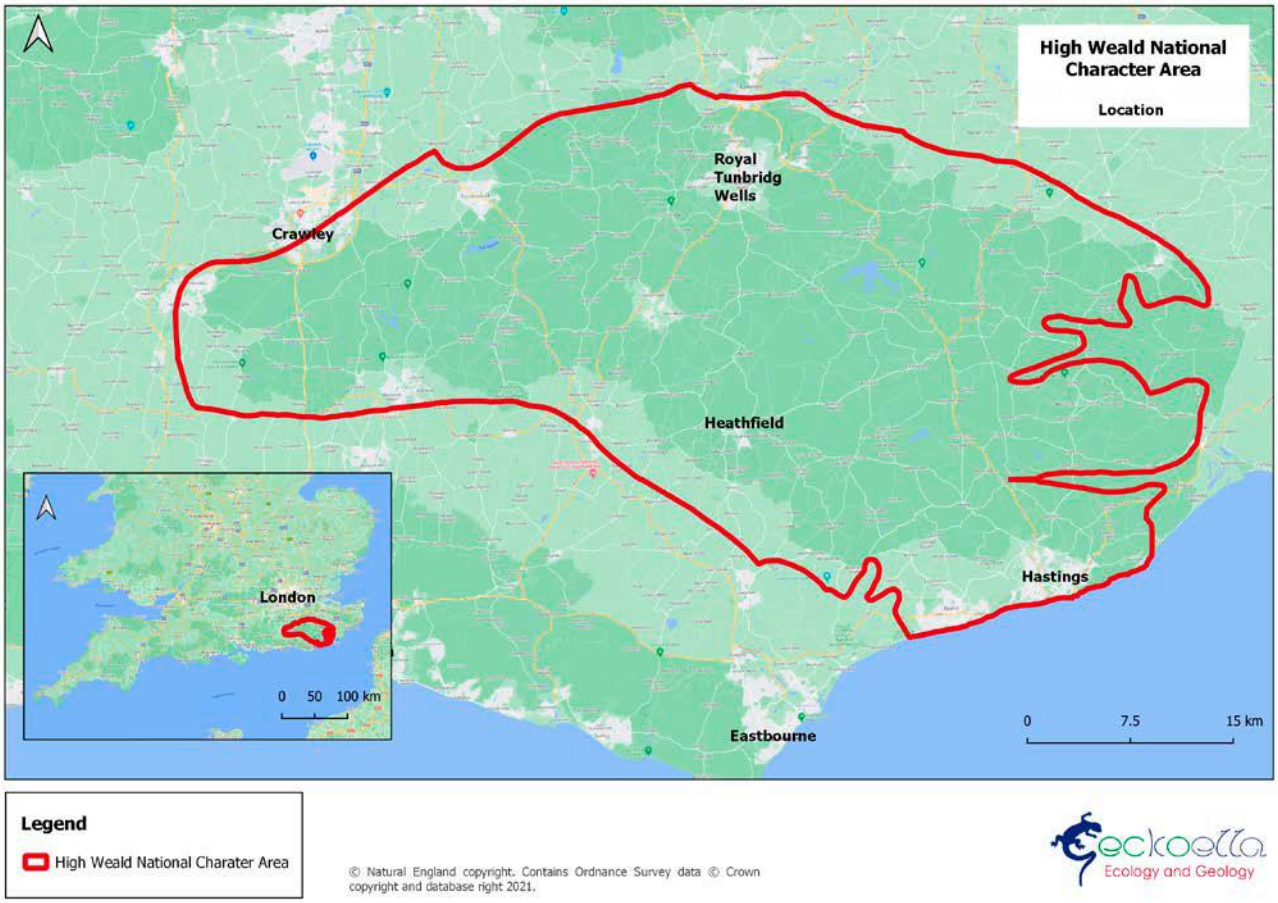

Figure 48: Location of High Weald National Character Area

4.3.3 The High Weald NCA is characterised by an ancient landscape with an intimate patchwork of small fields, enclosed by high hedges and interspersed with broad leaved woodland. Historic timber framed farmsteads are a particular feature of the area. It has

been described as “one of the best-preserved medieval landscapes in Northern Europe, with its mix of small fields bounded by thick hedges, abundant woodland and farmsteads connected by ancient sunken lanes.” (Edwards, 2008).

4.3.4 High Weald includes the ridged and faulted sandstone core of the Kent and Sussex Weald. The geology of the NCA is primarily neutral to acidic sandstones and clays which have been heavily faulted. It is bisected by several streams (gills) and rivers which ultimately flow to the English Channel or North Sea.

4.3.5 Many rivers and streams run across the NCA, some linking to the Medway which joins the North Sea, while others such as the Rother and Adur flow south to the English Channel at Romney Marsh or further west at Newhaven and Shoreham. Deep gills are a feature of the area and are often highly incised into the sandstone.

4.3.6 The land rises from sea level at Hastings and Bexhill to 241 metres high at Crowborough Beacon. It is a land of steep undulating countryside, with occasional sandstone outliers and exposures. Soft eroding sea cliffs are found in the east of the NCA.

4.3.7 The area is one of the most wooded in Britain, with over 26% tree cover (primarily broadleaved, except on the acid heaths of Ashdown Forest, where introduced pine is prevalent having been planted in the 19th century). 17% is semi natural, although there are some sites which are classified as PAWS, where plantations have been planted on ancient woodland sites. At Ashdown Forest There are also some pine plantations on what was previously lowland heathland. Veteran trees are a feature of the NCA and are often found in historic parks and areas of wood pasture, but also as boundary and hedgerow trees.

4.3.8 Farms are generally small and predominantly pastoral, with a focus on sheep and to a lesser extent cattle grazing (62%). Dairy farming has declined significantly. Arable farming only makes up 12% of the area and is focussed on the periphery of the NCA and includes oil seed rape, wheat and barley. There are still some traditional orchards although many are now planted with modern trees. Hop growing has declined, but can still be found, as can the associated oast houses, now mostly converted to dwellings.

4.3.9 The NCA is still made up of generally small family farms, with over 36%, under 20 ha in size and only 12% over 100 ha; far smaller than much of the country; this will likely have helped to retain the intimate landscape.

4.3.10 Despite its proximity to London and Gatwick Airport, the High Weald feels very rural and relatively undeveloped and has few major roads crossing it. It is generally an affluent area in the west, although some towns have social deprivation.

4.3.11 The landscape and geology have made it an attractive place to create several country estates and gardens, such as Sissinghurst, Hever Castle, Groombridge Place, Bateman's, Sheffield Park and Great Dixter (see case study). There are 56 Registered Parks and Gardens in total located in High Weald NCA covering 4,599 ha. Many of these are open to the public.

4.3.12 Open access land includes Ashdown Forest, which is the largest area in South East England at 2,790 ha. There is also a lot of open access to woodlands and in particular, Forestry Commission woods such as Bedgebury, which amount to a further 3,600 ha. National Trust properties are well represented in the NCA and includes Bateman's, Sheffield Park, Bodiam Castle, Standen, Scotney Castle, Wakehurst Place, Sissinghurst and Nymans.

4.3.13 Ecologically, the High Weald NCA is not as rich as some neighbouring NCAs; particularly on the North and South Downs but does have several habitats and species of importance, notably on the acid heathland of Ashdown Forest Special Area of Conservation (SAC), which is of international importance. The historic pattern of small fields and hedges with scattered woodlands can provide a flourishing environment for wildlife. The hedges create invaluable connectivity between sites for species such as hazel dormouse, bat, hedgehog and stoat to safely move. They also create significant edge habitat which is lost in large fields or in sites where hedges are heavily flailed. Unfortunately, the vast majority of the fields, (like much of the country where 97% of species rich meadows have been lost), have been re-seeded or fertilised and are now quite impoverished. There are also seven Country Parks in the NCA, such as at Crowborough and Hastings.

4.3.14 The littoral zone and coast off Pevensey, Hastings and Fairlight is also of very high wildlife value and has been designated as a Special Protection Area (SPA) for its bird interest, as well as a small area of Pevensey Levels as a Ramsar site.

4.3.15 There are 91 Scheduled Monuments spread across the NCA, although this is not as high as some other comparably sized NCAs. These include remains of blast furnaces, moated sites and Romano-British settlements. There is also a Registered Battlefield site at Battle and three Protected Wrecks, such as The Amsterdam, offshore.

4.3.16 Of particular note in the High Weald are the number of Listed Buildings (7370), ranging from Grade I Hever Castle and Great Dixter Manor to Grade II and II* farmsteads. There are an incredible 3,500 farmsteads recorded in the Historic Farmsteads Landscape Character report.

4.3.17 The iron industry started in High Weald in the Roman period and had a renaissance in the 16th century when blast furnaces were invented, and it was one of the most important areas for making canons.

4.3.18 Transport corridors are limited, and the roads and railways are generally narrow and windy, which has restricted development. The High Weald is generally quiet and tranquil but does suffer from aeroplane noise near Gatwick Airport as well as road noise and pollution near the M23, A26 and A21. There are two long distance footpaths- the High Weald Way and the Sussex Border Path. There are some large areas of open access- notably Ashdown Forest, which is the largest area of free public access in South East England, plus Bedgebury Forest and some smaller National Trust properties such as Bateman's.

4.3.19 The buildings of the High Weald are locally distinctive, with steep hipped roofs and timber frames. Churches are often positioned on the ridges, providing glimpses from distant viewpoints.

4.3.20 Villages are generally small and have retained much of their character, although the towns of Crowborough, Uckfield, Heathfield, East Grinstead and Tunbridge Wells have expanded, but still retain much of their heritage. Hastings and Bexhill are more typical of somewhat fading seaside resorts on the south coast, with many Victorian hotels and villas as well as post war development.

Figure 49: Ashdown Forest Special Area of Conservation, High Weald

High Weald National Character Area*	
Heritage Designations	
Site	**Total**
Number of Scheduled Monuments within Statutory Biodiversity Designations	14
Number of Scheduled Monuments in Priority Habitats	42
Number of Scheduled Monuments in NCA	89
Number of Listed Buildings in NCA	7,430
Area of NCA	174,885 ha

Percentage covered by Statutory Biodiversity Designations		
Statutory Designations	**Percentage Cover**	**Hectare**
Ramsar	>0.1%	35 ha
SAC	1.7%	2,911 ha
SPA	1.8%	3,214 ha
SSSI	3.1%	5,438 ha
LNR	1.4%	821 ha
Total	3.1%	5,441 ha

Percentage covered by Non-Statutory Biodiversity Designations		
Non-Statutory Designations	**Percentage Cover**	**Hectare**
Ancient Woodland	18%	31,148 ha
Country Parks	0.2%	424 ha
Total	18%	31,147 ha

Percentage Covered by Priority Habitat		
Priority Habitat	**Percentage Cover**	**Hectare**
Wood Pasture and Parkland	3.1%	5,468 ha
Coastal and Floodplain Grazing Marsh	0.3%	525 ha
Coastal Vegetated Shingle	>0,1%	3 ha
Deciduous Woodland	18.9%	33,183 ha
Good Quality Semi-Improved Grassland	1.1%	1,888 ha
Lowland Dry Acid Grassland	0.1%	148 ha
Lowland Fens	>0.1%	49 ha
Lowland Heathland	1%	1,792 ha
Lowland Meadows	0.2%	475 ha
Maritime Cliff and Slope	>0.1%	168 ha

No main habitat but additional habitats present	1.3%	2,259 ha
Purple Moor Grass and Rush Pasture	>0.1%	26 ha
Reedbeds	>0.1%	18 ha
Traditional Orchard	0.2%	474 ha
Total	26.6%	46,476 ha

Percentage covered by Heritage Designations			
Heritage Designations	**Percentage Cover**	**Hectare**	**Percentage of which is Priority Habitat**
Battlefields	>0.1%	77 ha	
Parks and Gardens	2.5%	4,447 ha	
Scheduled Monuments	0.1%	181 ha	
Total	2.6%		

*Detailed figures for High Weald National Character Area can be found in Appendix 5

Table 15: Overview of High Weald National Character Area

Heritage of the High Weald NCA

4.3.21 The undulating wooded landscape has attracted people to build country estates and many of these have associated Registered Parks and Gardens. Examples include Hever Castle, Penshurst Place, Groombridge Place, Rudyard Kipling's Bateman's, Great Dixter Garden, Scotney Castle, Wakehurst Place, Herstmonceux Castle and Bodiam Castle, many of the buildings are listed Grade I or II*, while 56 of the parks and gardens are registered. Ashdown Forest is also a great draw for enthusiasts of Winnie the Pooh and Christopher Robin.

4.3.22 The ancient field systems of the High Weald NCA are an important heritage feature with strong links to biodiversity "the field systems of the High Weald are essentially medieval in pattern and are a key component of the natural history of the AONB" (Edwards, 2008). The High Weald's medieval character remains largely intact and not greatly impacted by modern development, conventional farming practices and forestry. This has resulted in small, irregularly shaped fields, interlaced with a network of hedgerows and ditches, woodlands, sunken lanes and streams. This provides wildlife corridors across the AONB, as well as a large area of ecotones, which are considered biodiverse habitats (Bannister, 2017).

4.3.23 In total, there are 7,370 Listed Buildings in the High Weald. Perhaps the most important group of buildings are the ancient farmsteads which are scattered across the landscape, of which 3,500 have been recorded as part of the Historic Farmsteads Landscape Character Report. Almost 1,300 of these or 36% have at least one building which is 17th century or earlier.

Figure 50: Medieval building in the High Weald NCA

4.3.24 There are fewer Scheduled Monuments than comparably sized NCAs elsewhere in England, with 91 across the NCA. Many of these relate to the main industry which was carried out in the Weald, which was iron ore mining and smelting. There are however also several moated structures such as Bodiam Castle, Iron Age barrows and Romano British settlements. Four Scheduled Monuments are on the Heritage at Risk Register (HAR).

4.3.25 The Battle of Hastings (1066) was fought at Battle, which is located 6 miles northwest of Hastings and this is now a Registered battlefield.

4.3.26 There are three Protected Wrecks in the marine environment off Fairlight, including The Amsterdam

4.3.27 From a historical perspective, the High Weald (along with the Weald of Sussex further west) was exceptionally important for the production of iron ore and was the premier area in Britain. It was first quarried by the Romans, but there was a renaissance in the 16th century with the invention of blast furnaces to smelt the ore. This needed charcoal from the local woodlands and a series of 'hammer ponds'. Cast iron was the main industry which included the production of canons which were transported to the coast at Romney Marsh. Many of the traditional buildings were 'iron master's houses'.

4.3.28 The Historic Land Characterisation of the NCA focuses on the "small scale landscape, hewn by hand from woodland and wood pasture and remains remarkably intact. Interlaced with thick hedgerows and woodlands, irregular fields and dispersed historic farmsteads with sunken lanes and gill streams".

Biodiversity of the High Weald NCA

4.3.29 The High Weald is one of the most wooded landscapes in Britain with over 26% woodland cover, double the average for the UK. Many of these are connected by the tall, dense hedges which are synonymous with the area. Weald means wilderness or forest of which it still retains much of.

4.3.30 Large areas of lowland acid grassland and heathland are found in the acid sandstone areas, particularly focussed on Ashdown Forest.

4.3.31 19% of the NCA is classified as having Priority Habitats, which is higher than average in England.

4.3.32 Ashdown Forest and Hastings Cliffs are the only terrestrial SACs in the NCA. Pevensey Levels are particularly important for birds and are listed as a Ramsar site. The coastline off Hastings and Fairlight is designated SPA, as is Ashdown Forest, which is also a SAC.

4.3.33 SSSIs cover 3% of the NCA (5,416ha), although they are fragmented with only Ashdown Forest having any significant size at 3,200 ha. Local wildlife sites cover 6% of the area and total 268.

4.3.34 Traditional orchards are a feature of the NCA, including those associated with the historical landscape use of the area for growing hops, and some are host to a range of invertebrates including ladybirds, hoverflies as well as birds such as the bullfinch.

4.3.35 Areas of ancient woodland are scattered along the east/west sandstone core of the NCA. Many are coppice with standards, and sweet chestnut coppice is a particular feature. There is a high degree of interconnectivity. There are areas of pine and conifer

plantation at Ashdown Forest on the sandy soil as well as Bedgebury Pinetum and 3% of sites are Plantation on Ancient Woodland Site (PAWS). Only 15% of the NCA's woodlands are managed (Natural England, 2013) and this can result in an impoverished bird and ground flora due to excessive shade. Deer and grey squirrels are also impacting on regeneration and understorey development. Bluebell and wood anemone create impressive displays in the spring in many woodlands.

4.3.36 In addition, the NCA is of great importance for lichens, mosses and ferns and Eridge Park has been declared a SSSI for "one of the richest lichen flora in Britain" as well as its parkland and woodland habitats. (Natural England, 2013).

4.3.37 Lowland heath and acid grassland is a particular feature of the sandstone ridge around Ashdown Forest. Much of the original area was planted with pine and other conifers in the 19th century but is now being managed for its biodiversity. This habitat has a wide range of associated wildlife, including nightjar, Dartford warbler, dyer's greenweed, green winged orchid and pepper saxifrage.

Figure 51: Dartford warbler, distinctive species of the Ashdown Forest, High Weald

4.3.38 Although the NCA has a significant number of small pastures, including characteristic acid grassland swards, unfortunately almost all of them have been agriculturally ‘improved’, since the second world war and there are now very few species rich meadows left.

4.3.39 A unique feature of the High Weald is the number of ponds across the landscape. There are believed to be over 10,000 ponds, the majority the result of either iron ore extraction or of the creation of hammer ponds to help in the smelting process – illustrating the strong links between heritage and open water habitats in England. These ponds tend to have a rich amphibian and invertebrate fauna, including dragonflies and damselflies.

4.3.40 There is a rich bat fauna, many using historical houses and barns with voids for roosts, while other species use hollow trees. There are few mines for cave dwelling bats, although there are some using cavities in the sandstone exposures as well as the sea cliffs.

4.3.41 There is a small section of coast between Pevensey and Fairlight and this is of great significance for its sea birds. The area has important populations of Bewick swans, smew and little grebe.

Geodiversity of the High Weald NCA

4.3.42 The geology of the High Weald NCA is predominantly a mixture of heavily faulted sandstones and clays, many are assigned to the ‘Hastings Beds’. One of the best-known exposures of sandstone away from the coast is at Harrison’s Rocks, near Tunbridge Wells, which is very popular with climbers.

4.3.43 The NCA has one of the finest exposures of Lower Cretaceous Wealden Bed sediments in Britain and fossils of plant material and marine animals can be found.

4.3.44 Near Battle, there is an outcrop of Purbeck Stone. This is extensively quarried for building stone and aggregate. There are also bands of gypsum within the rocks which are quarried.

4.3.45 Iron ore was first found in Neolithic times, and the Romans started quarrying it systematically; there are now many iron ore quarries and pits to be found.

4.3.46 The sea cliffs between Bexhill and Fairlight are composed of actively eroding soft sedimentary rocks and there is a section which is undeveloped to the east where there are no coastal defences.

4.3.47 4There are 17 SSSIs where geology is a key component and 38 Regionally Important Geological and Geomorphological Sites (RIGS) in the NCA.

Relationships between heritage, biodiversity and geodiversity

4.3.48 In the High Weald, the historic nature of the landscape, with its small fields bounded by high hedges and interspersed with large areas of ancient broad leaved woodland is also highly beneficial for wildlife. It creates connectivity and links in a way that is rarely seen in England. Comparing the NCA and the HLC; in most cases, optimum management for the historic environment closely matches that for the natural environment.

4.3.49 On first impressions, the High Weald is a landscape which does not appear to have changed a great deal and is one of the best-preserved medieval landscapes in Northern Europe. The National Character Area and the Historic Landscape Characterisation for the High Weald have broadly similar objectives favouring a mix of ancient woodland, small pastoral fields, tall and dense hedges, bisected by small streams and sunken lanes.

4.3.50 From an ecological perspective, what has changed, but is not immediately apparent to the layman, is that much of the diversity in the grassland has been lost. This is due to agricultural intensification, re-seeding and the application of fertiliser, which has substantially reduced overall species diversity across the High Weald.

4.3.51 Ploughing can impact on archaeology as well as wildlife. Access for the large plant associated with modern agriculture requires the widening of gateways, loss of hedges and infilling of semi-natural habitats, again, impacting both ecology and archaeology.

4.3.52 The few remaining areas of unimproved grassland are often isolated, and species find it very difficult to move away from isolated ‘islands’ or biodiversity. They can also be challenging to manage. On marginal land or steep slopes, as well as on archaeological monuments, specialist skills, stock and equipment are often required; heritage breeds and traditional management techniques can have a role to play.

4.3.53 Sheep are now the dominant grazier, which can be less desirable than having cattle as cattle can create more diversity of structure and species. However, due to their weight, cattle can impact on archaeological sites by poaching of the soil in wet weather. A move to horses in some areas is not ideal as they can eat desirable species.

4.3.54 Ashdown Forest comprises an ancient heathland, acid grassland and woodland remnant designated as a SSSI, SPA and SAC for wildlife. Ashdown Forest also has a rich archaeological heritage, including important Bronze Age, Iron Age, and Romano-British remains, as well as a historic medieval hunting forest. The designated heritage assets of the forest include designations of small areas as Scheduled Monuments reflecting interest from different ages within the site. By contrast the ecological designated site boundaries are extensive, with the diversity of habitats reflected in different units within the overall site.

4.3.55 Ashdown Forest is grazed with Hebridean sheep, Riggit Galloway cattle and Exmoor ponies, illustrating the role played by heritage livestock in the conservation of important sites for wildlife and heritage.

4.3.56 There are over 10,000 ponds in the NCA and enhancement can benefit heritage as well as wildlife. However, many ponds are currently neglected and heavily shaded, and sometimes polluted. The vast number of ponds spread across the Wealden landscape; a vestige primarily of the historic iron ore industry, has clear benefits for the likes of amphibians, dragonflies and aquatic plants and invertebrates. It also creates important feeding areas for species such as Daubenton's bats.

4.3.57 Veteran trees have significant wildlife and heritage interest. They are vulnerable to direct impacts and loss, as well as lack of successful recruitment of new specimens to the population.

4.3.58 Traditional orchards are another habitat with significant heritage interest that need ongoing conservation management as well as protection. Traditional orchards are home to rare historic varieties of fruit as well as important habitats for species such as noble chafer moth and bullfinch.

Natural capital of the High Weald NCA

Cultural services

4.3.59 Tourism is less well developed than in other parts of the country, although the coastal towns of Bexhill and Hastings do attract domestic holidaymakers. Winnie the Pooh at Ashdown Forest is another draw for UK and foreign visitors. Many sites tend to attract day visitors, rather than people on holiday.

4.3.60 Traditional skills in the High Weald, including woodland management, coppicing and traditional orchard management are important to the conservation of heritage and biodiversity features. This knowledge, together with organic farming and gardening, can continue to evolve and develop into new techniques for land management based on the historic tradition, to achieve wellbeing benefits alongside the practical, cultural and economic values.

4.3.61 There are wellbeing benefits from walking and hiking in the High Weald NCA, as well as from wildlife and birdwatching.

Supporting services

4.3.62 Historic buildings with their many voids and places for bats to roost are also extremely important as is seen at Scotney Castle and Bateman's as well as many smaller farmhouses and dwellings. These buildings are also key for species such as barn owls, swallows, house martins and swifts.

4.3.63 There are many important habitats present, including ponds, hedgerows, traditional orchards, veteran trees and woodlands, which support rare insects, birds, bats and other mammals and amphibians.

Regulating services

4.3.64 The area can play an important part in flood mitigation and slowing the flow downstream in the catchment.

4.3.65 With such a wooded landscape, carbon sequestration is clearly a key ecosystem service.

4.3.66 The variety of habitats provide a nectar source for pollinators.

Provisioning services

4.3.67 While timber is extracted, trees are also planted. Coppicing is of note and the High Weald provides a great deal of the sweet chestnut used for fencing and building in the UK, however the majority of building materials, such as fencing are still imported. Oak is also of significance as a timber resource. Commercial crops of conifers are grown at Ashdown Forest and Bedgebury.

4.3.68 Rivers and streams feed the largest reservoir in Southeast England at Bewl Water, which supplies water to Maidstone and the Medway towns. Drinking water is also abstracted from other rivers in the area. Bewl Water is the largest lake in Southeast England and provides water to the Medway towns and is also an important recreational resource.

4.3.69 Organic farming is relatively common in the NCA and sold in farm shops as well as in markets in London and across the area. Traditional orchards and agriculture also provide food.

Management challenges

Woodland management

4.3.70 Only 15% of woodlands continue to be managed and this is resulting in quite closed and shady woodlands which are not suitable for light demanding species which have evolved with traditional coppicing and woodland management over long periods of time.

4.3.71 Tree diseases are having an increasing impact, especially Ash dieback, which will have significant implications for historic landscape features as well as ecology. There is also a great financial impact, which diverts resources from other conservation work.

4.3.72 Some areas of ancient woodland have been replanted with conifers or non-native trees (Plantations on Ancient Woodland Sites (PAWS) and trees also have been planted on heathland as at Ashdown Forest. With increased concern about climate change and the desire to plant more trees, care will be needed to only plant them in appropriate sites so as not to unwittingly damage historic sites or herb rich swards. The species of tree planted should also be considered taking into account both the biodiversity and ecosystem benefits, as well as any potential natural capital.

4.3.73 Woodlands are seeing an increasing impact of deer browsing, both on the ground flora, but also the regeneration of the understorey. In addition, non-native grey squirrels can bark strip trees, causing them to become poor specimens and in some cases die.

Climate change

4.3.74 Wildfires are an increasing problem with drought conditions more common. This is a particular threat to areas of heathland and pine woodland such as around Ashdown Forest. Climate change is causing increasingly erratic weather, with strong gales in the winter causing wind blow, excessive rain causing flooding and water ingress into historic buildings. Drought in the summer is causing the decline and loss of sensitive species. A resilience framework outlining organisational adaptation to climate change and weather extremes, which outlines multiple capabilities and response approaches in response to changing extremes, may be beneficial in the long term (IPCC, 2012).

Water management

4.3.75 Soil erosion on sandy soils in the north of the area is an issue. Compacted soils and impermeable clays exacerbate run off down the characteristic deep gills which incise the sandstone hills.

Air quality management

4.3.76 Atmospheric nitrogen deposition is an increasing problem and is thought to be impacting species in Ashdown Forest. This is partly caused by road traffic, but also air travel and Gatwick airport is very close to the periphery of the NCA.

Development pressures

4.3.77 Development pressure is ever present, particularly near the large towns such as Crawley, Horsham, East Grinstead, Hastings and Tunbridge Wells. Gatwick Airport is at the northwest end of the area and creates direct (noise and pollution), as well as indirect impacts on the NCA. The AONB designation helps provide some protection.

4.3.78 There is a strong need to maintain the dispersed settlements which are so characteristic in the High Weald and resist inappropriate development pressure. There are development pressures from housing and infrastructure, particularly near the larger towns such as Crawley, Gatwick Airport and Horsham and this can affect both historical and natural features if not carefully planned.

Opportunities for funding and support

4.3.79 Agri-environment grants cover much of the land in the High Weald NCA. Some sites are in Countryside Stewardship (CS), some Higher Level Scheme (HLS) and others Woodland Grant Schemes (WGS). It is hoped that many of these will continue under the new Environmental Land Management Scheme (ELMS).

4.3.80 Heritage Lottery Fund and Landfill Tax Credits have been successfully sought for heritage and natural environment projects.

4.3.81 Tourism is not a major draw in the NCA, although there are a number of attractions from National Trust and privately owned heritage properties, Bewl water for sailing and paddle boarding, Bedgebury Forest has mountain bike and walking trails, and Ashdown Forest is a popular recreational site, and this brings income to the local area through hotels, bed and breakfast establishments, tearooms and pubs and souvenir shops. Hastings and Bexhill are attractive as seaside resorts with their associated infrastructure, such as Clambers Play Centre and an aquarium.

4.3.82 Farm shops are a common feature of the area, ranging from free range eggs by the farm gate, to large concerns, selling meat, vegetables and fruit from the area.

4.3.83 The High Weald Way and Sussex Border Path cross part of the area. Climbing is popular at Harrison’s Rock.

Key points from High Weald NCA

4.3.84 The High Weald NCA is not as well-known as other parts of England but is home to a unique and important landscape.

4.3.85 On first impressions, the area looks like little has changed, with its patchwork of small fields and timbered farmsteads, but unfortunately when one looks closer, there are significant issues affecting biodiversity and heritage in the area.

4.3.86 The objectives for management of the historic and natural environment are broadly similar. Many Priority Habitats have heritage interest. This can comprise historic landscape features as well as point features of heritage interest that may well be designated. These habitats, such as woodland, grassland, orchards, ponds and field boundaries, also often benefit from traditional management techniques such as the use of heritage breeds for grazing.

4.3.87 Landscape-scale changes relating to Nature Recovery can be well-informed by consideration of the historic landscape of the High Weald. This can both help to pinpoint ancient field systems ripe for enhancement as well as indicating areas where the heritage would be vulnerable to change, such as tree planting and measures relating to catchment flood management.

4.4 Orton Fells National Character Area

General description of Orton Fells NCA

4.4.1 Orton Fells NCA (17) is situated on the border of Cumbria and North Yorkshire on the Pennines covering 29,280 ha. It is a sparsely populated area, with only 5,861 residents, living in the scattering of small villages and towns such as Kirby Stephen, Newbiggin on Lune, Ravenstonedale and Great Asby. It is bordered in the west by the M6 motorway between Tebay and Shap and the uplands of the Yorkshire Dales to the east.

4.4.2 9% of the NCA falls within the Lake District National Park, while much of the eastern area has recently been added to the Yorkshire Dales National Park (2015). In addition, some of the northern area falls within the North Pennines AONB. Small areas around Tebay and Kirby Stephen are outside the National Park and AONB. The Lake District National Park is also designated as a World Heritage Site.

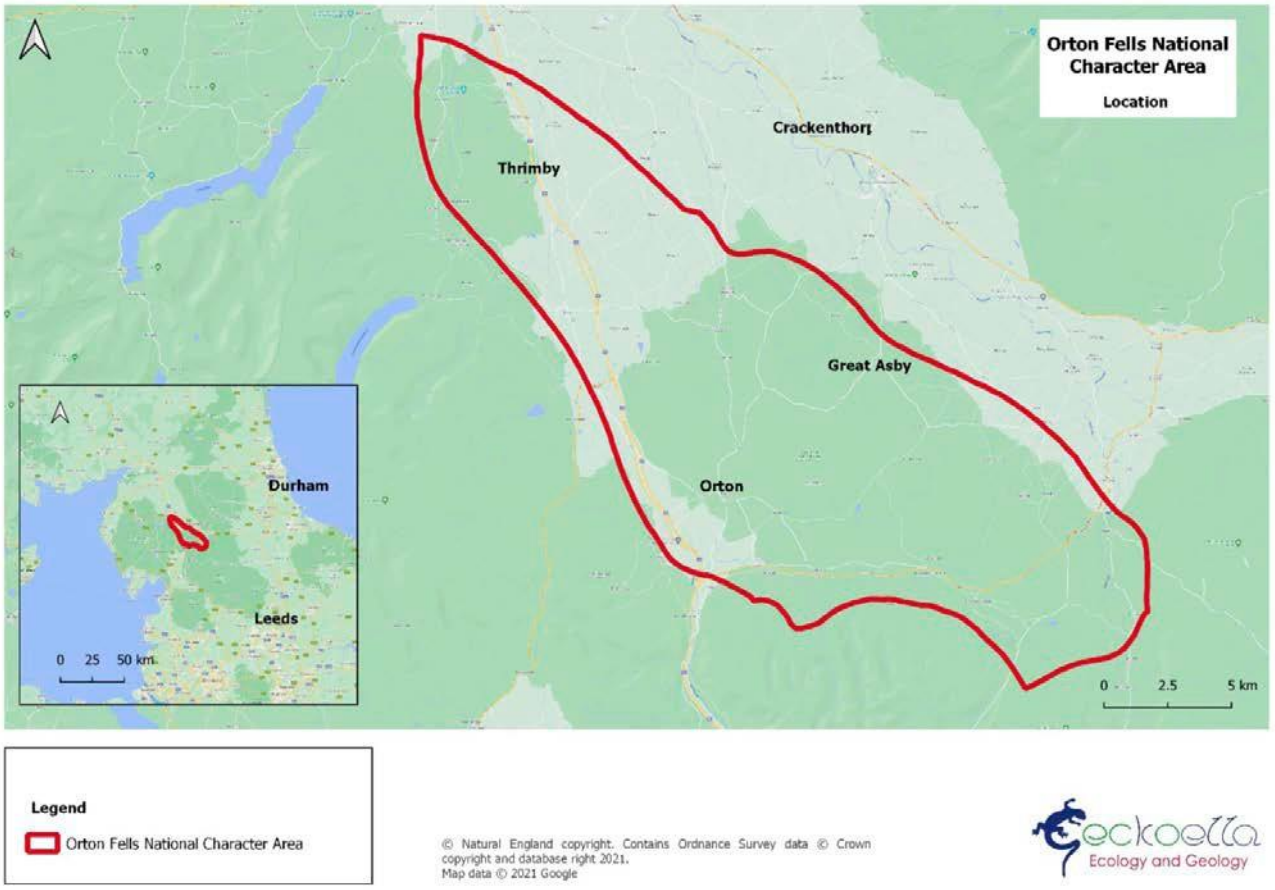

Figure 52: Location of Orton Fells National Character Area

4.4.3 Orton Fells are a “complex mix of limestone plateau, pavement, upland heath and calcareous and acid grassland”. (National Character Area profile: 17: Orton Fells, 2013). They are situated on an exposed, relatively treeless landscape, with scattered settlements, mostly situated along the river valleys of the Eden and Lune.

4.4.4 The area has an exceptional assemblage of archaeological earthworks, including lynchets, ridge and furrow, dykes and tracks as well as historic farmsteads with associated dry-stone walls.

4.4.5 The area is identified as one of the most tranquil in England (with the exception of the M6 corridor) and is relatively little visited compared to the Lake District to the west and the better-known areas of the Yorkshire Dales to the south and east. There are sweeping views to the mountains of Cumbria and to the Howgill Fells and North Pennines near Mallerstang.

4.4.6 It has one of the best examples of relatively intact limestone pavement and karst scenery in the UK, as well as herb rich calcareous grassland and hay meadows. There are also extensive areas of upland heath, purple moor grass and rush pasture as well as acid grassland.

Figure 53: Limestone pavement at Orton Fells

4.4.7 Narrow gills (streams) cross the area and join the two main rivers of the Lune and Eden. Woodland (predominantly ash and wych elm) can be found in these more sheltered areas. Most settlements are also found in the valleys, although there are scattered 18th century farmsteads on the open plateau.

4.4.8 There are few roads, and many are long and straight (due to the construction of the enclosures in the 18th century) or would have originally been drovers' roads to move sheep to market.

4.4.9 130 Scheduled Monuments are scattered across the landscape, while there are 324 Listed Buildings. There are few large estates and gardens, although three are registered at Lowther Castle, The Image Garden and Askham Hall.

4.4.10 Almost all the farming activity is pastoral, with 67% of the area grazed by sheep or cattle; dairy farming is present in the river valleys. Arable farming has increased from 1% to 3% in the past decade but is still only a marginal activity. Horse rearing is increasing in some areas. Common grazing is an important activity for many farmers in the upland areas, where 18% of the NCA is registered Common. 47% of the farms are under 50 ha, although one third are over 100 ha, and there is a growing trend of merging holdings to make larger farms. The lack of cultivation has helped protect the archaeology and land-use history of the NCA.

4.4.11 Development pressure is generally very low and there is strong protection through the planning system, due to the majority of the NCA being situated in either the Lake District or Yorkshire Dales National Park or the North Pennines AONB. (The National Park was only extended in 2015 to add the majority of the NCA and so this has helped ensure inappropriate activity does not impact the NCA).

4.4.12 There is a growing demand for the installation of wind turbines as a method of generating renewable energy. However, the National Park and AONB designations generally mean that they are not considered acceptable on landscape grounds.

4.4.13 The NCA is mostly of an elevation between 180 and 300 metres, although the highest point is 412m above sea level.

4.4.14 Only 5% of the area is wooded; well below the national average, although not untypical for much of the uplands and not changed a great deal in recent years, although there are some shelter belts of conifers which have been established in the past decades.

4.4.15 Quarrying is limited in the NCA, except for a large granite quarry at Shap and some smaller limestone quarries on the periphery.

4.4.16 The transport corridor of the M6 and the west coast mainline has seen some upgrading and increased traffic. However, the installation of electric gantries has had the benefit of reducing diesel emissions from trains.

4.4.17 Tourism is not as developed in Orton Fells NCA as in nearby National Park areas, although there are holiday cottages, bed and breakfasts and pub establishments which cater for visitors. There are however perhaps less dramatic draws for visitors at Orton Fell than in other parts of the north of England. It remains however, a very good area for outdoor recreation such as walking, cycling, horse riding and watching wildlife, especially with 27% of the area having open access.

Orton Fells National Character Area*	
Heritage Designations	
Site	**Total**
Number of Scheduled Monuments within Statutory Biodiversity Designations	20
Number of Scheduled Monuments in Priority Habitats	32
Number of Scheduled Monuments in NCA	102
Number of Listed Buildings in NCA	326
Area of NCA	29,280 ha

Percentage covered by Statutory Biodiversity Designations		
Statutory Designations	**Percentage Cover**	**Hectare**
NNR	1.2%	351 ha
SAC	11%	3,125 ha
SSSI	13%	3,856 ha
Total	13.2%	3,860 ha

Percentage covered by Non-Statutory Biodiversity Designations		
Non-Statutory Designations	**Percentage Cover**	**Hectare**
Ancient Woodland	1.3%	368 ha
Total	1.3%	368 ha

Percentage Covered by Priority Habitat		
Priority Habitat	**Percentage Cover**	**Hectare**
Wood Pasture and Parkland	2.7%	379 ha
Blanket Bog	0.1%	35 ha
Coastal and Floodplain Grazing Marsh	>0.1%	1 ha
Deciduous Woodland	1.5%	434 ha

Good Quality Semi-improved Grassland	0.5%	150 ha
Grass Moorland	4.4%	1,283 ha
Limestone Pavement	0.8%	246 ha
Lowland Calcareous Grassland	0.8%	236 ha
Lowland Fens	0.4%	103 ha
Lowland Heathland	0.3%	96 ha
Lowland Meadows	>0.1	28 ha
No main habitat but additional habitats present	1.6%	472 ha
Purple Moor Grass and Rush Pasture	0.2%	58 ha
Traditional Orchard	>0.1%	3 ha
Upland Calcareous Grassland	2.6%	754 ha
Upland Flushes, Fens and Swamps	0.2%	72 ha
Upland Hay Meadow	0.4%	127 ha
Upland Heathland	10%	2,884 ha
Total	26.6%	7,364 ha

Percentage covered by Heritage Designations			
Heritage Designations	**Percentage Cover**	**Hectare**	**Percentage of which is Priority Habitat**
Parks and Gardens	1.9%	553 ha	27.8%
Scheduled Monument	0.6%	171 ha	46%
World Heritage Site	8.7%	2,535 ha	7.8%
Total	9.3%		

*Detailed figures for Orton Fells National Character Area can be found in Appendix 5

Table 16: Overview of Orton Fells National Character Area

Heritage of Orton Fells NCA

4.4.18 Orton Fells NCA has seen human activity as early as the Neolithic period, although it was the Romano-British period when settlements began to be built in the valleys.

4.4.19 Many of the early irregularly shaped enclosures were constructed between the 14th and 18th centuries, although the large rectilinear fields on the limestone plateau were enclosed from open or common land in the 18th century. Dry stone walls constructed of limestone are one of the most important features of the NCA. Although some have been lost or have collapsed, many are being maintained through agri-environment grants.

4.4.20 Some of the earliest examples of human activity were the construction of Bronze Age stone circles, cairns and burial mounds, many of which are well preserved, partially due to the lack of arable cultivation in the area.

4.4.21 There are well preserved sections of Roman roads as well as several pillow mounds for breeding rabbits, visible in the landscape.

4.4.22 Historic landscapes are particularly well represented at Orton Fells and includes an “exceptional assemblage of archaeological earthworks, such as lynchets, ridge and furrow, dykes and tracks and historic farmsteads”. (Orton Fells LCA, Yorkshire Dales National Park).

4.4.23 The monasteries at Gaythorne and Asby introduced much of the area’s sheep grazing and developed high quality fleece. Both sites later became Granges after the dissolution of the monasteries and are now important historic farmsteads. Lowther Castle and Pendragon Castle are both Grade I Listed Buildings and Lowther Castle is a draw to visitors. Unfortunately, one of the biggest losses in the past century was of historic parkland, with two thirds being reverted to farmland.

4.4.24 Registered Parkland and Gardens are limited in the NCA to three sites at Lowther Castle, the Image Garden and Askham Hall. There are however high-quality areas of parkland also at Orton Hall and Holme House, which are also of importance for biodiversity.

4.4.25 Farms are generally built of local limestone in a vernacular style typical to this part of the Pennines. Earlier farmsteads tend to be in the valleys, while the exposed uplands were only enclosed generally in the 18th century and so these farmsteads are more recent. It is also in valleys of rivers such as the Lune and Eden where the villages are found, although most are small, such as Newbiggin on Lune or the market town of Kirby Stephen. White Hill, Crosby Gill and Ravenstonedale have interesting medieval buildings. There are 324 Listed Buildings and structures in the NCA which are listed Grade I, II* and II.

4.4.26 Part of the Carlisle to Settle railways crosses the NCA, but the disused railway line from Tebay to Darlington is of particular interest due to the impressive Smardale viaduct.

4.4.27 The area of Orton Fells NCA which is in the Lake District National Park is also within The English Lake District World Heritage Site. This WHS was designated by UNESCO in 2017 as a mountainous side shaped by agro-pastoralism, which inspired the art and literature of the Picturesque and later Romantic movements. This also triggered early efforts to conserve beautiful landscapes.

4.4.28 Turner painted Orton Scar and more recently, the sculptor and environmentalist Andy Goldsworthy created some enigmatic art works by building a series of stone sheepfolds to highlight the link between history and geology.

Figure 54: Smardale viaduct in Orton Fells NCA

4.4.29 The Historic Land Characterisation of Orton Fells describes the “exposed, open unsettled and treeless landscape”. One of the most characteristic elements of the Orton Fells landscape are the exceptional limestone pavements at areas such as Great Asby Scar and Smardale Gill, both of which are designated National Nature Reserve (NNR) and Special Area of Conservation (SAC). Another area of synergy between the cultural and natural environment are the upland hay meadows, with their herb rich grassland, traditional field barns and dry stone walls.

Biodiversity of Orton Fells NCA

4.4.30 Orton Fells NCA includes areas of very high nature conservation value, particularly for their upland habitat and their associated species, such as Upland Heathland, Upland Calcareous Grassland and Limestone Pavement.

4.4.31 11% (3,129 ha) of the NCA is European designated as SAC for Limestone Pavement, the River Eden tributaries and North Pennine meadows.

4.4.32 There are two National Nature Reserves (NNR) at Great Asby Scar and Smardale Gill totalling 1% (347 ha) of the area. These are designated for their extensive intact Limestone Pavement, Calcareous Grassland and ash/wych elm woodland.

4.4.33 There are 19 SSSIs covering 13% (3,868 ha) of Orton Fells and they are generally in improving conditions as judged by Natural England.

4.4.34 In addition, there are 46 Local Nature Reserves (LNRs) covering a further 2% (589 ha) of the area.

4.4.35 The main driver for biodiversity is the underlying carboniferous limestone and karst scenery as well as the area's rivers and their tributaries.

4.4.36 Herb rich upland hay meadows are one of the most important features in the area and include rarities such as globeflower, a variety of orchids and ladies' mantle with meadow cranesbill, oxeye daisies and salad burnet. These habitats are maintained through dedicated conservation action and traditional small-scale farms undertaking upland grazing.

Figure 55: Curlew in a moorland habitat

4.4.37 Associated traditional barns are roosts for bats, barn owls and house martins. In the valleys, many of the species-rich grasslands have been agriculturally improved by the application of fertiliser or reseeding, and there is an increasing trend towards arable and larger farms within the NCA.

4.4.38 The area has one of the most extensive intact areas of limestone pavements in Britain, with its characteristic clints and grykes, where wildflowers and shrubs survive out of reach of grazing sheep. In the past, some areas were quarried for rockeries and ornamental stone, but this was prohibited in the 1980s. Two of the best areas, Great Asby Scar and Smardale Gill are now designated as NNR and SAC. Scotch and northern brown argus butterflies are found in these areas.

4.4.39 Extensive areas of acid grassland and heathland are another feature of Orton Fells, and this is the largest area of Priority Habitat in the NCA. Peaty soil in some areas has Blanket Bog and Upland Flushes as well as areas of Purple Moor Grass and Rush Pasture. These upland areas are notable for several wading and upland birds, such as breeding golden plover, curlew, lapwing, redshank, snipe and red grouse. Peat could also be important for palaeoecological records and for archaeological preservation in Orton Fells as has been found in peatlands elsewhere such as Exmoor.

4.4.40 The springs and flushes are of importance as is Sunbiggin Tarn which is a rare example of a marl lake, with associated alkaline fen and petrifying springs, which are of national importance.

4.4.41 Woodlands and standard trees tend to be a rare feature of the limestone plateau, but are instead found in the gills and river valleys. However, they only cover 5% (1,398 ha) of the area and only 1% are recorded as ancient woodland. There are some modern coniferous shelterbelts on the exposed areas which are generally considered incongruous and of limited ecological value. The most important woodland habitats are ash and wych elm woodland, although both are now sadly threatened by tree diseases.

4.4.42 Veteran or ancient trees are limited to a few areas of parkland at Lowther Castle, Orton Hall and Holme House and records show that Wood Pasture and Parkland has declined by two thirds in the past century. There are occasional maiden ash trees in the landscape, which are important features. Traditional Orchards are limited to small areas around the villages in the Lune and Eden valleys.

Geodiversity of Orton Fells NCA

4.4.43 The geology of the Orton Fells is of international importance and is one of the key reasons for many of the area’s designations.

4.4.44 The NCA is a tilted plateau of Carboniferous Limestone, displaying some of the best and most extensive examples of karst scenery in Britain. This includes limestone pavements with clints and grykes, screes, sink holes and scars of which two are designated as National Nature Reserves; Smardale Gill and Great Asby Scar.

Smardale is regarded for its outstanding populations of northern butterfly species. There are an additional 3 geological SSSIs and 7 Regionally Important Geological or Geomorphological Sites (RIGS) in the area.

4.4.45 To the west at Ash Fell, there are sandstone outcrops and at Shap, an outcrop of granite occurs, surrounded by metamorphic rocks. The River Lune flows down the border with the northern gritstones of the Howgill Fells.

4.4.46 During the Pleistocene period, ice scoured the area and left the plateau of Orton Fells. Large boulders (glacial erratics) of granite and other rocks were transported to the district by the ice sheets. Drift deposits were also laid down and much of the heathland and acid grassland is found in these areas.

4.4.47 Tufa has been deposited by petrifying springs at Sunbiggin Tarn.

4.4.48 There are small (generally disused) limestone quarries which would have been used for building stone and the inferior stone used for dry stone walling or for aggregate.

Relationships between heritage, biodiversity and geodiversity

4.4.49 Because of the nature of the area, Orton Fells NCA has changed far less than many NCAs. Farming remains traditional upland grazing, with very little cultivation and as such, there are less direct impacts on the archaeological remains or the wildlife interest than in more intensively farmed areas.

4.4.50 Orton Fells remains very traditionally managed with only minor changes in the past years. Although farms are increasing in size, with people merging units into larger holdings, 47% are still under 50 ha though, while one third of holdings are over 100 ha (excluding common rights).

4.4.51 The majority of the landscape is managed by grazing in one way or another, as has happened for millennia. This helps maintain the archaeological resource; protected under grassland or heathland in a way which is not possible under cultivation or forestry. Culturally sensitive farming, maintaining traditional breeds and methods of husbandry, provides important continuity and protection.

4.4.52 Extensive grazing with sheep and cattle provides the optimum management in most cases for archaeology and nature conservation. Overgrazing can cause loss of floristic diversity, erosion of archaeological features and soil loss. Within the karst scenery the right level of grazing is important to prevent woody vegetation from developing, but it can also impact on wildflower diversity. Fencing has been recently installed to reduce sheep browsing on the NNR at Great Asby Scar,

4.4.53 In addition, an overgrazed landscape exacerbates runoff and flooding downstream. One particular issue is for wading birds which often ground nests and overgrazing can expose the young to predators or make the area unsuitable for breeding.

4.4.54 Trampling and poaching of riverbanks is an issue on some farms and causes sediment to enter the rivers and gills, damaging water quality and the ability for fish to spawn. In addition, habitats such as reedbeds and marginal vegetation can be browsed off, with impacts on many species that rely on this.

4.4.55 On the limestone pavements, quarrying and theft of limestone for rockeries and ornamental stone was a problem for biodiversity, heritage, and landscape until the 1980s, although it has now been stopped including through protection of some areas by designation as a SSSI/SAC.

4.4.56 One of the main areas of concern in the NCA is the impact ash dieback and other tree diseases might have on the relatively small areas of ancient woodland and ash standards. The disease could easily create an impoverished woodland community as well as make great changes to the local landscape and wildlife associated with it.

4.4.57 Unsympathetic rigid blocks of conifers have been planted in places as a shelter belt. These can detract from the landscape as well as affecting the underlying historic interest and wildlife value.

4.4.58 Conservation of traditional structures including traditional barns and dry stone walls bring heritage and wildlife benefits – and often requires heritage skills.

Natural capital of Orton Fells NCA

Cultural services

4.4.59 The NCA is one of the most tranquil in England and has very good measures for dark skies, this provides a sense of place to those who live and visit the NCA.

4.4.60 The area has high natural capital values associated with landscape, recreation and wellbeing, for visitors and residents, although it is not as extensively visited as other nearby National Parks.

4.4.61 At Shap, there is a large granite quarry which provides employment in the area. The quarries are used as an important teaching resource by schools and universities.

Supporting services

4.4.62 Woodlands only cover 5% of the NCA. Natural England is restricting grazing in some areas of limestone pavement to encourage scrub regeneration. There are also plans to diversify areas of coniferous shelterbelts by planting broad leaved trees, partly to reduce their landscape impact by softening their harsh edges.

4.4.63 Upland hay meadows, calcareous grassland and acid grassland are important habitats and much sits within farmed landscapes, whilst common land tends to be upland heath and purple moor grass and rush pasture. There has been a loss of species rich grassland to farm improvement, re-seeding and fertiliser application, although this is not as great at Orton Fells as many parts of the UK. The broad roadside verges are often very botanically rich and require appropriate conservation management.

Regulating services

4.4.64 13% of the soils in the NCA are peaty and have one of the greatest capacities to store carbon of all soils, if in good condition. In addition, other semi natural habitats with undisturbed soils are of great value for carbon sequestration.

4.4.65 Air quality is generally very good in the NCA, although the M6 corridor does create atmospheric nitrogen and disturbance. The west coast main line which runs beside it has recently been electrified, reducing diesel emissions from trains.

4.4.66 Flooding can be an issue in towns downstream, such as at Carlisle and Lancaster and there are real opportunities to carry out natural flood management, sometimes known as ‘Slow the Flow’.

Provisioning services

4.4.67 Food provision is a key form of natural capital from the NCA. This includes the breeding of livestock. 75% of farming is focused on grazing while 16% is dairy farming. Most farms on the NCA are uncropped.

4.4.68 Orton Fells is the watershed between the River Eden, which flows to the Solway Firth near Carlisle and the River Lune which flows to Morecambe Bay. There are many small tributaries (gills) which join the two main rivers. Most of the rivers are in very good ecological condition and have excellent water quality and act as good water provision. These rivers provide potable water for Carlisle and the surrounding areas.

Management challenges

Farming, agriculture and grazing

4.4.69 Although arable farming remains a small-scale enterprise, the increase has the potential to create issues due to increased runoff into rivers and loss of soil on slopes or in periods of flood, as well as to degrade some of the valued cultural and natural assets. Water is abstracted from the rivers further downstream and hence one third of the NCA is declared a Nitrate Vulnerable Zone (NVZ), restricting agricultural inputs. Some areas of peat soils are exposed and eroding, particularly in the areas of blanket bog. Past drainage and over grazing are a particular threat and releases carbon into the atmosphere.

4.4.70 Overgrazing, as well as compaction, particularly by sheep, is a major cause of flooding as it reduces percolation and infiltration and causes surface runoff and flash floods. Some rivers have been artificially straightened and dredged and this has cut them off from their flood plain, exacerbating flood risk.

Woodland management

4.4.71 Non-native invasive species are not an issue in the NCA, although the tree disease, ash dieback, could have a devastating impact on the dominant tree in the area.

4.4.72 Some woodlands are over grazed by sheep and this is preventing regeneration and impacting on the ground flora.

Soil management

4.4.73 One third of soils are classified as vulnerable to poaching, overgrazing and being lost by water and aerial erosion if poorly managed.

Peatland restoration

4.4.74 Another issue has been the draining of blanket bogs which reduces their ability to act as a natural sponge, slowly releasing water. Catchment-scale measures to ‘slow the flow’ including peatland restoration can bring benefits for biodiversity and heritage as well as helping to protect communities from flooding. However, there are potential issues with landscape-scale changes that early discussions can help to address.

Opportunities for funding and support

4.4.75 The prime source of funding remains agri-environment grants. Some sites are in Countryside Stewardship (CS), some Higher Level Scheme (HLS) and others Woodland Grant Schemes (WGS). In the past, Environmentally Sensitive Area (ESA) payments were also important, but this has now ceased. It is hoped that many of these will continue under the new Environmental Land Management Scheme (ELMS).

4.4.76 Agri-environment grants are for example helping fund the restoration of dry stone walls, with 688km of wall and hedge under agreement.

4.4.77 Heritage Lottery Fund and Landfill Tax Credits have been successfully sought for heritage and natural environment projects.

4.4.78 Agri-tourism is a growing area of income generation, although is perhaps more limited at Orton Fells compared to the more popular parts of the Lake District and Yorkshire Dales. There is however an increasing interest in outdoor recreation, with various long distance paths attracting visitors and bringing funds. This can include holiday cottages, camp sites, pubs and bed and breakfast establishments as well as farms selling meat, eggs and vegetables from the area.

Key points from Orton Fells NCA

4.4.79 Orton Fells has a rich and valuable landscape and natural environment which tend to dovetail harmoniously, with little tension between the heritage and wildlife assets. The karst scenery has significant ecological, geological and heritage value.

4.4.80 The area has changed much less than much of England, but there have been losses, particularly relating to the ecological value of the area.

4.4.81 Priority Habitats have significant heritage interest, not least in the requirement for knowledge of traditional breeds and management techniques to conserve important features.

4.4.82 Traditional structures, including stone walls and field barns that are so emblematic of the landscape and history of the area provide important habitat for some key species, such as bats and swallows.

4.4.83 Landscape-scale projects, for example catchment management initiatives including peatland restoration, would benefit from prompt engagement with heritage as well as ecological specialists to ensure that opportunities for heritage conservation are maximised and any issues identified at an early stage.

4.5 Bedfordshire Greensand Ridge National Character Area

General description of Bedfordshire Greensand Ridge NCA

4.5.1 Bedfordshire Greensand Ridge NCA (90) is relatively small compared to other NCAs at 27,337 ha, comprising an 'island' of greensand running SW to NE, encircled by the heavy clay of the Bedfordshire and Cambridgeshire Claylands.

4.5.2 It straddles the three counties of Buckinghamshire, Bedfordshire and Cambridgeshire, north of London. The new town of Milton Keynes (see Case Study for Campbell Park) is situated to the northwest, while Dunstable and Luton are immediately south of the NCA. Leighton Buzzard, Ampthill, Flitwick, Sandy and Gamlingay are within the NCA boundary and there is a resident population of 89,994 people.

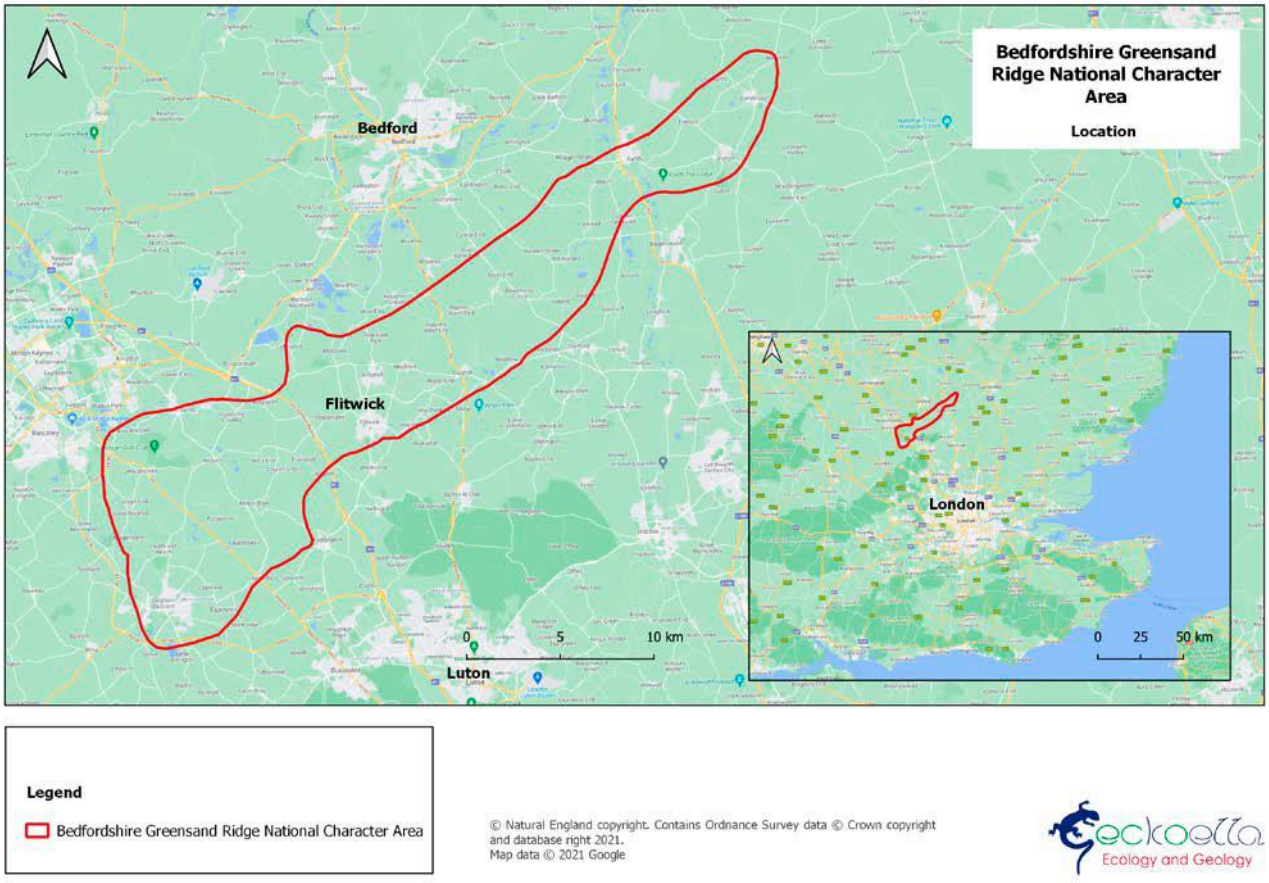

Figure 56: Location of Bedfordshire Greensand Ridge NCA

4.5.3 The underlying sandstone geology and topography are the main influence on the habitats of the area, from the amount of woodland, positioning of the historic estates, farming activity and watercourses. The free draining, infertile, neutral to acid soils are not ideal for many types of productive farming, although the use of modern inorganic fertilisers have meant that more intensive farming has been possible on the shallower dip slope to the south.

4.5.4 The NCA is not within an AONB or protected landscape, although some of the southern area forms part of the Luton greenbelt.

4.5.5 There is a steep scarp slope in the Marston Vale facing northwest towards the county town of Bedford. The undulating dip slope gives views south to the Chilterns. The NCA ranges from 20 metres to 150 metres above sea level.

4.5.6 The NCA is relatively heavily wooded with a mixture of deciduous beech and sweet chestnut dominated woodland and commercial conifers.

4.5.7 The area still has a wealth of historic landscapes, with a mixture of parkland, farmland, woodland interspersed with small settlements and vernacular architecture.

4.5.8 Perhaps the most unique feature is the amount of wood pasture and historic parkland, which is representative of the large number of historic estates that were established in the area. Linked to this are several estate villages, built by wealthy individuals such as the Duke of Bedford at Woburn Abbey and Lord Onslow.

Figure 57: Historic Wood Pasture on Greensand Ridge

4.5.9 Woodland is another component which is relatively prolific in the Greensand Ridge NCA, with 17.5% of the area wooded, either by broad leaved or conifer trees.

4.5.10 There are three main rivers in the NCA, the River Flit and River Ouzel, which both rise on the Chilterns, while the River Ivel starts on the East Anglian chalk. In addition to the rivers, the Grand Union Canal crosses the area and links the Midlands and London. The rivers tend to be heavily canalised (deepened and straightened) and eventually flow into the Great Ouse which meets the sea at The Wash in East Anglia.

4.5.11 Arable farming now dominates the flatter dip slope, making up 40% of the area, with large fields and many boundaries removed. On the steeper scarp slope, sheep and cattle grazing is more common and historic field patterns are better preserved. Dairy farming is declining. Market gardening and horticulture is a component of the river valleys in the NCA. Horse and pony paddocks are increasing, particularly near towns and villages.

4.5.12 46% of the farms are under 20 hectares in size, indicative of the number of small holdings in the NCA. However, perhaps more important is the increasing number of farms which are being merged into large commercial holdings, with 73% of the agricultural land owned and managed by 39 estates. 40% of the NCA is ploughed for crops such as wheat, oil seed rape, maize and barley. Cultivation is focussed on the shallower sloping land to the south and has increased considerably since the use of inorganic fertilisers which have allowed the infertile sandy soils to grow crops. Quite a lot of historic parkland has been ploughed up and the trees that have been left, damaged by ploughing under the canopy.

4.5.13 Sheep grazing has increased a little in extent and tends to be on the greensand scarp. Cattle are less frequent, although they would generally be the favoured domestic stock for grassland management for wildlife. Horse and pony grazing has increased significantly, particularly close to the larger towns and has resulted in the degrading of some sites due to their grazing patterns and tendency to ring bark trees.

4.5.14 Dairy farming has declined, although there are small pockets on the river valleys, where there can be problems with slurry entering rivers.

4.5.15 Pig breeding is a feature of some areas, including outdoor breeding on sandy soils, but can create water quality problems as well as damage buried archaeology.

4.5.16 Horticulture and vegetable growing occurs on the peaty soils. There are some large greenhouses on the River Ivel.

4.5.17 46% of the farms are less than 20 ha, due to the number of smallholdings and horse paddocks. However, there is a strong trend towards merging farms into large holdings and 73% of the farmland is now owned and managed by only 39 operators, who are generally very commercial with little opportunities for wildlife.

4.5.18 There are no internationally designated sites for nature in the NCA and only 2% of the area is designated SSSI, lower than many other National Character Areas and well below the national average of 7%. There are however some important Priority Habitats and species within the Bedfordshire Greensand Ridge.

4.5.19 There are only 36 Scheduled Monuments (SMs) within the NCA, well spread across the district and these range from moated sites, Roman forts, motte and bailey, medieval fisheries, Iron Age hillforts to long barrows. This is a lower number of scheduled features than comparable areas, although there are many non-scheduled historic records on the Historic Environment Records database, ranging from Neolithic axe and spear heads to anti-aircraft batteries.

4.5.20 Listed Buildings are well represented with 1,099 Grade I, II* and II, including Grade I Woburn Abbey and Wrest Park, to dovecotes, orangeries, churches, memorials and domestic houses.

4.5.21 There are several towns within the NCA such as Leighton Buzzard and Sandy as well as many smaller villages. Many of these are now ‘dormitories’ for those working in neighbouring towns as well as London, which is within easy commuting distance.

4.5.22 The Bedfordshire Greensand Ridge NCA is crossed by several roads and railways, including the M1, A6 and A5 as well as the East Coast Mainline railway and the Grand Union Canal. Luton and Stansted airports are close by, and planes fly over the NCA to land and take off. Its tranquility index is expectedly quite low, although it is still possible to find quiet places, especially at the eastern end in Cambridgeshire.

4.5.23 Many of the residents living in the Bedfordshire Greensand Ridge NCA, work elsewhere in surrounding towns and in nearby London, rather than in the local area. There is a very strong demand for development in the area, particularly due to its proximity to London and the Midlands as well as good road and railway transport links. The lack of protection from AONB or other designations, puts the area at higher risk of damaging development, although there is a green belt, protecting part of the area, north of Luton.

4.5.24 Tourism is an important element of the NCA and is a significant employer, particularly since the new Center Parcs has opened. The area remains important for outdoor recreation such as walking, cycling, horse riding and watching wildlife, although open access land is restricted.

Bedfordshire Greensand Ridge National Character Area*	
Heritage Designations	
Site	**Total**
Number of Scheduled Monuments within Statutory Biodiversity Designations	0
Number of Scheduled Monuments in Priority Habitats	8
Number of Scheduled Monuments in NCA	34
Number of Listed Buildings in NCA	1100
Area of NCA	27,317 ha

Percentage covered by Statutory Biodiversity Designations		
Statutory Designations	**Percentage Cover**	**Hectare**
NNR	0.5%	149 ha
SSSI	2.4%	649 ha
Total	2.6%	704 ha

Percentage covered by Non-Statutory Biodiversity Designations		
Non-Statutory Designations	**Percentage Cover**	**Hectare**
Ancient Woodland	5.2%	11,791 ha
Country Parks	>0.1%	14 ha
County Wildlife Sites	13.5%	3,696 ha
Local Wildlife Sites	0.4%	125 ha
Total	19.4%	5,301 ha

Percentage Covered by Priority Habitat		
Priority Habitat	**Percentage Cover**	**Hectare**
Wood Pasture and Parkland	7.8%	2,136 ha
Coastal and Floodplain Grazing Marsh	0.4%	115 ha
Deciduous Woodland	9.8%	2667 ha
Good Quality Semi-improved Grassland	1.8%	484 ha
Lowland Dry Acid Grassland	0.8%	223 ha
Lowland Fens	>0.1%	23 ha
Lowland Heathland	0.2%	43 ha
Lowland Meadows	0.5%	141 ha

No main habitat but additional habitats present	1.8%	499 ha
Purple Moor Grass and Rush Pasture	>0.1%	17 ha
Traditional Orchard	>0.1%	23 ha
Total	23.3%	6,373 ha

Percentage covered by Heritage Designations			
Heritage Designations	**Percentage Cover**	**Hectare**	**Percentage of which is Priority Habitat**
Parks and Gardens	7%	1,936 ha	45.6%
Scheduled Monument	0.6%	170 ha	48.2%
Total	7.7%		

*Detailed figures for Bedfordshire Greensand Ridge National National Character Area can be found in Appendix 5

Table 17: Overview of Bedfordshire Greensand Ridge National Character Area

Heritage of the Bedfordshire Greensand Ridge NCA

4.5.25 The Bedfordshire Greensand Ridge NCA, positioned on key transport corridors, north of London has a long history of habitation and there is plentiful evidence of human endeavour.

4.5.26 The area is of relatively high historic interest, focussed on the large number of estates and their associated cultural features.

4.5.27 Earliest records are from the Neolithic period, with flint finds such as arrow and axe heads and earthworks. During the Bronze Age, long barrows and tumuli were constructed and in the Iron Age, a hillfort was built at Sandy. A Roman town and fort as well as various settlements were constructed and Watling Street (now the A5), crosses the NCA.

4.5.28 Hunting estates were established on the greensand, partially attracted by the free draining soil and extent of woodland.

4.5.29 During the Middle Ages, monasteries were built in the area, most notably the Cistercian Abbeys of Woburn and Warden and they controlled much of the sheep grazing and woodland management and started developing agriculture as well as several rabbit warrens (pillow mounds).

4.5.30 Ridge and furrow farming is distinctive on flatter areas and is particularly well preserved at Hockliffe and Potsgrove, while many other areas have been lost to the plough. Land on the steeper scarp tends to be more pastoral, while arable farming is much more dominant on the dip slope. In this area, many hedges have been lost and woodlands grubbed up to make way for wheat and oil seed rape.

4.5.31 Following the Dissolution of the Abbeys, the ecclesiastic estates were broken up and given to the aristocracy and much of what we see today, emanates from that period. There are many landed estates such as Ampthill Park, Chicksands Priory, Flitwick Manor, Woburn Abbey, Wrest Park, Stockgrove House, Old Warden Park, and Gamlingay. Many include estate villages or model villages, and Woburn Abbey demolished the original hamlet to create a new village, now a popular and elegant Georgian place to visit. Arts and Craft architecture is also a feature of some sites.

4.5.32 Capability Brown was engaged in the design of many historic parks such as Ampthill Park and these are one of the most distinctive features of the Bedfordshire Greensands. Miles of estate walls surrounds many of the stately homes and are a feature of the area. 11 of the sites are Registered Parks and Gardens.

4.5.33 Small settlements are often built of brick and tile and sometimes in the local ironstone with thatch roofs, in the local vernacular style. A relatively high proportion of buildings are listed Grade I, II* and II and range from domestic houses, to churches, orangeries, memorials and statues, dovecotes and stately homes.

4.5.34 The NCA states that 79% of farm buildings remain unconverted as dwellings or offices.

4.5.35 The Historic Landscape Characterisation of the NCA describes, “enclosed agriculture, orchards, horticulture and woodlands with dispersed settlements and towns in the valleys”.

4.5.36 The plethora of stately homes and their associated villages and parklands are a very distinctive feature of this part of Bedfordshire.

4.5.37 Woodland coverage is higher than the national average, perhaps partly due to the lack of inherent fertility in greensand, making farming less productive, but maybe also due to shooting and hunting which was and still is popular with wealthy landowners.

4.5.38 Farmland has changed a great deal, with many farms merging into large, commercially managed arable holdings, particularly on the flatter areas to the south. Traditional boundaries have been swept away and woodlands, parklands and orchards grubbed up.

4.5.39 Scattered settlements in the local style are still a feature of the area, but the towns have expanded and changed significantly and in large parts have become dormitories for the large urban centres such as London, Milton Keynes, Luton and Peterborough. This has brought an added demand for activities such as horse paddocks, golf courses and cycle routes.

Figure 58: Wrest Park, an example of a landed estate in the Bedfordshire Greensand Ridge NCA

Biodiversity of the Bedfordshire Greensand Ridge NCA

4.5.40 The Bedfordshire Greensand Ridge NCA is of moderate biodiversity value, although a great deal more diverse than the neighbouring Bedfordshire and Cambridgeshire Clay-lands.

4.5.41 The most significant biological feature and Priority Habitat is Wood Pasture and Parkland and there is more than in any other NCA in England.

4.5.42 There are no internationally designated sites for wildlife (Special Area for Conservation (SAC)/ Special Protection Area (SPA)/Ramsar sites) in the NCA.

4.5.43 There is a 149 ha National Nature Reserve (NNR), called King's Wood and Rushmere, managed by the Wildlife Trust, Greensand Trust and Bedfordshire County Council. It was designated as the largest area of ancient woodland in the county, with small leaved lime, lily of the valley, white admiral, purple emperor and adder. The area abuts a Country Park, which in December 2020 was added to the NNR, totalling 191 ha of protected site.

4.5.44 There are 16 Sites of Special Scientific Interest (SSSIs) in the NCA covering about 2% of the area, compared to a national average of 7%. The SSSIs are scattered across the area, although quite disjointed. These include Flitwick Moor, King's Wood, Coopers Hill and Gamlingay Wood and are designated for a variety of features including ancient woodland, Wood Pasture and Parkland, Coastal and Floodplain Grazing Marsh and Lowland Heath. They are generally in improving condition, although 7% are declining.

4.5.45 14% of the area (123 sites) are declared Local Nature Reserves (LNR) or Sites of Nature Conservation Interest (SNCI).

4.5.46 The area has a 17.5% woodland cover, which is significantly higher than the national average of about 10% in England and 13% in the UK. There are also several hedgerow trees and some ancient/veteran standards as well as the previously mentioned wood pasture. 11% of the woodland is broadleaved and tends to be dominated by beech, sweet chestnut, sessile and pedunculate oak, with an understorey of holly, birch and rowan and occasional small leaved lime and hornbeam. Only 5% of the woods are considered ancient woodland and this is focussed on King's Wood and Rushmere.

4.5.47 Conifers are a major component of the NCA, often driven by the commercial interests of the large estates. The Duke of Bedford was particularly interested in forestry and planted many conifers but had concerns about the impact of soil erosion after clear felling and so devised a scheme where different age classes of tree were planted in blocks. (This was also trialled on his large estate called Tavistock Woodlands on the River Tamar in Devon).

4.5.48 There are ongoing works to create a large community forest known as the Vale of Marston Forest, with aspirations to increase woodland coverage to about 30%.

4.5.49 The valleys have a number of streams and rivers, including the River Ivel which rises in the East Anglian chalk and the River Ouzel and Flit which rise in the Chilterns. The rivers flow into the Great Ouse. Much of the length has been straightened and deepened, negatively impacting the wildlife value of the habitats. In addition, the Grand Union Canal crosses the NCA. There are some important riparian habitats such as fen and wetland and coastal and floodplain grazing marsh as well as wet woodland with rare trees such as black poplar at Flitwick Moor.

Figure 59: Purple emperor butterfly, found in ancient woodland in the Bedfordshire Greensand Ridge NCA

4.5.50 There are several Priority Habitats in the NCA, including Deciduous Woodland, Lowland Acid Grassland, Lowland Meadow, Lowland Heath, Wood Pasture and Parkland, Coastal and Floodplain Grazing Marsh, Lowland Fen and Purple Moor Grass and Rush Pasture. These are well dispersed across the NCA and are in a variety of conditions. Conifers and scrub are impacting some of the heathland, while non-native invasive species are a problem on some riparian habitats.

4.5.51 The majority of the cultivated land is of low biological value, with few headlands. Hedges are often lost or degraded, but there remain a few sites with some notable species such as the arable weeds; sand spurrey, leaved fluellen, sand spurrey as well as grey partridge and skylark (Bedfordshire and Luton Biological Records Centre).

4.5.52 Other species of note include dormice in Maulden Wood, adders and slow worms on heathland sites, bats in buildings and hollow trees, mistletoe on fruit trees and poplar, and wood lark, nightjar and natterjack toad on acid heaths.

4.5.53 Herb rich grasslands are limited and very dispersed. They have reduced in area significantly and the increase in the number of horse paddocks is causing further loss.

Geodiversity of the Bedfordshire Greensand Ridge NCA

4.5.54 The underlying geology of the Bedfordshire Greensand Ridge comprises mainly Lower Greensand (Woburn Sand) sandstones and ironstones dating from the early Cretaceous period, approximately 112 to 124 million years old. Many of the sediments contain distinct 'speckly' grains of the green-brown iron silicate mineral, glauconite. Overall, the geological strata form a northwestern facing scarp, with a gentle dip slope running southwards. The Greensand Ridge forms a topographic high and rises above the surrounding softer clay sediments belonging to the Bedfordshire and Cambridgeshire Clay lands.

4.5.55 Soils within the NCA are generally neutral to slightly acidic, although there are drift deposits of boulder clay capping the sand in places which causes local variation in soil types, and occasionally may be calcareous.

4.5.56 In the Flit Valley, there are peat deposits which have been used by the market gardening and horticultural industry. In addition, there is gravel extraction along some sections of river valleys.

4.5.57 At Woburn, deposits of 'Fuller's Earth' type clays were used in the Middle Ages to extract grease from sheep's wool. More recently, these clays been quarried for use in the paper milling and chemical industry.

4.5.58 A small localised outcrop of Cretaceous limestone at Shenley is of considerable importance to palaeontologists on account of its fossil brachiopod fauna.

4.5.59 There are two Geological SSSIs and 15 Regionally Important Geological and Geomorphological Sites (RIGS) in the NCA.

Relationships between heritage, biodiversity and geodiversity

4.5.60 The number of areas of historic park in the NCA is exceptional. A large part of the Bedfordshire Greensand Ridge is under the management of historic landed estates. This has resulted in a significant number of large houses (sometimes dating back to the Cistercian Abbeys), associated designed parkland and gardens and in some cases, estate villages. There are more Wood Pasture and Parklands than in any other NCA in England.

4.5.61 Significant changes include a shift from pastoral farming to arable agriculture on the south facing aspect as the use of inorganic fertilisers has allowed cultivation of areas that would previously not have been suitable. Impacts for both biodiversity and heritage include a 29% reduction by area of historic parkland.

4.5.62 Associated with this agricultural intensification has been the loss of many hedges and field boundaries in the post-war expansion to larger fields to aid mechanised farming. Those hedges that remain are often in poor condition, heavily flailed and with many gaps.

4.5.63 Species-rich neutral and acid grasslands and lowland meadows have also been agriculturally improved or converted to arable farming, whilst areas of heath and deciduous woodland have been converted to conifer plantations, affecting the wildlife and landscape.

4.5.64 Woodland management by traditional techniques such as coppice helps to provide conditions that are suitable for light demanding birds, flowers and invertebrates. There are cultural impacts arising from the decline in heritage skills in coppice management and an intangible cultural benefit from maintaining these skills within the community.

4.5.65 Ridge and furrow and archaeological features have been levelled or damaged by the plough.

4.5.66 Historic buildings with their many voids and places for bats and birds to roost are also extremely important as is seen at many of the historic estates, farms and dwellings

4.5.67 Areas of heath and deciduous woodland have been converted to conifer plantations, affecting the wildlife and landscape.

4.5.68 Sweet chestnut is characteristic of managed woodlands of the Bedfordshire Greensand NCA and was introduced into the UK by the Romans. The tree and naturalised within South East England and provides benefits to native wildlife, as well as providing heritage value, in that roasted chestnuts are a traditional part of Christmas dinner in England and are often sold on the streets during winter.

Natural capital of the Bedfordshire Greensand Ridge NCA

Cultural services

4.5.69 The area is nationally important for recreation in various forms. There are golf courses at Rushmere and Stockgrove. Woburn Abbey and its safari park are probably the biggest attractions in the NCA. In addition, in 2015, a large new Center Parcs complex was constructed near Woburn and this brings a large number of families to the area from all over the UK. Boating is popular on the Grand Union Canal, while horse riding is popular across the ridge. While there are no long-distance paths in the NCA,

the Greensand Ridge Walk is locally popular, as is off road cycling. However, only 4% of the land (mostly Forestry Commission land) is publicly accessible and there are no registered Commons in the Bedfordshire Greensands NCA.

4.5.70 Two main rivers in the NCA, the River Flit and River Ouzel, both rise on the Chilterns, while the River Ivel starts on the East Anglian chalk. The rivers tend to be heavily modified and eventually flow into the Great Ouse which meets the sea at The Wash in East Anglia. The Grand Union Canal crosses the area and links the Midlands and London and there are some small man-made and ornamental lakes scattered across the landscape, particularly associated with the historic estates.

Supporting services

4.5.71 The Marston Vale Community Woodland aims to create 30% woodland cover and is one of eight such sites in Britain. This would include areas of the greensand, as well as the clay-lands, increasing habitat for wildlife.

4.5.72 Heathlands comprise important habitat supporting a range of important species, including invertebrates and reptiles such as adder, slow worm and common lizard.

Regulating services

4.5.73 A small band of peat in the Ivel Valley, as well as habitats such as woodlands and heathland, will store and sequester carbon. However, cultivation of peat in the Ivel Valley for market gardening, and intensive agriculture generally will cause the release of carbon to the atmosphere.

Provisioning services

4.5.74 There is a large aquifer under Greensand Ridge, which is an important site for extraction for potable water, as well as for industry and agriculture.

4.5.75 There are several springs which rise at the foot of the greensand where it meets the underlying clay. Of note is a spring which is locally known as Boiling Pot, due to the bubbles rising up.

4.5.76 Many of the woodlands (particularly the coniferous woods) are managed commercially by the Forestry Commission and private estates. The Duke of Bedford was very much at the forefront of the forestry movement and came up with innovative ways of maximising production, while protecting the soils underneath. In particular, the

Bedford/Hutt Scheme ensured that clear felling and the resultant erosion did not occur, by planting different age classes together so there is continuous tree cover. Woodchip is a significant industry now at Woburn Abbey Estate.

4.5.77 The greensand is quarried as a key constituent of glass and there are large factories associated with the quarrying at Leighton Linslade. Sand is also extracted for the building industry at the village of Heath and Reach.

Management challenges

Farming, agriculture and grazing

4.5.78 Many areas of high conservation value for both heritage and biodiversity would benefit from more extensive grazing with sheep and cattle providing the optimum management in most cases for archaeology and nature conservation. Where poaching or overgrazing occurs, it can have negative impacts on both areas of interest and create erosion of the light sandy soils and environmental damage.

4.5.79 Pollution of the watercourses is high as benchmarked against the Water Framework Directive assessment (The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017). Most of the issues relate to agriculture, particularly dairy farming and arable cultivation but are also impacted by sewage discharge. 100% of the NCA is covered by a Nitrate Vulnerable Zone (NVZ), meaning restrictions on fertiliser applications and sewage discharge.

4.5.80 Soil erosion is a significant concern, particularly on light sandy soils and there is a real lack of organic matter to bind them. The sandstone soils are leached due to being left exposed in the winter months through arable farming.

Woodland management

4.5.81 Ancient and veteran trees are being damaged by ploughing close to the trunk, cabling work or being felled due to health and safety concerns. In other cases, they are being lost to competition from fast growing species such as conifers or ash and sycamore regeneration. Management of veteran trees can involve trade-offs between ecology and heritage. Different specialists may see trees in decline as unsightly, while for nature, where important species such as saproxylic (deadwood) invertebrates, bats and birds, trees would ideally be left in situ with rot features celebrated.

4.5.82 Coppice is being neglected and the lack of woodland management is meaning that many light demanding birds, flowers and invertebrates are not able to thrive due to excess shade.

4.5.83 Overgrazing by deer (mostly roe and muntjac, but also fallow in some areas), is preventing understorey development and damaging the ground flora. Grey squirrels are also bark stripping many trees, especially beech, hornbeam, oak and sycamore, preventing them from growing to maturity.

4.5.84 Tree diseases, particularly ash dieback is killing many trees and there are risks from other diseases such as Phytophthora and sweet chestnut blight.

Climate change

4.5.85 Summer drought is being exacerbated by climate change, leading to more regular fires on the heathland areas (deliberate and accidental), and the coniferous woodlands are also threatened. This also releases carbon to the atmosphere.

Water management

4.5.86 Soils runoff into the local rivers and on to roads during periods of wet weather. Arable cultivation is only possible with the use of inorganic fertiliser applications. Nutrient and sediment runoff have pollution implications. There are also flood risk implications for the surrounding towns arising from water.

Noise and air quality management

4.5.87 Regarding air quality, atmospheric pollution is high. Nitrogen dioxide levels are raised by strategic roads such as the M1, A5 and A6 which runs across Greensand Ridge. The East Coast Mainline railway line also runs across the area, along with other local train lines, but the section is electrified and so has less impact than the road network. There are two airports at Luton and Stansted nearby. Transport links also cause noise pollution. There are also minor issues with dust and pollution from local quarries.

4.5.88 The East Coast Mainline railway line runs across the area, along with other local train lines. The M1, A5 and A6 cross Greensand Ridge and this causes noise pollution as well as nitrogen dioxide atmospheric pollution. Noise pollution is also generated by planes taking off and landing at Luton and Stansted airports.

4.5.89 The land is not considered to have a high tranquility index by CPRE, due to urbanisation and transport infrastructure, as well as noise from planes going to Luton and Stansted airports.

Development pressures

4.5.90 The Bedfordshire Greensand Ridge NCA has significant development pressures, due to its proximity to large urban centres, position on major transport corridors and its lack of designated Protected Landscapes. There is less protection for the landscape than in other parts of England due to the lack of designations such as AONB. Development includes housing, industry and road and rail infrastructure. Tourism is also expanding with a large Center Parcs recently built at Woburn Abbey. These all have the potential to adversely impact wildlife and heritage if not carefully managed.

Tourism and recreation

4.5.91 Hillforts are suffering from pedestrian erosion, as well as root damage from self-seeded trees and gorse/bracken. In some cases, burrowing animals (badgers, foxes and rabbits) are digging into archaeological features and undermining the remains.

Opportunities for funding and support

4.5.92 For the natural and historic environment, the prime source of funding remains agri-environment grants. Some sites are in Countryside Stewardship (CS), some Higher Level Scheme (HLS) and others Woodland Grant Schemes (WGS). It is hoped that many of these will continue under the new Environmental Land Management Scheme (ELMS).

4.5.93 There has been a lower take up of agri-environment grants for the Historic Environment than in many comparable NCAs. This may partly be due to estate managers not wishing to be restricted by the requirements for environmental land management included in the schemes, and since intensive agriculture and other business ventures can be relatively profitable within the NCA as compared to more marginal NCAs.

4.5.94 Heritage Lottery Fund and Landfill Tax Credits have been successfully sought for heritage and natural environment projects.

4.5.95 Tourism is a significant income stream, with several heritage attractions such as Wrest Park and Woburn Abbey. The new Center Parcs site draws many visitors. There is an increasing interest in outdoor recreation, with Greensand Ridge path, a variety of bridle paths and woodland attractions as well as golf courses. There are several holiday cottages, pubs and bed and breakfast establishments.

4.5.96 Biodiversity Net Gain and other development control and enhancement measures, including green infrastructure levies, Section 106 funding and Nature Recovery Mapping all have the potential to provide valuable funding for conservation as well as enabling strategic landscape enhancement to benefit biodiversity and heritage.

Key points from Bedfordshire Greensand NCA

4.5.97 The Bedfordshire Greensand Ridge NCA is an area rich in historic estates and the associated cultural landscapes of parkland, woodland, estate villages and vernacular architecture. In turn, this has provided the places for many species to thrive.

4.5.98 There have been many changes in the Bedfordshire Greensand Ridge NCA, relating to modern development and transport infrastructure and the intensification and ploughing up of much of the farmland. The remaining heritage-rich areas may be refuges for wildlife as well as cultural features in an otherwise intensively managed landscape, where many historic features and hedge boundaries have been lost, as well as significant loss of wood pasture and historic parkland.

4.5.99 4.5.99 There is significant commonality between the heritage and biodiversity sector in terms of seeking to influence development control and agriculture sectors at the landscape scale. The objectives for management of the historic and natural environment at the site level are also broadly similar. There are however some issues where, for example, aesthetic parkland management considerations differ to ecological prescriptions. Discussion and engagement between the disciplines can generally find ways to work through these.

4.6 Exmoor National Character Area

General Description of Exmoor NCA

4.6.1 The Exmoor National Character Area (145), straddles the counties of Somerset and Devon, covering 130,373 hectares (ha). It covers the whole of Exmoor National Park, but additionally extends west to the Atlantic coast between Barnstaple and the Taw/ Torridge estuary and north to Combe Martin. It also includes areas to the south such as Bampton and South Molton, up to the North Devon link road, covering much of the upland area as well as parts of the North Devon Area of Outstanding Natural Beauty (AONB).

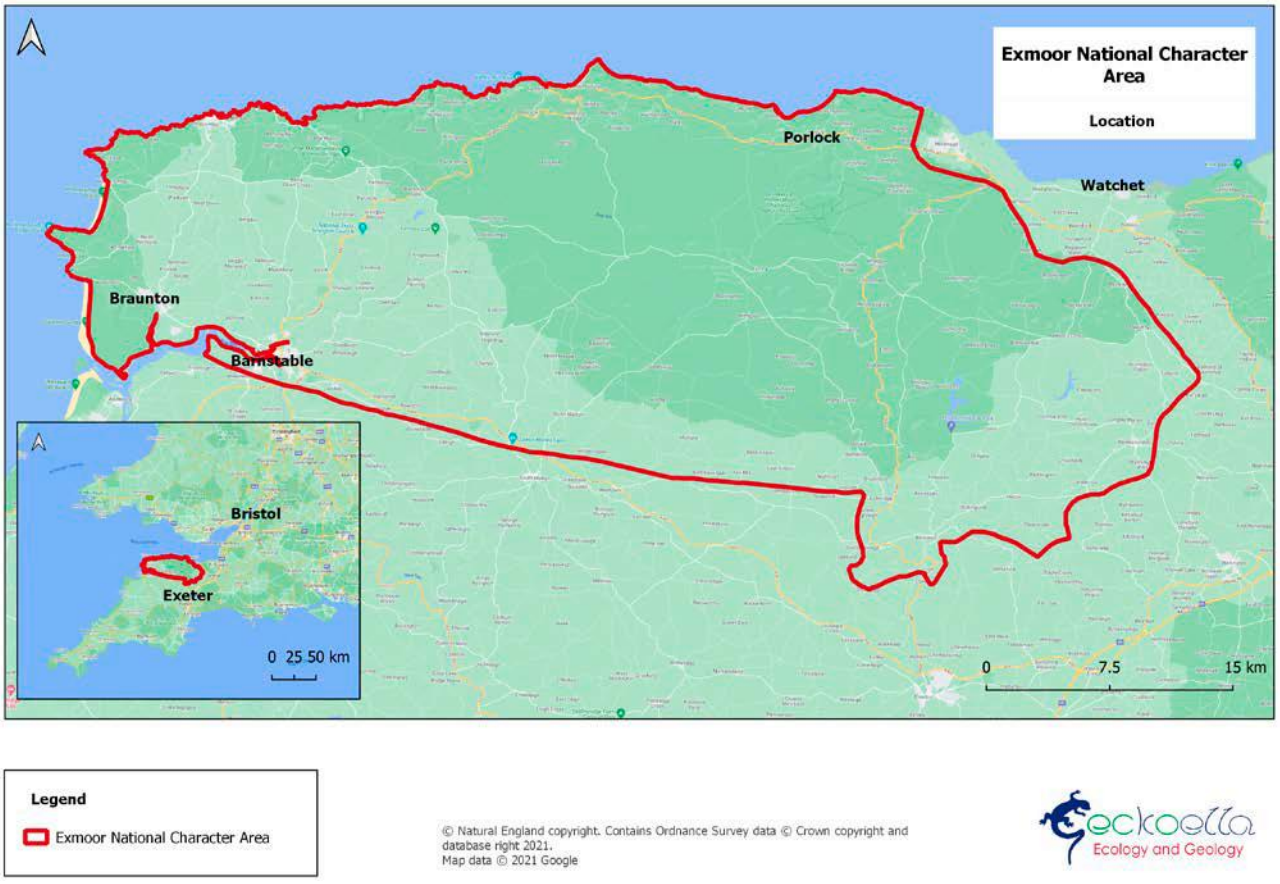

Figure 60: Location of Exmoor National Character Area

4.6.2 The landscape of Exmoor NCA is very varied, with high cliffs, heather moorland and pasture. Steeply incised, generally wooded coombes bisect the area and include important rivers such as the headwaters of the River Exe. The Taw/Torridge estuary forms the southwestern boundary of the NCA. Tall beech hedge-bound fields along with stone and earth Devon banks with deeply incised narrow lanes, and there are scattered stone and cob hamlets and villages.

4.6.3 Exmoor is a very rural area with limited developments with isolated dispersed farmsteads often representing shrunken former settlements. The NCA scores exceptionally high in terms of tranquility and has a sense of remoteness and openness, particularly on undeveloped areas of the coast and the central uplands. There are distant views across different landscape settings and the cliffs offer superb views of Lundy Island and the Welsh coast on the other side of the Bristol Channel.

4.6.4 The majority of the farmland in the NCA is a dark skies reserve with 87% pastoral land, with sheep being the dominant grazier, although beef cattle and ponies are also grazed. Only 4% of the area is under arable cultivation, mostly in the south and west of the area. 77% of farms are owner occupied and 58% of farms are larger than 100 ha in size. There are a growing number of smallholdings in the NCA. 4,816 ha (4%) of the NCA is registered common land, much less than the comparable area of Dartmoor. The National Trust is a significant landowner, owning 5,468 ha of the NCA as well as two thirds of the coastline.

4.6.5 There are some major trunk roads (notably the A361 North Devon link road) and development - ranging from the moderate size town of Barnstaple and seaside resorts such as Croyde, Ilfracombe and Minehead, to small towns and villages. Parts of the coast outside the National Park are peppered with caravan and holiday resorts. The population of the NCA is low and totals 83,500 including the towns of Barnstaple, Lynton, South Molton, Ilfracombe, Braunton and Dulverton.

4.6.6 The NCA is rich in historic and cultural features, many of which are designated as Scheduled Monuments (254) or Listed Buildings (2,328). There are also six Registered Parks and Gardens.

4.6.7 The natural environment is also exceptionally rich, with both national (Site of Special Scientific Interest (SSSI) and international (Special Area of Conservation (SAC)) designations. There are also three National Nature Reserves (NNR). Exmoor's moorland also is designated as Principal Archaeological Landscapes (PALs).

4.6.8 An Exmoor National Park Assessment (ENPA) was conducted to assess the condition of Exmoor's moorland PALs. It concludes that the condition is complex and while the issues of vegetation and scrub encroachment, land management and human/ livestock erosion or damage have emerged as the most prevalent, the relative severity of issues affecting condition of the PALs varies (Balmond, 2015).

4.6.9 Geologically, the area is dominated by Devonian Old Red Sandstone, although there are also areas of slate, mudstone and an area of culm measures to the south of the NCA. The highest part of the NCA is at Dunkery Beacon which rises to 513 metres above sea level - the highest area in southern England outside Dartmoor. Additionally, the highest cliff in England is found at Great Hangman at 318 metres high. In the west of the NCA, there are impressive Quaternary sand dune systems at Braunton Burrows and Saunton Sands.

4.6.10 Since the Enclosures Act and modern agriculture, as well as the introduction of commercial conifers, large areas of once rich habitat has been lost. Development for housing and industry has less impact however than many other NCAs.

4.6.11 The Exmoor NCA contains or overlaps with the following Protected Landscapes, which include with heritage interest and objectives:

- Exmoor National Park sits entirely within the Exmoor NCA and comprises over half the area.
- The North Devon Coast Area of Outstanding Natural Beauty (AONB) within this area extends from the Taw and Torridge estuary to the Exmoor National Park.
- North Devon Heritage Coast runs along almost the entirety of the NCA. Although not a statutory designation, Heritage Coasts are afforded protection through development control, and Local Authorities and stakeholders work together on their conservation.
- The North Devon Biosphere Reserve, designated under UNESCO's Man and Biosphere Programme on the basis of the special landscapes and wildlife areas, sustainable development and a rich cultural heritage.

Figure 61: Typical heath and coastal habitats within Exmoor National Character Area

Exmoor National Character Area*	
Heritage Designations	
Site	**Total**
Number of Scheduled Monuments within Statutory Biodiversity Designations	113
Number of Scheduled Monuments in Priority Habitats	129
Number of Scheduled Monuments in NCA	254
Number of Listed Buildings in NCA	2,328
Area of NCA	130,286 ha

Percentage covered by Statutory Biodiversity Designations		
Statutory Designations	**Percentage Cover**	**Hectare**
NNR	1.3%	1,785 ha
SAC	10.1%	13,129 ha
SSSI	15.6%	20,308 ha
LNR	<0.01	38 ha
Total	15.6%	20,352 ha

Percentage covered by Non-Statutory Biodiversity Designations		
Non-Statutory Designations	**Percentage Cover**	**Hectare**
Ancient Woodland	<0.01%	381 ha
Total	<0.01%	381 ha

Percentage Covered by Priority Habitat		
Priority Habitat	**Percentage Cover**	**Hectare**
Wood Pasture and Parkland	<0.01%	7.7%
Blanket Bog	2%	2649 ha
Coastal and Floodplain Grazing Marsh	0.4%	456 ha
Coastal Saltmarsh	0.1%	147 ha
Coastal Sand Dunes	0.7%	965
Coastal Vegetated Shingle	<0.1%	2 ha
Deciduous Woodland	6.4%	8373 ha
Fragmented Heath	<0.1%	87 ha
Good Quality Semi-improved Grassland	0.6%	826 ha
Grass Moorland	2%	2576 ha
Lowland Calcareous Grassland	<0.1%	5.6 ha
Lowland Dry Acid Grassland	0.4%	513 ha
Lowland Fens	<0.1%	122 ha

Lowland Heathland	1.2%	1503 ha
Lowland Meadows	0.2%	197 ha
Maritime Cliff and Slope	1.2%	1519 ha
Mudflats	<0.1%	10 ha
No main habitat but additional habitats present	1.8%	2395 ha
Purple Moor Grass and Rush Pasture	0.4%	554 ha
Reedbeds	<0.1%	3 ha
Traditional Orchard	0.1%	106 ha
Upland Flushes, Fens and Swamps	0.1%	138 ha
Upland Hay Meadow	<0.1%	3 ha
Upland Heathland	7.3%	9551 ha
Total	25%	32,697 ha

Percentage covered by Heritage Designations			
Heritage Designations	**Percentage Cover**	**Hectare**	**Percentage of which is Priority Habitat**
Parks and Gardens	1.3%	1785 ha	16.6%
Scheduled Monuments	0.1%	158.7 ha	
Heritage Coast	10.6%	13,878 ha	37.7%
Total	12.1%		

*Detailed figures for Exmoor National National Character Area can be found in Appendix 5

Table 18: Overview of Exmoor National Character Area

Heritage of Exmoor NCA

4.6.12 The Exmoor NCA has a very rich assemblage of historic features, ranging from Mesolithic worked tools and late Neolithic standing stones and worked tools, through Bronze Age barrows and Iron Age hillforts, Roman iron workings, medieval field systems, designed parks and gardens to second world war pill boxes.

4.6.13 Due to the extensive management of the moorland and some surviving pasture areas many features in these areas appear well preserved, having suffered less damage from ploughing and clearance than other areas. Although this is less evident in the more farmed landscapes to the south. This is because there has been considerable loss on the moorland and permanent pasture areas from ploughing and moorland improvement. However, damaging activity has generally been less than in the more intensively farmed areas where you would expect there to have been more settlement activity as the land would have been more hospitable (so the loss there is also greater).

4.6.14 Due to changes in grazing agriculture the remaining moorlands and pastures are further at risk and vulnerable to damage by bracken and scrub encroachment, which can impact on both the biodiversity of the habitat and the historic features present (Historic England, 2022). There is also the additional threat from changes in leisure activities, leading to off road vehicles, cyclists and visitor erosion (Historic England, 2022).

4.6.15 Designated cultural heritage assets include those listed below:

- 254 Scheduled Monuments
- 6 Registered Parks and Gardens
- 2,328 Listed Buildings
- 16 villages are partly covered by Conservation Areas, including Porlock Weir, Dunster, Parracombe, Dulverton, Lynmouth and Porlock.

4.6.16 Exmoor National Park Authority also defines “Principal Archaeological Landscapes” (PALs), which were initially established to inform the Agri-environment scheme in liaison with Natural England (then England Nature). PALs can be used to identify areas of high-quality archaeological / historic importance, recognising the significance of the landscape-scale setting for heritage assets (ENP, 2015). These areas are used to target projects and inform development control and other activities.

4.6.17 The key characteristics of the heritage in Exmoor NCA comprise:

- High archaeological interest. Evidence of extensive early occupation - Mesolithic evidence such as flints and hearths, Late Neolithic stone settings: standing stones, rows and circles; Bronze Age barrows, clearance, fields and settlement, Iron Age hillforts. Roman iron working and coastal forts and signal stations. Industrial heritage assets.
- A particularly rich archaeological resource on moorland and coastal heath, protected from modern agriculture.
- The landscape surrounding the moorland is largely medieval with predominantly pastoral fields and open field systems including the surviving Braunton Great Field, one of the few strip field systems surviving in Britain.
- The Saxon - Medieval Royal Forest of Exmoor.
- Medieval villages characterised by the use of cob, stone and thatch.

- 18th - 19th century enclosure by large estates of over 4,000 ha with model farms, estate buildings, coastal harbours, fishing industry and parks and gardens. Enclosures bounded by distinctive beech hedges.

- Registered Parks and Gardens at Arlington Court, Castle Hill, Nettlecombe Court, Staunton Court, Tapeley Park, Youlston Park and Dunster Castle.

- Cultural influences on e.g. RD Blackmore, (Lorna Doone), Henry Williamson (Tarka the Otter). Romantic poets such as Coleridge.

- Industrial development, lime kilns and the west Somerset mineral railway and the silver mining influences.

- Coastal leisure and tourism resorts such as Woolacombe, Ilfracombe, Lynton, Lynmouth.

- Heritage railways (West Somerset line from Bishops Lydeard to Minehead and Lynton and Barnstaple railway near Parracombe) and a funicular railway (Lynton to Lynmouth).

4.6.18 Heritage has influenced the landscape and wildlife of Exmoor in several different ways. These include:

- The legacies of ancient administration linked to the Exmoor Royal Forest, followed by the agricultural and industrial transformation at the heart of the former Exmoor Royal Forest.

- The beech tree windbreaks characteristic of enclosure and roadsides.

- Forest industries, such as charcoal burning relating to lime burning and industrial processes and the tanning industry. This shaped the existence of woodlands in the area.

- Common land and civil resistance that helped to limit enclosure changes.

- Moorland management traditions such as swaling (management of heather by burning), cutting and burning moorland peat as fuel; use of gorse and bracken in livestock husbandry.

- Post-medieval accelerations in the development of agriculture and forestry, particularly 20th century policies that most rapidly altered landscape through e.g. non-native conifer plantations, mechanised drainage and cultivation of moorland and other wetland; soil fertilisation and liming; subsidised stock levels; policies to protect landscape resources, habitats and species.

- 21st century transition towards peatland restoration (e.g. Exmoor Mires Project) to improve river flow and water quality (South West Water) and to remedy the hydrological, ecological and carbon-sequestration impacts of Victorian and 20th century activities to drain and exploit blanket bog habitats.

- Tourism and leisure development, particularly on the coast.

- Natural Flood Management projects to mitigate flood risks e.g. Holnicote Estate.

4.6.19 There is significant biocultural heritage within the NCA reflected in locally distinctive livestock breeds including Exmoor ponies, Exmoor Horn sheep, Devon Red and Devon cattle. Free-roaming stock is a particular feature of much of the unenclosed upland areas of the NCA and they are valued as part of the “greater Exmoor” local landscape heritage. The Exmoor Pony is particularly linked with moorland settings and very popular with residents and visitors alike. They are used as a key conservation grazier on many sites across the UK. Free-roaming stock is a particular feature of much of the unenclosed upland areas of the NCA.

Figure 62: Tarr Steps on the River Barle

Biodiversity of Exmoor NCA

4.6.20 The Exmoor NCA is of great significance for its wildlife. Much of the area is covered by a variety of Priority Habitats, including Upland Heath, Upland Acid Grassland, Mire, Deciduous Woodland, Sand Dune and Maritime Cliffs, which is reflected through statutory and non-statutory nature conservation designations.

4.6.21 Moorland often comprises a mosaic of upland heath, purple moor grass, rush pasture, heather and blanket bog. Since 18C agricultural improvements then purple moor grass has become dominant over heather and mire habitats. Nonetheless there remains a significant resource of peatlands, blanket bog and other wetlands and the River Barle is also a high-quality upland acidic river for biodiversity.

4.6.22 High maritime cliffs and slopes include Great Hangman, the highest cliff in England, and grade into coastal heath inland. Further west along the coast the largest sand dune expanse in England is found at Braunton Burrow, grading into coastal shingle, saltmarsh and floodplain grazing marsh habitats

4.6.23 Notable species include most species of UK bat, notable birds such as hen harrier, and the Dartford and wood warblers and fine assemblages of heathland flora. Notable insects, which include the heath and high brown fritillary butterflies. There is an iconic red deer population. West Atlantic woodland habitat hosts rare lichens, mosses and ferns due to the clean air, and endemic species of whitebeam.

4.6.24 Offshore, the area is important for grey seals and cetaceans such as bottlenose dolphins. Gannets, shags, kittiwakes and fulmar hunt for food and there are important sub-littoral communities. Peregrine falcons' nest on the inaccessible cliff ledges.

4.6.25 Designated biodiversity sites in Exmoor NCA comprise:

- 3 Special Areas of Conservation (SAC). Area = 10% / 13,129 ha. (Exmoor Heaths SAC, Exmoor and Quantock Oakwoods SAC, Braunton Burrows SAC.)
- 3 National Nature Reserves (NNR). Area = 1% / 1,736 ha. (Dunkery and Horner Wood NNR, Hawkcombe Woods NNR, Tarr Steps Woodland NNR.) Braunton Burrows was previously a NNR and is now part of a UNESCO Biosphere Reserve
- 33 Sites of Special Scientific Interest (SSSI). Area = 16% / 20,352 ha.
- 769 Local Nature Reserves. Area = 8% / 9,759 ha.
- Marine Conservation Zone- Bideford to Foreland Point

Figure 63: Glenthorne House - a listed building set in a geological SSSI and coastal woodland on Exmoor

Geodiversity of Exmoor NCA

4.6.26 The geodiversity of the upland massif of Exmoor is dominated by Devonian Old Red Sandstone, especially the characteristic purple-red sandstones assigned to the Hangman Sandstone which form most of the dramatic cliff scenery of the eastern Exmoor coast. Further west, there are areas of slate and mudstone on the Atlantic North Devon coast and Permo-Triassic deposits occur in the Vale of Porlock. Carboniferous limestone, often siliceous in parts, has a relatively limited outcrop in the south of the NCA.

4.6.27 The coast is as important for geodiversity as wildlife, with Braunton Burrows comprising an important geomorphological feature as well as hosting Quaternary coastal sand deposits. Coastal exposures at Mortehoe and west of Porlock display impressive geological structures related to the Permo-Triassic Variscan Orogeny; Porlock Bay is also renowned for its extensive pebble shingle ridge, an active geomorphological feature. The ridge area is no longer maintained to keep the sea at bay, and saltmarsh flats and creeks are becoming re-established landward of the ridge.

4.6.28 There are 12 geological and geomorphological SSSIs and a further 27 SSSIs notified for both their biodiversity and geodiversity interest. There are 99 Regionally Important Geological and Geomorphological Sites (RIGS). The Valley of the Rocks is one of many SSSIs valued for geological features as well as heritage and biodiversity (Exmoor4all, 2013).

Relationships between heritage, biodiversity and geodiversity

4.6.29 Some areas of the NCA are remote and challenging to farm. These areas, broadly coincide with the following NHLC types:

- Unimproved land
- Enclosed agricultural land (typically ancient form)
- Enclosed agricultural land (typically premodern form)

4.6.30 Areas with the least intensive / repeated change of boundary and field structures are least likely to have been impacted by mechanised cultivation and often retain some of the best biodiversity, including woodland, blanket bog or dwarf scrub, and often retain the highest concentration of significant archaeology sites and deposits.

4.6.31 There can also be trade-offs between heritage and biodiversity, including the following, which can be managed through discussions at the early stages in any scheme:

- A risk of damage to heritage assets during peatland restoration / re-wetting e.g. when installing dam structures. Advice should be sought to ensure that heritage requirements are also met, and any work required should be managed through an agreed plan.
- A risk of impact on specialist heathland species from clearing vegetation at heritage assets.
- Habitat creation or recreation, including woodland restoration and linking of habitats can impact on heritage assets and their settings. Likewise, inappropriate habitat management, such as increased grazing by cattle in winter to manage bracken can impact on earthworks of archaeological sites.
- Direct physical damage to heritage sites and habitats, or indirect impacts such as erosion caused / exacerbated by tree clearance and replanting, as part of fungal disease control measures (e.g. *Phytophthora ramorum* killing larch and other species, *Hymenoscyphus fraxineus* causing ash dieback).

4.6.32 Hunting has been carried out on Exmoor since at least the 11th century when it was a Royal Forest. An emotive subject, field sports remain ingrained in some rural communities and considered an integral part of local cultural heritage. Whilst there is an argument that some land management for game can have benefits for wildlife as compared to intensive agriculture, for example headlands for farmland birds. Other

aspects of field sports can have negative impacts, such as required vehicle access causing erosion of catch water and leats of water meadows, as well as potentially damaging any present historic assets. Intensive pheasant rearing in woodlands can also impact negatively on biodiversity.

4.6.33 Positively integrated management policy and practice can derive benefits for heritage and biodiversity that go beyond actions for each single interest. Examples include:

- Some of the parkland landscape areas coincide with a range of Scheduled Monuments and Priority Habitats. This includes Arlington (Scheduled Monuments and Priority Habitats); Castle Hill (Scheduled Monuments); Dunster Castle (Scheduled Monuments and Priority Habitats); Nettlecombe (Scheduled Monuments and Priority Habitats).

- An integrated partnership and management approach was achieved as part of the Exmoor Mires Project. Synergies delivered: protection of heritage assets as part of the scoping and design of works; additional archaeology research data and understanding (including new finds and reports) at the target sites; improved water resource quality; an influence on water flow patterns; stabilisation and restoration of peatland; benefits to biodiversity including species associated with short-term pools and expected longer-term benefits to peat-associated species communities; long-term funding and land management agreements.

- Adaptations of parking and access arrangements at visitor hotspots to avoid or lessen impact (chiefly through erosion) on the setting of heritage assets and the condition of habitats and associated biodiversity.

- Bracken management can benefit both the historic and natural environment if carried out in a sympathetic manner.

- The protection and repair of traditional buildings and stone walls is beneficial to the cultural environment, as well as for wildlife such as barn owls, bats, swallows and little owls.

- The removal of self-seeded scrub from earthworks such as at Grabbist Hill, Dunster, also benefits the valuable heathland community.

- Ancient and veteran trees often have a direct link with history, such as boundary markers, designed landscapes or historical management practices such as pollarding and coppicing. These trees have also become of great value for instance to rare lichens, mosses and ferns or the voids are used by bats and rare birds. Ensuring continuity of management and succession, where appropriate if they die, will benefit both the cultural and natural environment.

- Traditional orchards, particularly for cider, are still well represented on Exmoor, although some are beginning to fall into neglect or have been grubbed up for farmland/forestry. They have an important place for rare wildlife, such as deadwood insects and species associated with mistletoe. It is important to ensure their continuity wherever possible.

- Coastal defence work results in change and hence often trade-offs. Allowing natural processes to work, as seen at Porlock Marsh where the shingle ridge was breached, resulted in significant biodiversity and natural capital gains (including financial savings due to the reduction in active management). However, there were negative impacts on some of the heritage associated with the area, as well as freshwater habitats. Similarly, coastal erosion will sweep away historic features such as lime kilns, old harbours and clifftop hillforts as well as terrestrial habitats; the environmental and financial costs of active intervention however are often considerable. Active coastal processes can favour specialist habitats and reveal important geodiversity and heritage. For heritage assets, timely targeted active mitigation in terms of preservation by record will mitigate the risks of coastal erosion upon the historic environment and provide a raft of wellbeing and cultural services.

Natural capital of Exmoor NCA

Cultural services

4.6.34 The NCA includes areas within a National Park, AONB, Heritage Coast and Biosphere Reserve, as well as 109 km of the South West Coast Path. The area is of great importance for tourism and recreation. There are also three National Nature Reserves providing and promoting access to important habitats and species found in the area. The variety of opportunity accommodates contemplative recreation and outward-bound activities, such as upland walking, mountain biking and pony trekking, which although is positive for the local economy it does impact on the heritage assets in the area, such as increased soil erosion from well-worn paths. The coastal towns, such as

Minehead, Woolacombe, Croyde and Ilfracombe, offer a more traditional seaside holiday with many visiting the area for its fine sandy beaches. Canoeing, surfing, shooting and birdwatching are all common and popular activities supported by the area. Historic houses and gardens such as Dunster Castle and Arlington Court (National Trust) are a draw for visitors as are sites such as Tarr Steps, Hunters Inn, and Lynton.

4.6.35 Rewetting mires can benefit heritage since the peat itself is a significant heritage resource, preserving artefacts and pollen when in good condition, for example at the Chains near Simonsbath. Conversely, representing a later period in the 'time depth' of the area. The ditches that result in peat degradation sometimes have heritage value, providing examples of agricultural management from the 19th century (Historic England, 2021a).

4.6.36 The landscape and coastline of the Exmoor NCA has offered great inspiration through the centuries and to the present day. The open moorland and exquisite diversity of landscapes includes open unenclosed countryside and beautiful wooded river valleys. The wildness and remoteness have inspired romantic poets such as Coleridge and Wordsworth, authors such as R D Blackmore and painters and photographers through to modern times.

4.6.37 A landscape rich in archaeology, including bronze-age remains (with standing stones, stone settings and rows, and barrows) and historic settlements, such as Dunster, as well as deep-rooted agricultural and coastal traditions and cultures is valued by residents and visitors alike.

4.6.38 The NCA is a tranquil place of dark skies (Europe's first International Dark Sky Reserve), uncluttered views and is free, in most part, from major infrastructure. The dark sky reserve status makes it a popular area to view the night skies

4.6.39 The Field Studies Council run educational programmes on Exmoor and school and universities visit to study the geology, geography, biology and historic features. It is a popular area for Duke of Edinburgh Bronze and Silver expeditions. The area is also an active research area including in sustainable development and natural capital management.

4.6.40 Physical exercise, from walking, cycling, horse riding, canoeing, surfing and swimming are popular activities, although this doesn't come without impact on heritage assets. Many come for the fresh air and quiet nature of Exmoor to enhance their well-being. The South West Coast Path runs along the entirety of the coast and the Two Moors Way runs north to south across Exmoor and Dartmoor to the English Channel. and the Tarka Trail along the estuary of the Taw/Torridge. 14% of the NCA is Open Access Land.

Supporting services

4.6.41 Exmoor NCA provides habitats for notable species including bat, birds, heathland flora, rare insects, rare lichens, mosses and ferns.

Regulating services

4.6.42 Much of the area forms part of the upper Exe catchment with the peatland plant communities of the open moorland storing water and feeding the headwaters of a radial pattern of rivers. The Exe and its principal tributary the Barle flow south to the English Channel. On the western side of the NCA the rivers Yeo, Mile and Bray drain into the River Taw and into the Bristol Channel. The River Tone rises at Beverton Pond near the south eastern edge of the area.

4.6.43 The undeveloped character and relatively low-input nature of much of the land management across the Exmoor NCA is important for the Regulating services relating to water quality within the catchments. One third of the NCA is within a Nitrate Vulnerable Zone (NVZ) and hence restrictions on the application of fertilisers and discharge of sewage.

4.6.44 Significant resources have been put in place to trial various forms of natural flood management throughout catchments in Exmoor. Restored blanket bogs and mires, through grazing management and physical interventions help the wetlands to act as sponges and limit the rate of water flow from the upland areas. Incised man-made channels for streams have been removed and the water is instead allowed to spread over the valley and find its own route; ‘slowing the flow’. Timber has been placed in channels and beavers have been reintroduced by the National Trust at Holnicote to the catchment to act as ‘natural engineers’, by felling trees and creating dams.

4.6.45 Positive contribution of heritage features, in particular linear features such as hedgerows, historic boundary banks, lynchets, cross dykes and ramparts upon slowing runoff has been demonstrated in Blackdown Hills AONB and is likely to have an impact on flood defences across the Exmoor NCA.

4.6.46 Woodlands perform an important function in storing carbon, although tree planting on some habitats, particularly peat soils, can be counter-productive (Friggens et al., 2020).

4.6.47 The deeper peat soils, found across the extensive areas of blanket bog habitat, house significantly high volumes of atmospheric carbon, particularly along The Chains. Degraded peat, impacted by drainage, overgrazing or excessive swaling (burning) will

release carbon into the atmosphere. Across most of the NCA, greenhouse gas regulation through carbon stored in the soils is promoted through pastoral rather than arable land management.

Provisioning services

4.6.48 Exmoor NCA is a key source of water for the region. Clatworthy reservoir releases water into the River Tone for use by Taunton whilst Wimbleball reservoir supplies Exeter and parts of East Devon by releasing water into the River Exe. Most of the area is classed as having water available for abstraction, although the eastern part of the NCA is classed as either over licensed or having no further water available for abstraction. The growth of Barnstaple in the west and Exeter to the south may place further pressure on the water resources of Exmoor.

4.6.49 The majority of the NCA is agricultural and the bulk is pastoral, primarily producing beef cattle with some dairy; arable production tends to be located to the west of the NCA.

4.6.50 The moorland, coastal and hinterland areas of the NCA include some high-quality meat and other products, including oysters at Porlock Bay. Much of the marketing around these high-end products focuses on the quality of the environment in which they are produced. Projects seek to link producers directly with their customers (e.g. www.edibleexmoor.co.uk).

4.6.51 Traditional Orchards, particularly for cider, are still well represented on Exmoor, and offer significant biodiversity, heritage, cultural and community value.

4.6.52 Western oak woodland often forms single species stands and was previously used for the tanbark industry and as pit props in the Welsh mines. Some high-quality, specialist oak products are currently derived from the area. The main source of commercial timber from Exmoor is currently however the conifer plantations on the upper moorland fringes, and some steeper slopes and valley sides.

4.6.53 Many heritage features across Exmoor reflect the previous use of waterpower as an energy source for agricultural and industrial use.

4.6.54 Geodiversity is reflected in the use of local building stone, including the purplish-red and green sandstones of the Hangman Sandstone Formation for farm and village buildings within Exmoor National Park and Ilfracombe Slates for roofs (English Heritage, 2011).

Management challenges

Farming, agriculture and food growing

4.6.55 Traditional Orchards comprise Priority Habitat and are of great heritage value, including for apple varieties unique to this area of Somerset and Devon. They are however still being lost to old age and lack of replacement planting, grubbing up for agriculture or forestry and ring barking by horses. Articulating the combined value for biodiversity and heritage helps to secure protection and resources for enhancement.

4.6.56 Overgrazing by livestock and deer in woodlands and on moorlands, as well as cutting and burning can lead to reversion of heathland communities to acid grassland.

4.6.57 Fragmentation and isolation of habitats through farming and forestry practices has reduced the ability of many species to move through the landscape and impacted historic landscapes; agricultural practices can directly impact both wildlife and heritage, and damage archaeological sites and features.

Woodland management

4.6.58 Active scrub and woodland management through grazing and cutting is however required for some habitats and features. Livestock and husbandry skills appropriate to the task can be hard to source.

4.6.59 Loss of ancient and veteran trees with their associated wildlife and heritage, due to the lack of suitable continuity, either by natural regeneration or planting of successors. Lack of species diversity or age structure in many woodlands also puts them at risk of events such as storm damage or disease such as Phytophthora.

4.6.60 Tree planting in inappropriate areas, including to sequester carbon, can impact biodiversity and heritage.

Wildlife management

4.6.61 Roots, rhizomes and burrowing animals can damage buried and upstanding heritage interest, and cause stock erosion damage to archaeological sites and historical features.

Habitat management

4.6.62 Inappropriate heathland regeneration and creation can cause damage to heritage assets and archaeological features through increased scrub, bracken root and rhizome damage.

4.6.63 Rhododendron and bracken spread can overwhelm woodland understory and upland moorland habitats respectively, as well as causing damage to heritage features.

Climate change

4.6.64 Adaptive management of heritage assets to understand and accommodate change will be increasingly important. Heritage specialists engaged at an early stage in restorative landscape-scale enhancements can advise and influence the relative gains and losses for heritage, bringing added benefits to the project.

4.6.65 There is also slight but notable coastal erosion of the cliffs, which impacts on the heritage and biodiversity of the area.

4.6.66 Increased periods of drought due to climate change are making extensive wildfires on heathland and in conifer plantations, an increased risk.

Water management

4.6.67 Steeply sloping topography occurs across most of the area resulting in fast flowing rivers and streams often descending into constricted river valleys. This can present significant flood risk and particularly where settlements have been established in the lower reaches of river valleys. High rainfall or rapid snow melt on the moorlands, particularly when running over saturated, compacted or frozen ground, can result in hazardous flash floods that threaten settlements and infrastructure downstream. The flooding of Lynmouth in 1952, which resulted in a significant loss of life and damage to property, is a severe example. A pilot study in the Aller catchment is one of three national initiatives considering whole-catchment flood management.

4.6.68 Coastal flooding and erosion are also issues in some places. The majority of the coastline is naturally functioning, and the coastal processes and landforms, as well as the current sustainable management, at, for example, Porlock Bay and Braunton, contribute to reduction of flooding to built areas and productive agricultural land. Nonetheless some areas of the coast, for example at Minehead, are susceptible to coastal flooding. Uncontrolled or unmonitored Mires work can have negative impacts

on heritage features, where creating scrapes for materials for dams can negatively impact upon extant features and unrecorded deposits. A programme of assessment and monitoring to mitigate this risk is essential.

Building restoration and management

4.6.69 Traditional stone buildings and stone walls are a unique part of the NCA, although many are in a dilapidated condition. Where deemed appropriate they should be repaired or consolidated to ensure they do not deteriorate further, to benefit both heritage and the biodiversity that relies upon these features in the landscape. There is also the potential benefit to the community from skills increase and retention of traditional skills. Some former stone-faced boundaries are now remnant and wouldn't necessarily be recommended for repair.

Development pressures

4.6.70 Flat coastal plains landward of beach habitats are under development pressure, often compromising their potential capacity for coastal and fluvial flood management functions.

4.6.71 One of the largest terrestrial wind farms in the UK is situated on Fullabrook Down near Ilfracombe and consists of 22 turbines. There is ongoing pressure onshore and offshore for further renewable energy developments, including an 'Atlantic Array', proposed for the Bristol Channel near Lundy Island.

4.6.72 Abandonment or redevelopment of traditional buildings potentially drives out species such as barn owl and bat as well as losing the distinctive Exmoor vernacular.

Tourism

4.6.73 Pedestrian, 4x4, mountain bikes, horse riding and livestock poaching can impact habitats and cause erosion to archaeological features such as barrows and hillforts.

Opportunities for funding and support

4.6.74 The key mechanism for funding conservation of the natural and historic environment on Exmoor has been and will likely remain agri-environment schemes. These include Higher Level Scheme and Countryside Stewardship Scheme, which will now become the Sustainable Farming Incentive from 2024. These schemes can include

area-based payments, as well as funding for capital works. Agri-environment schemes, however, are limited in what they can achieve due to them being voluntary, time-limited and not always securing permanent change. This needs to be considered during any management plans or proposals.

4.6.75 In woodlands, the Woodland Grant Scheme (WGS), has been a key funding mechanism for conservation work and has included the production of Woodland Management Plans to inform sustainable management.

4.6.76 There are opportunities for funding for some projects through the Landfill Tax Credits, through organisations such as Viridor and Biffa, depending on the proximity from registered landfill sites.

4.6.77 The Heritage Lottery Fund (HLF) and People's Postcode Lottery have provided contributions for several works, both to enhance wildlife as well as the cultural environment.

4.6.78 Wessex Water have also contributed to projects in the aquatic environment, including catchment-scale natural capital enhancements.

Key points from Exmoor NCA

4.6.79 The fragmentation of semi-natural habitats such as upland and lowland heathland, blanket bog and deciduous woodland, to create rough pasture or conifer plantations is undoubtedly one of the biggest threats to both biodiversity on the Exmoor NCA. This has occurred over the years and only slowed after financial incentives to 'reclaim' areas of moorland were no longer provided to landowners.

4.6.80 There is a high priority within the NCA to protect existing semi-natural habitats as well as to reconnect Priority Habitats through restoration. This also has potential benefits and potential harmful impacts on the historic landscape if conducted with joint objectives. The recent Exmoor National Park Nature Recovery Vision stated the following:

"We realise that we cannot continue to segregate the themes biodiversity, landscape and cultural heritage if we are to address the ecological and climate emergencies. They are all underpinned by natural process and adaptive land management, and it is only by working together, across these topics, that nature recovery and climate action will be achieved recognising natural beauty and cultural heritage are integral elements of National Park purposes." (ENP, 2020)

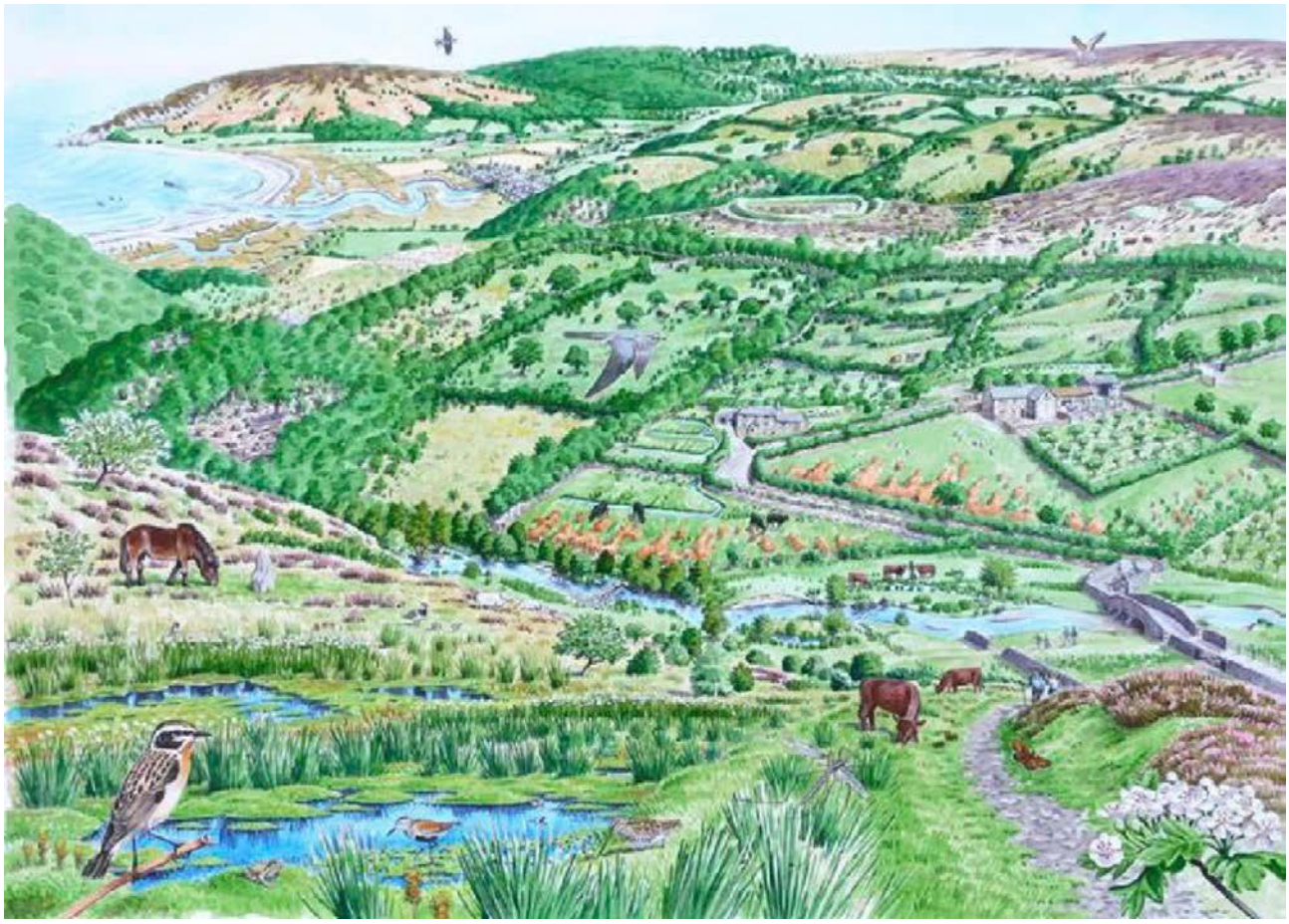

Figure 64: Heritage-rich Nature Recovery Landscape in Exmoor

4.6.81 Catchment scale work includes ‘slow the flow’ works such as those carried out in the Aller catchment below Dunkery Beacon, and the extension of tree planting in deep gills as well as placing woody debris in channels. Initiatives are in place for this to be extended to other catchments within the NCA such as the East and West Lyn and tributaries of the River Taw. In other areas rivers that have been canalised and levees constructed will reconnect with floodplains and enable a new river / stream system to be created through natural processes.

4.6.82 Some areas of ancient woodland previously felled and replanted with conifers (PAWS) are planned to be restored to native deciduous woodland when an opportunity arises. This will yield heritage as well as biodiversity benefits. These ancient woodlands, as well as newly planted connecting areas, required active management for conservation. Resilient, healthy, wildlife-rich woodlands have a range of tree species, invasive species such as Rhododendron ponticum are kept in check, and recruitment is enabled through deer control. At present, many woods in Exmoor are dominated by single species such as sessile oak and are over grazed by deer, limiting understory

diversity and preventing young trees from maturing. This means that felling due to tree diseases such as Phytophthora ramorum and ash dieback has even more of an impact. Resources are scarce for positive woodland management and promoting the heritage value of ancient woodland restoration alongside the biodiversity value could help to secure additional support. Surveys may also be desirable to inform management of new management plans and woodland creation schemes, this can help ensure any management plan will be sensitive to any heritage assets present on site.

4.6.83 In other areas and habitats, for example species-rich grassland and dune habitat at Braunton Burrows, conservation requires investment in more grazing, to help control scrub and woody vegetation. The use of invisible fencing provides new innovative opportunities that can help to address landscape and heritage concerns. Support for the distinctive character of small-scale mixed farming can help to maintain heritage skills as well as landscape and biodiversity.

4.6.84 There is development pressure on the coast and other valuable areas. Articulating the joint heritage and biodiversity values of the area, for example around the coastal villages of Woolacombe, Braunton and Croyde can strengthen the case for appropriate rather than unsustainable development.

5 Themes and Findings for the Historic and Natural Environment

5.1 Analysis of data relating to heritage and biodiversity

5.1.1 The themes and findings below set out regularly occurring relationships and observations found across the suite of case studies and NCAs selected for study, based on evidence collected, analysed and presented in sections 3 and 4 of this report, informed by in-depth interviews with site managers for some of the case studies.

5.1.2 The tables and figures presented in each of the case study Assets and National Character Areas illustrate strong connections between biodiversity, geodiversity and heritage.

5.1.3 Statistical analysis underlined the complexity of the relationships. Heritage assets were overall statistically more likely than not to coincide with biodiversity and geodiversity sites (statutory and non-statutory) in the Bedfordshire Greensand Ridge, Cotswolds and High Weald NCAs at 95% confidence levels. Conversely, despite the strong relationship between heritage and biodiversity on Exmoor understood by land managers and practitioners, this was not borne out by the statistics. This either means that the relationship between heritage and biodiversity on Exmoor is weak (considered unlikely), or that the current suite of heritage designations is inadequate in the reflection of the relative value of heritage-rich farmed landscapes. This matters because practitioners need ready access to usable data to indicate where to prioritise conservation management and actions. Appendix 3 sets out the results of the statistical analysis in more detail.

5.1.4 Hillforts, wood pasture habitats, and Registered Parks and Gardens stand out as particularly significant contributors to biodiversity across a range of different sites and NCAs. Targeted advice to those asset managers most likely to host biodiversity of significant value is recommended.

5.1.5 Further analysis of the coincidence between heritage and biodiversity/ geodiversity outside of statutory designations, including full datasets for local wildlife or geology sites, as well as Priority Habitats, would help to yield further nuanced understanding of the relationships between different types of heritage asset and the biodiversity they support.

5.1.6 Empirical data relating to the location of ancient, farmed landscapes was not readily available, particularly in polygon format. Similarly, areas rich in heritage, such as peat deposits or sub-tidal areas important for marine heritage, tended to be reflected on maps as clusters of point features reflecting individual finds, potentially understating their significance and perhaps failing to reflect their character as areas of heritage interest.

5.1.7 Local Wildlife Site data was only available in polygon format for some NCAs, comprising a significant limitation to the statistical analysis. Similarly, the analysis excluded Conservation Areas, and local Historic Land Characterisation information was not always available. These limitations are not considered significant in terms of the overall findings and recommendations of the study.

5.2 Themes and findings from case studies and NCAs

5.2.1 The conservation of heritage assets and landscapes often has considerable benefits for wildlife at the site and landscape scales. For example, hillforts can act as biodiversity hotspots within an intensive agricultural landscape. Their designation as Scheduled Monuments prevents damaging activities such as ploughing, and species rich grassland thrives under low-impact management. The identification and conservation of ancient field systems and their boundaries can also help to protect the wildlife present.

5.2.2 Priority Habitats in England, and the statutory and non-statutory sites designated to protect the best examples, often have strong associations with heritage. The clearest examples include Wood Pasture and Parkland, Lowland and Upland Meadows (particularly, for example Water Meadows) and Traditional Orchards. The continuation of low impact, often traditional management is important to their conservation, as well as continuity over significant periods of time.

5.2.3 Within urban environments the range of niches and crevices often found in the historic fabric provide opportunities which are often not available in modern hermetically sealed buildings, whilst the garden and green space settings for historical assets can offer valuable habitat in an otherwise built-up environment. Many of these green spaces and buildings will have been unchanged for many years (sometimes centuries) offering a stable environment for urban biodiversity.

5.2.4 The designation of the English Lake District World Heritage Site in 2017 (part of which is in Orton Fells NCA – see section 4.4) illustrates the relationships between heritage, biodiversity and geodiversity. This “mountainous region is shaped by agro-pastoralism, including the use of local breeds of sheep including the Herdwick, and inspires art, literature, and the creation of grand houses, gardens and parks from the 18th century onwards”. It also inspired “an awareness of the importance of beautiful landscapes and triggered early efforts to preserve them” (UNESCO, 2017).

5.3 Relationships between biodiversity and heritage

5.3.1 The statistical analysis, site visits, interviews and desk studies of the case study sites and NCAs, demonstrated a strong relationship between heritage and biodiversity. Often heritage being a key influencer in the biodiversity of a site, where the heritage

could have either a positive or negative impact on the biodiversity present. Several types of relationships were identified during the study, these have been explored further with examples below.

Synergistic relationships

5.3.2 The heritage and biodiversity interest of some sites are inter-dependent and strongly related. Examples of these and a discussion of the issues are set out below

Traditional woodland and grazing management

5.3.3 Traditional woodland management, such as coppicing, pollarding, felling and charcoal production have heritage and biodiversity importance. These traditional skills stretch back centuries and play an important role in shaping the landscape and biodiversity found within an ecosystem. For example, felling trees within a woodland ecosystem can open up the canopy, which allows light to penetrate the woodland floor, creating ecotones and varying habitats within the woodland ecosystem. Coppicing and pollarding can also prolong the tree's life, as well as providing varying habitat for different species.

5.3.4 Woodlands in England often lack the scale and rich faunal composition required for natural processes to deliver structural and ecotone diversity. Also given the centuries-long history of management, the biodiversity of many woodlands is dependent on beneficial management techniques that also comprise part of the cultural heritage for an area for their long-term survival. Although based on ancient principles such as coppicing and pollarding, woodland management techniques have never been fixed in time, and the continual evolution of skills and approaches is an important part of their ongoing success.

5.3.5 Wood pasture and traditional species-rich meadow conservation similarly depends upon heritage skills, as well as sometimes heritage livestock breeds to achieve a management regime favourable to biodiversity conservation.

5.3.6 Mature and veteran trees are a recurring shared interest and discussion point between biodiversity and heritage specialists. Veteran trees are an important historical record, sometimes dating back centuries and they comprise important features within historical landscapes.

5.3.7 Biodiversity objectives favour the conservation of veteran trees in the landscape to benefit species and assemblages such as deadwood invertebrates, woodpeckers and bats; the mistletoe marble moth is a specialist of old fruit trees in orchards. Veteran trees also represent important wildlife features in their own right, and key features for Priority Habitats such as Deciduous Woodland, Wood Pasture and Parklands, and Traditional Orchards.

Industrial landscapes and built heritage features

5.3.8 Mining heritage sites have a strong relationship with geodiversity conservation, for example at Geevor in Cornwall. They also support specialist flora and fauna assemblages rarely found outside industrial landscapes.

5.3.9 Building stone quarries have an influence on the built heritage of an area, and may comprise heritage, geodiversity and biodiversity features in their own right once disused. Examples in South Purbeck are often in intensive farmland.

Parks and gardens

5.3.10 Landscape parks, such as those of the 18th and 19th century created and pioneered by William Kent and John Bridgeman and popularised by Humprey Repton and Lancelot “Capability” Brown provide many opportunities for biodiversity and natural capital gain. In some areas, such as the Bedfordshire Greensand Ridge NCA, the parks and gardens of large country house estates represent a significant contribution to the biodiversity as well as the heritage interest of the area. Biodiversity significance is often reflected in statutory designations such as SSSIs and the recognition of Wood Pasture and Parkland as a UK Priority Habitat under Section 41 of the NERC Act.

5.3.11 Historic gardens have the advantage of being in place for a significant period of time. Although their management and vegetation may have evolved, their longevity has allowed wildlife populations to grow and develop. Approaches to gardening which favour avoidance of chemicals and pesticides have often added wildlife as well as natural capital value. Many historic gardens could be exemplary for wildlife gardening. As such they would likely gain additional support from visitors for taking these extra steps to benefit wildlife. Additionally, heritage skills and knowledge could be developed by practices on the site that may be environmentally beneficial, such as the avoidance of peat as a growing medium, informed by the knowledge of gardening techniques before peat was widely available.

5.3.12 Some gardens contain biodiversity collections of heritage plants that can include non-native plant species. These can provide historical value and wildlife benefit to insects, birds and mammals. An example of this can be seen at Kew Gardens.

5.3.13 Historic gardens located in urban areas or intensively farmed landscapes can offer oases for wildlife, such as at Sea Mills. Grass snakes and slow worms may use compost heaps and rockeries for basking, whilst pollinators benefit from garden flowers.

Coincidental relationships

5.3.14 The heritage and biodiversity interest of some sites are coincidental, in that they are often found in the same place, and the management may be mutually beneficial. However, the features are not defined by or dependant on one another to a great extent. Examples of these and a discussion of the issues are set out below.

Grazing, scrub and trees

5.3.15 Grazing is important for the management of many wildlife and archaeological sites, to ensure a short sward. The control of scrub and woody vegetation helps to conserve buried historic interest, as well as, in many cases, to conserve species-rich grassland. This is a classic example of a neutrally beneficial relationship, such as is found at many Wessex hillforts. Hambledon Hill hillfort in Dorset is an NNR for its chalk downland wildlife as well as a Scheduled Monument.

5.3.16 There is real potential to enhance the management of many archaeological sites, by minor changes which would have no material impact on the archaeological asset, but which could have significant benefits for wildlife. For example, many buried asset sites, such as Daw's Castle, have few wildflowers due to a grazing and mowing regime which is sufficient to conserve the buried heritage interest, but which, with a little tweaking, could also deliver additional wildlife benefits without impacting on the heritage interest of the site.

5.3.17 The details of management need careful thought, discussion, and cooperation as in some cases there may be different objectives or priorities. For example, cattle may be better for wildlife than sheep, because of their greater impact on rank growth, whilst archaeologists may be concerned about grazing causing poaching if this is not carefully managed.

5.3.18 Heritage conservation objectives on some sites may require very targeted grazing of features, whilst nature conservation objectives work over a larger area.

Public access

5.3.19 Managing visitors can be a significant benefit, and issue, for many parks and gardens. Whilst increasing people's access to biodiversity and heritage is beneficial, it can bring practical challenges. The significant increase in visitor numbers during the Covid-19 crisis increased pedestrian and bicycle erosion to archaeological features such as hillforts and other earthworks. This has also affected the flora, although some bare ground can be beneficial to heat loving species such as solitary bees. It can be easier to encourage visitors to use and engage with a site in a sustainable way if you connect with

their sense of what is important about a site – this can be the combination of biodiversity and heritage, or one or the other. It is a good option for site managers to use every 'carrot' they have available to persuade visitors to appreciate and value the places they visit, and hence use the site responsibly.

Agriculture

5.3.20 Commercial farming activities have a negative impact on wildlife and on the heritage and archaeology in many sensitive areas. Examples are deep ploughing in historically rich landscapes such as Purbeck and the Cotswolds. Conversion from arable to grassland would often be a desirable outcome for both biodiversity and heritage. There may well be additional natural capital values in relation to soil conservation, fluvial management and carbon storage. Additional biodiversity benefits may be achieved using a wildlife-rich seed mix which has been collected locally.

Supporting relationships

5.3.21 Heritage features can support biodiversity on some sites, in the provision of habitat by the heritage features. In many cases this reliance of biodiversity on heritage assets can be benign; in others there may be trade-offs that require management. In some cases, biodiversity can support heritage conservation. Examples of these and a discussion of the issues are set out below.

Setting and green infrastructure

5.3.22 The 'setting' of heritage sites offers potential wildlife habitat particularly in the urban environment. In many areas (for example. Canterbury World Heritage Site and Sea Mills Conservation Area in Bristol), the setting and green features related to and within heritage assets comprises important green infrastructure in an otherwise heavily developed area. These areas outside but related to heritage assets may offer significant opportunities for biodiversity gain through enhancement, helping to secure funding and increased resources for management and conservation in the long-term.

Structures, mines and adits

5.3.23 The built environment contributes significantly to the conservation of many priority species. Buildings of historical importance are often more likely to host such species than more recently constructed structures. Barn owls, swifts, swallows and house martins are all heavily dependent on heritage features. Structures that support biodiversity can include bridges, walls and aqueducts. These built heritage features

comprise important habitats which would not have been widely available if it was not for human endeavour, and which offer stable and secure conditions in the long-term related to heritage listings and protection.

5.3.24 Perhaps the most well-known link between heritage structures and wildlife is with bats, which have suffered dramatic and sometimes catastrophic declines in the UK but are often found in buildings. A greater range of species can be found in the lofts of old houses, due to the suitable temperatures and humidity, and range of undisturbed crevices and voids available (Collins, 2016). Some such as St Juliot Church, Boscastle, Cornwall have been designated SSSI for their population of rare bats. Industrial features can also provide suitable habitat features in mines and adits. Lesser and greater horseshoe bats in South West England to a large extent are dependent on manmade structures and features.

5.3.25 There can be issues when bats and birds roost or nest within historic buildings and structures such as churches, old houses and agricultural and industrial buildings. Although most bat roosts in churches are hardly noticeable, some of the larger maternity colonies make their presence felt, through for instance staining to the fabric of a building by urine and droppings. Urine contains high concentration of uric acid, which causes erosion and etching metal, marble and stone, and their faeces encourages algal growth. This can impact on the users of the buildings, as well as, in a limited number of cases, potentially damaging heritage features. Projects like the Bats in Churches Project and the Living Churchyard are gathering data and developing techniques to resolve recurring practical issues and raise awareness of best practice techniques.

5.3.26 Rare invertebrates, lower plants and lichens, can be found in a wide range of the specialist micro-climates associated with heritage assets. Old masonry often has voids which are home to species like masonry bee, as well as plants such as maidenhair fern, wall rue, rusty backed fern and ivy-leaved toadflax. Lichens are often associated with stones such as gravestones and monuments as well as standing stones or masonry walls.

Vegetation

5.3.27 Some wildlife and natural features can benefit heritage. The role of grassland in the protection of buried assets is the most obvious example. This principle has been expanded to (literally) cover some above ground assets. The use of soft capping (grass and soft herbaceous plants) on the top of ruined walls rather than hard capping of stone, mortars and cement can have many long-term conservation benefits (Wood et al., 2018).

Challenging relationships

5.3.28 The management of the heritage and biodiversity interest of some sites requires trade-offs and discussion. This is generally best done at a very early stage in management planning. Examples of these and a discussion of the issues are set out below.

Grazing, scrub and trees

5.3.29 There may be cases where the scrub or tree component of a site is important for wildlife, in supporting nesting rare birds such as the Dartford warbler, whilst the tree roots have a damaging impact on buried archaeology. Careful planning is needed to resolve these matters. In some cases, alternative habitat can be provided elsewhere since biodiversity may be delivered at the wider geographical scale. However, this can be more challenging when the character of the site or the conservation requirements of the wildlife concerned limits opportunities to do so.

5.3.30 The growth of woody plant species such as buddleia and valerian, as well as ivy, growing in the soft masonry of a building or walls, whilst providing a habitat for wildlife, can cause damage to the historic fabric.

5.3.31 Heritage and wildlife interests are generally shared in relation to invasive species such as Japanese knotweed and bracken; these are likely to be detrimental to wildlife as well as the historic interest. In some cases, heritage and wildlife priorities differ. One example is where historic gardens maintain collections of Rhododendron sp. From a wildlife perspective this carries a risk of spreading to, and eventual dominance of, nearby areas of wildlife interest. However, from a heritage perspective Rhododendron is culturally and historically important and these collections have no or minimal risk to the environment. Rhododendron was introduced to the UK via Gibraltar in 1763 for botanical gardens and used on big estates as cover for game birds. The shrub can grow up to 8m tall and outcompetes with native species, displacing all other vegetation and local fauna. Once removed, the understorey plant community composition does not return to the state pre-invasion, even decades after removal. It is an example of how heritage has impacted and continues to impact on native habitats and biodiversity.

5.3.32 Biodiversity and heritage priorities may differ in relation to veteran and mature trees in terms of detailed management, such as pollarding or leaving deadwood in situ. There can be practical impacts from veteran trees on heritage as well, like issues relating to scrub and bracken, due to leverage and root damage to heritage features including buried archaeology. Discussions over detailed management may well be required between heritage and ecology specialists to understand and address the priorities for each discipline.

5.3.33 Although veteran trees tend to have limited heritage protection or recognition in comparison to a building of similar significance, they do comprise part of the heritage interest of some designated assets and Protected Landscapes. Heritage and landscape specialists often wish to clear dead or dying trees as they can be seen as impacting on the aesthetics and tree health. Ecologists however tend to favour keeping trees with rotting features, as well as any fallen branches and deadwood in situ. Detailed discussions may be required.

Animals

5.3.34 Burrowing animals can cause significant damage to earthworks. Rarely would there be concern about the removal or exclusion by netting of rabbits or foxes, but badgers have comprehensive legal protection and often will require a new artificial sett building at great expense. Some insects, such as mining bees can also damage historic structures, particularly those built of earth-based materials such as cob and wychert, although the concerns can be overstated.

5.3.35 Bats often use building features as roosts and the surrounding grounds for foraging or commuting. Guidance, such as Historic England's Building Works and Bats guidance can help support property owners and managers in sympathetically managing their property for bats.

5.4 Relationships between geodiversity and heritage

5.4.1 The local geology is often critical in the vernacular design of buildings. For instance, in areas underlain by clay and soft rocks, historic properties are often constructed of wattle and daub or are timber framed or of cob construction, such as in the High Weald. Where clay is of suitable quality, it was dried in kilns to create brick such as in Canterbury or Bedfordshire. In chalk country such as in Dorset, Sussex and Wiltshire, buildings are often made with flint with brick quoins. In areas with stronger sedimentary, metamorphic or igneous rocks, stone quarries abound, and buildings are invariably composed of these. Examples are the Cotswolds oolitic limestone, South Purbeck Purbeck limestone, Old Red Sandstone of Exmoor and West Cornwall granites (e.g. Historic England, 2011).

5.4.2 In hard rock areas such as Cumbria, West Penwith, Purbeck and Cotswolds, stone was often collected through surface quarrying or from arable land, as well as from natural exposures or even beach stones to construct stone walls and many historical features such as kist vanes, quoits, long barrows, standing stones and stone circles. It is also used in industrial features such as mines, factories and mills.

5.4.3 The geology itself is also a resource through mining for minerals, such as the tin mines at Geevor, iron ore in the High Weald and flint for tools such as spear and axe heads in Wessex.

5.4.4 The landforms created by the geomorphology of an area, often are key in the positioning of a settlement in a sheltered valley or on a defensive ridge or headland. This is also important for the supply of water, through springs and rivers.

5.4.5 Soils directly relate to the underlying geology, in most cases. This affects the agricultural land use, such as whether it is arable or pasture or woodland. It may also directly impact where gardens are created, such as on the greensand in Bedfordshire, or Stourhead in Wiltshire where it makes it possible to grow a great variety of shrubs and plants, as well as construct lakes.

5.4.6 The legacy from mines and quarries, for both heritage and biodiversity, can be mixed. They can offer structures and unique micro-climates favourable to rare fauna and flora, such as associated with the mining heritage found at Geevor and St Just. Meanwhile, pollution from old mine adits can impact water quality, affecting catchments for people and wildlife.

5.5 Relationships between natural capital and heritage

5.5.1 The heritage of an area and landscape often reflects the natural capital on which settlements and communities depended in the past and continue to use today, for example mining, orchards and farming. The variety of natural capital assets associated with heritage reflects this diverse and rich association. This in turn influences the biodiversity of an area.

5.5.2 Soils and geology influenced agriculture and industry and hence the character of historical landscapes. The need for fresh drinking water is fundamental when positioning settlements. Water may be obtained through surface water such as streams, rivers and reservoirs, but also from the ground where aquifers exist. In some areas, such as on porous chalk, heritage features such as leats and aqueducts as early as the Roman period are found. These fundamental environmental factors, together with the changes made by man, both gradually through practices such as agriculture and by engineering, continue to have a significant influence on wildlife and habitats today, as well as significant changes to soils, landforms and natural features.

5.5.3 Heritage assets reflect a change in the landscape or site from their natural state. Some of these changes were originally targeted to harvesting wildlife (for example, fish traps, decoy ponds), or preventing wildlife from entering or leaving an area (for example,

deer banks). Some heritage assets had incidental effects upon wildlife. (e.g. field boundaries targeted to domestic stock also prevent or facilitate movement by wildlife). Some of these structures have significant ongoing implications for wildlife.

5.5.4 Some heritage features reflect the adaptation of water flows through a catchment to benefit communities and individuals. Important aquatic habitats in England are often shaped by cultural interventions as well as impacted by anthropological pressures (Riley et. al., 2018). Open water bodies are often artificial, and ponds can be important features for biodiversity in some landscapes, for example dew ponds on the chalk of the South Downs, moated manor houses in the High Weald and some canals are now SSSIs. The restoration of traditional water management for habitats such as water meadows can aid both heritage and biodiversity, and the 'rewetting' of peatlands can offer heritage benefits through the preservation of buried artefacts, such as the Sweet Track on the Somerset Levels.

5.5.5 Sometimes there are trade-offs. Working with natural processes can adversely affect heritage. Some heritage structures or features cause ongoing damage to biodiversity and natural capital or may restrict choices for biodiversity enhancement. Examples include water management structures or barriers created for historic industrial use such as watermills, flood defence or drainage, which now restrict the movement of fish and other wildlife and/or constrain natural processes. Drainage ditches on mires and wetlands for agricultural improvement, as seen in areas such as Exmoor, the Somerset Levels, East Anglia and Tewkesbury for example have heritage value as examples of water management. However, they can adversely affect wildlife today, and impact on the multiple natural capital benefits that wetlands offer including carbon budgets and flood management.

5.5.6 Joint working to find ways to conserve heritage assets whilst addressing the ongoing impacts on natural processes from historic structures is required. A positive approach and ongoing development and communication of 'best practice' examples can be useful. For example, water structures in the Derwent catchment in Yorkshire have been supplanted or modified to enable fish to migrate upstream, whilst conserving the heritage interest of the features (RH, 2010).

5.5.7 There are trade-offs too at some coastal and estuarine sites, relating to current and past choices in how communities react to and change the boundary between land and sea. Daws Castle in Somerset, once a defence for incursions from the sea, will be eroded as the cliff erodes through natural processes. These natural processes will likely be acerbated through climate change. Erosion may potentially be further accelerated by a hard engineering response to climate change, as a revetment-style sea defence is considered for an adjacent section of cliff (WSP, 2020). This may lead to 'end effect' erosion in the vicinity of Daw's Castle.

5.5.8 Examples of joint working at the national strategic scale includes the new England Peat Action Plan. This states that:

"Natural England and Historic England will be developing joint guidance around peatland restoration and the historic environment. The guidance will demonstrate the need to consider the scale of losses not only of historic information, but also of the other public goods and services inherent within degrading peatland habitats. By adhering to the new guidance, stakeholders will have assurance that historic environment issues have been duly considered, and peatland restoration projects can progress with less risk" (Defra, 2021).

5.5.9 Another example of joint working is the creation of the 'Neighbourhood Planning for the Environment' Guide prepared by the Environment Agency, the Forestry Commission, Historic England and Natural England. This guide provides information on how to consider the environment in Neighbourhood Plans and includes heritage, environmental and natural capital considerations.

5.5.10 The natural and cultural capital wellbeing benefits (health, recreation, knowledge, sense of place) arising from many sites and areas often arise from the combination of heritage and wildlife. Assets such as parks and gardens, hillforts and Conservation Areas provide essential well-being opportunities for people, whether that is for quiet recreation and contemplation or for activities such as walking, cycling, canoeing and horse riding. They also create a sense of place, a feeling of belonging, store academic and social information and provide potential for learning and curiosity, as well as often providing opportunities for engagement, volunteering and creative activities, this can be seen in forest schools and green social prescribing activities. This will also have positive impacts on the NHS, through reducing the demand on counselling and more costly treatments.

5.5.11 There is an overlap in natural capital and the capital of heritage assets, which are often recognised in the cultural services. For effective valuation of cultural services, measurements such as visitor numbers should only make up one aspect of the final valuation and in some cases improving methodologies for valuation is needed (Sagger et al., 2021).

5.6 Challenges

5.6.1 Natural capital, biodiversity, heritage and cultural capital often have a strong association. Synergies include soil conservation through the management of long-established grassland and/or arable reversion; high carbon budgets are often associated with long-established habitats and landscapes, (e.g. Youngs and Horner, 2019). Heritage and wildlife-rich habitats often have a role to play in water-quality and flow management at the catchment scale. The shift of agriculture to 'net zero' carbon may favour extensive

low-input techniques with significant biodiversity and heritage benefits. There are however sometimes tensions. For example, planting trees for carbon is not the same as woodland or wood pasture conservation, and, in fact, can be damaging to either or both biodiversity and heritage. The joint-articulation of shared interests could be helpful in directing enthusiasm for tree planting towards appropriate less-sensitive areas. As always, early discussions can be useful to identify and resolve issues and to make the most of shared objectives.

5.6.2 There are pressures in the marine environment. Damage to ecology can arise despite designations such as Marine Conservation Zones. Similarly, Protected Wrecks, such as at Goodwin Sands, are still at risk from fisheries, dredging and development. Choices in coastal management, including realignment, may have significant implications for both heritage and biodiversity.

5.6.3 Pressure groups seeking improved management and protection for important areas in the terrestrial and marine environments often articulate both the historic as well as the ecological interest of a site or area when making their case to the public and to authorities. However, there are occasions where this isn't the case, for example the pressures to rewild landscapes doesn't always take the historic environment into consideration. Regardless, statutory agencies as well as other organisations are often most effective when working together to adopt joint-statements and approaches when faced with development or other pressures and/or seeking support for conservation. To do this well, there is a need for investment in joint working techniques.

5.6.4 Geodiversity has a significant influence on biodiversity, heritage and wellbeing for some sites and areas, including economic benefits, as shown by our study of, for example Purbeck and the Cotswolds NCAs. Historical and current land use is usually significantly influenced through landform and soils, and hence shapes the location and character of the built heritage that has developed in an area over time. Quarrying can in addition provide building stone for heritage buildings and structures. Disused extraction sites can provide wildlife havens; working quarries by contrast can impact negatively on both biodiversity and heritage depending on location and scope. Mining heritage, for example at Geevor Mine in Cornwall, can have significant heritage and biodiversity value, whilst the adverse natural capital implications for water quality can be severe. There is value in considering geodiversity alongside heritage and biodiversity.

5.6.5 Climate change is widely recognised as having a significant impact on the environment. Examples are the gradual deterioration and eventual loss of heritage features on the coast, such as Daws Castle or the mining heritage in West Cornwall and on wildlife becoming 'squeezed', by coastal erosion and sea level rise, such as in South Purbeck. Erosion however also creates the sediment which ultimately forms our beaches and can protect the coastline, as well as maintaining geological exposures and heritage landscape features such as the White Cliffs of Dover.

5.7 Opportunities

5.7.1 Although Site Management Plans often cover all aspects of a site, they understandably tend to exhibit a bias towards the primary aims of the organisation that writes them. In general, (and noting that there are many exemplary exceptions to this), heritage might tend to be considered a 'constraint' for a site managed by a wildlife organisation, and vice versa – biodiversity may be considered a constraint, or even a threat, by a heritage organisation. Organisations with a wide brief, such as the National Trust, Ministry of Defence and Forestry Commission generally appear to have better mechanisms than specialist heritage and biodiversity organisations to adopt an inclusive approach to broad conservation objectives for site management, and to make the most of all opportunities to value and enhance a site.

5.7.2 For both wildlife and heritage organisations, there may be a need for them to learn more about and communicate better the advantages associated with integrated management to their stakeholders, including staff and the members or organisations, to help gain 'buy-in' for the changes needed to include wider benefits in site and organisational management objectives and actions.

5.7.3 Ranger/Warden teams, who are often responsible for site management (such as National Trust, Natural England, Wildlife Trust, National Parks), tend to come from a wildlife, rather than a historical educational background. Universities and training schemes need to address the need for a broader understanding of the wider environment including heritage, to ensure a good understanding of wider conservation issues at the site level.

5.7.4 Joint site meetings between heritage and biodiversity specialists are strongly recommended as the best way to gain a more inclusive understanding of what is needed for the wider conservation of a particular site or area, to make the most of opportunities and to help resolve the details of management to address any conflicts between heritage and wildlife management. The need for good people management is a key aspect of addressing these types of conflicts.

5.7.5 Protected species legislation often requires survey and mitigation for species such as bats, great crested newt, dormouse, badger and slow worm should large-scale changes be proposed. These can be costly and time consuming and, since heritage-rich structures and features are more likely to also host wildlife, represent a significant 'burden' on heritage managers. The 'Bats in Churches' project is a good example of where additional support has been provided to those managing heritage sites in recognition that they need some help.

5.7.6 Similarly, the requirements for watching briefs add significant bureaucratic hurdles in working on Scheduled Monuments, and can cause issues, for instance on projects such as fence erection, replacing footpath furniture or planting trees. Assistance for and recognition that biodiversity specialists could benefit from support with the paperwork and processes involved would be welcomed.

5.7.7 The National Trust's Conservation Performance Indicator (CPI) process is an excellent way to track management conditions for all aspects of conservation, with separate archaeology and historic landscape, buildings and structures and nature and wildlife objectives and scores. However, to ensure CPI is accurate the scores need to be based on current and up-to-date data for each aspect of conservation.

5.7.8 Support for positive management, including agri-environment schemes, National Lottery Heritage Fund grants and Landfill Tax Credits are extremely important mechanisms for funding vital conservation work for the natural and historical environment. A more joined-up approach to describing the value of sites and the benefits to be gained from sympathetic management may enable more funding bids to be approved.

5.7.9 Heritage includes cultural skills, including those related to management of the natural and historic environments. Such skills include those related to wildlife-friendly farming, such as coppicing and pollarding, stockmanship relating to the use of heritage breeds, and other techniques important for the maintenance and enhancement of landscapes rich in heritage and biodiversity and skills to maintain and restore historic buildings, structures, parks and gardens. Lack of skills is often cited as a constraint to the expansion and adoption of wildlife-friendly farming and to heritage conservation and could be a key area for joint working and investment between the heritage and biodiversity sectors. This is an area where good people management would be beneficial.

5.8 Data and assessment

5.8.1 Conserving and enhancing a site for biodiversity, geodiversity and heritage is much easier when sound baseline data is available and simple to understand and interpret. This should indicate both the current and the ideal state of a feature. Although it was not an original intention of the study to appraise sources of data, the volume and variety of data we collected resulted in us contracting and working with a wide range of data providers across the country. This gave us an insight into the current accessibility of baseline data in different areas of England at both the site and landscape scale.

5.8.2 MAGIC is a 'game changer' in terms of a (relatively) easy to use comprehensive online resource, with both a good desktop interrogation feature and – crucially – the ability to download and analyse GIS files (magic.defra.gov.uk). There are however still

limitations with using MAGIC since it focusses on designated heritage assets. As this study has found, for example for Exmoor NCA, High Weald NCA and Hatfield Forest case study, these tend to focus on point features rather than managed landscapes of heritage importance. SHINE (the Selected Heritage Inventory for Natural England) is a dataset of undesignated historic features and is an alternative to MAGIC, although this too has its limitations (Defra, 2022).

5.8.3 Local biological record centres (LRCs) and Historic Environment Record centres (HERs) are also useful, informed and helpful sources of detailed biological and heritage data relating to sites and areas.

5.8.4 Local record centre data was generally well organised and clearly indicated the priority and value attributable to different species and features. Some of the variations in cost between LRCs were surprising, and, for those working at the landscape scale, would represent a significant barrier to the use of records. Also, although the general approach and contents of LRC data was often similar, the format for delivery varied. Since LRC data is often organised at the county or unitary authority level, sites near or cross-boundary added costs both in terms of the primary dataset, and in terms of collating data in different formats.

5.8.5 Clearly, the more data which is easily online the better, and the lack of easy access to Local Wildlife Site and Regionally Important Geological Site information is a barrier to their conservation. Given the significant associations found in this study of local wildlife sites and heritage assets, it would be good for heritage site owners to have an easier way to find out whether their site has non-statutory designation. Local Wildlife Site boundaries are shown in local development plans, and (in contrast to species data) rarely comprise large, dynamic or complex datasets. It would be useful for the boundaries to these sites to be made available on MAGIC, alongside Priority Habitat and other national datasets. This could then flag to owners and managers of Local Wildlife Sites that the area under their jurisdiction is of significant biological/geological importance, and prompt them to contact their relevant Local Records Centre for more detailed information.

5.8.6 HER datasets by comparison tended to be more readily available at reasonable cost. However, the format also varied between centres, again adding complexity for areas on or close to Local Authority boundaries. More fundamentally, whilst biological datasets tended to be delivered categorised and prioritised, so that a researcher can see ‘at a glance’ the relative conservation value of different biological and geological features, the same approach is not generally taken with heritage datasets. Instead, with heritage data, beyond designated assets, additional heritage expertise and time is typically required to analyse the large amount of data available, and to interpret what it means in terms of priorities and the key characteristics that define the most important heritage within an area. Whilst appreciating that this allows flexibility in analysing HER

datasets for different purposes, it is a potential barrier to the non-specialist, who then needs to source additional advice to work out the heritage priorities for a particular location. It may also contribute to differences in opinion and potential difficulties in relation to identification of priorities for heritage conservation and action.

5.8.7 Standard designated heritage assets (Scheduled Monuments, Protected Wrecks etc) are a useful start, and these sites have a strong association with biodiversity. However, these assets fail to reflect the full wealth of heritage, particularly at the landscape scale. Protected Landscapes such as National Parks, AONBs and Heritage Coasts can show the way in the integration of heritage, biodiversity and geodiversity conservation, but there are gaps between these areas, and gaps in data and knowledge or expertise within the protected landscape. Hatfield Forest for example, one of the finest medieval hunting forests in Europe, lacks a formal statutory heritage designation that encompasses the forest. Another example is the National Parks of Dartmoor and Exmoor, which have resorted to designated PALs, because the archaeological resource is not suitably protected, but the rich peat wetlands remain around the Somerset levels in Sedgemoor have only fragmented SM designations.

5.8.8 Historic Land Characterisation helps understanding the historic landscape character for an area, but further information is needed to derive heritage priorities for action from this information, and the availability of this resource is variable.

5.8.9 There are many examples of innovative approaches to the identification and 'flagging' of key areas and features for heritage beyond the scope of the existing suite of national heritage designations. For example, Exmoor and Dartmoor National Parks have Principal and Premier Archaeological Landscapes respectively, whilst the existing village Conservation Area for Chew Magna in Somerset has been extended to include medieval enclosures. Although this county level action may well be the best level to determine local priorities, a regional or national programme of support for such work could be useful, particularly in helping to negotiate the new legislative and funding frameworks surrounding development control and agriculture. This suggestion is not new – a 2004 review of the use of Historic Landscape Characterisation datasets made similar points (Clark et al., 2004). Further work and guidance, at the local, regional and national levels, is recommended to help practitioners define, understand and explain to others the key heritage priorities in their areas.

5.8.10 Work on this topic would be timely. Landscape-scale conservation actions are imminent across the country, in the form of Local Nature Recovery Plans and other projects funded through Sustainable Farming Incentive and Environmental Net Gain initiatives. Actions relating to Green Recovery Funding administered by the National Lottery Heritage Fund Accessible are currently underway (June 21). Consultation with heritage professionals would yield benefits for both biodiversity and the historic environment.

5.8.11 Landscape-scale changes have significant implications for heritage conservation, and many of our NCA studies show how landscape of heritage value often provide the areas with the high current biodiversity value, and potential for further large-scale wildlife gains, alongside other natural capital benefits. Robust and standardised guidance as to how to develop heritage priorities within different areas including outside Protected Landscapes and designated assets is essential. Mapped guidance should help to clearly explain: what would heritage conservation and enhancement look like in these areas? There are several different mechanisms potentially suitable for consideration. Guidance relating to Conservation Areas in the Pennines looks to field patterns beyond settlement limits (EDC, 2011). Locally specific non-statutory designations such as 'PALS' in Exmoor also have potential (ENP, 2015). A review of these options and how this could be supported and actioned by key agencies and stakeholders is recommended.

5.8.12 We found National Character Area accounts to comprise good integrated descriptions of areas at the landscape scale with clear objectives. It would be helpful for key sources for landscape-scale heritage assessment, conservation and enhancement to be aligned with NCAs, to help those working at the wider scale to deliver integrated conservation benefits.

5.8.13 As part of this, the adoption of the concept of the 'enhancement' of a heritage asset or landscape, with targets and objectives, could be more widespread within the heritage sector. It would help applications for funding for example to see clear targets, objectives and benefits. It would also fit with the wider concept of 'Environmental Net Gain' which Defra and the government are currently endorsing. Examples of enhancement could include, for example, securing better long-term management, better access for researchers, and improved interpretation and access, so visitors, whether direct or remotely, gain more from a heritage asset. Conversely, Heritage Asset enhancement as a concept could be more widely engaged within the ecological sector.

5.8.14 Scheduled Monuments and other designated heritage assets are classified regarding risk, condition, vulnerability condition and trend (Historic England, 2021b). There are many sites which are not at risk and have the potential to provide increased services, which is why consultation with Heritage England partnership teams about any proposed changes, funding or strategy at an early stage is essential.

5.8.15 The marine environment also includes significant areas which are rich in heritage assets, such as Goodwin Sands. However, the heritage interest is only reflected as point features – Protected Wrecks. A better recognition and articulation of the heritage value of the wider area in which the wrecks are located would be helpful to agencies with responsibility for the marine environment (Evans and Davison, 2019). This would allow for instance identification of areas where restrictions to damaging practices such as bottom trawling could be put in place.

5.8.16 Further work could identify those historic landscapes which are best suited to alignment with large-scale nature recovery, including areas rich in wildlife and/or ripe for biodiversity restoration. Nature recovery plans also offer significant opportunities for the rehabilitation of historic landscapes as an added benefit. Early discussions can also tease out potential conflicts at an early stage in scheme design. In fact, as our case studies, including Exmoor National Park, make clear, it often makes little sense to enhance a landscape without having due regard for cultural and historical values as well as biodiversity and can diminish the capital value.

6 Conclusions

6.1 Key relationships between heritage, biodiversity and natural capital

6.1.1 This study found regular and strong connections between heritage and biodiversity distribution and management at both the site and the landscape scale. Biodiversity in England reflects the history of a place and is intimately linked to its heritage. This is seen in the distribution of many Priority Habitats including Woodlands, Traditional Orchards, farmed landscapes, Ponds and historical sites, such as hillforts, as well as the wildlife of more urban areas found in allotments and gardens. Biodiversity conservation and enhancement is also frequently linked to ongoing active traditional management. Where biodiversity is at risk, for example through inappropriate management such as deep ploughing of ancient meadows, heritage may also be at risk. Natural capital, for example relating to pollinator support in gardens and allotments, also often had a strong heritage element.

6.1.2 Many semi-natural features, habitats and landscapes have significant heritage interest. Veteran trees, ancient woodland and heritage farmed landscapes are a good example and were found throughout our case studies and example NCAs. These features tended to be celebrated by the biodiversity sector as a priority for active conservation; the heritage of many of the case studies and NCA areas was recognised as part of the character of the site, and often relevant to ongoing favourable management for biodiversity. Semi-natural features are in turn recognised as important components for some historic parks and gardens and Protected Landscapes. For example, the ancient field system is considered part of the Registered Battlefield interest for Tewkesbury. However, we generally found semi-natural features and biodiversity and geodiversity interest were not commonly considered integral to the heritage value of a site, whether through designation or management practice.

6.1.3 The active engagement of the heritage sector in conservation at the wider landscape scale across a wider range of sites and areas may lead to benefits. These may include improved identification and recognition of heritage features, skills and cultural elements in managed semi-natural landscapes, which in turn could help to access additional resources for heritage conservation. Early recognition of heritage aspects can also help to address and resolve tensions and trade-offs. This is pertinent given the imminent roll-out of landscape-scale nature recovery action across England.

6.1.4 Through this engagement, the heritage sector can also offer significant gains in helping to address the ecological emergency. Given the pressures that biodiversity is under, then the additional weight, knowledge, focus, insight and resources that the

heritage sector could bring to help achieve successful actions would be valuable and working together the sectors would be more likely to achieve joint benefits and 'design-in' heritage conservation alongside biodiversity conservation at scheme inception.

6.1.5 Key initiatives to influence and target regarding a greater understanding of the relationship between heritage and biodiversity include those working with natural processes, including catchment-scale interventions ('slow-the-flow'), coastal realignments and (re)wilding projects and (in particular) large scale or incremental tree planting. Regarding tree planting, the biodiversity sector shares with the heritage sector concerns relating to the inappropriate planting of bulk growth trees and shrubs for carbon sequestration on Protected Landscapes and long-established habitats

6.1.6 Semi-natural features in urban settings, such as street trees, and green and blue infrastructure, also often have a significant heritage component. The conservation and enhancement of these features, including to maximise natural capital and wellbeing gains, would therefore bring significant heritage benefits.

6.1.7 Many biodiverse, geodiverse and heritage-rich landscapes have a variety of additional natural capital values. We found the natural capital approach helpful in identifying and describing a broad range of common objectives, or sometimes tensions, arising from or relevant to biodiversity and cultural/ heritage at the site and landscape scale. For example, orchards and allotments in Sea Mills, Bristol had significant heritage and natural capital value, as well as comprising features supporting urban biodiversity. It is a useful concept for understanding the various benefits that communities gain from the biotic and abiotic elements of the environment.

6.1.8 Although research is ongoing, the literature still currently rarely captures the inter-relationships and contribution that cultural heritage and the built environment make towards supporting biodiversity conservation, including directly through providing habitats suitable for wildlife, as well as through aspects such as the use of traditional skills and heritage livestock in biodiversity management. A position statement by Historic England on Natural Capital, Environmental Net Gain, and the relationship of these to heritage may be helpful.

6.2 Challenges and opportunities

Joint working

6.2.1 Development control remains an ongoing concern and significant work area for those seeking to conserve both biodiversity and heritage. Recognised joint-interest can strengthen the case for good quality outcomes.

6.2.2 Biodiversity, geodiversity and heritage are on everyone's doorstep. Understanding what there is, and articulating this effectively, can be the first stage in both conserving it, and in making the most of it for communities. The shared primary pressures on both heritage and biodiversity, both at the site and the landscape scale, tend to be agriculture, climate change, leisure and development. A joint voice can be a louder voice in the face of such pressures. More close working could help to better protect sites from adverse effects arising from specific proposals. It could also help to secure resources for active conservation, including the kind of low impact management that favours both aspects, when agri-environment and other funding schemes and local and national plans and projects are in development.

6.2.3 Specialists do need to have a basic understanding and appreciation of other disciplines to help these discussions to be successful, as well as a 'can do' positive attitude to negotiation and compromise.

6.2.4 Tensions between the requirements for the natural and historical environment do exist. These tend however to be related to site/feature level details rather than fundamental differences in objectives and 'vision' for a particular site or area. Early discussions and joint meetings are often the best way to iron out any disparities, at a variety of geographical scales. The England Peat Action Plan is a good example of strategic collaboration by agencies to develop guidance for use by those working at the landscape and site scale on how to address issues and make the most of opportunities (Defra, 2021).

6.2.5 Heritage includes cultural skills, including those related to management of the natural and historic environments. Such skills include wildlife-friendly farming skills, such as coppicing, the use of heritage breeds, and other techniques important for the maintenance and enhancement of landscapes rich in heritage and biodiversity and skills to maintain and restore historic buildings, structures, parks and gardens. Lack of skills is often cited as a constraint to the expansion and adoption of wildlife-friendly farming and to heritage conservation. This could be a key area for joint working and investment between the heritage and biodiversity sectors.

Community engagement

6.2.6 Support from local communities will be better garnered when they feel involved in decision making and that it will have some benefit to them. By ensuring that a site delivers wider cultural, natural and wellbeing benefits, then there is likely to be a broader coalition of backing for newly proposed projects.

6.2.7 Wellbeing is a very significant opportunity for the heritage, biodiversity and geodiversity sectors. Recreational, educational and access benefits derived arising from biodiversity, geodiversity and/or heritage can be considerable. Importantly, the

inter-relationships between these can be of greatest value. People's sense of place is often derived from the combination of these aspects. This is often articulated effectively at the site level, but at the landscape and national levels, separations seem more commonplace in actions, policy and practice. Protected Landscapes (National Parks, AONBs, Heritage Coasts etc) offer some excellent case study examples for how an integrated approach can yield benefits.

Policy and governance

6.2.8 Effective use of new and emerging policies, schemes and funding, such as Environmental Land Management, Local Nature Recovery Strategies, and the new responsibilities for public bodies under the Environment Act will be important to maximising benefits. The recognition and integration of heritage, geodiversity and biodiversity within schemes and plans at the earliest opportunity is crucial, due to the synergies between the disciplines, and the extra weight that a united approach brings when articulating to audiences the importance of an area or site.

6.2.9 Government funding, in particular agri-environment support, as well as grant bodies such as Heritage Lottery Fund, People's Postcode Lottery and Landfill Tax Credits all now expect applications which show wider benefits than for instance a single species or an individual historic feature. There will almost certainly need to be a wellbeing benefit, whether that is increased access or improvements to health, as well as environmental benefits such as better water or air quality or a reduction in flood risk. It should however be recognised that agri-environment schemes should not be wholly relied upon and are at present limited to what they can achieve, as they are voluntary, time-limited and don't always secure permanent change.

6.2.10 The guidance should also be helpful to those working on nature recovery. Landscape-scale changes are planned across England. Heritage specialists should be engaged in these initiatives at the earliest stages, to make the most of opportunities for heritage enhancements, and to identify and help to resolve potential issues and trade-offs.

6.2.11 Landscapes and sites in England generally have significant heritage, biodiversity and geodiversity values. The overlap and synergy between heritage and ecology at both the site case asset level and at the landscape NCA level are considerable. Integrated management and identifying the relationships at an early stage can yield added benefits to both heritage and biodiversity. There are significant opportunities for heritage sites and assets to deliver more for biodiversity, and vice versa through adjustments to management. Historic England, as a public body, has a statutory duty to further the conservation and enhancement of biodiversity. A statement setting out how they propose to fulfil this responsibility would be helpful.

6.2.12 Lending a statutory or non-statutory weight to these areas through a formal designation process may aid heritage conservation through the development control sector as well as helping to direct and target agri-environment support. For example, Conservation Areas are a proven mechanism in relation to the built environment that non-specialists can use and understand. It may be possible to expand the use of Conservation Areas to more often include the very best heritage landscape areas, including setting out their conservation priorities, although a specialist conservation officer who is supported by the LPA might be required to successfully achieve this. We recommend a review to consider the best way to approach this topic.

Management

6.2.13 Management plans and strategies for landscapes and sites that have integrated objectives are likely to deliver more than 'single issue' objectives, due to the early identification and hence resolution of issues, as well as helping to make the most of what matters about a site and landscape to those using it on a regular basis. A natural capital approach to evaluation and planning can help to overcome a 'silo' tendency for organisations prioritising either heritage or biodiversity. Continuity of benign management over time through a management plan may be key.

6.2.14 The 'timeline' contribution that beneficial management (whether intentional or incidental) over millennia makes to the favourable conservation status of some important sites and species is also not often clearly articulated – these populations and communities do not build up overnight. Some of these features that are of value for biodiversity are also of heritage value, for example the medieval field boundary patterns of the High Weald and the population of veteran trees in Hatfield Forest. This beneficial management may comprise a valuable cultural heritage element which is rarely well described through designated heritage assets.

6.2.15 Protected Wrecks are similarly often point features on constraint maps. The wider context and character of areas of marine heritage may not be fully described or recognised in marine strategies. Marine conservation for biodiversity, through Marine Conservation Zones and other initiatives, works through implementing management controls across wider areas. Mechanisms to better recognise areas of heritage interest may help to integrate heritage into marine conservation actions and strategies. We recommend that a review is carried out into this topic.

Data and information

6.2.16 A clearer articulation of what may comprise a heritage 'enhancement' would be helpful to non-specialists and would help those working at the site and wider geographical scales to make the most of opportunities to fully integrate heritage objectives into management actions. This would be timely given the ongoing shift in agri-environment support and development control to Environmental Net Gain objectives – practitioners need to be guided as to what heritage enhancement should comprise as part of these initiatives.

6.2.17 Those working at the landscape scale would welcome better tools to help identify where the areas of greatest heritage value are located, how they could be enhanced, and their relationship to biodiversity and natural capital. At present, (with the possible exception of Registered Parks and Gardens, and some local schemes) datasets and designations tend to indicate point features and finds within such areas, or they cover very wide areas such as Heritage Coasts and AONBs. Historic Landscape Characterisation provides a valuable resource for understanding heritage at the wider scale; however, their availability is variable.

6.2.18 Further investment in making heritage and biodiversity information more readily available online would be welcome. MAGIC and SHINE are excellent online resources, widely used by a variety of environmental specialists (magic.defra.gov.uk and myshinedata.org.uk). There are also many county-level websites that show biodiversity, geodiversity and heritage designations, such as HER. However, Local Wildlife Site boundaries are not often readily accessible.

6.2.19 Where negotiation is required to resolve conflicting requirements at the site or landscape scale, biodiversity specialists have at their disposal a wealth of approaches that help to explain which feature is most important (e.g. protected sites, Priority Habitats, red lists for rare species, etc.), and the condition that the population or habitat is in ('State of Nature'). For heritage specialists, a more bespoke approach seems to be commonplace. An accepted framework for the prioritisation of heritage features and areas beyond the existing suite of heritage designations may be helpful to the day-to-day practicalities of multi-interest negotiation and decision making, as well as helping to make the most of opportunities to enhance heritage. This may require a resourced review of the condition and potential of heritage assets, both designated and otherwise.

7 Recommendations

7.1 Training, expertise and further review

7.1.1 We recommend basic training from university and college level, including apprenticeships and professional CPD courses for heritage, geodiversity and ecology specialists, to raise awareness of the basic principles for aligned disciplines.

7.1.2 Veteran trees and ancient woodland are examples of features with significant wildlife and heritage value, embodied in the definitions of these priority features. We recommend that Historic England works more closely with those active in veteran tree and ancient woodland conservation, to provide expertise as well as helping to secure funding and additional resources, in order to reflect and protect the integrated heritage and biodiversity values of these features.

7.1.3 Community engagement will be important to the future conservation of heritage as well as biodiversity sites. Heritage stories associated with natural features often have resonance for local people, and provide an opportunity for storytelling, which will help raise awareness and engage the community in how our heritage is deeply rooted with our natural environment. Training for professionals in how to articulate an integrated 'sense of place' that covers both aspects would help to safeguard important sites for the future.

7.1.4 We recommend that a review is carried out as to how best to further integrate heritage into existing maritime conservation schemes and actions.

7.1.5 We recommend a review to consider the best way to identify and conserve areas and features in the farmed landscape that have heritage interest. For example, the expansion of Conservation Areas into use for the protection and enhancement of ancient, farmed landscapes may be one option to consider. Alternatively, an approach like the Historic Environment Farm Environment Record (HEFER), with a consultation similar to a felling licence or SHINE, may help to go beyond farms and holdings to cover wider areas and landscapes (Defra, 2022).

7.2 Policy and governance

7.2.1 In current government policy there is a risk that heritage and biodiversity are being separated in terms of land management and planning. We recommend both are considered early on as a whole, failure to do this could result in missed opportunities for enhanced outcomes and negative outcomes for biodiversity and natural capital of heritage features.

7.2.2 Wider recognition and description of heritage assets that manifest at larger geographical scales would help to address the current fragmentary nature of the heritage record and aid integration into landscape-scale initiatives. We found that the heritage record for some areas, such as Hatfield Forest and The Weald NCA, did not fully reflect their cultural and historical value as ancient sites of national significance at the wider scale. The biodiversity designations of sites and mapped Priority Habitats by contrast tended to cover wider areas. They also frequently recognised heritage as a key contributor to the biodiversity value of the site and habitats.

7.2.3 Rural archaeological management specialists could be employed to work proactively and directly with sites, monitoring conditions and providing a Strategic Meetings Management Program for each site outlining enhancement potential and management requirements of each site and prioritising SMs within every Local Planning Authority (LPA) for any funding or enhancement opportunity.

7.2.4 We recommend that Historic England set out their views on the relationship between heritage, Natural Capital and Environmental Net Gain. HE needs to better identify and elucidate the considerable eco and cultural system services that heritage assets already supply and describe how they propose to fulfil their statutory duty to further the conservation and enhancement of biodiversity.

7.2.5 We recommend that Historic England contacts each of the emerging Nature Recovery Partnerships that are operating across the country, offering and requesting engagement, and that specific national guidance in relation to Nature Recovery Strategies is developed to include the early consideration and integration of heritage opportunities, objectives and priorities alongside biodiversity restoration.

7.2.6 We recommend that the heritage and biodiversity sectors work together to help understand and articulate the relationships between the disciplines, to develop ‘at a glance’ guidance on a habitat-by-habitat basis suitable for sustainable development practitioners. This guidance should be highlighted to those working with natural processes, including catchment-scale interventions (‘slow-the-flow’), coastal realignments and (re)wilding projects. As well as heritage enhancements, particularly those with biodiversity benefits, such as replacing lost hedgerows or parkland features. These initiatives would benefit from the engagement of the heritage sector at early stages of proposals. Consultation will still be required for specific sites/ features within those habitats.

7.3 Site management

7.3.1 This joint working should be reflected in integrated management plans for sites with multiple objectives, not just focussed on the special interest of the managing organisation. A natural capital approach can be helpful in this regard.

7.3.2 At the site level, joint meetings and discussions between heritage and biodiversity specialists are frequently found to be the best way to gain a more inclusive understanding of what is needed, in order to make the most of opportunities and to help resolve the details of management.

7.3.3 Many semi-natural features, habitats and landscapes have significant heritage interest. Better access to clear information on these, including on how they can be managed and enhanced for heritage as well as ecological objectives, would be helpful to practitioners at the site and wider geographical scales. This could be targeted to heritage asset practitioners most likely to manage designated biodiversity and geodiversity sites and Priority Habitats and species.

7.3.4 Semi-natural features in urban settings, such as street trees and green infrastructure, also often have a significant heritage component. We recommend that the heritage sector engages with those working on green and blue infrastructure projects to help make the most of opportunities to make both heritage and biodiversity gain. This includes engagement with the Environmental Net Gain agenda and the targeting of developer contributions for enhancements. The heritage sector could benefit substantially from working with these initiatives, to ensure that heritage is properly accounted for in decisions relating to our towns and cities, and to achieve heritage benefits through better funding and integrated design and management

7.4 Data and information

7.4.1 We recommend that the boundaries of Local Wildlife Sites and Conservation Areas are made more readily accessible online, ideally on MAGIC (magic.defra.gov.uk). This would aid, for example, further analysis of the coincidence between heritage and biodiversity/geodiversity outside of statutory designations, contributing to a further nuanced understanding of the relationships between different types of heritage asset and the biodiversity they support. More readily available Heritage Landscape Characterisation information would also be helpful.

7.4.2 A clearer articulation of what may comprise a heritage ‘enhancement’ would be helpful to non-specialists and would help those working at the site and wider geographical scales to make the most of opportunities to fully integrate heritage objectives into management actions.

7.4.3 We recommend a joint project to develop best practice in maximising wellbeing for sites and landscapes that adopts an integrated approach; a natural capital perspective to tease out the various types of wellbeing benefits (e.g. health, recreation, learning etc) may be helpful in this regard.

8 References and Relevant Sources

8.1 Generic datasets and sources

AONB Management Plans: for the Cotswolds, Cornwall, Dorset, High Weald, North Devon, North Pennines

Conservation Area Assessments for: Sea Mills, Canterbury

Historic England data on designated sites, including SMs, Registered Battlefields, Registered Parks and Gardens, Scheduled Monuments, Listed Buildings, World Heritage Sites, Protected Wrecks. Downloaded from www.magic.defra.gov.uk. 2020

Historic Environment Record Centre Data relating to:

- Bath and North East Somerset
- Bedfordshire and Luton
- Bristol
- Buckinghamshire
- Cambridgeshire
- Cornwall
- Cumbria
- Devon
- Dorset
- East Sussex
- Essex
- Gloucestershire,
- Kent
- Milton Keynes
- Oxfordshire, Bath and North East Somerset, Warwickshire, Worcestershire, Wiltshire,
- Somerset
- South Gloucestershire,
- Surrey
- Warwickshire,
- West Sussex
- Wiltshire
- Worcestershire

Historic Landscape Character Assessments: English Heritage (2018) Historic Landscape Characterisation [data-set]. York: Archaeology Data Service [distributor] https://doi.org/10.5284/1047634

Local Record Centre (biodiversity and geodiversity) data from:

- Bristol Regional Environmental Records Centre
- Buckinghamshire and Milton Keynes Environmental Records Centre
- Cambridge and Peterborough Local Records Centre
- Cumbria and North Yorkshire Biological Records Centre
- Dorset Environmental Records Centre
- Essex Wildlife Trust Biological Records Centre Gloucestershire Environmental Records Centre
- Environmental Records Centre for Cornwall and the Isles of Scilly (ERCCIS)
- Kent and Medway Biological Records Centre
- Sussex Biodiversity Records Centre
- Wiltshire and Swindon Biological Records Centre

National Park Management Plans: for Exmoor, Lake District, Yorkshire Dales

National Character Area Profiles:

- National Character Area 107, The Cotswolds. Natural England. 2015
- National Character Area 90, Bedfordshire Greensand Ridge. Natural England. 2013
- National Character Area 17, Orton Fells. Natural England. 2013
- National Character Area 122, High Weald. Natural England 2013
- National Character Area 145, Exmoor. Natural England 2012
- National Character Area 136, Purbeck. Natural England 2012

Natural England data on designated sites, including SSSIs, NNRs, SACs, SPAs, Ramsar, MCZs, AONBs, HCs. Downloaded from www.magic.defra.gov. 2020

Natural England dataset on National Historic Landscape Characterisation. Downloaded from www.magic.defra.gov. 2020

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9 Glossary

Biodiversity - Biological diversity means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems (CBD, 1992).

Countryside Stewardship Scheme – Scheme managed by Defra that provides financial incentives for farmers and other land managers to look after and improve the environment.

CBD - Convention of Biological Diversity. Definition of biodiversity adopted in 1992

Cultural services – All the non-material, and normally non-rival and non-consumptive, outputs of ecosystems (biotic and abiotic) that affect physical and mental states of people (Dasgupta, 2021)

DCMS - Department for Digital, Culture, Media and Sport

Defra - Department for Environment, Food and Rural Affairs

Ecosystem services – The contributions that ecosystems make to human well-being. The Review classifies these into Provisioning services, regulating and maintenance services, and Cultural services (Dasgupta, 2021)

ELMS – The Environmental Land Management Scheme. Farmers and other land managers may be paid for delivering public goods, including clean air, clean and plentiful water, thriving plants and wildlife, protection from environmental hazards, beauty, heritage, and engagement with the environment, and reduction of and adaptation to climate change. A new agri-environment scheme managed by Defra and planned to be operational by 2022.

ENPA - Exmoor National Park Assessment

HER - Historic Environment Records comprise datasets providing detailed information about the historic environment of a given area (Historic England, 2019).

Heritage - “Heritage is a broad concept and includes the natural as well as the cultural environment. It encompasses landscapes, historic places, sites and built environments, as well as biodiversity, collections, past and continuing cultural practices, knowledge and living experiences. It records and expresses the long processes of historic development, forming the essence of diverse national, regional, indigenous and local identities and is an integral part of modern life. It is a social dynamic reference point and positive

instrument for growth and change. The heritage and collective memory of each locality or community is irreplaceable and an important foundation for development, both now and into the future." International Cultural Tourism Charter, ICOMOS, 2002

Heritage Asset - "A building, monument, site, place, area or landscape identified as having a degree of significance meriting consideration in planning decisions, because of its heritage interest. Heritage assets include designated heritage assets and assets identified by the Local Planning Authority (including local listing)." National Planning Policy Framework, 2012

Heritage at Risk Register - annual English Heritage publication which identifies the most important heritage assets at risk of damage or loss.

Heritage Coast - A non-statutory designation agreed between Natural England and the relevant Maritime Local Authority, and managed by Local Authorities and stakeholders with the following objectives:

- Conserve, protect and enhance the natural beauty of the coastline, their marine flora and fauna, and their heritage features
- Encourage the public's enjoyment, understanding and appreciation
- Maintain and improve the health of inshore waters affecting heritage coasts and their beaches through appropriate environmental management measures
- Take account of the needs of agriculture, forestry and fishing, and of the economic and social needs of the small communities on these coasts

HLC – Historic Landscape Characterisation (HLC) data seeks to identify and recognise the historic / heritage basis (the 'time-depth' underlying the modern-day landscape (English Heritage, 2018).

HLF - Heritage Lottery Fund comprises a share of the money raised through the National Lottery for good causes for the benefit of communities across the UK. Distribution of the fund to heritage across the UK is administered by the National Heritage Memorial Fund (known as the HLF), set up under the National Heritage Act 1980.

Historic environment - All aspects of the environment resulting from the interaction between people and places through time, including all surviving physical remains of past human activity, whether visible, buried or submerged, and landscaped and planted or managed flora

Historic designed landscapes - Designed landscapes created before the late 20th century that have historic significance. This includes a diverse range of landscapes, such as cemeteries, hospitals, new towns, deer parks, industrial landscapes, town squares and recreational parks.

Human capital – the productive wealth embodied in labour, skills and knowledge (Dasgupta, 2021).

ICOMOS - International Council on Monuments and Sites (ICOMOS), a non-governmental organisation dedicated to the conservation of the world's monuments and sites. Its work is based on the principles in the 1964 International charter on the conservation and restoration of monuments and sites (The Venice Charter) with ICOMOS created in 1964.

Listed Building – a building of special architectural or historic interest included on a list compiled under the Planning (Listed Buildings and Conservation Areas) Act 1990.

LIDAR – Light Detection and Ranging, is a remote sensing method that uses light to the form of a pulsed laser to measure ranges (variable distances) to the Earth.

Local Development Plan / Local Plan - "A plan for the future development of a local area, drawn up by the Local Planning Authority in consultation with the community. In law this is described as the development plan documents adopted under the Planning and Compulsory Purchase Act 2004." (NPPF, 2019)

LNRS - Local Nature Recovery Strategies will be required under the Environment Bill currently progressing through parliament. Local Authorities will be obliged to develop spatial mapping and planning tools to inform nature recovery through actions and incentives that will drive change on the ground.

LPA - Local Planning Authority. The public authority whose duty it is to carry out specific planning functions for a particular area.

LRC - Local Record Centre. Organisation which collects collates and manages information on wildlife and the natural environment and can supply to local users.

MAGIC - Multi Agency Geographic Information for the Countryside (MAGIC). A web-based interactive map located at https://magic.defra.gov.uk/, which brings together information on key environmental schemes and designations in one place. MAGIC is a partnership project involving six government organisations who have responsibilities for rural policy-making and management (Natural England, 2021).

MCZ – Marine Conservation Zone Areas designated by Government under the Marine and Coastal Access Act 2009 for the purposes of conserving (a) marine flora or fauna; (b) marine habitats or types of marine habitat; (c) features of geological or geomorphological interest.

MNR – Marine Nature Reserve. Sites designated under the Wildlife and Countryside Act 1981 (as amended) for the conservation of flora, fauna and/or geological features in the marine environment.

Natural assets – Naturally occurring living and non-living entities that together comprise ecosystems and deliver ecosystem services that benefit current and future generations (Dasgupta, 2021).

Natural Capital - The stock of renewable and non-renewable natural assets (e.g. ecosystems) that yield a flow of benefits to people (i.e. ecosystem services). The term 'natural capital' is used to emphasise it is a capital asset, like produced capital (roads and buildings) and human capital (knowledge and skills) (Dasgupta, 2021).

Natural Heritage – "natural features consisting of physical and biological formations or groups of such formations, which are of outstanding universal value from the aesthetic or scientific point of view; and/or geological and physiographical formations and precisely delineated areas which constitute the habitat of threatened species of animals and plants of outstanding universal value from the point of view of science or conservation; and/or natural sites or precisely delineated natural areas of outstanding universal value from the point view of science, conservation or natural beauty." (UNESCO, 1972).

NCA - National Character Areas. A natural subdivision of England based on landscape characteristics, biodiversity, geodiversity and economics. Each of 159 profiles, produced and revised on a rolling programme by Natural England, includes a description of the natural and cultural features that shape landscapes, how the landscape has changed over time, current key drivers for ongoing change, and a broad analysis of each area's characteristics and ecosystem services.

NHLC - National Historic Landscape Characterisation. Data set which presents the historic landscape character of England at a national level in a 250m scale grid. The data is extracted from a dataset of merged sub-regional Historic landscape character assessments.

NNR - National Nature Reserve. Designated under the National Parks and Access to the Countryside Act 1949 and the Wildlife and Countryside Act 1981 to protect the UKs habitats, species and geology of particular importance in the terrestrial environment.

NPPF - National Planning Policy Framework sets out the Government's planning policies for England and how these should be applied (NPPF, 2019).

PALs - Principal Archaeological Landscapes designation

Plantsmanship - an expertise in plant diversity and culture.

Priority Habitat – habitat of principal nature conservation importance as listed under Section 41 of the Natural Environment and Rural Communities Act 2006

Priority species – species of principal nature conservation importance as listed under Section 41 of the Natural Environment and Rural Communities Act 2006

Protected species –species protected by law. Key legislation for England includes the Wildlife and Countryside Act 1981 (as amended), the Conservation Natural Habitats and Species Regulations 2017, the Protection of Badgers Act 1992 and the Wild Mammals (Protection) Act 1996.

Protected Wreck Sites – A vessel protected on the account of the historical, archaeological, or artistic importance of the vessel or any objects contained or formally contained in it (Protection of Wrecks Act 1973).

Public goods – Goods or services that are neither rivalrous (access to a public good by any one group of people has no effect on the quantity available to others) nor excludable (no one can be excluded from access to the good) (Dasgupta, 2021).

Ramsar site – A wetland recognised as of international importance under the Ramsar Convention for the conservation and wise use of wetlands and their resources (Ramsar, Iran, 1971)

Registered Battlefield – A site included on the Register of Historic Battlefields, which is maintained by Historic England.

Registered Parks and Gardens – A site included on the register of historic parks and gardens in England, which is maintained by Historic England (Historic Buildings and Ancient Monuments Act 1953).

SAC - Special Area of Conservation are high-quality conservation sites that make a significant contribution to conserving the habitats and species listed under the European Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora, known as the Habitats Directive. Can be both terrestrial and marine.

Scheduled Monument (SM) – is an historic building or site that is included in the Schedule of Monuments as set out in the Ancient Monuments and Archaeological Areas Act 1979, and maintained by the Secretary of State for Digital, Culture, Media and Sport.

Setting - 1) “The surroundings in which a heritage asset is experienced. Its extent is not fixed and may change as the asset and its surroundings evolve. Elements of a setting may make a positive or negative contribution to the significance of an asset.” (NPPF, 2019)

2) “The surroundings in which a place is experienced, its local context, embracing present and past relationships to the adjacent landscape.” Conservation Principles, English Heritage, 2008

3) “The setting of a heritage structure, site or area is defined as the immediate and extended environment that is part of, or contributes to, its significance and distinctive character. Beyond the physical and visual aspects, the setting includes interaction with the natural environment; past or present social or spiritual practices, customs, traditional knowledge, use or activities and other forms of intangible cultural heritage aspects that created and form the space as well as the current and dynamic cultural, social and economic context.” (Xi’an Declaration on the Conservation of the Setting of Heritage Structures, Sites and Areas, ICOMOS, 2005)

Social capital – Mutual trust and associated norms of reciprocity that enable people to engage with one another (Dasgupta, 2021)

SPA - Special Protected Area. Strictly protected site was originally protected with Article 4 of the EC Birds Directive (now transposed into UK law) for the conservation of birds.

SSSI - Site of Special Scientific Interest. Site designated by Natural England under the Wildlife and Countryside Act 1981 due to special interest in its flora, fauna, geological and/or geomorphological features.

Sustainable development – Development that meets the needs of the present without compromising the ability of future generations to meet their own needs, i.e. by bequeathing to its successor at least as large a productive base as it had inherited from its predecessor (Dasgupta, 2021)

UNESCO – United Nations Education, Scientific and Cultural Organisation.

Vernacular heritage landscapes - A landscape that is shaped by the cultural attitudes and behaviours of an individual or the community that uses it. These landscapes reflect the physical, biological, and cultural character of those everyday lives.

Wellbeing – A measure of the extent to which a person's informed desires are realised (Dasgupta, 2021)

WHS - World Heritage Site. An area which is deemed by UNESCO to have outstanding universal value in cultural and natural heritage, UNESCO (1972).

Appendix 1
Questionnaires

A1.1 Hatfield Forest: Questionnaire

Discussion between Simon Ford (Geckoella) and Henry Bexley, Property Operations Manager. National Trust (NT). 1.45 hrs

Management Plan: A NNR Conservation Management Plan (2021) is in place with Natural England sign-off (CMP).

Format of Plan: Feel it works well but have tweaked the NNR MP format to fit NT layout. In addition, there is a Conservation Plan for the designed landscape and medieval forest, written by Sarah Rutherford.

Future Plans: The last major development was an extension to the Shell House car park in circa 2002 and this was done on the understanding that no further expansion will be carried out to ensure it does not damage the conservation of the site. The aim is not to drive visitor growth, but to provide a better experience for those who come. The main conflict is at the edges of the parkland and in development in towns such as Harlow. Footprint Ecology has carried out research and it is believed that the 'zone of influence' at Hatfield, extends to 14.6 kms. A key recommendation is to develop recreational green space near new development to buffer impact. A Mitigation Strategy has been drawn up with Natural England and local authority support. This seeks S106 funding from developments within the ZOI to remediate the impacts of increasing recreational pressure on Hatfield Forest using a suite of sensitive environmental land management techniques appropriate to the site. It also makes a strong case for developers to ensure the provision of high-quality green space within or close to their sites.

Funding and Grants: CS for woods and coppice and HLS for grassland and wood pasture. WGS was used in the past. Aim to pull all schemes in to ELMS. Enterprises include café, shop and car parking (£8.00 for non-members). NT have looked at charging as pay for entry, but multiple entry points at the edge of the estate makes this impractical. Landfill Tax, People's Postcode Lottery and Green Recovery Challenge have helped fund specific projects.

Wildlife Knowledge: There is a comprehensive NT Bio Survey. In addition, there is a long history of knowledgeable naturalists surveying most taxa- birds, butterflies, moths, insects, bats, saproxylic invertebrates, lichens, bryophytes, flora and of course veteran trees. Further volunteers are sought, in particular for fungi.

Threats to Biodiversity: Erosion and compaction from visitors is probably the most direct impact. Root protection zones are being created and in some cases paths and tracks re-routed. In woodlands, people avoiding muddy paths are trampling ‘notable ancient woodland ground flora such as oxlips’. Atmospheric pollution is a major concern and monitoring suggests impacts on lichen and bryophytes particularly in the northern area nearest the airport. Reduced water flow to the fen could be attributed to development and balancing ponds at the airport- needs further research.

Biodiversity Audit: This is in place and monitoring continues, although there are concerns about the recent reduction in technical ecological specialists within NT.

Challenges in Management: Visitor access near ancient trees (tree safety and compaction). Getting suitable cattle grazing. In the past there were continental breeds, but now have good Red Poll stock and sympathetic graziers. Deer, particularly muntjac, are preventing regeneration, but active deer management groups shoot year-round. Dog disturbance to ground nesting birds (conversely reduces muntjac). Air pollution to sensitive lichens and may be affecting veteran trees.

Engaging Public: Guided walks, talks, interpretation and online information. Lots of volunteers in all manner of work. Specialist training courses on managing ancient trees and deadwood for professional ecologists and arborists.

Advice: Concerns about the availability of NT and Natural England specialists and survey teams, including continuity of engagement and knowledge about the site.

How Could Advice be Improved: Concerns that many new residents in the area have moved from North London to towns such as Harlow and do not understand the countryside. Essex Wildlife Trust are running an excellent initiative where new houses are given a guide on local green spaces and how to look after them.

Valuing Wildlife and Heritage: Nature and open space seems to be more valued than ever before. Visitor numbers have over doubled since Covid-19, although this has had impacts such as litter, erosion, and some vandalism around the periphery. Because visitors need to book at present due to Covid-19, they are parking at the edge and damaging verges and blocking gates.

The heritage of the designed landscape is greatly enjoyed, although the buildings such as Shell House have had to close due to Covid-19. The lake (designed by Capability Brown) is a favourite site.

Issues with Managing Historic and Natural Environment: This is not a significant problem at Hatfield Forest, although occasionally there have been discussions about the retention of deadwood in the more formal landscape near the lake. A compromise has been

found where it is retained but in a less prominent position. Cattle grazing has created tensions in the past, mainly because the grazier was unsympathetic and kept stock on too long, but this has now improved. Deadwood is an example of an issue with different perspectives as to how to best manage; a Deadwood Policy was formalised within the new NNR Conservation Management Plan.

Information on Heritage: There is a good website with information on the history of Hatfield, with the NNR Conservation Plan uploaded and historical information boards are in the Shell House.

A1.2 Campbell Park, Milton Keynes: Questionnaire. 19/02/2021.

Discussion between Simon Ford (Geckoella) and Philip Bowther. Head of Environment and Volunteering, The Parks Trust. 1.30 hrs

Management Plan: There is no Management Plan for Campbell Park yet, although there is a Management Plan/Development Plan in embryonic form. There are MPs for other sites in the Parks Trust portfolio such as the nature reserves and woodlands. Mr Bowther said that staff tended to know their sites so well that there was less need for a dedicated plan.

Future Plans: Being in the centre of Milton Keynes new town, there is a great deal of development ongoing or proposed. At present, there is a development adjacent to the canal and plans are underway for a large housing development immediately to the north of Campbell Park. This is likely to make the park significantly busier, but this is generally not seen as an issue because there are hard surfaced paths, and it is felt that there is capacity to increase use. One perceived benefit of development is that it should drive away some anti-social behaviour, such as drug dealing/taking at the periphery of the park as more people use it.

There has been a long-standing proposal to create a new café/lavatories and multi-use community building and town council office in Campbell Park. This was shelved due to resources, but is hoped may be funded through development-linked money.

Funding and Grants: The Parks Trust was set up as a charity in 1992 by the Milton Keynes Development Corporation, with a Board of Trustees and an Executive. The aim was to create an endowment to pay for the running costs of the parks and open spaces in MK, by transferring a portfolio of commercial properties from shopping centres, a youth hostel, a marina, pub, petrol station and houses to the Trust. These are freehold properties and can be bought and sold when opportunities arise. In recent years, new

investment opportunities have been made in other parts of the country. This has been successful in helping fund much of the works in the green spaces at MK and there has not been a great need to apply for further grants and funding.

Basic Payment Scheme (BPS) is claimed for the wildflower grassland which is grazed by sheep and cut for hay. Agri-environment grants such as CS and HLS are used elsewhere in the portfolio, and it is hoped that it can all be put under a new ELMS bid to include Campbell Park.

There are also plans to apply for Section 106 development funding to assist with specific projects such as managing the hydrology of the ponds and rills in Campbell Park.

Wildlife Knowledge: There have been over 300 different surveys on the Parks Trust land since 1974, although no dedicated Biological Survey for Campbell Park. There are 3 Biodiversity Officers for the Parks Trust who have a good knowledge of the wildlife-particularly protected species, such as great crested newts. A map listing some species of birds, plants and insects has been produced and a transect is carried out in the wildflower meadow annually as well as a bumblebee survey. There are a large number of volunteers who help the Parks Trust and some would no doubt be happy to do further surveying or monitoring if required.

Threats to Biodiversity: There are limited threats to wildlife, although there are occasionally sheep worrying incidents from dogs despite careful signing. Dogs can also disturb ground nesting birds. Litter and antisocial behaviour can be an issue in some areas, but does not generally have a significant deleterious effect on the ecology.

Erosion and trampling are not generally a problem because there are paved paths, although there is some erosion forming along the Belvedere.

Biodiversity Audit: There is a Biodiversity Audit in place (2017-2022), with a series of Habitat and Species Action Plans, although many relate to other parts of the property portfolio.

Challenges in Management: Sheep grazing in the park can be affected by dogs under poor control. However, issues are reasonably limited.

Green hay has been collected from donor sites elsewhere in the Parks Trust land in MK to spread over the wildflower meadow. The sheep are an in-hand flock which can be moved from site to site and have their own farm manager, giving more flexibility than with a tenant.

Engaging Public: There is a Community Engagement and Learning Team in the Parks Trust. An extensive programme of activities and events is put on from bat watching to litter picking and fitness to hedge laying. Being in the centre of MK and connected to a variety of other green spaces, it is a well-used community resource. Covid-19 has seen an increase in usage and in particular fitness activities.

Education Officers go out to schools in the locality to provide information on the works and sites in the area.

If the Café/Community Centre can be built, this would open new opportunities for engagement. There is a free car park, but no public lavatories.

Advice: There is a good relationship with other bodies such as Natural and Historic England, Berks, Bucks and Oxon Wildlife Trust (BBOWT), Forestry Commission, Environment Agency and Inland Drainage Board. The Parks Trust is also well staffed with people such as ecologists, community and landscape officers.

How Could Advice be Improved: Feel happy with present structure.

Valuing Wildlife and Heritage: Campbell Park is most used by people for exercise (formal such as cricket to informal such as jogging). People do enjoy the gardens and designed landscape as well as nature, but would tend to go to other sites specifically for bird watching or looking at historical places.

Issues with Managing Historic and Natural Environment. There are no real conflicts between the natural and historic interests. All the staff work from one office and can discuss contentious matters if needed. The trees are not yet at the stage where they need a great deal of management (other than those affected by ash Chalara). Some members of the public have questioned why more trees are not planted to store carbon.

Some of the water bodies have been drying up and the rills stopped flowing in the summer. Further investigation is needed and it is hoped that section 106 money could be used to improve this situation and perhaps use water from balancing ponds.

Information on Heritage: There is a very good website with information on Campbell Park and events. There are lots of guided walks and talks and interpretation boards. The recent Historic England listing of Campbell Park has increased awareness of its heritage value.

A1.3 Wessex Hillforts and Habitats Project: Questionnaire

Discussion between Simon Ford (Geckoella) and Marie McLeish. Project Manager, The National Trust. 1.30 hrs. 25 Feb 21.

Management Plan: The aim is that by the end of 2021, there will be individual management plans written for each of the 13 hillforts. These will sit under the wider NT Estate Management Plans. All the works will be programmed and funded in the property budgets and informed by Priority Habitat and Archaeological Surveys. The Hillfort site management plans dovetail with the NT Estate Management Plans, which tend to cover larger areas of the property.

Format of Plan: The Hillfort MP is capped at 18 pages long for each site, but each one has a summary annotated map for the Rangers, to show what work needs doing where and when and can be carried in their vehicles.

Future Plans: Generally, conflicts with development and management are rarely seen. However, on some sites, there is an aim to develop outdoor concessions, which could add to the issue of erosion and wear. Footfall increased dramatically through Covid-19 and the NT have sometimes found it hard to balance the “everyone welcome” objectives with conservation.

It is hoped that most of the four sites which are on the Heritage at Risk Register will be removed through 2021 or 2022, through careful management. In addition, the objective is to move all SSSIs to Favourable Conditions.

Funding and Grants: Funding for the Wessex Hillforts and Habitats project has come through a variety of means. The largest is the People’s Postcode Lottery, followed by a Historic England grant, but in addition South Dorset Leader and National Trust Restricted Funds have helped resource work.

The National Trust has been “working hand in glove with HE”, helping to ensure delivery of the objectives and the project is seen as exemplary both within NT and HE. It has been an excellent opportunity to invest in local and regional relationships between the two organisations.

It has been seen as particularly important that the grants have helped fund staff and the Project Officer post has been pivotal in driving forward the volunteer recruitment and development workstream.

Wildlife Knowledge: Each of the hillforts has a dedicated Biological Survey produced by the NT Bio Survey team, as well as an Archaeological Survey. The dedicated team of volunteers (Biodiversity and Archaeology) bring a wealth of knowledge and their research is significantly increasing understanding of the sites.

There remains a need to ensure that these surveys include indicators, rather than just list species, to help ensure that the data informs as to condition and quality of the habitat.

Threats to Biodiversity: Appropriate grazing levels and timing remain an issue, when using tenants' stock, rather than in hand sheep/cattle. Dogs chasing sheep are a perennial issue on some hillforts such as Badbury Rings and Hambledon Hill and can deter tenants putting stock out. Getting the right level of scrub management to protect the hillfort but act as a habitat is another balancing act.

There can be issues with erecting the necessary stock fencing to graze a site, while HE has not wanted fence posts erected on Scheduled Monuments.

Burrowing animals can be damaging, and badgers are particularly difficult because of the legal protection they afford.

Climate change is having an effect, including an increase in mild wet winters resulting in excessive erosion and impacting on a variety of species at the edge of their range. Atmospheric pollution is increasing nitrogen inputs and reducing diversity as well as encouraging species such as European gorse and tor grass.

Challenges in Management: Sheep grazing on the hillforts with public access can be challenging if dogs are not kept under close control.

The isolated nature of the hillforts spread across a large area and steep topography make them difficult to manage.

Engaging Public: This is a key part of the Hillforts and Habitats Project brief. An impressive series of Hillforts Guides have been produced. There is a plan to produce a series of self-lead walks and to provide links between sites for those on foot or bicycle.

Advice: The National Trust has a good team of expert Nature Conservation and Archaeology Advisers. There is an excellent relationship with Historic England and Natural England.

How Could Advice be Improved? This is not seen as an issue at present. The NT has good coordinated multi-disciplinary advice. There are also strong relationships with external conservation NGOs and statutory agencies.

Valuing Wildlife and Heritage: Visitors to the hillforts are very varied and each has a different reason for going. Some are local people who want to walk their dog, while others want to take their children for exercise or to go for a walk/jog. A smaller number have specialist interests, such as birds, flowers or butterflies or Iron Age archaeology.

There remain a small number who visit sites for antisocial reasons such as illegal metal detecting, fly-tipping, 4WD or motorcycling.

Hillforts are greatly valued for their spectacular views and unfettered space to wander which is not available in many areas of the country.

Issues with Managing Historic and Natural Environment.

It is imperative to get the right people around the table and to come up with solutions, rather than to work in ‘silos’.

Joint meetings with NE and HE at the Hillforts and Habitats project sites has helped foster a much more joined up approach to management and an understanding of each other’s objectives.

The Hillforts and Habitats Project has been an excellent way to show what can be achieved when working together and to find new and innovative ways to deliver conservation.

Information on Heritage: This is a key element of the project. The historic and natural environment carry equal weight in both interpretation and management, helping to break down barriers.

Web pages are being developed as a free resource, available to everyone.

There are plans to work with the volunteer archaeologists and the NT Regional Archaeologist to revisit historical digs and to republish the finds data for everyone to be able to use it.

Appendix 2
Advice Notes for Heritage Asset Managers

A2.1 Advice Note - Heritage and Biodiversity at the Site Scale

Introduction

Wildlife is suffering a catastrophic decline. There is a growing understanding of the importance of nature to people.

Heritage sites and assets are often also of great significance for nature. This may be due to their long-term continuity and as a result of the diversity of structures and features, which provide opportunities for wildlife. In most cases, minor changes can be made to the management to accommodate or enhance the site for nature, without compromising the historic or aesthetic value.

Importance of the site for wildlife

Wildlife designations and legislation may apply to a site in addition to any legislation relating to the heritage. It is important to be aware of the wider responsibilities of managing a site, to ensure it is properly looked after for its conservation value for both heritage and wildlife.

In many cases, places which are scheduled as historic or cultural assets are also designated or mapped as of importance for nature conservation, for instance as a Site of Special Scientific Interest (SSSI), Local Wildlife Site (CWS/SNCI/LWS) or Priority Habitat. In other cases, they may have Protected or Priority Species present, such as bats or dormice, which need particular care and may have legal protection (see Glossary). Sites may also have features of value for local wildlife, such as nesting sites for birds and flower-rich meadows and gardens for pollinating insects.

Existing information on the biodiversity interest of your site may be obtained online, for example from magic.defra.gov.uk, and/or from your Local Records Centre (www.alerc.org.uk/lerc-finder.html), and you can help improve knowledge of the wildlife of your area by submitting records as well to these resources.

What wildlife do you have on your site?

Features of value for wildlife that are often found on sites important for heritage include:

- Historic parklands and wood pastures are an exceptionally important resource as well as often being a key part of the designed landscape and are home to a large variety of important species and habitats.

- Old trees are important since their cavities and features are often used by roosting bats as well as nesting birds and insects. Hedgerows may be habitat for dormouse.

- Dead wood on the ground in woodlands and parklands can be exceptionally important for rare invertebrates and lichens.

- Long-established grassland in old lawns, estates and farmed landscapes may be flower-rich and host rare species; lowland and upland meadows are a priority for wildlife conservation.

- Ponds and water features, including wet and boggy ground, and areas subject to occasional flooding, can be extremely important for wildlife as well as being attractive. Rare and protected amphibians such as great crested newts can be found as well as dragonflies and other aquatic insects.

- Orchards are an important recognised heritage and wildlife feature. Traditional orchards often have rare and local varieties of fruit as well as being home to rare wildlife species.

- Historic gardens can be a very important local resource for wildlife, particularly in urban settings, providing flowers for pollinating insects and features such as compost heaps used by reptiles and other species.

- Piles of deadwood or stone can provide valuable hibernaculum and habitat for important species such as slow worms, grass snakes, toads and hedgehogs.

Figure A2.1: Traditional apple and pear orchard, Gloucestershire

What can be done to look after and enhance the wildlife on your site?

- Often small changes to management will provide significant gains for nature.

- Consider commissioning a survey to list the biodiversity found on site and derive site-specific advice. Install information for visitors to the site on what they may find. Your local wildlife trust or other voluntary nature conservation groups may be able to help with this.

- Buildings and structures may host bats and nesting birds. The conservation of a range of important bat species, as well as some birds such as house martins, swallows, swifts and barn owls, are all broadly dependent on heritage buildings and structures at key points in their life cycle. They are protected by law and should not be disturbed. An ecologist should be consulted for advice, particularly when planning building work, and including periods when the species may not be present. If in doubt, call in an expert or speak to Natural England.

- Some buildings and structures, including stone walls and bridges, support important vegetation and lichens. Although woody plants such as buddleia, valerian and ivy often need control to avoid damage to masonry, where practicable, non-damaging plants, lichens and mosses should be retained and valued as part of the wildlife of the site. Similarly, some masonry bees are rare, and imaginative solutions may help to conserve both wildlife and heritage, for example through the provision of alternative areas suitable for the bees that won't affect the structural integrity of the structure.

- If there is an orchard or parkland present on your site, it is an important asset and should be retained. Management for wildlife includes looking after both the trees and the surrounding grassland and other linking habitats. Continuity planting is valuable, ideally using similar species to those already present. Dead and dying trees are often extremely valuable and they should be retained in situ (sometimes excluding the public from under them on safety grounds). Mowing and grazing regimes around the trees should promote a diversity of species and structure.

- If planning works to or felling of trees or woodland areas with good potential for wildlife, then consult an ecologist for advice. Carry out essential tree works outside bird nesting season (March to August) and be aware that other protected species such as dormice and bats may also be present. Mature and veteran trees in particular may be important to wildlife. Seek specialist advice to inform work.

- Retain dead wood, both on trees, and fallen on the ground.

- Protect old and ancient trees from compaction (for instance from car parking and footfall) and if considered a health and safety risk, consider fencing from the public.

- Reduce mowing and retain areas of long grass to benefit flowers and insects and reduce environmental and other costs. Instead of regular mowing of grass, cut it instead twice per year- after mid-July and again during the winter, raking and composting the cuttings.

- If the grass lacks diversity of flowering plants, consider spreading hay collected from local sites with interesting species.

- Ponds and water features may host great crested newt and other protected or important species. In general, measures to maintain good water quality, shelving sides and banks offering different water depths, and a variety of vegetation structure mixed with open water in both shade and sun, offers opportunities for a wide range of flora and fauna. If there is a pond on site, try to maintain some natural vegetation both in and around the pond. Ideally do not introduce goldfish and carp which will eat many aquatic animals. Some species, notably great crested newts are protected by law and a licence is needed from Natural England before carrying out work.

- Some features of heritage value may be causing on-going damage to wildlife populations, such as river weirs restricting fish migration. Joint site-visits by heritage and ecological specialists may be required to come up with solutions that conserve the heritage interest whilst achieving wildlife conservation. These may comprise the provision of alternative features suitable for wildlife.

- Non-native invasive species such as Japanese knotweed, Himalayan balsam and New Zealand pygmy weed can sometimes be present on heritage sites. Specialist advice is needed to control them, and legislation applies to these and other species to help prevent further spread (www.nonnativespecies.org).

- Burrowing animals, such as foxes, badgers, rabbits and moles may damage historic features. Badgers are protected from disturbance and a licence from Natural England may be required if a sett needs to be moved away from the heritage interest.

- Provide dead wood and stone piles in shady undisturbed spots, to create a home for reptiles and amphibians. Compost bins are also a valuable resource.

- Aim to reduce the use of herbicides and pesticides to a minimum and use non-peat-based composts for propagation and soil improvers.

- Pollinators

- Structural diversity, range of flowering seasons

- Having clear environmental value in reducing and recycling on site waste.

A2.2 Advice Note - Heritage and Biodiversity at the Landscape Scale

Introduction:

There are greater opportunities to make beneficial changes for nature working at a landscape scale than can be made at a small, often isolated site. The government recognised this with Sir John Lawton's, 2019 State of Nature Report, where he called for protected sites to be "Bigger, Better, More and Joined". By following these principles, it is possible to create more resilient and diverse populations of wildlife (Lawton et al., 2010).

Landscape-scale changes also have significant implications for heritage conservation, and landscapes of heritage value often provide the areas with the best potential for large-scale wildlife gains, alongside other natural capital benefits. Decisions on what is most appropriate need to be made on a site-by-site basis to ensure that both the historic and natural environment are enhanced.

Importance of Heritage Assets for Wildlife:

Much of what is valued by heritage asset managers is also considered of significance by the ecologist. There is rarely much divergence between the objectives for management and by working together, it is perfectly possible to have broader conservation delivery benefits. Additionally, by developing improvements to management on the landscape scale, this can 'buffer' sensitive sites from damage

Figure A2.2: Volunteers surveying Pilsdon Pen Hillfort, Dorset (reproduced with permission of the National Trust)

What opportunities are there to work on a landscape scale?

Many organisations are already working on projects at the landscape scale, from creating larger National Nature Reserves on sites such as Purbeck Heaths in Dorset and the Cotswolds Commons and Beechwoods in Gloucestershire to ‘Wild Ennerdale’, in Cumbria. This ranges from the re-creation of species rich grassland and woodland, with improved connectivity, representing an enhancement of current features, to more adventurous change and ‘re-wilding’, at sites such as Knepp Castle in Sussex. Several large estates are integrating ecology and heritage as part of a long-term landscape-scale plan. For example, at Great Dixter Garden the wider estate is being managed to allow species to move across the landscape and onwards to the High Weald AONB. Operating at a wider scale, the Wessex Hillforts and Habitats Project includes 13 separate Iron Age Scheduled Monuments in Dorset and Wiltshire. Equipment and skills are shared across sites and there are ambitions to link sites with high quality grassland. On the Polden Hills in Somerset, Butterfly Conservation, Somerset Wildlife Trust, the National Trust and the Large Blue Butterfly Committee work together as a team over 21 sites of historic and natural value, to improve the habitat for a rare butterfly. Grazing projects are often a key ingredient for landscape-scale grassland conservation due to the specialist management requirements of sites of nature conservation value, for example across a suite of high value grassland sites in the Cotswolds.

Local Nature Recovery Strategies across the country are being developed with the mapping and targeting of areas for wildlife enhancement and improved connectivity being the first step. These are expected to have a statutory basis as part of Local Development Plans as set out in the Environment Bill which is currently (May 2021) going through parliament. Additional resources to fund landscape-scale change are expected to be available from developer contributions to ‘Biodiversity Net Gain’, and from the Sustainable Farming Initiative which will increasingly target agri-environment support towards payment for public goods. Exmoor National Park is amongst those at the forefront of nature recovery work that integrates heritage at the outset, both in capitalising on opportunities and working out innovative solutions where trade-offs may occur.

Natural capital welfare and health benefits for communities derive from recreation, knowledge, aesthetics and landscape, as well as the local understanding and sense of place of an area. Both heritage and biodiversity contribute to these values and maximum benefits derive from an integration of these aspects. Enhancement of other natural capital values, including water quality, carbon management and soil conservation also often depend on a good understanding of both the natural and the human history of an area.

Changes at the landscape scale may be profound and far-reaching, and it is imperative that the heritage and ecological sectors work together to make the most of these exciting opportunities.

Key points:

- To create real gains, it is important to work in collaboration, with the creation of broader Conservation Management Plans, encompassing both the historic and natural environment. Where possible, joint site visits should be arranged to ensure a joined-up approach to management.

- Grazing Projects, where cattle and sheep can be moved across a variety of sites to help achieve integrated management goals can be good solutions to specialist management requirements. Equipment sharing and other cooperative actions between partner organisations, including the sharing of advice and knowledge, can also help resources go further.

- Grant applications to bodies such as the Heritage Lottery Fund or Landfill Tax are much better received when they show that there will be broader benefits to the historic and natural environment and to people, rather than treated in a ‘silo’ manner. In addition, bids for agri-environment grants are more likely to be successful when linked over larger areas and integrating multiple objectives.

- Many conservation organisations have volunteer work parties working across multiple sites under different ownership, but with a common goal of improving conservation. Projects that link similar sites as a theme can help local actions achieve regional significance.

- It is important to have a good understanding of the habitats and species present in a landscape as well as the heritage interest. Local Records Centres (biological and heritage) often hold much of this information, and it can help ensure that management is tailor made to protect the heritage asset, while enhancing wildlife. The gathering and management of high-quality information is an important aspect of landscape-scale work. Whilst volunteers can offer a significant contribution to on-the-ground data gathering, this must be set within a wider, well-resourced structure and plan for ecological and heritage monitoring and data gathering, including targets to measure success.

- Development control will be required to deliver Biodiversity Net Gain as part of a suite of measures in the Environment Bill. Developer contributions, whether through direct habitat creation and management, or through contributions to conservation projects, may be a significant driver for change at the landscape scale. This is particularly the case in urban and urban-fringe areas, as well as in areas affected by major infrastructure projects, such as HS2, nuclear power and major trunk roads. There are opportunities for conservation bodies from both the heritage and wildlife groups to work together to influence and design works, to mitigate damage and make the most of opportunities to enhance sites and areas.

- Carbon budget plans are in development across the country. Whilst tree planting has achieved a high profile, actions to conserve and enhance existing habitats and features of nature conservation and heritage value may well, in many cases, achieve better carbon budgets, as well as a wider range of natural capital benefits than the type of agri-forestry monoculture most suited to carbon absorption. The heritage and nature conservation communities should work together to engage with the carbon agenda and plans and help to prioritise and target actions on a landscape scale to ensure a wide range of environmental benefits.

A2.3 Advice Note - Heritage and Natural Capital

Introduction:

Natural Capital is described as “the world’s stock of natural assets, including soils, minerals, air, water and biodiversity”. Without these critical functions, we would be unable to thrive or indeed survive as a race. They provide key services (sometimes known as ‘ecosystem services’), such as the food we eat, the timber we use for construction and as fuel and the water we drink. In addition, it includes the ability of soils and water to store carbon and help regulate climate change.

Importance of Sites for Natural Capital:

It is imperative that we all do what we can to look after our natural capital, whether as individuals, organisations or governments. At the site scale, it may not always be evident what can be done, as it may only be seen as performing a very minor function, compared to the extent of the problems the world is suffering. However, cumulatively, it will make a difference.

It is first important to understand what there is at each site. This is often called a Natural Capital Audit, where a simple map identifies elements such as water courses, soils, areas of woodlands, and species present. It will also include their condition, such as soil erosion, whether the soil is under permanent grass or cultivated, water pollution, air pollution (or noise for instance from airports, industry and roads). Opportunities to improve condition are then identified and examples are included in the later section below.

Identifying Natural Capital Assets on the Site:

Every site differs, depending on such matters such as size, complexity, geology, soils, topography, altitude, position in a catchment, proximity to urban development such as housing, roads, airports, railways, and the wildlife that is present. Another factor to consider is whether the activities at the site might be contributing positively or negatively to the environment. This might include any farming operations, woodland management, enterprises such as catering or retail, lavatories, pressure of footfall and car parking, provision of renewable energy sources, etc.

- Check the underlying geology and soils of the site. This may be a single rock and soil type on small sites, but may vary greatly on larger more complex sites. Identify any quarries, mines, adits or mineral extraction, past or present.

- What farming operations are there on site, if any? Is this in keeping with the objectives or is it for instance creating pollution, soil erosion, damaging trees and wildlife or impacting archaeology and historic landscapes?

- Are there any trees or woodlands? Is this native woodland or conifer plantation. How are the woodlands managed, if at all?

- Identify any water bodies, which might include springs, ponds, lakes, streams, rivers, estuaries and the sea. Record if there are flooding issues on site or downstream of the site. What is the condition of the water and is water abstracted from the site?

- List any transport infrastructure on the site or in proximity and whether there are impacts such as air pollution, fuel run off, noise pollution and whether it creates a barrier for wildlife to cross, such as otters, hedgehogs, dormice, hares, badgers and reptiles/amphibians.

- Are in house operations, impacting on natural capital, such as large car parks, compaction, erosion from footfall, is peat still used in the garden or in plant sales, are the lavatories properly managed and is grease discharged to drains in catering outlets?

Figure A2.3: Woodland and stream, Cotswolds

Opportunities to Improve the Natural Capital on the Site:

- Where possible, do not cultivate land in the flood plain or beside rivers or on steep slopes, due to the potential for soil erosion into water courses.

- Peat soils are very important stores for carbon and should ideally not be cultivated and should be vegetated. Peat should not be used in gardens or propagation; there are many good alternatives.

- Is there compaction and erosion caused by footfall or damage to ancient trees? Consider relocating paths or reducing car parking in sensitive areas. Work with local authorities to generate more public transport options or cycle paths. Provide secure cycle parking and electric vehicle charging points.

- Engage with the planning process, where new development is planned close to the site. Seek opportunities to buffer sensitive sites and to provide alternative green infrastructure to reduce the impact on the site.

- Work with natural processes where possible. Rivers and coastline should ideally not be engineered. Floodplains should be connected to rivers to act as a natural sponge to reduce flooding downstream. Investigate opportunities for natural flood management such as ‘slow the flow’ and ‘leaky dams’.

- Install where appropriate, renewable energy such as biomass boilers, photovoltaics, ground or air source heat pumps and wind turbines to reduce the use of oil and gas heating. Ensure sewage is discharged correctly and that grease traps are regularly cleared in catering establishments.

- Consider whether there are opportunities for tree planting to reduce the carbon footprint. This must however only be planted where it does not impact on the historic environment or on sites of high nature conservation value. Tree planting may also have a positive impact on reducing atmospheric pollution and nitrogen from nearby roads.

- Is grass being mown excessively? By creating wildflower meadows instead, there is only a need for one or two cuts per year, reducing environmental damage, saving money and enhancing wildlife.

- Do roads and other infrastructure act as a barrier, or is there excessive mortality of wildlife on roads? Look for opportunities for ‘green bridges’ to allow wildlife to cross safely, or can shelves be installed where a road crosses a river, to prevent mortality of aquatic animals such as otters.

Appendix 3
Statistical Analysis Results

A chi-squared test was implemented that tests for associations between two or more categorical variables across National Character Areas (NCAs) for the project. Polygons were converted to randomised point data, and the degree of overlap was assessed. A p-value that is less than, or equal to the significance level (5%) indicates that there is sufficient evidence that the observed distribution of points within designations is not the same as the expected distribution. The percentage of points found within biodiversity designations was compared to the percentage of points found outside in order to determine the nature of the relationship. The full methodology is set out in the main report. The datasets tested for all NCAs included those set out in table A3.1.

Basic statistical tests at the 95% level across the NCAs as to the coincidence of designated heritage and biodiversity sites provided a mixed picture, as shown in Table 3-2.

Heritage assets were statistically likely to coincide with biodiversity and geodiversity sites (statutory and non-statutory) in the Bedfordshire Greensand Ridge, Cotswolds and High Weald NCAs at 95% confidence levels. (If AONBs and National Parks were included as statutory biodiversity/geodiversity designations, then Cotswolds, Exmoor and Purbeck all also demonstrated significant coincidence of heritage and designated sites. However, since these protected landscapes are also designated on heritage grounds, they were excluded from this analysis).

We compared statutory and non-statutory designated sites for coincidence with heritage assets in South Purbeck NCA due to the availability of LWS data for this area. Designated statutory biodiversity and geodiversity sites were statistically more likely to contain heritage sites than non-statutory sites at the 95% confidence level within South Purbeck NCA.

We were able to compare statutory and non-statutory designated sites for coincidence with heritage assets in South Purbeck due to the availability of LWS data for this area. Designated statutory biodiversity and geodiversity sites were statistically more likely to contain heritage sites than non-statutory sites at the 95% confidence level within South Purbeck NCA.

There was no clear relationship across the board between Scheduled Monuments, Registered Battlefields, World Heritage Sites, Heritage Coasts and designated sites for biodiversity and heritage at the 95% confidence level with the datasets used for this study. We recommend further study, for example using priority habitat data, to further explore nuances and relationships between heritage and biodiversity, in order to target advice

National Character Area	Heritage Assets	Asset 'points' coincident with biodiversity/ geodiversity sites	Other points in the NCA	Effective size (%)	Chi-squared value	P-value	Significant statistical relationship?
Bedfordshire Greensands Ridge	Scheduled Monuments	89	71	55.63	2.025	Not significant	No
	Parks and Gardens	1831	173	91.37	1371.7	<0.05	biodiversity/ geodiversity sites and heritage assets coincide
	Total	1920	244	88.72	1298	<0.05	sites and assets coincide
Cotswolds	Scheduled Monuments	1524	0	100.00	1524	<0.05	sites and assets coincide
	World Heritage Sites	3718	0	100.00	3718	<0.05	sites and assets coincide
	Parks and Gardens	2105	7238	77.47	2441.8	<0.05	assets do not coincide with biodiversity/geodiversity sites
	Battlefields	22	404	94.84	342.54	<0.05	sites and assets do not coincide
	Total	7369	7642	50.91	4.965	<0.05	sites and assets do not coincide
Exmoor	Scheduled Monuments	693	1128	61.94	103.91	<0.05	sites and assets do not coincide
	Parks and Gardens	49	100	67.11	17.456	<0.05	sites and assets do not coincide
	Heritage Coast	3716	10362	73.60	3137.5	<0.05	sites and assets do not coincide
	Total	4458	11590	72.22	2441.8	<0.05	sites and assets do not coincide
High Weald	Battlefields	46	31	59.70	2.9221	Not significant	No
	Parks and Gardens	3335	1141	74.51	1075.4	<0.05	sites and assets coincide
	Scheduled Monuments	80	84	51.20	0.097561	Not significant	No
	Total	3461	1256	73.37	1030.7	<0.05	sites and assets coincide
Orton Fells	Parks and Gardens	587	4	99.32	575.11	<0.05	sites and assets coincide
	Scheduled Monuments	25	134	84.28	74.723	<0.05	sites and assets do not coincide
	World Heritage Sites	609	1893	75.66	658.94	<0.05	sites and assets do not coincide
	Total	1221	2031	62.45	201.75	<0.05	sites and assets do not coincide
South Purbeck	Heritage Coast	1843	4936	72.81	1411.2	<0.05	sites and assets do not coincide
	Parks and Gardens	464	295	61.13	37.63	<0.05	sites and assets coincide
	Scheduled Monuments	214	112	65.64	31.914	<0.05	sites and assets coincide
	World Heritage Sites	274	2	99.28	268.06	<0.05	sites and assets coincide
	Total	2795	5345	65.66	798.83	<0.05	sites and assets do not coincide

Table A3.1: Datasets and statistical tests for NCAs

Appendix 4 Detailed Figures for Wessex Hillforts and Habitats Project

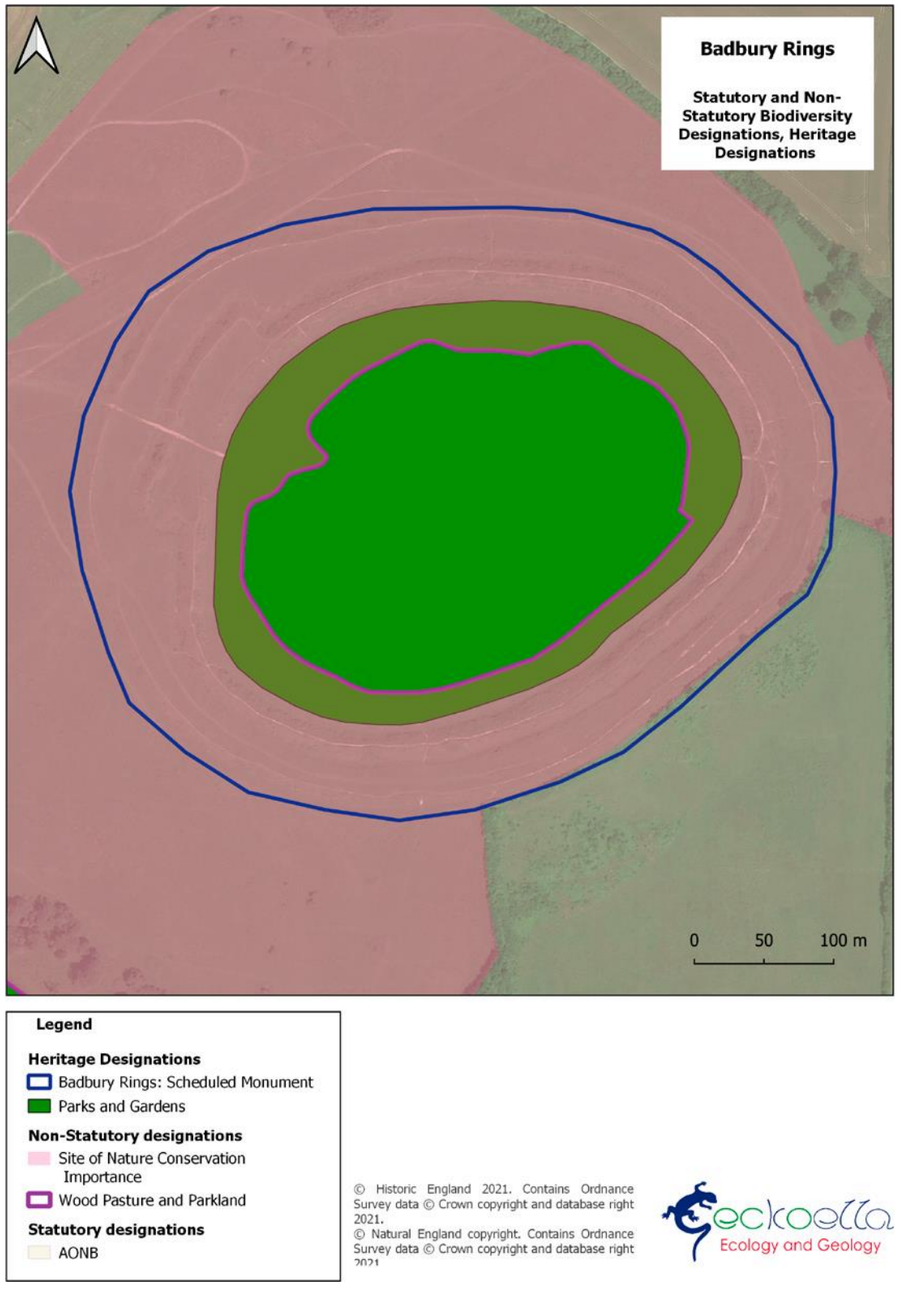


Figure A4.1: Badbury Rings Heritage and Biodiversity

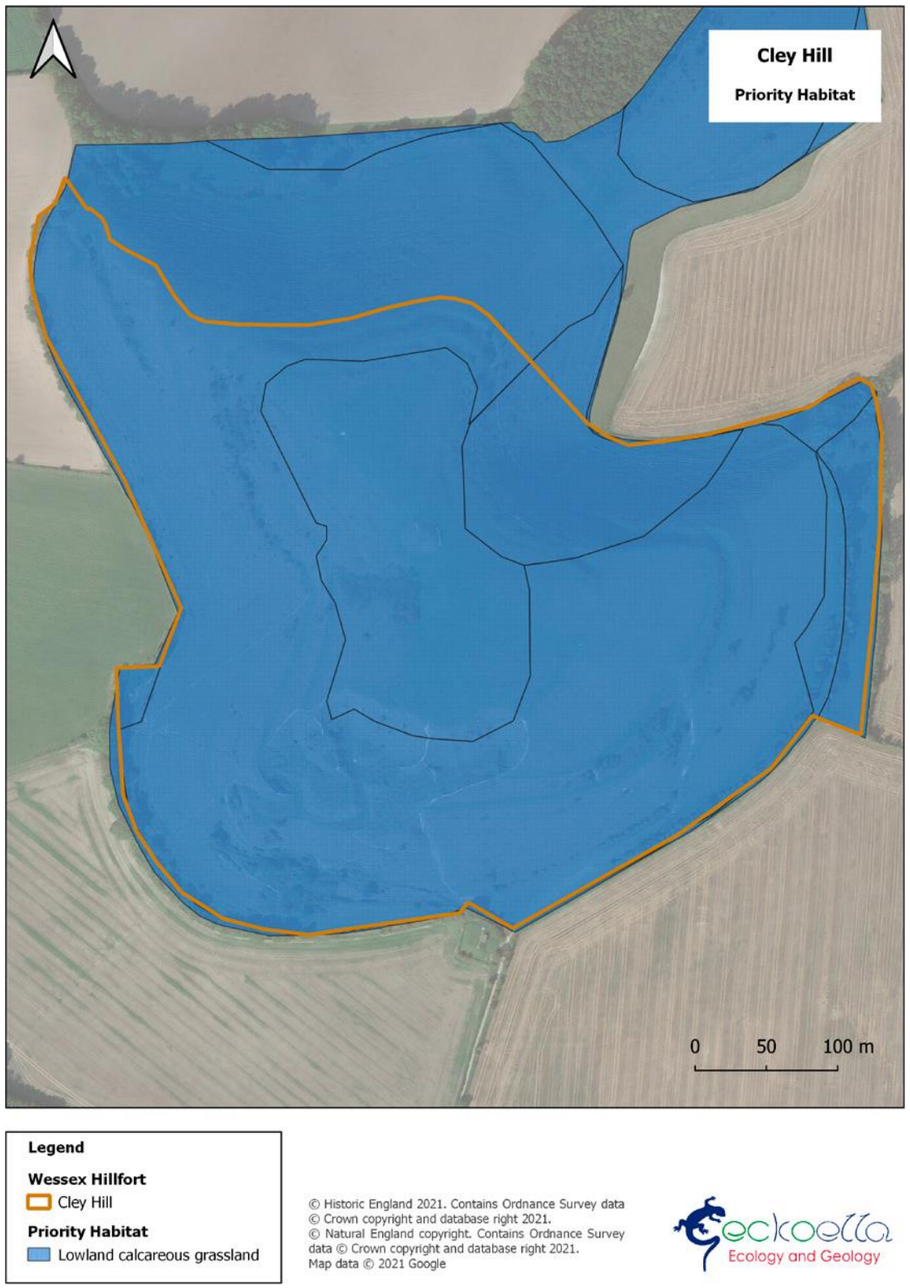
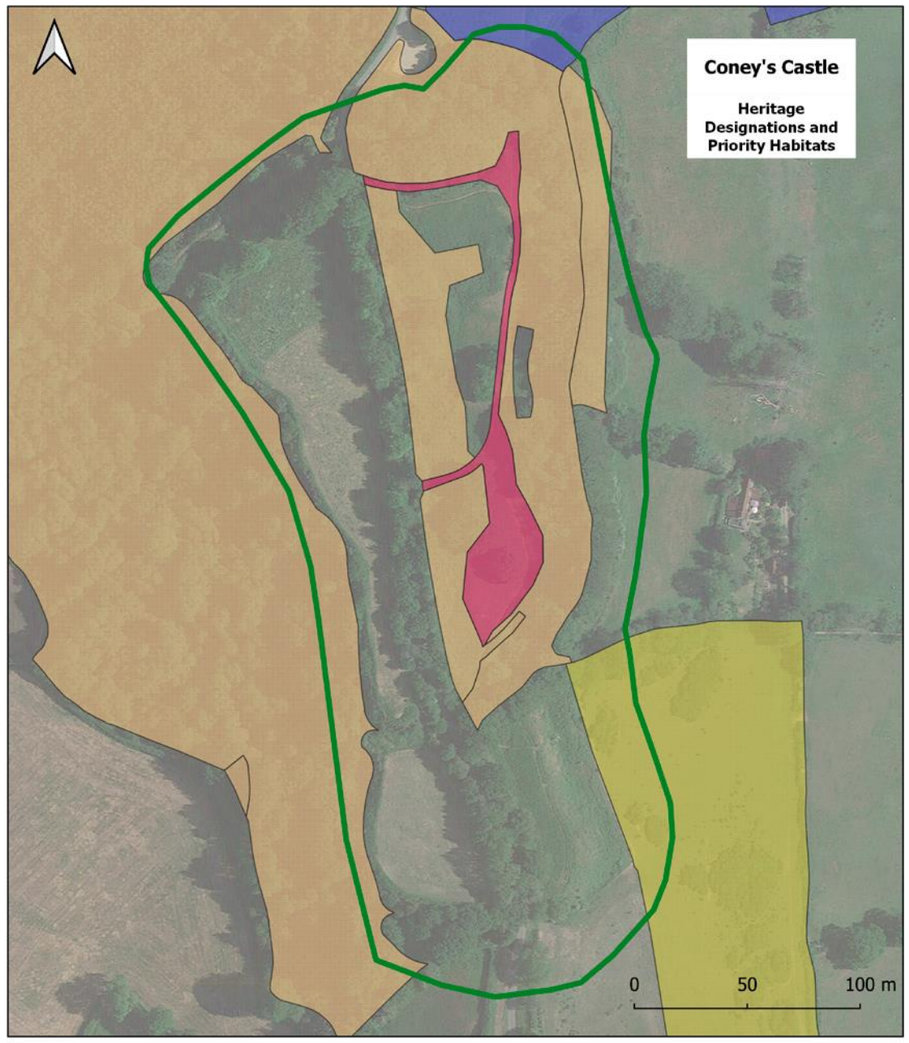


Figure A4.2: Cley Hill Heritage and Biodiversity



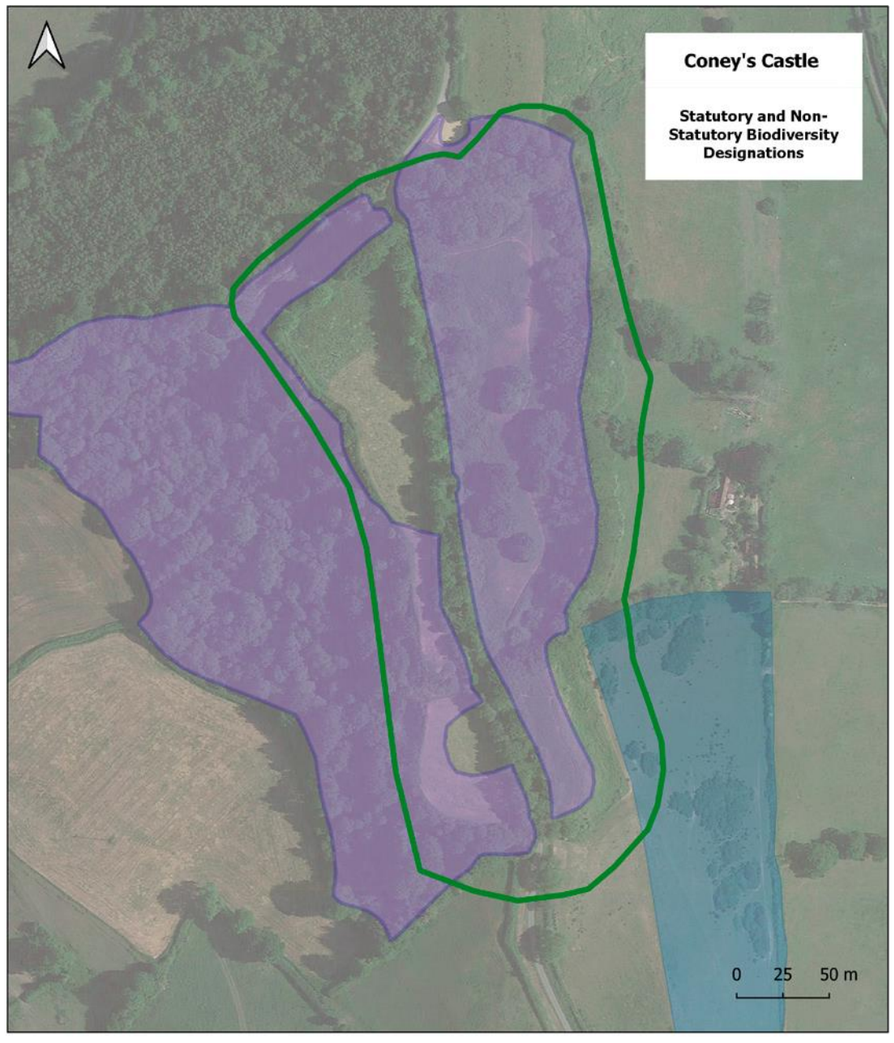


Figure A4.3: Coney's Castle Heritage and Biodiversity

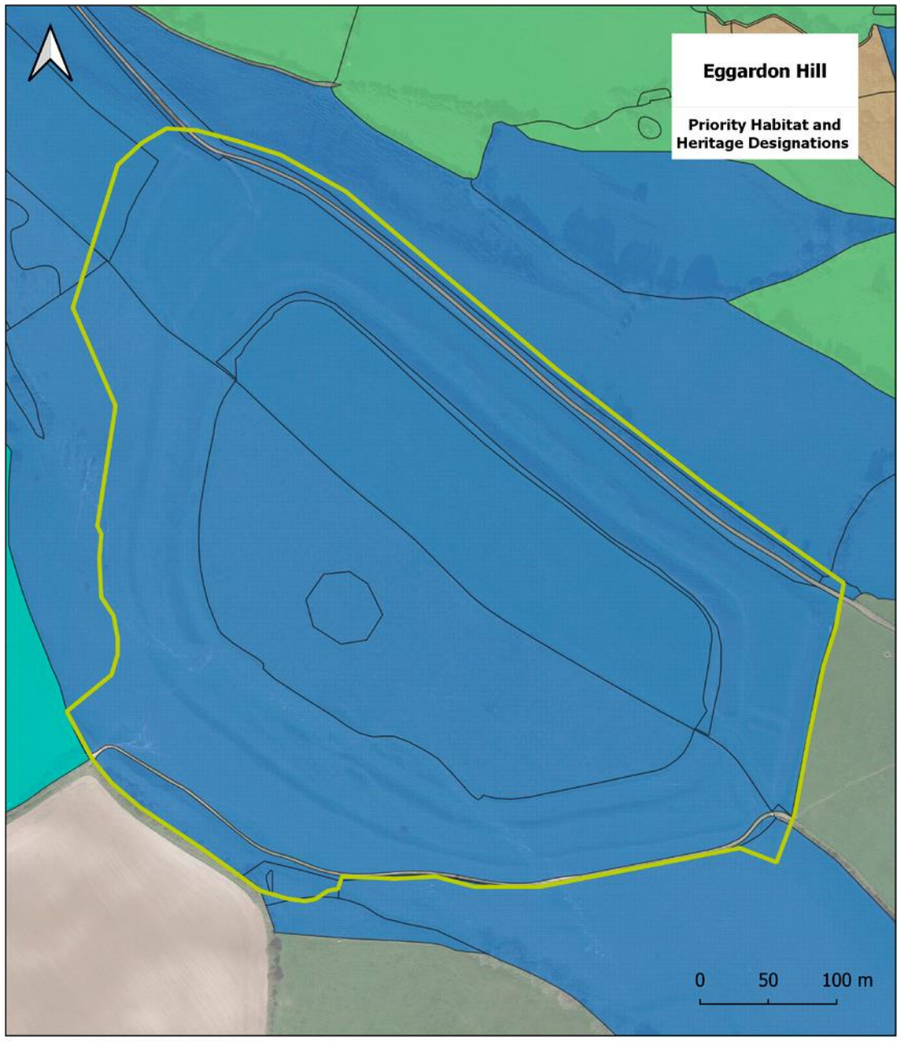


Figure A4.4 Eggardon Hill Heritage and Biodiversity

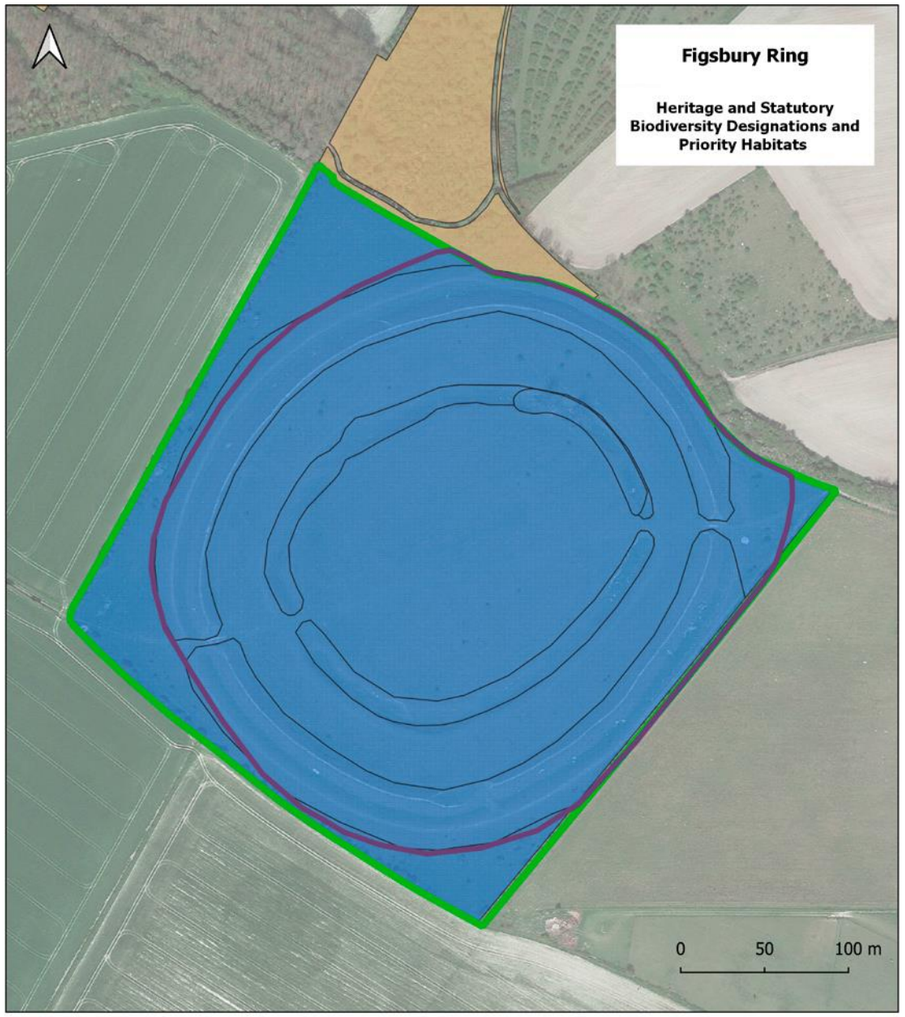


Figure A4.5: Figsbury Ring Heritage and Biodiversity

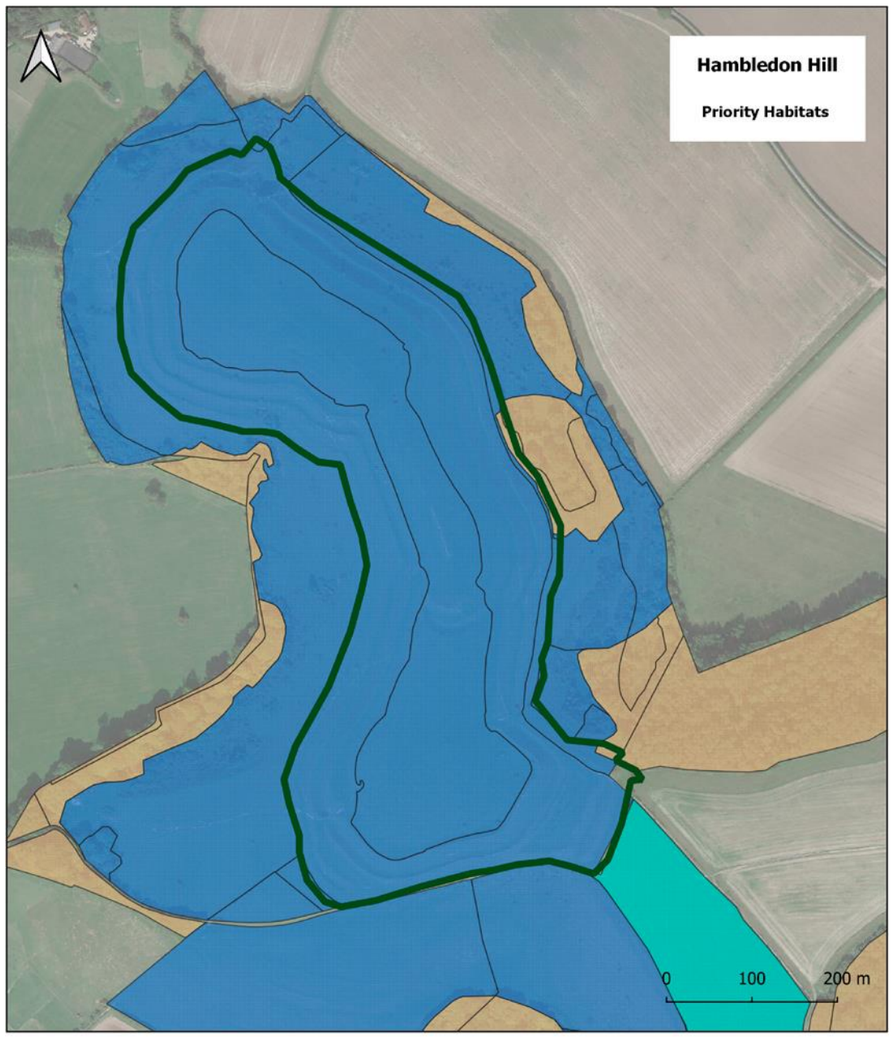


Figure A4.6: Hambledon Hill Heritage and Biodiversity

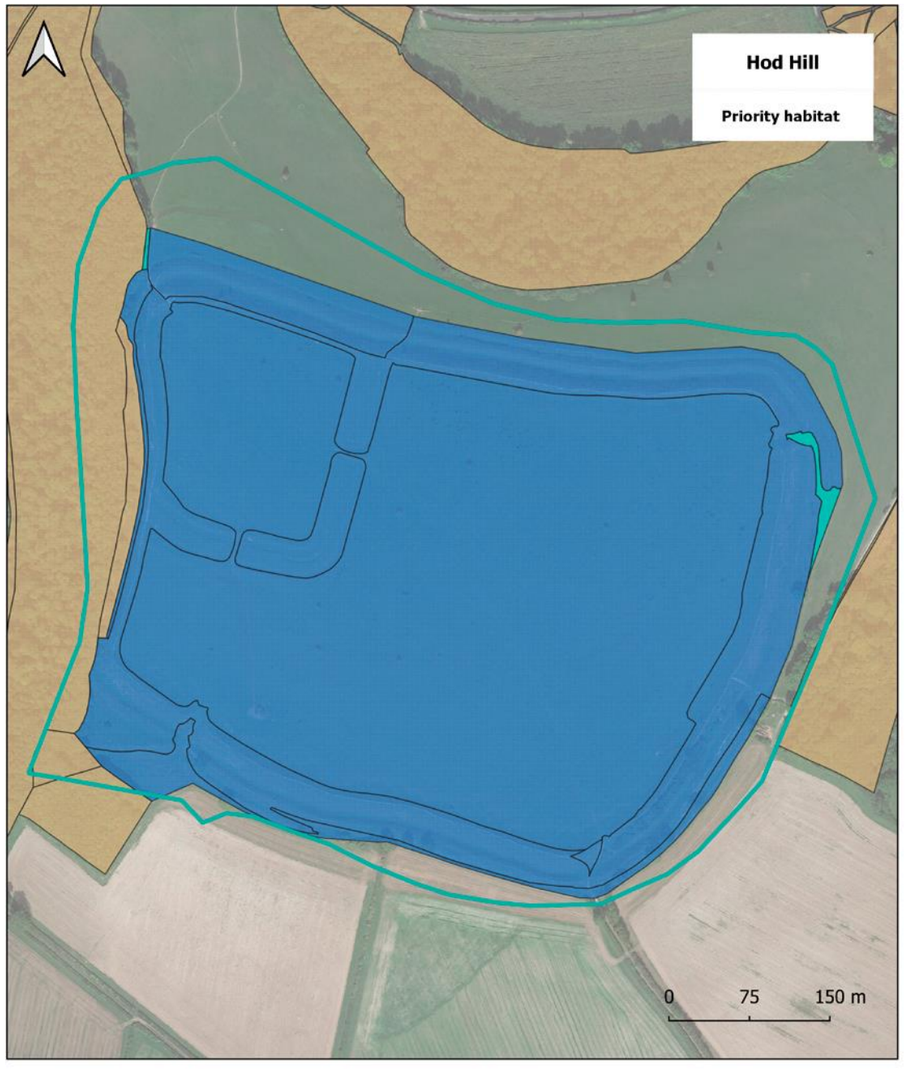


Figure A4.7: Hod Hill Heritage and Biodiversity

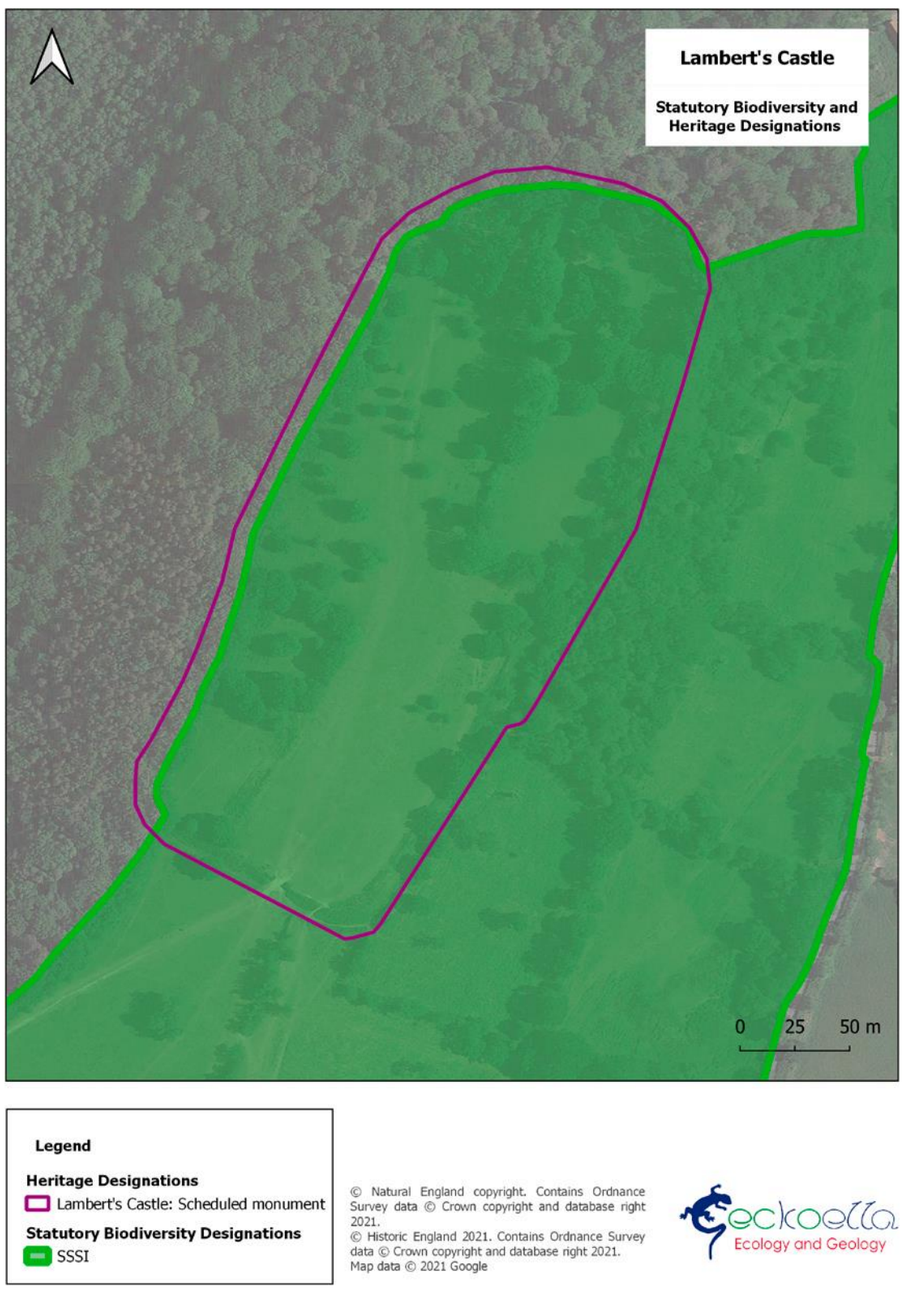
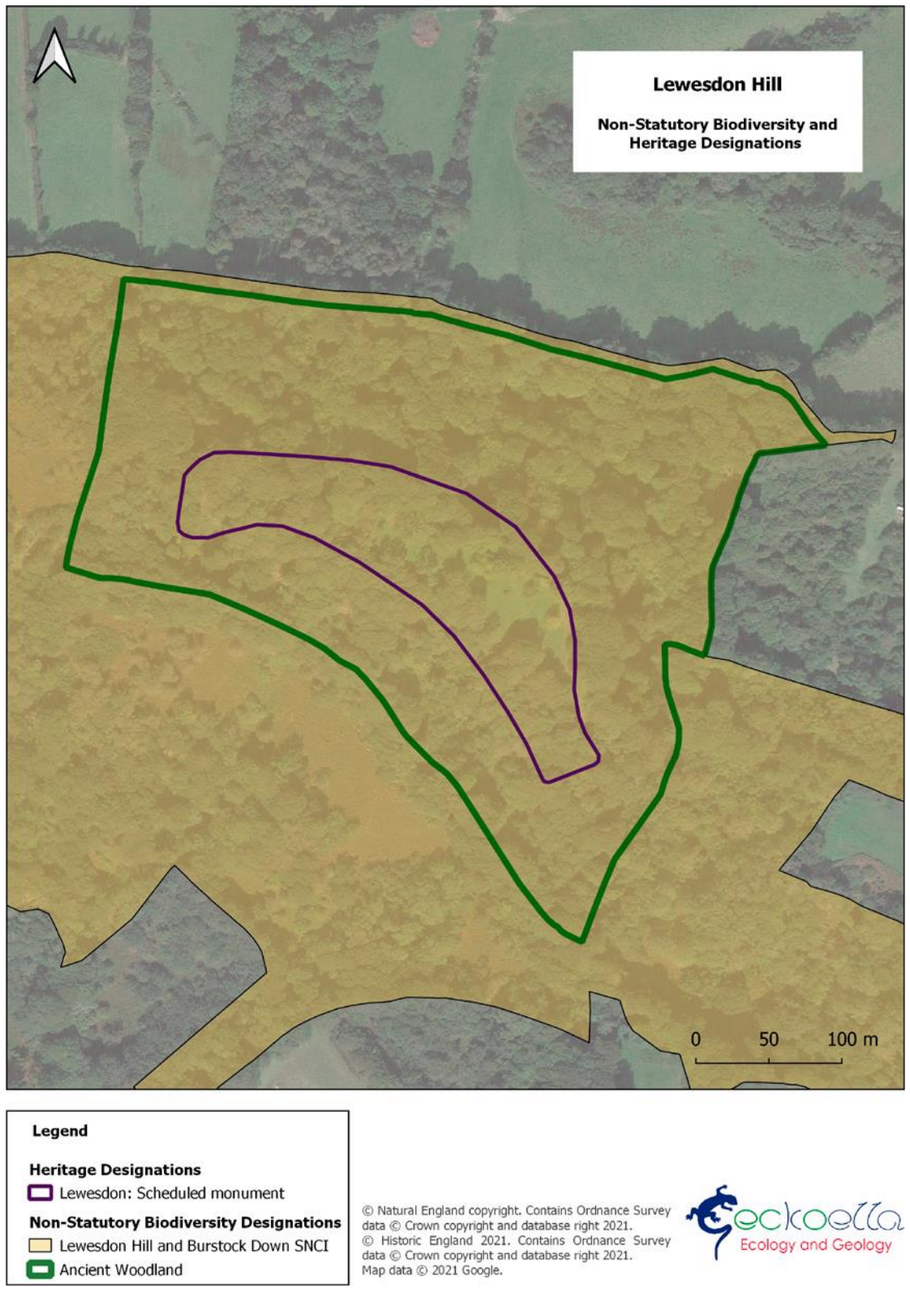


Figure A4.8: Lambert's Castle Heritage and Biodiversity



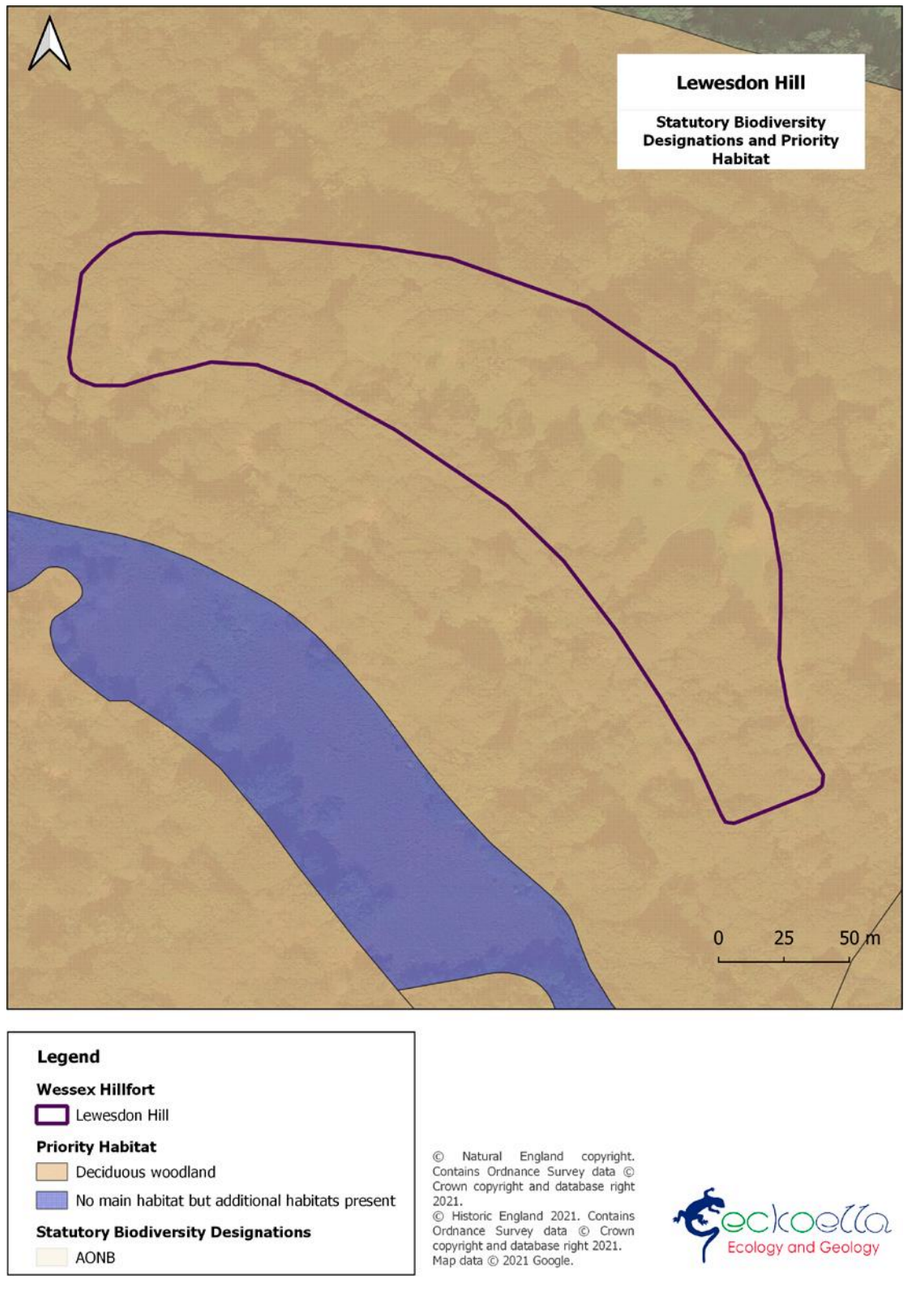


Figure A4.9: Lewesdon Heritage and Biodiversity

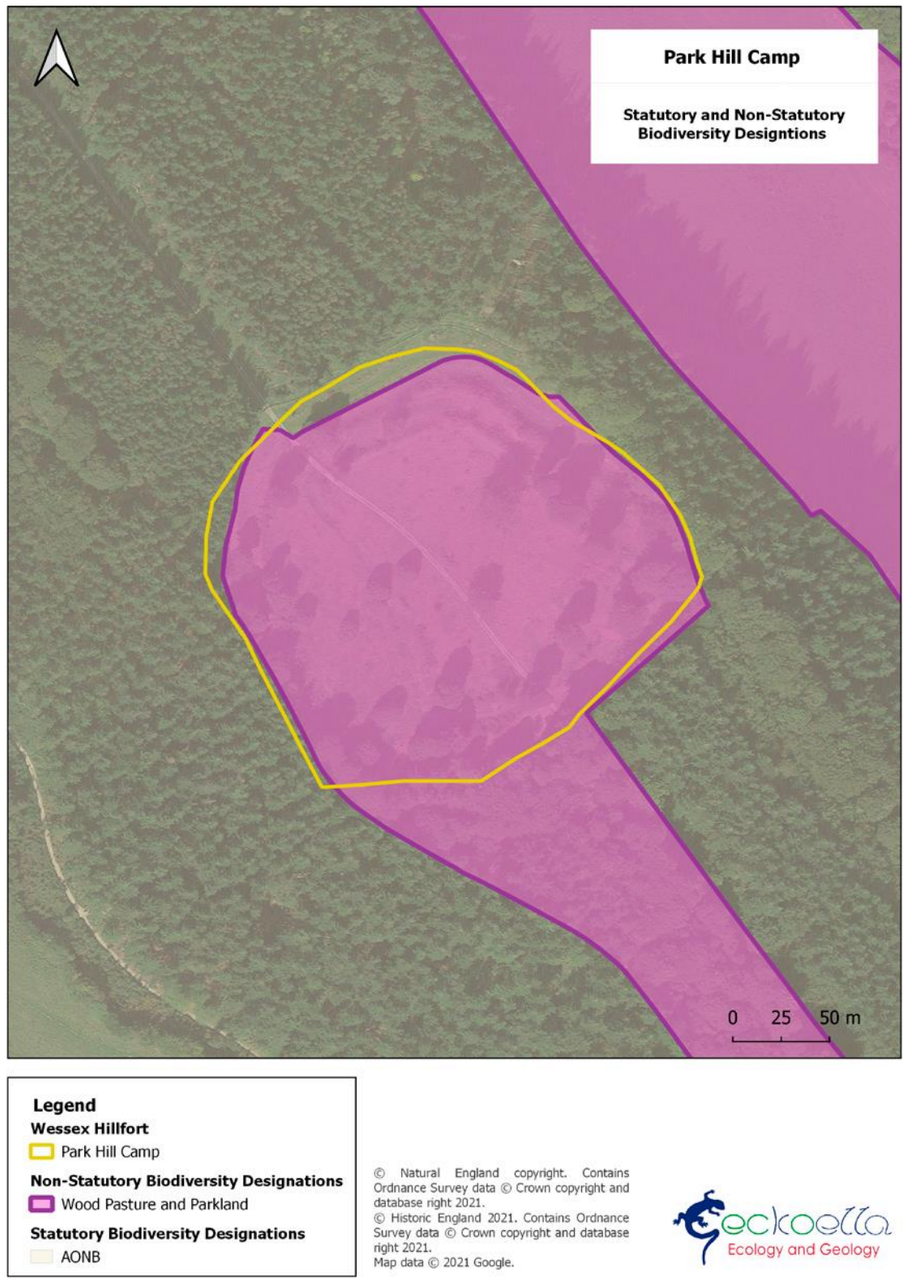


Figure A4.10: Park Hill Camp Heritage and Biodiversity

Figure A4.11: Pilsdon Pen Heritage and Biodiversity

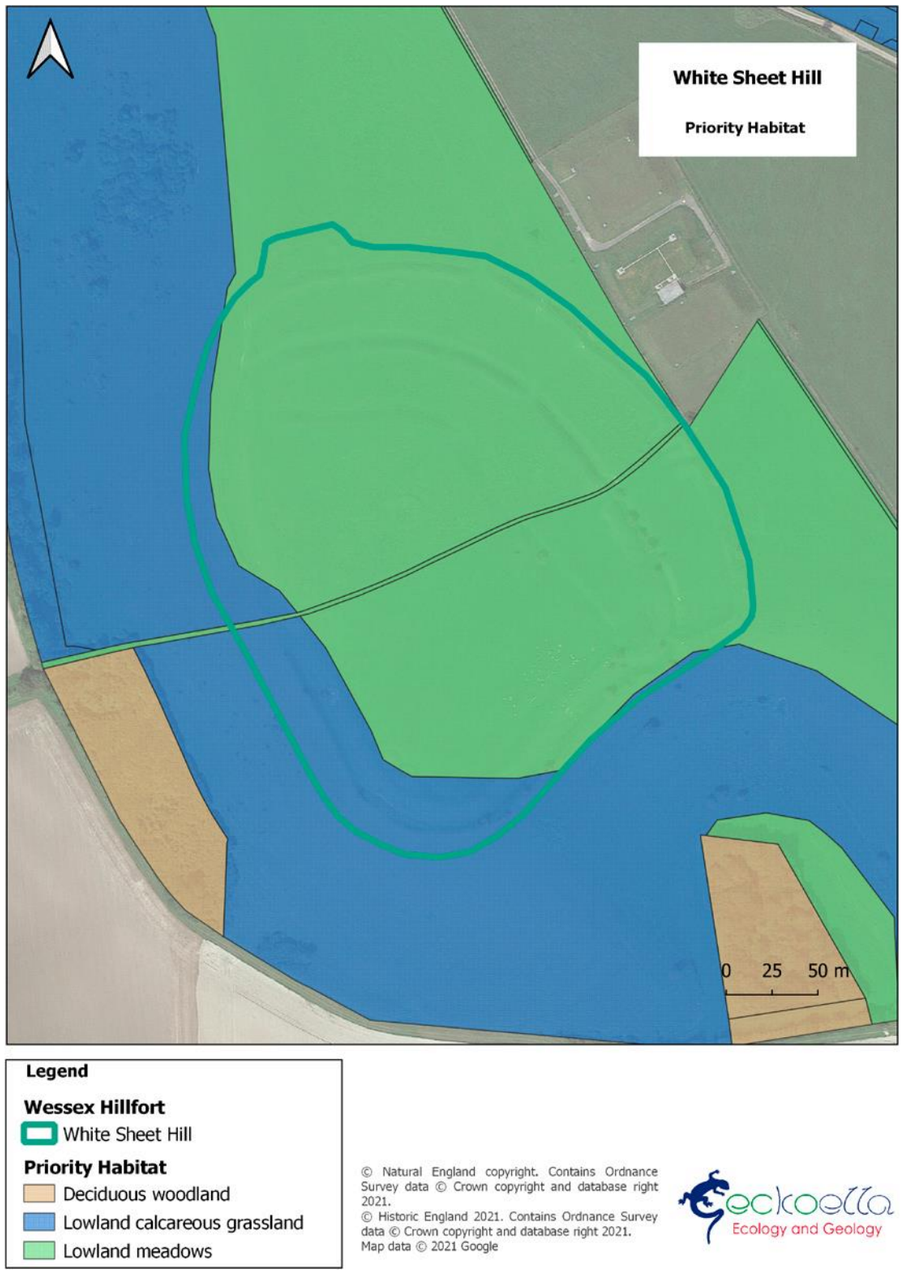
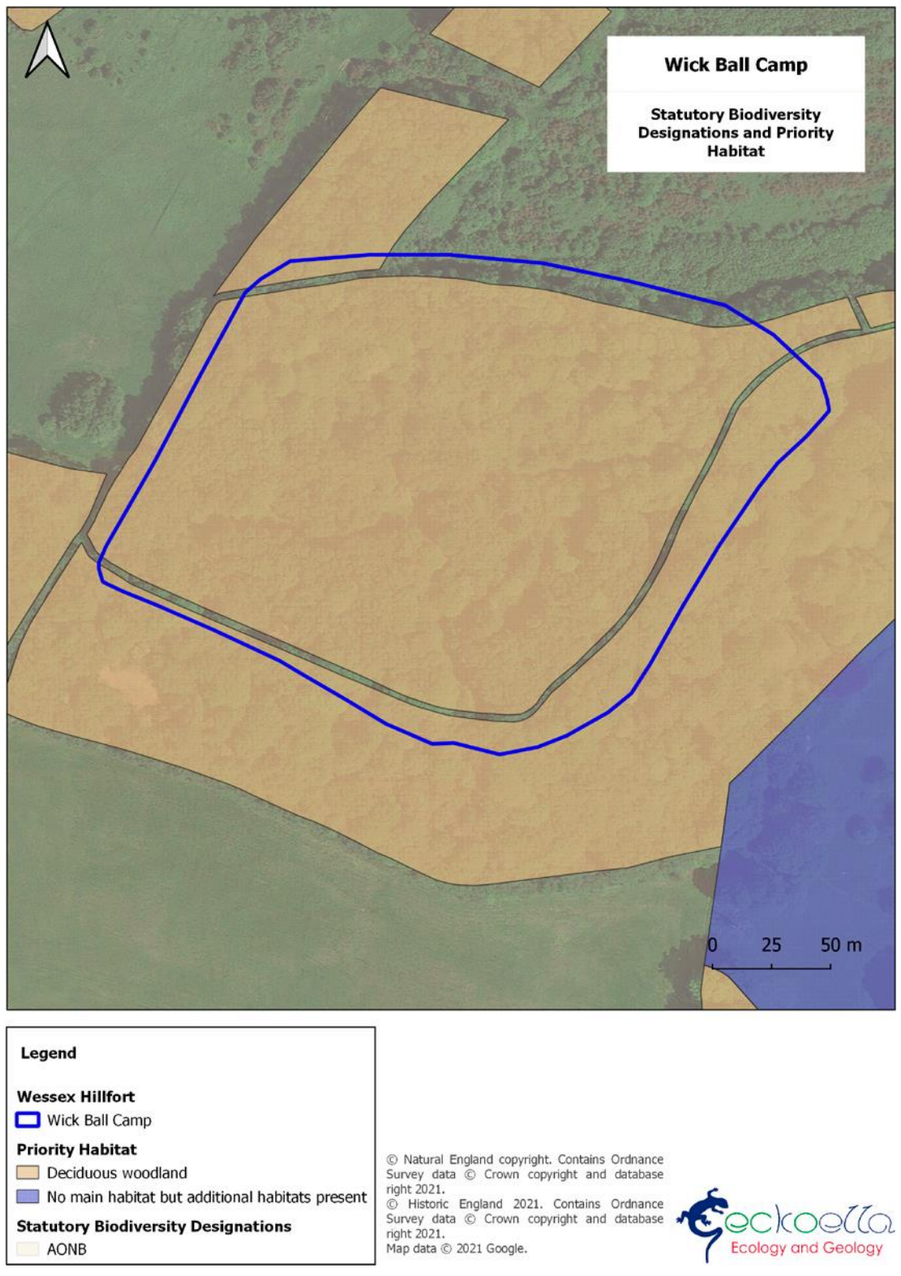


Figure A4.12: White Sheet Hill Heritage and Biodiversity



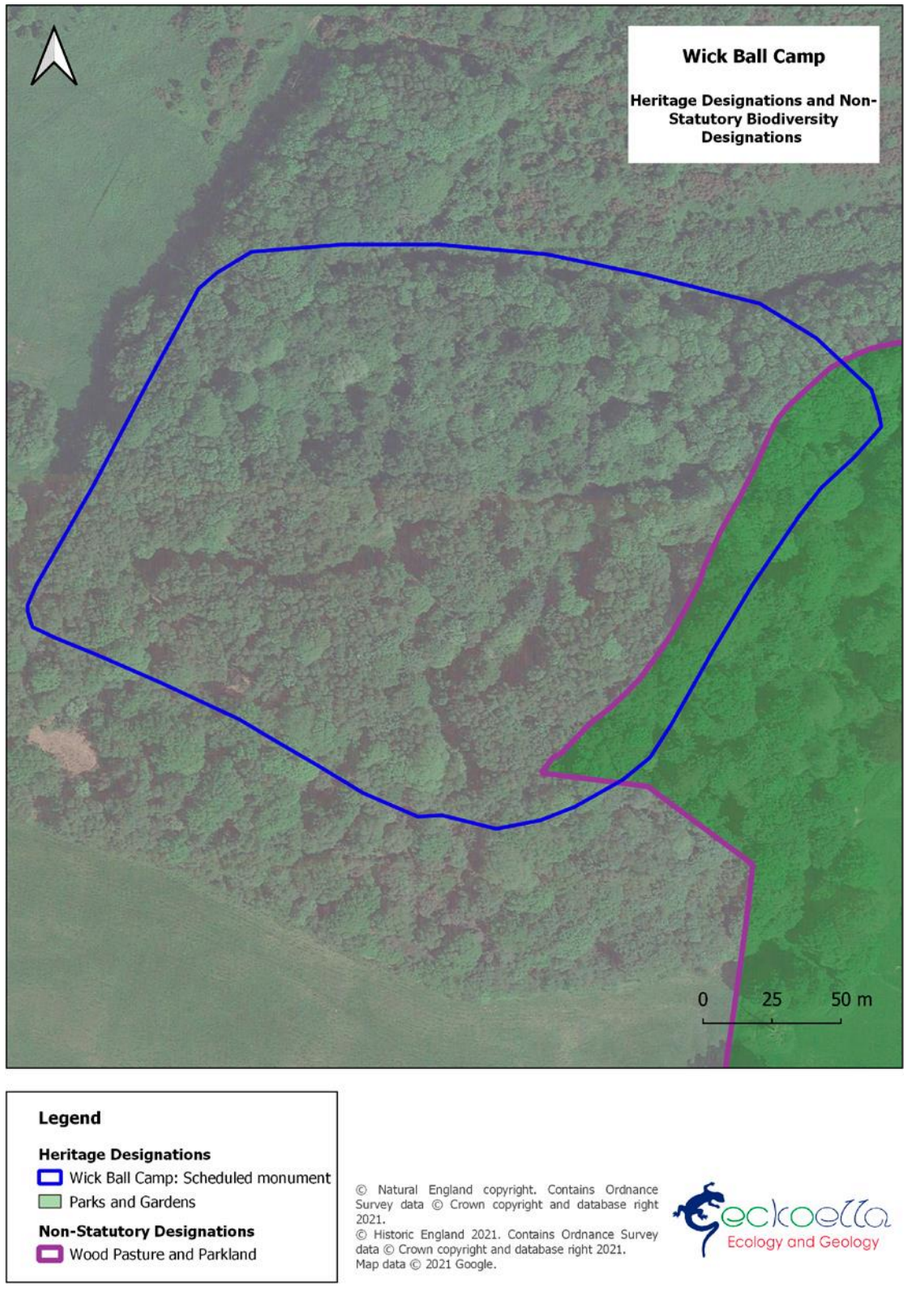


Figure A4.13: Wick Ball Camp Heritage and Biodiversity

Appendix 5 Detailed Figures for National Character Areas

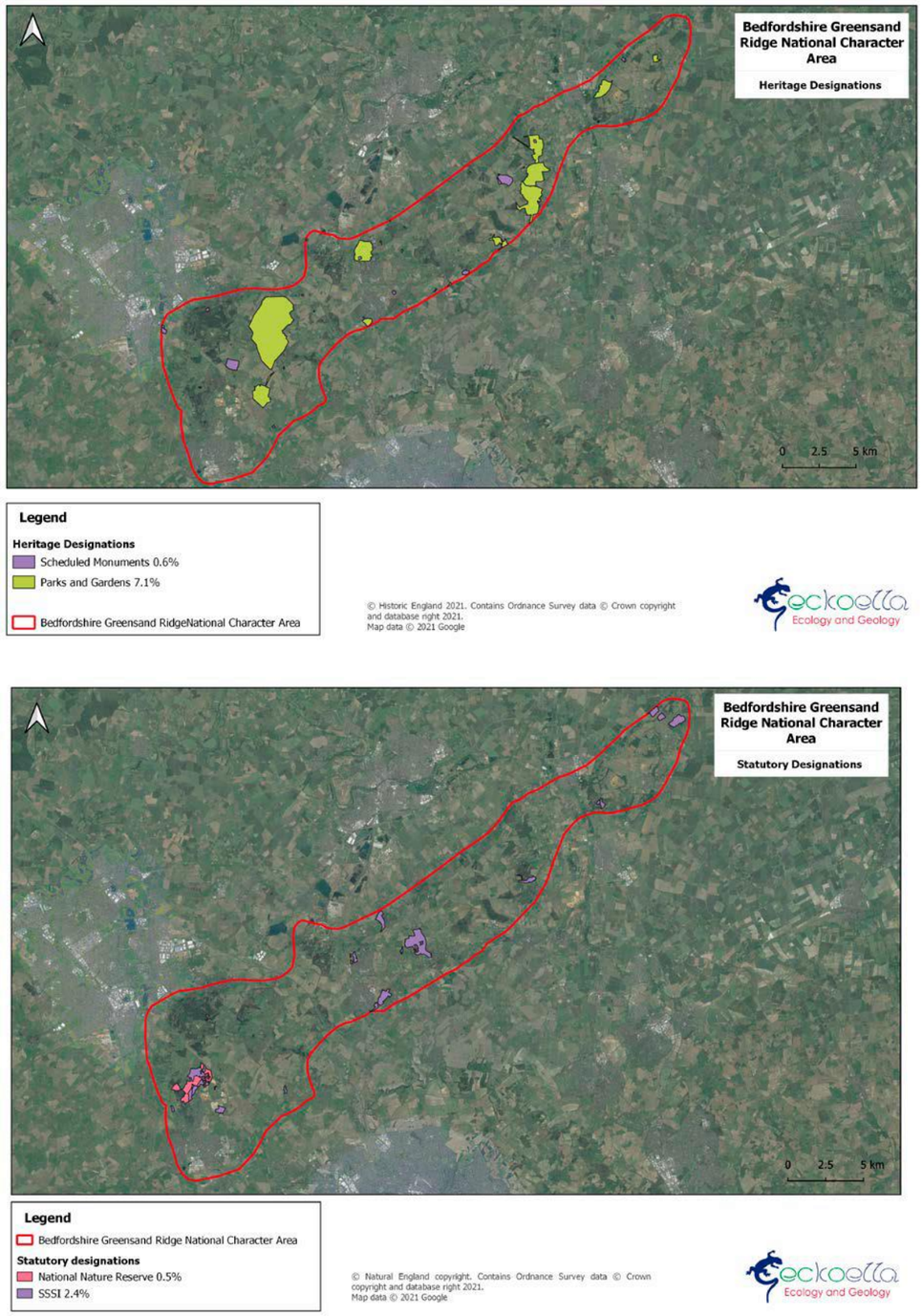
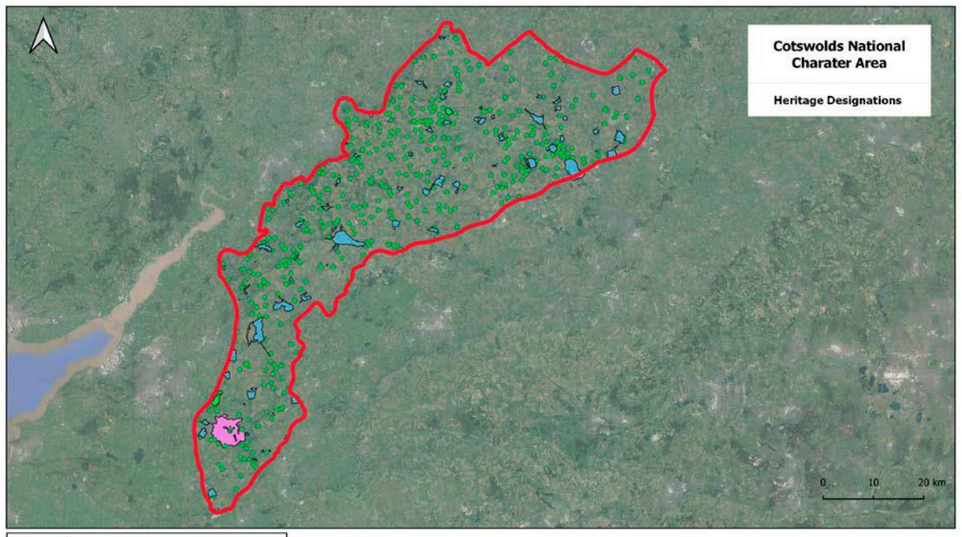


Figure A5.1: Bedfordshire Greensands Ridge NCA Heritage and Biodiversity



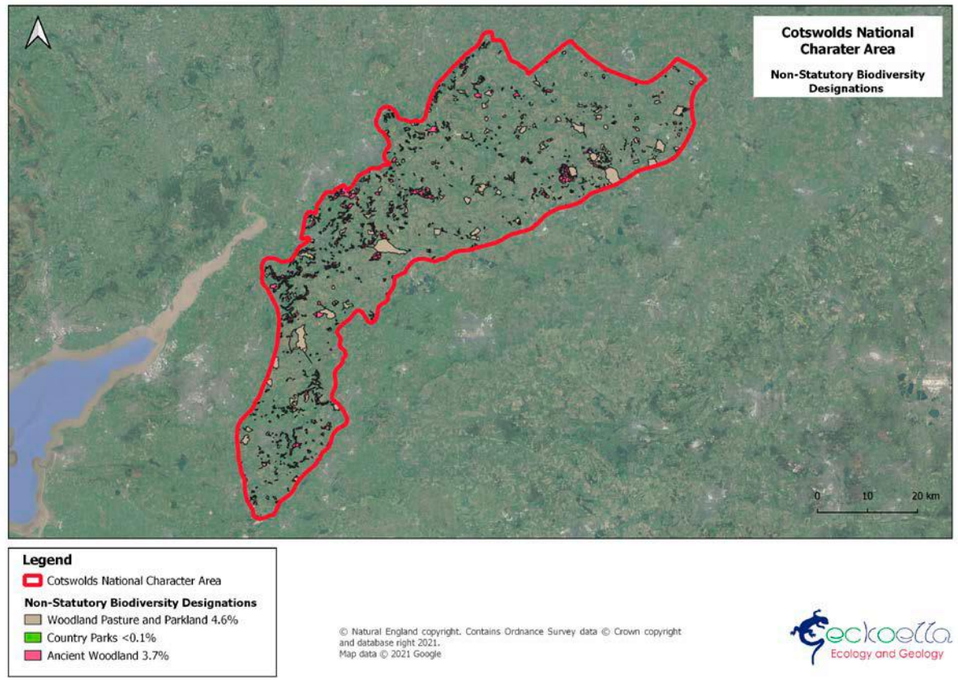
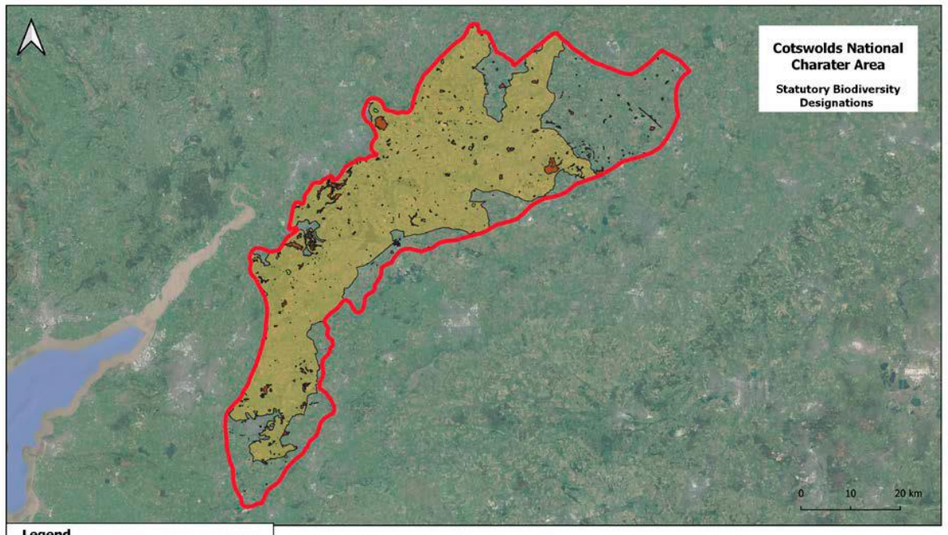
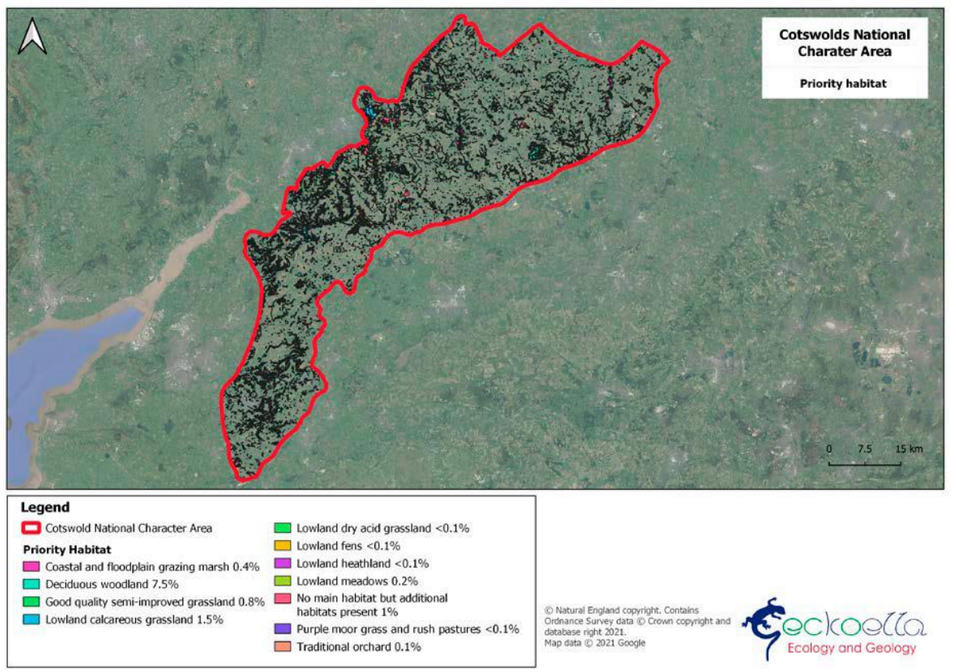
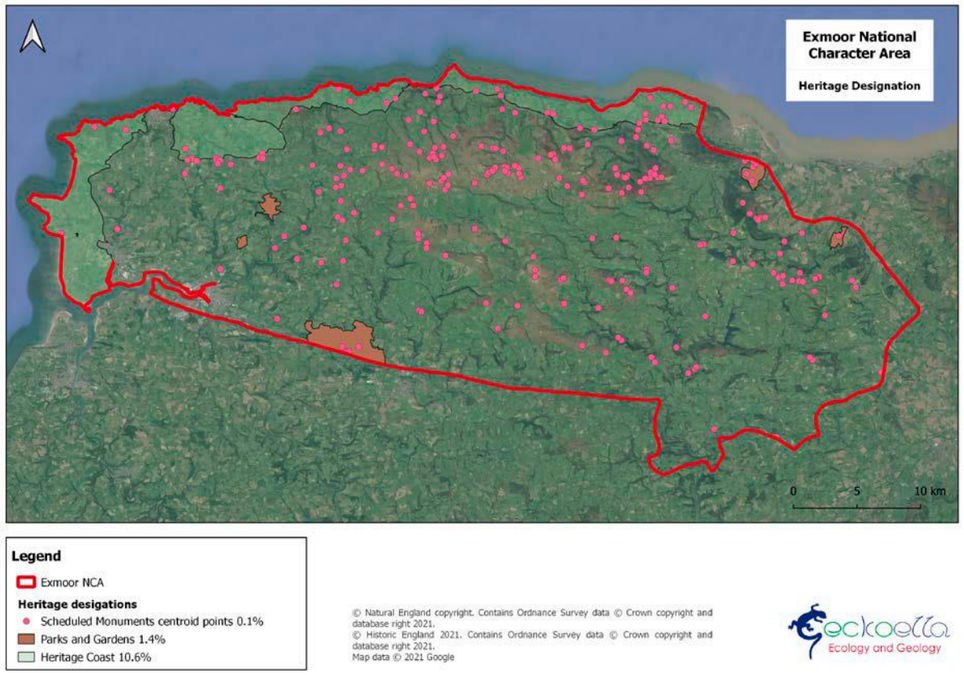


Figure A5.2: Cotswolds NCA Heritage and Biodiversity







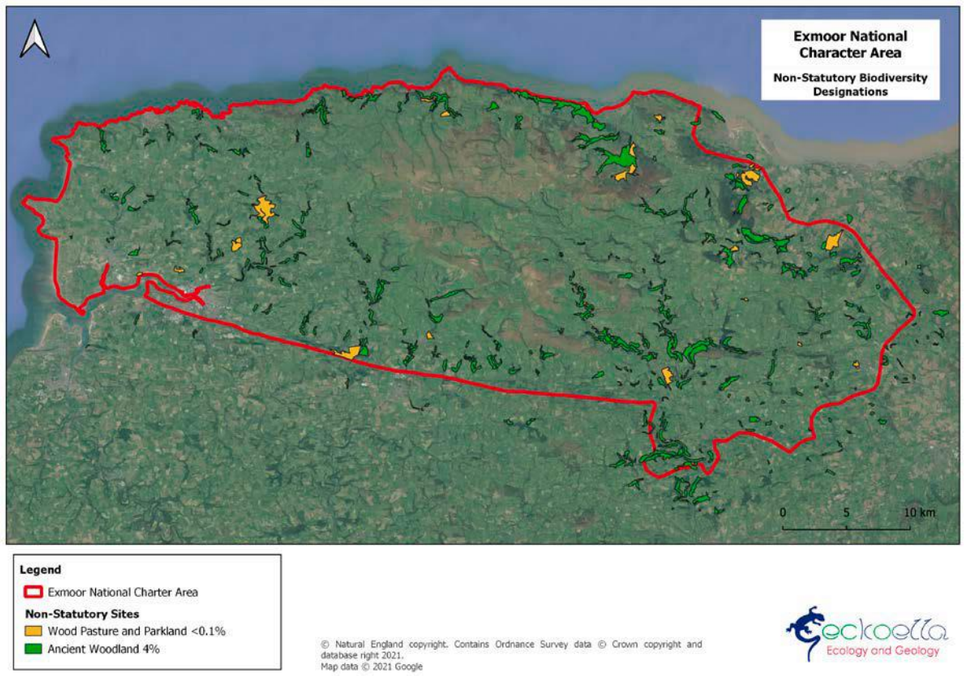
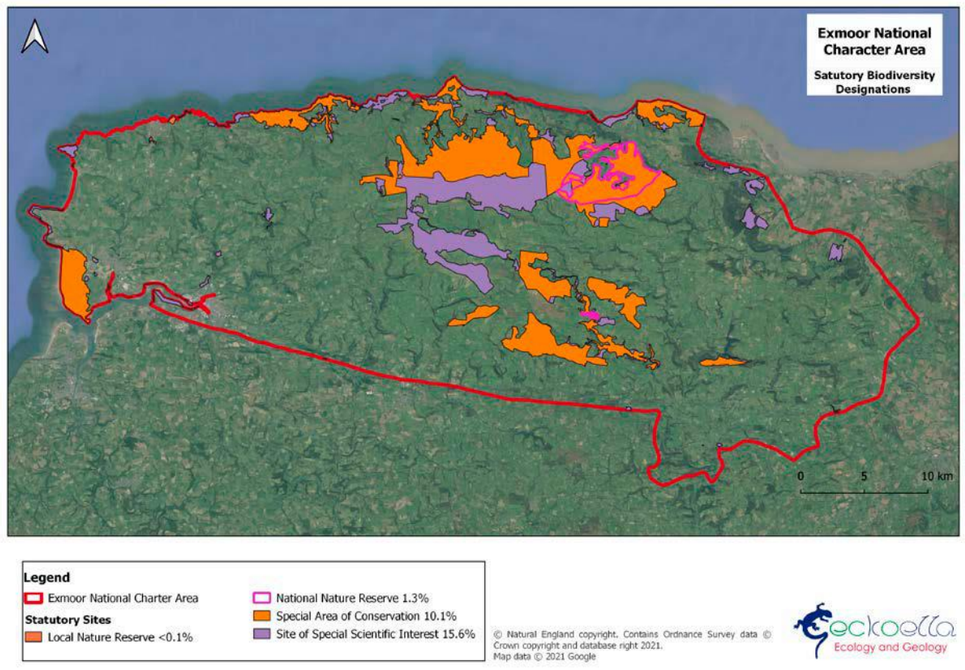
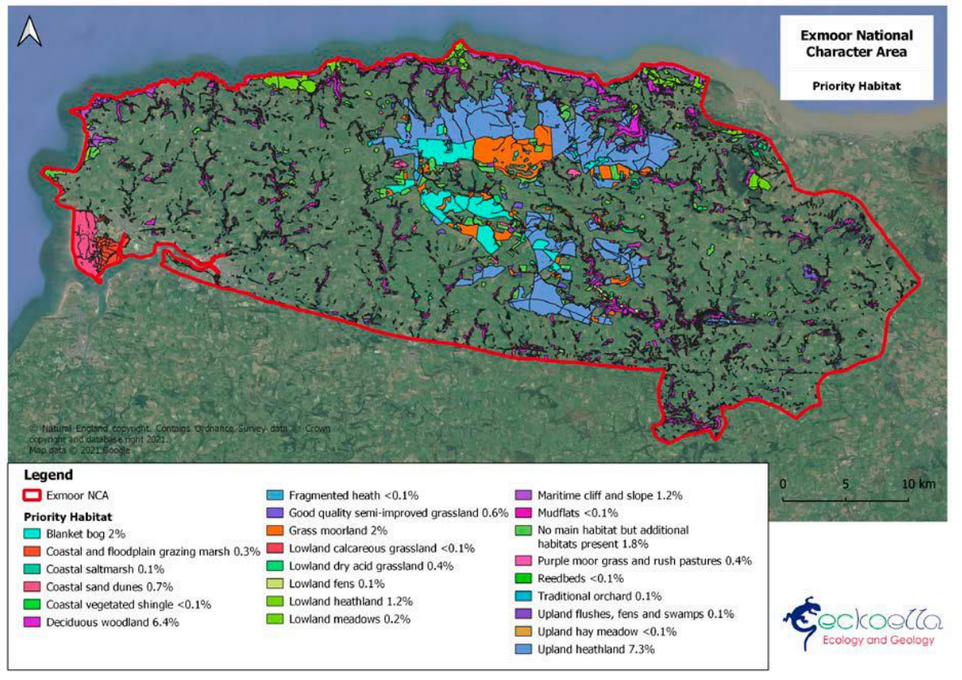
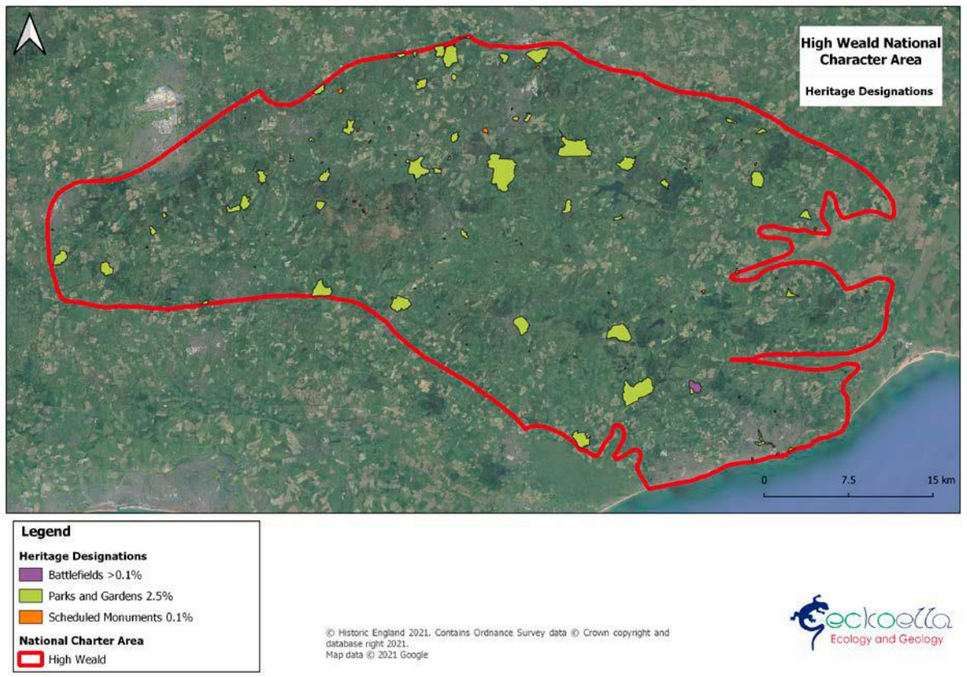


Figure A5.3: Exmoor NCA Heritage and Biodiversity







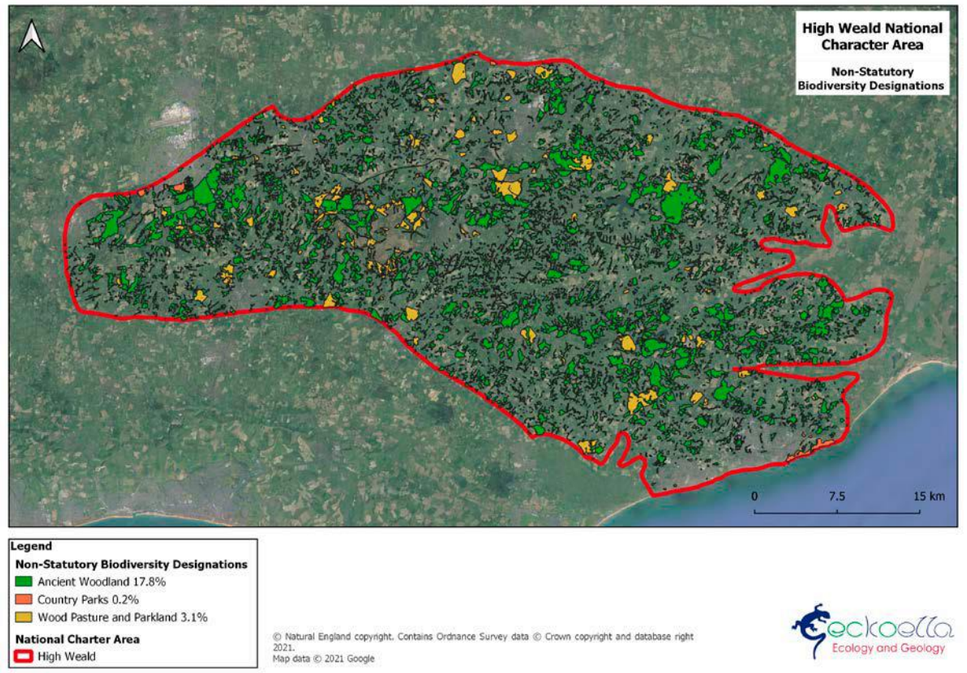
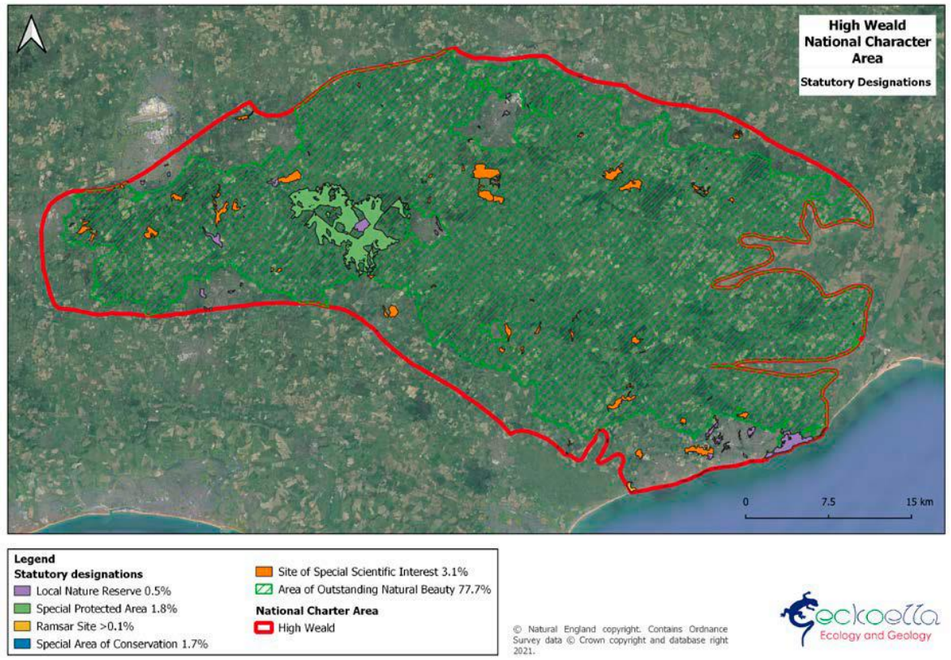
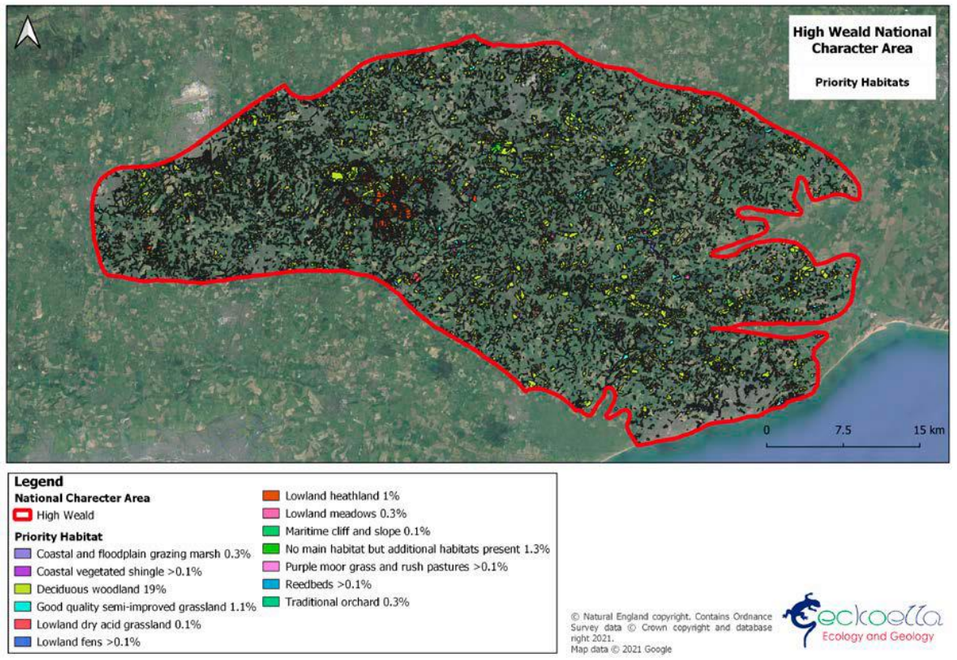
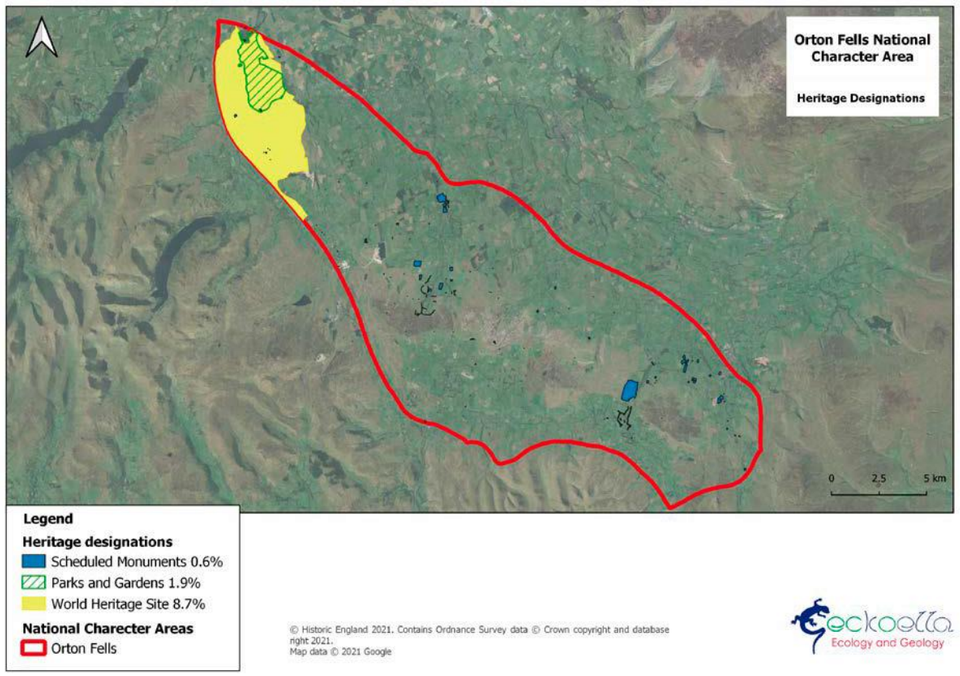
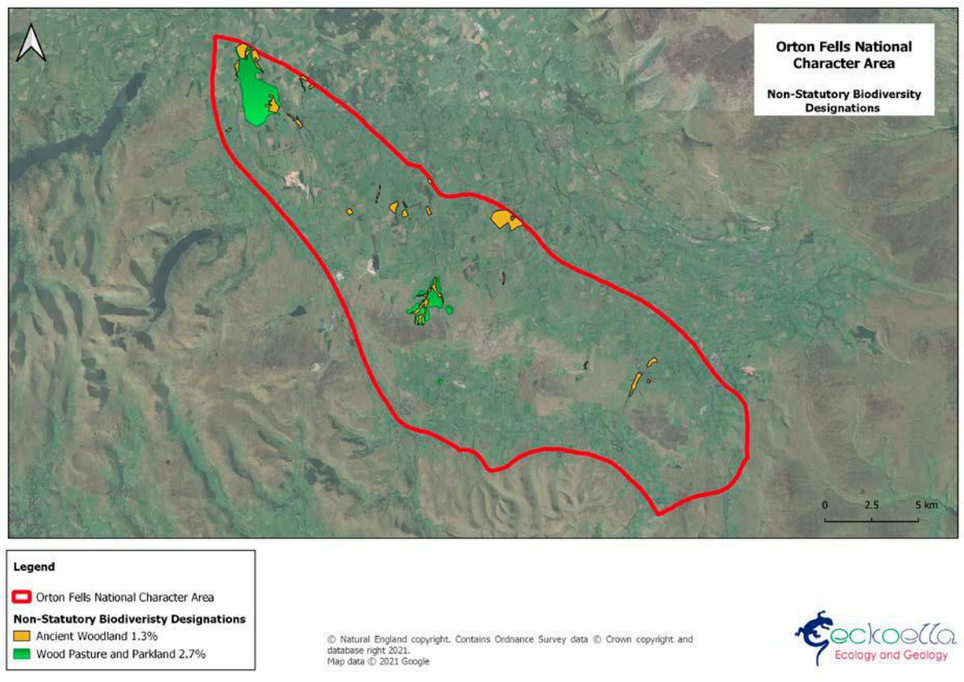


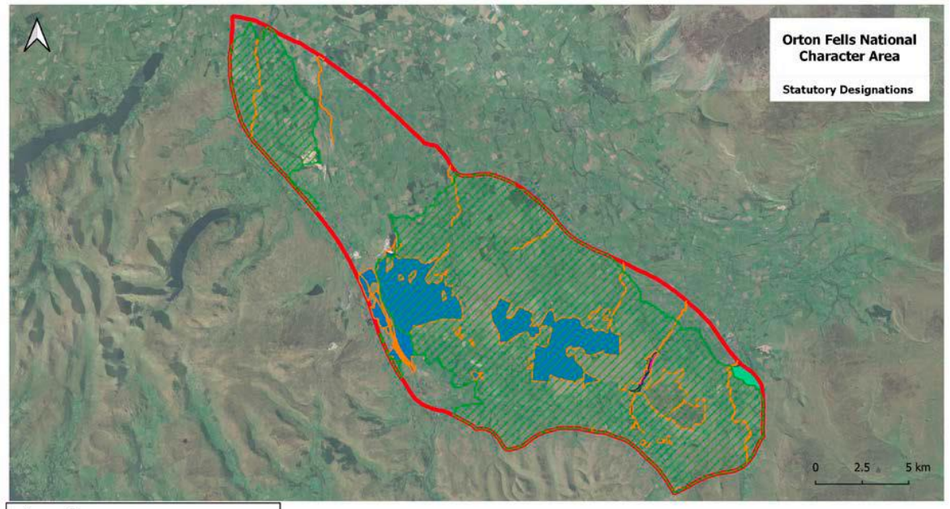
Figure A5.4: High Weald NCA Heritage and Biodiversity











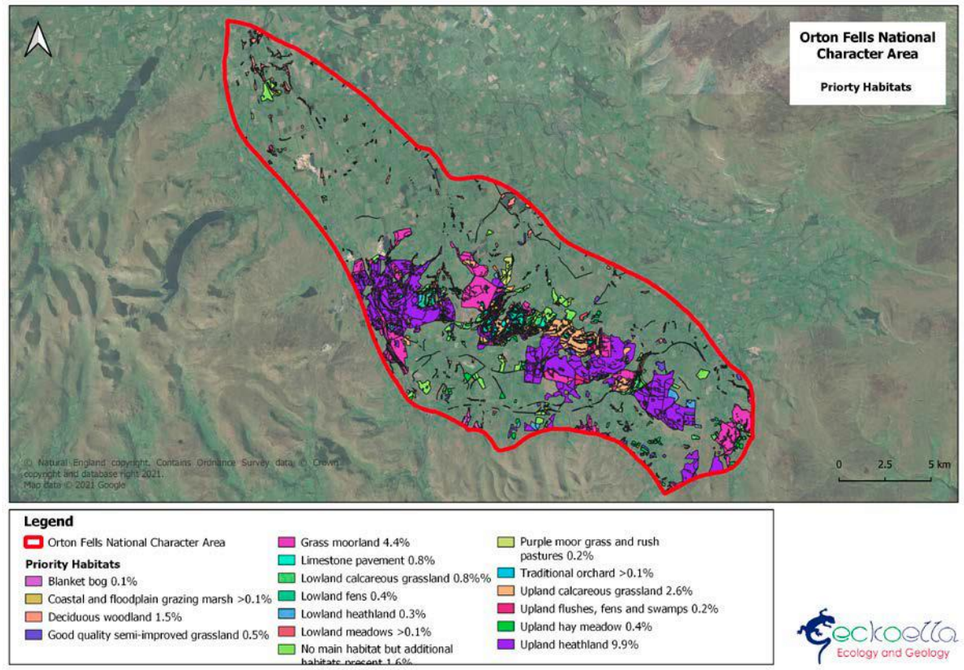
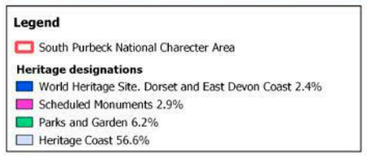
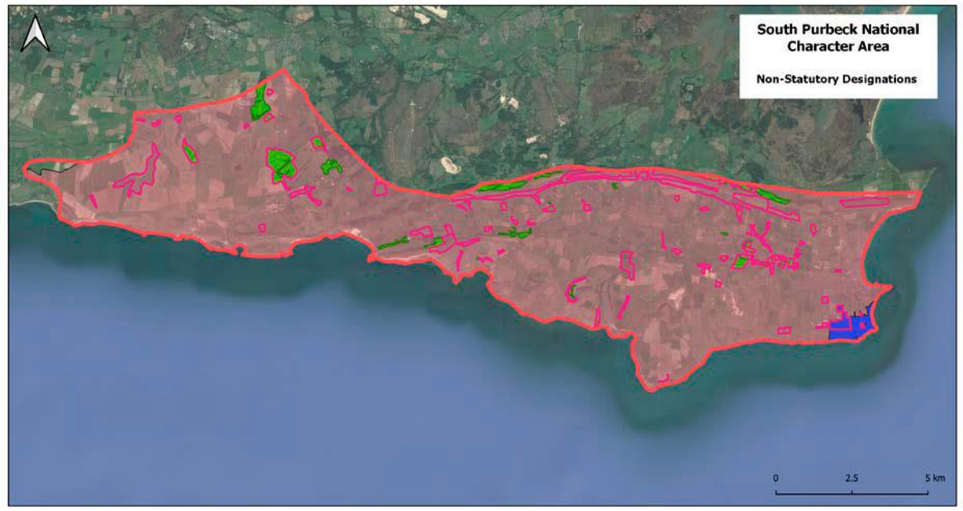
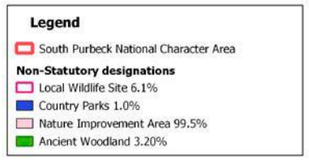
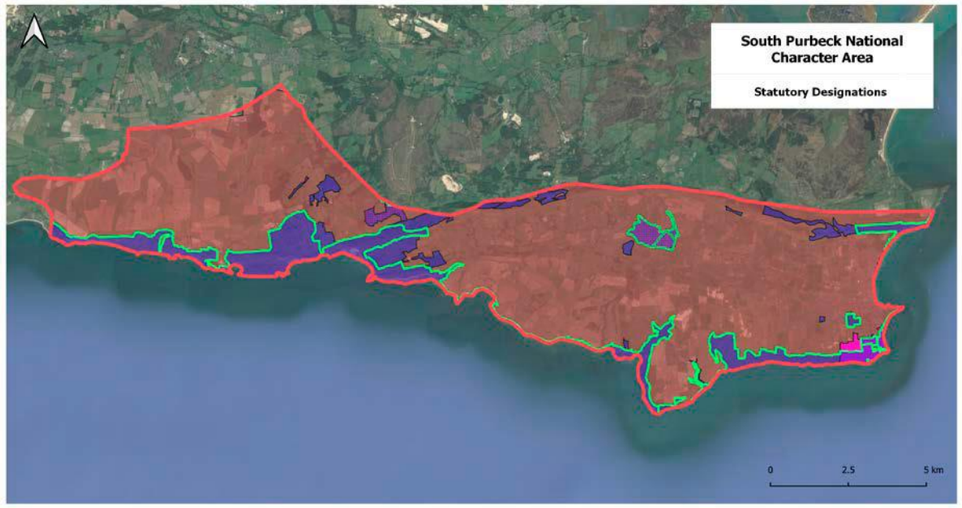


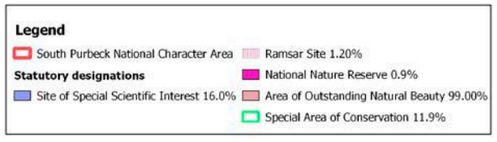
Figure A5.5 Orton Fells NCA Heritage and Biodiversity











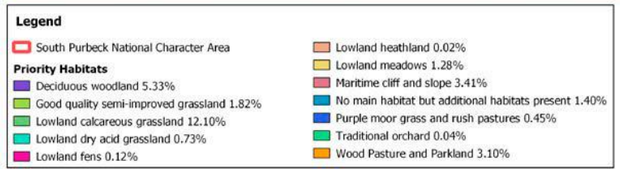


Figure A5.6: South Purbeck NCA Heritage and Biodiversity

Appendix 6
Species List

Common Name	Scientific Name
Mammals	
badger	*Meles meles*
bottlenose dolphin	*Tursiops truncatus*
brown hare	*Lepus europaeus*
brown long eared bat	*Plecotus auritus*
brown rat	*Rattus norvegicus*
common pipistrelle	*Pipistrellus pipistrellus*
Daubenton's bat	*Myotis daubentonii*
fallow deer	*Dama dama*
fin whale	*Balaenoptera physalus*
fox	*Vulpes vulpes*
greater horseshoe bat	*Rhinolophus ferrumequinum*
grey seal	*Halichoerus grypus*
grey squirrel	*Sciurus carolinensis*
harbour porpoise	*Phocoena phocoena*
hazel dormouse	*Muscardinus avellanarius*
hedgehog	*Erinaceus europaeus*
lesser horseshoe bat	*Rhinolophus hipposideros*
mole	*Talpa europaea*
muntjac deer	*Muntiacus reevesi*
noctule bat	*Nyctalus noctula*
orca (killer whale)	*Orcinus orca*
otter	*Lutra lutra*
pilot whale	*Globicephala* sp.
rabbit	*Oryctolagus cuniculus*
red deer	*Cervus elaphus*
roe deer	*Capreolus capreolus*
sika deer	*Cervus nippon*
soprano pipistrelle	*Pipistrellus pygmaeus*
sperm whale	*Physeter macrocephalus*
stoat	*Mustela erminea*

Common Name	Scientific Name
Amphibians	
common frog	*Rana temporaria*
common toad	*Bufo bufo*
great crested newt	*Triturus cristatus*
natterjack toad	*Epidalea calamita*
smooth newt	*Lissotriton vulgaris*
Reptiles	
adder	*Vipera berus*
common lizard	*Zootoca vivipara*
grass snake	*Natrix natrix*
slow worm	*Anguis fragilis*
Birds	
barn owl	*Tyto alba*
Bewick swan	*Cygnus columbianus bewickii*
black headed gull	*Chroicocephalus ridibundus*
bullfinch	*Pyrrhula pyrrhula*
cormorant	*Phalacrocorax carbo*
corn bunting	*Emberiza calandra*
cuckoo	*Cuculus canorus*
curlew	*Numenius arquata*
Dartford warbler	*Sylvia undata*
dunnock	*Prunella modularis*
fieldfare	*Turdus pilaris*
firecrest	*Regulus ignicapilla*
fulmar	*Fulmarus glacialis*
gannet	*Morus* sp.
goldcrest	*Regulus regulus*
golden plover	*Pluvialis apricaria*
grasshopper warbler	*Locustella naevia*
great crested grebe	*Podiceps cristatus*
green woodpecker	*Picus viridis*
grey partridge	*Perdix perdix*
guillemot	*Uria aalge*
hen harrier	*Circus cyaneus*
herring gull	*Larus argentatus*

Common Name	Scientific Name
hobby	*Falco subbuteo*
house martin	*Delichon urbicum*
house sparrow	*Passer domesticus*
jackdaw	*Corvus monedula*
kestrel	*Falco tinnunculus*
kittiwake	*Rissa tridactyla*
lapwing	*Vanellus vanellus*
lesser redpoll	*Acanthis cabaret*
lesser spotted woodpecker	*Dryobates minor*
linnet	*Linaria cannabina*
little grebe	*Tachybaptus ruficollis*
little owl	*Athene noctua*
Manx shearwater	*Puffinus puffinus*
marsh tit	*Poecile palustris*
nightingale	*Luscinia megarhynchos*
nightjar	*Caprimulgus europaeus*
peregrine falcon	*Falco peregrinus*
puffin	*Fratercula arctica*
razorbill	*Alca torda*
red grouse	*Lagopus lagopus scotica*
red kite	*Milvus milvus*
redstart	*Phoenicurus phoenicurus*
redshank	*Tringa totanus*
reed bunting	*Emberiza schoeniclus*
reed warbler	*Acrocephalus scirpaceus*
ringed ouzel	*Turdus torquatus*
shag	*Phalacrocorax aristotelis*
skylark	*Alauda arvensis*
smew	*Mergellus albellus*
snipe	*Gallinago gallinago*
song thrush	*Turdus philomelos*
spotted flycatcher	*Muscicapa striata*
starling	*Sturnus vulgaris*
stonechat	*Saxicola rubicola*
swallow	*Hirundo rustica*
swift	*Apus apus*
tree sparrow	*Passer montanus*

Common Name	Scientific Name
turnstone	*Arenaria interpres*
turtle dove	*Streptopelia turtur*
wheatears	*Oenanthe oenanthe*
willow warbler	*Phylloscopus trochilus*
wood lark	*Lullula arborea*
wood warbler	*Phylloscopus sibilatrix*
yellow wagtail	*Motacilla flava*
yellowhammer	*Emberiza citrinella*

Plants

adder’s tongue fern	*Ophioglossum vulgatum*
ash	*Fraxinus excelsior*
autumn gentian	*Gentianella amarella*
autumn ladies’ tresses	*Spiranthes spiralis*
bastard toadflax	*Comandra umbellata*
Bath asparagus	*Ornithogalum pyrenaicum*
bee orchid	*Ophrys apifera*
bell heather	*Erica cinerea*
betony	*Betonica officinalis*
birch	*Betula* sp.
bird’s nest orchid	*Neottia nidus-avis*
bird's foot trefoil	*Lotus corniculatus*
black poplar	*Populus nigra*
blackthorn	*Prunus spinosa*
bladderwrack	*Fucus vesiculosus*
buckshorn plantain	*Plantago coronopus*
buddleia	*Buddleja davidii*
burnet saxifrage	*Pimpinella saxifraga*
chalk milkwort	*Polygala calcarea*
cock’s foot	*Dactylis glomerata*
coltsfoot	*Tussilago farfara*
common gromwell	*Lithospermum officinale*
common heather	*Calluna vulgaris*
common restharrow	*Ononis repens*
common rockrose	*Helianthemum nummularium*
common spotted orchid	*Dactylorhiza fuchsii*
corky fruited water dropwort	*Oenanthe pimpinelloides*

Common Name	Scientific Name
corn buttercup	*Ranunculus arvensis*
corn marigold	*Glebionis segetum*
Cornish moneywort	*Sibthorpia europaea*
Cotswolds pennycress	*Microthlaspi perfoliatum*
cowslip	*Primula veris*
cross leaved heath	*Erica tetralix*
Douglas fir	*Pseudotsuga menziesii*
dwarf thistle	*Cirsium acaule*
dyer’s greenweed	*Genista tinctoria*
early gentian	*Gentianella anglica*
early purple orchid	*Orchis mascula*
English elm	*Ulmus procera*
European gorse	*Ulex europaeus*
fairy flax	*Linum catharticum*
field rose	*Rosa arvensis*
flat sedge	*Blysmus compressus*
fragrant orchid	*Gymnadenia conopsea*
frog orchid	*Coeloglossum viride*
galingale	*Cyperus* sp.
globeflower	*Trollius europaeus*
greater butterfly	*Platanthera chlorantha*
greater dodder	*Cuscuta europaea*
green winged orchid	*Anacamptis morio*
hairy bird's foot trefoil	*Lotus subbiflorus*
harebell	*Campanula rotundifolia*
hawthorn	*Crataegus monogyna*
heath milkwort	*Polygala serpyllifolia*
heath spotted orchid	*Dactylorhiza maculata*
herb Paris	*Paris quadrifolia*
Himalayan balsam	*Impatiens glandulifera*
Hound’s-tongue	*Cynoglossum officinale*
ivy-leaved toadflax	*Cymbalaria muralis*
Japanese knotweed	*Fallopia japonica*
Japanese wireweed	*Sargassum muticum*
kelp	*Laminariales* sp.
kidney vetch	*Anthyllis vulneraria*
ladies’ mantle	*Alchemilla vulgaris*

Common Name	Scientific Name
lady fern	*Athyrium filix-femina*
leaved fluellen	*Kickxia spuria*
limestone fern	*Gymnocarpium robertianum*
maidenhair spleenwort	*Asplenium trichomanes*
meadow clary	*Salvia pratensis*
meadow cranesbill	*Geranium pratense*
musk orchid	*herminium monorchis*
New Zealand pygmy-weed	*Crassula helmsii*
oar-weed	*Laminaria digitata*
ox-eye daisy	*Leucanthemum vulgare*
oxlip	*Primula elatior*
pale flax	*Linum bienne*
parrot's feather	*Myriophyllum aquaticum*
pasque flower	*Pulsatilla* sp.
pear	*Pyrus communis*
pellitory of the wall	*Parietaria judaica*
pepper saxifrage	*Silaum silaus*
primrose	*Primula vulgaris*
ragwort	*Jacobaea vulgaris*
rare eyebrights	*Euphrasia officinalis*
red helleborine	*Cephalanthera rubra*
red valerian	*Centranthus ruber*
ring ouzel	*Turdus torquatus*
rock rose	*Cistus* sp.
salad burnet	*Sanguisorba minor*
sand spurrey	*Spergularia rubra*
scaly male	*Dryopteris affinis*
sea campion	*Silene uniflora*
shepherd's needle	*Scandix pecten-veneris*
shield fern	*Polystichum* sp.
small scabious	*Scabiosa columbaria*
snakes-head fritillaries	*Fritillaria meleagris*
southern marsh orchid	*Dactylorhiza praetermissa*
spear thistle	*Cirsium vulgare*
spring squill	*Scilla verna*
squinancywort	*Asperula cynanchica*
sweet apple	*Malus pumila*

Common Name	Scientific Name
Sweet chestnut	*Castanea sativa*
sword leaved helleborine	*Cephalanthera longifolia*
thrift	*Armeria maritima*
twayblade	*Listera ovata*
weasel's snout	*Misopates orontium*
whitebeam	*Sorbus* sp.
wild clematis	*Clematis virginiana*
wild thyme	*Thymus serpyllum*
wood anemone	*Anemone nemorosa*
yellow rattle	*Rhinanthus minor*

Insects

Adonis blue butterfly	*Lysandra bellargus*
brown argus butterfly	*Aricia agestis*
chalkhill blue butterfly	*Lysandra coridon*
click beetle	Elateridae sp.
dark green fritillary butterfly	*Speyeria aglaja*
Duke of Burgundy fritillary butterfly	*Hamearis lucina*
festoon moth	*Apoda limacodes*
forest tubic moth	*Dasycera oliviella*
glow worm	*Lampyris noctiluca*
grayling butterfly	*Hipparchia semele*
green hairstreak butterfly	*Callophrys rubi*
high brown fritillary butterfly	*Fabriciana adippe*
hoverfly	Syrphidae sp.
ladybird	Coccinellidae sp.
large blue butterfly	*Phengaris arion*
lesser stag beetle	*Dorcus paralellapipidus*
long horned bee	*Eucera longicornis*
longhorn beetle	Cerambycidae sp.
Lulworth skipper butterfly	*Thymelicus acteon*
marbled white butterfly	*Melanargia galathea*
marsh fritillary butterfly	*Euphydryas aurinia*
mistletoe marble moth	*Celypha woodiana*
noble chafer moth	*Gnorimus nobilis*
northern brown argus butterfly	*Aricia artaxerxes*
oak mining bee	*Andrena ferox*

Common Name	Scientific Name
pearl bordered fritillary butterfly	*Boloria euphrosyne*
purple emperor butterfly	*Apatura iris*
purple hairstreak butterfly	*Favonius quercus*
red admiral	*Vanessa atalanta*
rhinoceros beetle	*Sinodendron cylindricum*
Roesel's bush cricket	*Metrioptera roeselii*
Roman snail	*Helix pomatia*
Scotch butterfly	*Pieris rapae*
sea squirt	Ascidiacea sp.
silver studded blue butterfly	*Plebejus argus*
silver washed fritillary butterfly	*Argynnis paphia*
small heath butterfly	*Coenonympha pamphilus*
soldier beetle	Cantharidae
southern hawker dragonfly	*Aeshna cyanea*
wall brown/ wall butterfly	*Lasiommata megera*
white admiral butterfly	*Limenitis camilla*
white bellied bee	*Andrena gravida*
yellow meadow ant	*Lasius flavus*
yellow-legged clearwing moth	*Synanthedon vespiformis*
Fish	
brown trout	*Salmo trutta*
cod	*Gadus morhua*
Dover sole	*Solea solea*
European eel	*Anguilla anguilla*
herring	*Clupea harengus*
plaice	*Pleuronectes platessa*
sea bass	*Dicentrarchus labrax*
whiting	*Merlangius merlangus*
Other	
blue mussels	*Mytilus edulis*
snake-lock anemone	*Anemonia viridis*
strawberry anemone	*Actinia fragacea*

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