Gloucestershire Local Nature Recovery Strategy

2025

Gloucestershire's Biodiversity and Opportunities for Nature Recovery

PART ONE

glos nature
GLOUCESTERSHIRE LOCAL NATURE PARTNERSHIP

Gloucestershire
COUNTY COUNCIL

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Foreword

Gloucestershire is a treasure trove for nature, from its undulating chalk hills supporting species rich grasslands and ancient beech woodlands in the east to the Severn Estuary and its flood plain supporting aquatic and wetland species, to the rare flora and fauna found in woodlands and grasslands from the five valleys to the Forest of Dean. Even our largest towns like Cheltenham and Gloucester contain biodiverse parks and nature reserves being managed for nature and hosting rare and protected including orchids and bats, to name a few.

Gloucestershire's landscape and nature is important for its people too – feeding us and lifting our spirits, supporting our mental and physical health, holding water in the landscape, absorbing carbon and particulate pollution, and massively supporting our economy by attracting people to visit, live and work in the county.

But just as in the rest of the UK, one of the world's most nature-depleted countries, Gloucestershire's nature is under threat. With a large rural landscape come associated challenges: pollution from intensive agriculture and loss of ecological connectivity, and huge pressure for land use change and overdevelopment. The county's unique landscape and geology support rare and important habitats and species – but these are often fragmented and in decline. In the 1930s, 40% of what we now call the Cotswold National Landscape was wildflower rich grassland. Today, shockingly, that percentage has fallen to just 1.5%.

Gloucestershire's Local Nature Recovery Strategy has been developed by the county council and its expert partners to address this nature emergency. It is an astonishing piece of work, mapping not only sites with existing ecological value across the whole county but also the opportunities for nature recovery in each place, whether in city or countryside, woodland or wetland, hills or valleys. It provides the evidence with which developers and planners must now "have regard" for nature, whilst providing the tools to help steer planning strategies and development to enhance not damage nature. It also empowers local people, communities and organisations to do their bit for nature, equipping them with the ideas, guidance and resources to maximise nature recovery wherever they are in the county.

I want to pay tribute to the County Council team and our partners in the Local Nature Partnership and the wide range of professionals and local wildlife experts who have worked together to deliver this strategy, along with landowners and farmers and the public who have all had their say.

We have all made a huge effort to produce a strategy to support the habitats and species that are most important to Gloucestershire, creating a scientifically robust spatial plan for where we should focus our efforts and a usable tool for everyone in the county who cares about nature.

Cllr Martin Horwood
Member for Nature, Climate & Waste Reduction


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Executive Summary

The development of a Local Nature Recovery Strategy for every county in England was one of the key statutory requirements of the Environment Act 2021. Gloucestershire County Council was appointed by the Department for Environment and Rural Affairs (Defra) to lead on the preparation of the Gloucestershire Local Nature Recovery Strategy. Gloucestershire County Council chose to co-produce the strategy with the Gloucestershire Local Nature Partnership who were commissioned to lead on its development. The strategy has been locally led and informed by the views from environmental professionals, farmers and land managers, foresters, our biological recording community, Gloucestershire Local Authorities, Town and Parish Councils, environmental NGO's and others though a series of workshops, surveys, events and consultation. The maps have been produced by Gloucestershire Centre for Environmental Records (GCER). The engagement, mapping methodology and consultation responses can be found in appendices A and B, housed on the strategy website.

The key uses of this Local Nature Recovery Strategy are intended to be:

- A spatial strategy to guide the best opportunities for nature recovery across Gloucestershire;
- A guide for farmers, landowners and land managers – to show the best locations for accessing funding for habitat management, restoration and creation, and species-specific projects;
- A guide for developers and planners to support designs and master planning for green and blue infrastructure, wildlife corridors and habitat creation;
- Information to help create nature and biodiversity projects and town and parish biodiversity action plans and policies.

User guides for various users can be found on the Local Nature Recovery Strategy website – including how to use the Local Nature Recovery Strategy within Biodiversity Net Gain projects, and how it can be used to guide actions by local community groups. The main way to use this strategy is to click on your location of interest on the Local Nature Recovery Strategy map. This will show the range of opportunities for nature recovery that are priorities in that particular location, in the form of Potential Measures (detailed in Part 2).

The strategy does not force the owners and managers of the land identified to make any changes. Instead, the strategy shows the priority opportunities and options for maintenance and creation of habitats, wildlife corridors and species-specific actions. It should be noted that this strategy is a county-level guide based on modelling from existing sites and surveys, therefore all detailed decisions about land management should be made in relation to site-specific advice and surveys.

This strategy has been developed through a range of discussions and input of information from nature conservationists, planners, local authority officers and members, farmers, landowners, land managers, and members of the public in Gloucestershire. From these discussions and information we have drawn out six key messages which describe the main aims for nature recovery in Gloucestershire:

1 Safeguarding, managing and enhancing existing biodiversity-rich sites.

The complex ecological relationships between species in a habitat are difficult to recreate quickly once a habitat is degraded or destroyed. With the pressures on Gloucestershire's wildlife, the highest priority is to safeguard and enhance high quality nature sites and species populations. Landowners and land managers who are already doing this should be supported.

2 Landscape scale connectivity – Better, bigger, more and more joined.

Working from existing good habitat, these sites should be increased in size, with connective habitat created to join multiple areas of value for wildlife. This is the core theme of Nature Recovery as expressed in the Making Space for Nature report, with the aim of creating a resilient and coherent nature recovery network. Areas put forward for new habitat creation can contribute to meeting the Government's goal of 30 by 30 – at least 30% of land to be protected for nature recovery by 2030.

3 Climate emergency

Climate change is already affecting our wildlife, with temperature, rainfall and growing season changes affecting the timing of natural events such as emergence, pollination and where species can thrive. Nature based solutions can help mitigate some impacts of climate change. Landscape-scale nature recovery will allow species to move and migrate to new or cooler habitat, when the conditions in their existing habitat are no longer suitable due to the impact of climate change.

4 Our relationship with water

Management of our watercourses needs to focus on re-naturalisation, restoration of floodplains and improving water quality. Actions to restore natural meanders and wiggles, along with removing artificial barriers, can have a wealth of benefit both for people and nature, such as slowing the flow of water, creating natural flood resilience and allowing fish to move freely. It is recognised that efforts to improve water quality need to focus on both point and diffuse sources, tackling sources of pollution such as run off, as well as how it moves through the watercourse.

5 The value of mixed and wilder habitats

In the right location, allowing sites to become "messy" and a complex mosaic of scrub, species rich grassland with varying sward heights and bare ground can result in a diverse ecosystem, supporting a wide range of species. The variety in structure also improves climate resilience allowing species to adapt and move between different patches of habitat. These habitats can be created through "natural regeneration" – the process of allowing large herbivores shape and maintain the habitat mosaic, or manual techniques that mimic the way they shape the landscape.

6 Biodiversity in our developments and settlements

The importance of nature in our settlements, urban areas and new developments was emphasised by participants in our public engagement sessions, as well as by other stakeholders. Nature in amongst our urban areas and settlements is important for health and wellbeing, for nature connection, for climate change mitigation and for connecting habitats and wildlife areas within and adjacent to settlements.

Part 1 of the LNRS explores the challenges and opportunities posed by these key messages. Whilst these were deemed the most important areas to focus efforts, it was noted that there are a range of other pressures or standalone opportunities that should also be considered, which include:

Pressures:

- Recreational pressures and disturbance to wildlife
- Diseases and invasive non-native species
- Pressure on woodland regeneration from an increasing deer population

Opportunities:

- The importance of fungi and soil health
- Working with the archaeological and historic environment
- Minerals extraction and restoration
- The need for ecological recording and monitoring

To address the key messages and additional pressures and opportunities 10 broad Biodiversity Priorities have been set, which are detailed in Part 2 of the strategy. Each Potential Measure has been designed to meet the aims of the Biodiversity Priorities. This strategy also considers the wider benefits of each priority for the environment and people. These benefits are also known as ecosystem services, and include benefits that affect human health and wellbeing, as well as benefits that indirectly benefit us, such as carbon sequestration and flood management. To demonstrate the ecosystem service that each priority provides, the following icons are used:

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1. What is a Local Nature Recovery Strategy?

The development of a Local Nature Recovery Strategy (LNRS) for every county in England was one of the key statutory requirements of the Environment Act 2021 [1]. The aim of a LNRS is to establish priorities and map proposals for actions to drive nature's recovery and wider environmental benefits.

The main elements of the Gloucestershire LNRS are:

1. Gloucestershire's Biodiversity and Opportunities for Nature Recovery (Part 1 of the Gloucestershire Local Nature Recovery Strategy). This document sets the scene for the county of Gloucestershire, describing its existing wildlife and protected sites, and the key messages of the strategy, which underpin the nature recovery actions being recommended.
2. Biodiversity Priorities and Potential Measures (Part 2 of the Gloucestershire Local Nature Recovery Strategy). The **Potential Measures** are the recommended actions or management options that will help deliver the biodiversity priorities.
3. Long-list of rare and threatened priority species in Gloucestershire, arranged in assemblages or groups in relation to their habitat needs.
4. The Local Nature Recovery Strategy map or Local Habitat Map, which maps where the Potential Measures should be focused for the best biodiversity outcomes. This identifies Areas that Could Become of Particular Importance to Biodiversity, or where the recovery or enhancement of biodiversity could make a particular contribution to other environmental benefits. It also shows a baseline map of Areas of Particular Importance for Biodiversity – sites already designated for wildlife importance, nationally and locally, and irreplaceable habitats.

1 Environment Act 2021 – https://www.legislation.gov.uk/ukpga/2021/30/contents

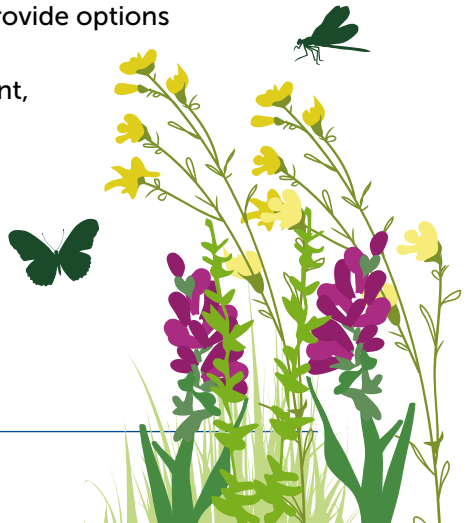
The main purpose of this strategy is to identify locations where creating or improving habitat will be most likely to provide the greatest benefit for nature and the wider environment. The strategy does not force the owners and managers of the land identified to make any changes. Instead, the strategy shows the priority opportunities and options for maintenance and creation of habitats, wildlife corridors and species-specific actions.

Gloucestershire County Council is the Responsible Authority appointed by the Department for Environment and Rural Affairs (Defra) for the Gloucestershire Local Nature Recovery Strategy. Responsible Authorities must review and republish this strategy when directed to do so by Defra, which could be between three and 10 years following publication. The mapping will be fixed until this review, to allow a consistent baseline for monitoring and informing actions, however any updates to data sets and local knowledge will inform changes that could be actioned during the review.

1.1 Who this strategy is for?

1.1.1 Farmers, landowners and managers

One of the key uses of this Local Nature Recovery Strategy will be as a guide for farmers, landowners, land managers and their advisors and land agents as to the best options for biodiversity in relation to the land they manage. This can help make decisions around conservation management, land-use changes, changes in farming options and help to provide options and supporting justifications for applications for agri-environment funding, natural capital investment, biodiversity net gain, natural flood management funding and other grant funding.



1.1.2 Planning and development

The Environment Act 2021 established two specific mechanisms to support the delivery of Local Nature Recovery Strategies – mandatory Biodiversity Net Gain (BNG), and a strengthened Biodiversity Duty for Public Authorities. The Local Nature Recovery Strategy plays a key role in recommending where, and what, habitat creation and other measures should be incorporated within projects that are subject to BNG [2]. Under the Biodiversity Duty for Public Authorities, local authorities must "have regard to" the Local Nature Recovery Strategy in, for example, the local planning process, as information to take into account in Strategic Housing Land Availability Assessments, to help seek opportunities for re-naturalisation of river corridors and natural flood management, and in making and monitoring Parish Biodiversity Action Plans.

Housing developers and other businesses who are making decisions that affect land or water management, can use this strategy to help steer their actions to help biodiversity in the most strategic direction. This can be done through BNG, and through designs and masterplanning for green and blue infrastructure, wildlife corridors and habitat creation, green building measures such as swift bricks and infrastructure improvements such as biodiversity-rich sustainable drainage systems (SuDS).

1.1.3 Environmental NGOs and local groups

This strategy can also help inform anyone planning a nature or biodiversity project in Gloucestershire – nature conservation organisations, local companies, community projects, town and parish councils who are creating neighbourhood development plans or biodiversity action plans, and more, on actions that can make a difference to give nature a chance of recovery.

Covering settlement areas of Gloucestershire a set of Settlements and Developments Potential Measures provide a variety of actions that can help to safeguard and enhance biodiversity in our existing towns, villages and new developments. In rural areas of Gloucestershire, even outside the areas mapped as "Areas that Could Become of Particular Importance for Biodiversity, there are many relevant Potential Measures that can support biodiversity and wider connectivity for nature recovery.

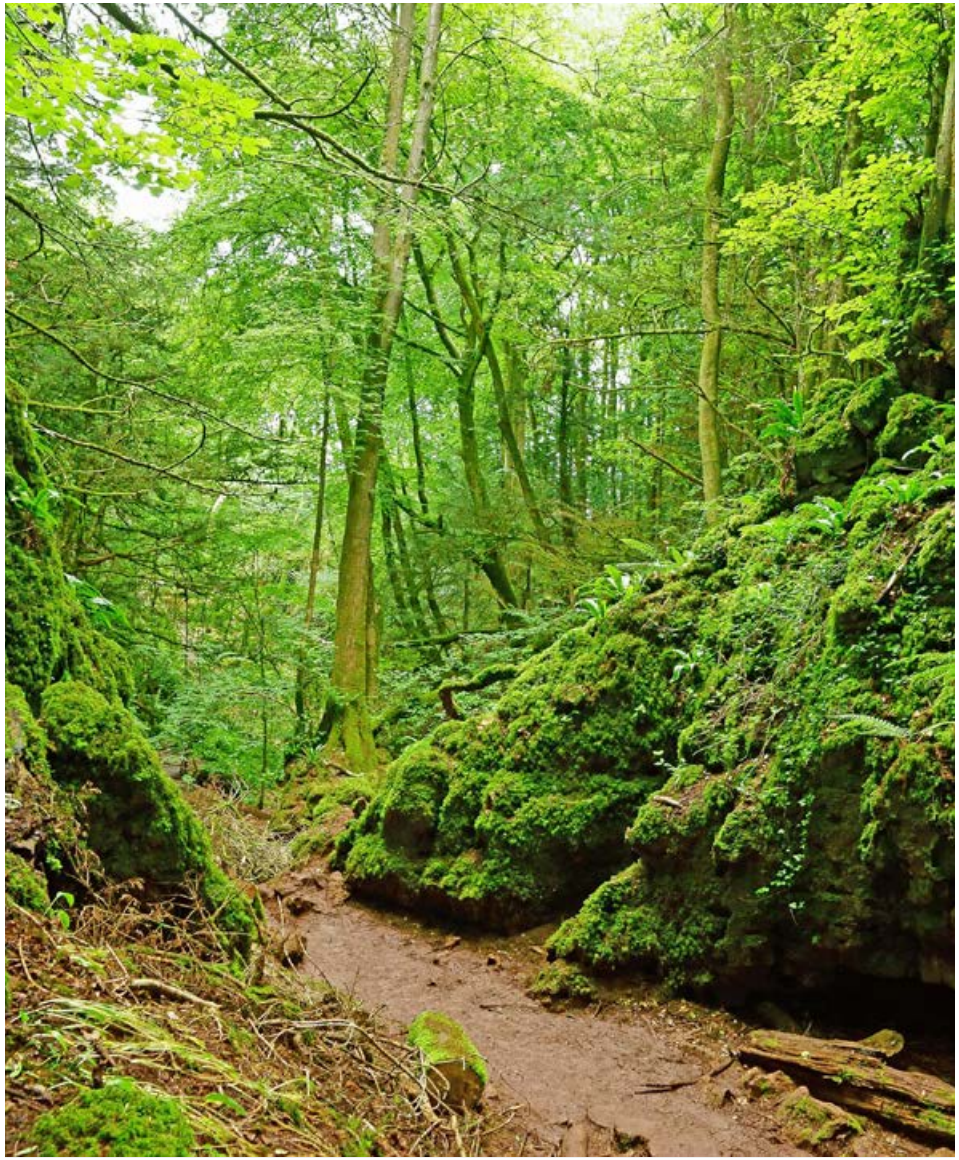
2 Biodiversity Net Gain is a mechanism for assessing a sites baseline and post-intervention ecological value. Most developments need to demonstrate a 10% "net gain" in biodiversity. https://www.gloucestershire.gov.uk/planning-and-environment/ecology-and-landscape/biodiversity-net-gain/

1.1.4 Considerations

An important caveat to take into account when using this strategy is that this is a high level county-scale strategy developed using the current best existing biodiversity information.

For all detailed decisions about habitat management or creation on any particular site, the general recommendations of this strategy should be supplemented with site-specific advice as appropriate, from ecologists, land agents, land managers, local authorities, Gloucestershire County Council Historic Environment Record, regulators including the Forestry Commission, Environment Agency and Natural England, and within protected landscapes the National Landscape teams.

Site specific advice including baseline ecological surveys and/or soil tests should be taken before determining habitat management plans or the best options for land management on that site. Within National Landscapes, the statutory Management Plan and associated guidance including Nature Recovery Plans should be followed. If felling trees, consent and an approved felling licence may be required from the Forestry Commission. The ongoing management costs of habitat creation and enhancement should be planned for. Ongoing survey and monitoring is needed to assess the long term impact of conservation management interventions.



2. Gloucestershire and its biodiversity

2.1 Introduction to Gloucestershire

Gloucestershire is an administrative historic county within the South West region of England, bordering South East Wales, the West Midlands and South East regions (Map 1). At time of publication there are currently six administrative local authorities within the county: Cotswold, Forest of Dean, Stroud District, Cheltenham, Tewkesbury Borough, and Gloucester City. The county is approximately 270,450ha hectares in extent, at least 5,000ha of this being estuarine habitat. Gloucestershire has a population of over 630,000 residents which is likely to approach 700,000 by mid-century. The main areas of population (over 100,000) are situated in the largest settlements of Gloucester and Cheltenham but also within the wider adjoining Severn Vale.

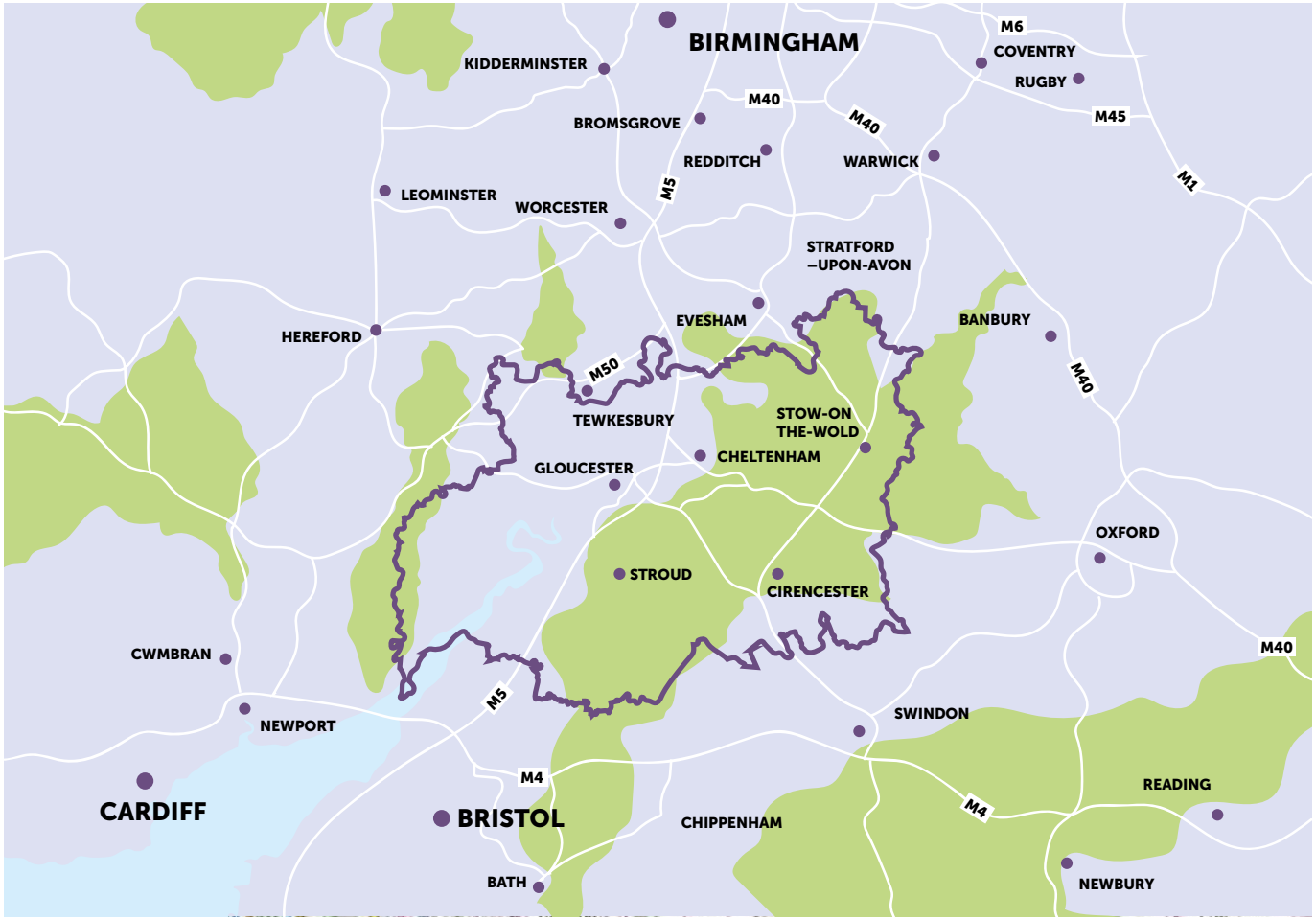


Figure 1 – Gloucestershire boundary

The total area of woodland in Gloucestershire is

36,028 hectares

Gloucestershire is a highly diverse county and is particularly special for its ancient woodland, unimproved limestone (calcareous) grassland, wetlands, old orchards, and species-rich hedgerows. It supports a range of protected and priority species, some of which are becoming increasingly rare such as a range of bat species, amphibians, reptiles, invertebrates, and rare plants.

Three National Landscapes (formerly known as Areas of Outstanding Natural Beauty); the Cotswolds, Wye Valley, and a small part of the Malvern Hills, overlap with the county. The National Landscapes collectively cover over 51% of the land area of Gloucestershire and all stretch well beyond the county boundaries into Monmouthshire, Herefordshire, Worcestershire, Warwickshire, Wiltshire, South Gloucestershire, and Oxfordshire.

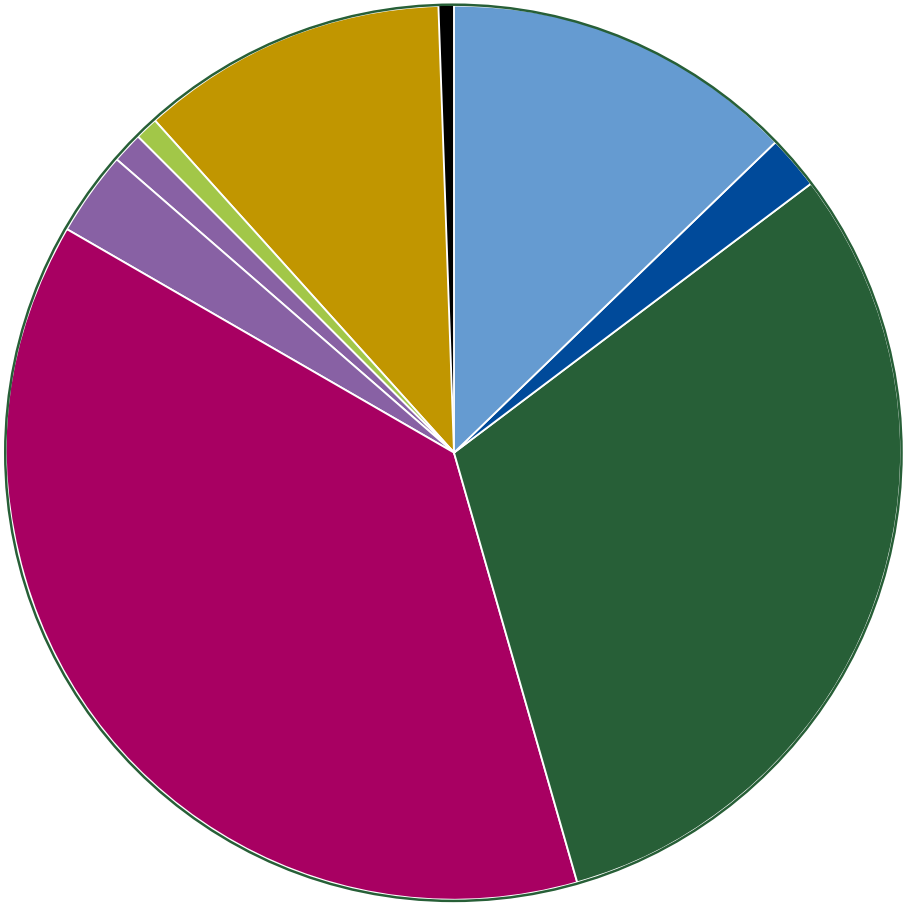
As well as encompassing the lower end of the UK's longest river, the River Severn (220 miles), Gloucestershire also hosts the source and upper parts of the Thames catchment (the UK's second longest river, 215 miles). Smaller river catchments occur throughout Gloucestershire, including the River Wye, River Frome and River Cam, with numerous tributaries.

Agricultural or horticultural practices occur on around 75% of Gloucestershire's total area and significant areas of forestry can be added to this. Gloucestershire's farmland area incorporates many types of habitat or features including disturbed or fallow ground, uncultivated field margins, hedgerows, ponds, grasslands (many flower-rich), small woods, and orchards. The total area of woodland in Gloucestershire is 36,028 hectares [3], with an extensive wooded area in the lower Wye Valley and Forest of Dean while the area around the Severn Estuary is the least wooded. In much of Gloucestershire outside of the Forest of Dean, woodland is relatively fragmented and consists of smaller patches of habitat.

3 National Forest Inventory 2021

Sixty nine percent of woodland in Gloucestershire is under sustainable management [4] with a proportion of this is managed commercially for timber, whilst some areas of privately owned woodland are unmanaged. Many forestry/ woodland areas are important for recreation and the enjoyment of the countryside.

Data from the Centre for Ecology and Hydrology [5] shows the general land cover categories in Gloucestershire are dominated by agriculture and improved grassland (68%) with urban areas taking up around 11% of the county. The most dominant natural habitat is broadleaved woodland, covering around 13% of the county.



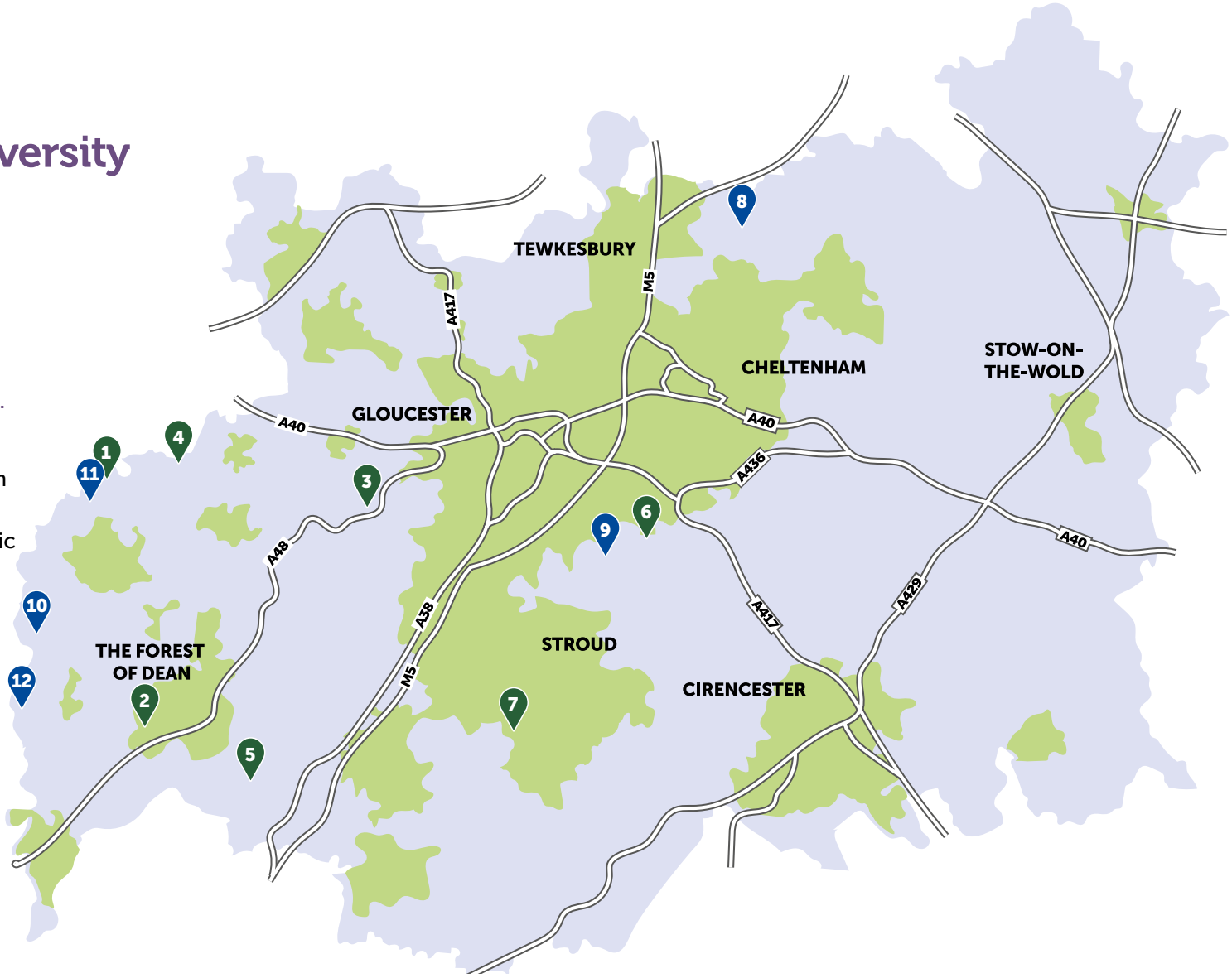
*other habitats such as wetlands, acid grassland, heaths and rock cover less than 1% combined.

4 Forestry England 2023 – https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1162830/Forestry-Commission-Key-Performance-Indicators-Report-2022-23.pdf
5 UK Centre for Ecology and Hydrology 2024 – https://catalogue.ceh.ac.uk/documents/5af9e97d-9f33-495d-8323-e57734388533?_gl=1*6w8arc*_ga*MjIzOTQ5NDgyLjE3NjMwMzAzMTc.*_ga_27CMQ4NHKV*czE3NjQ3ODQ0MjckbzkkZzAkdDE3NjQ3ODQ0MjckajYwJGwwJGgw

2.2 Gloucestershire's existing protected biodiversity

In Gloucestershire, there are a significant number of designated sites of international and national importance for nature that are afforded special legal protection [6] as well as Local Nature Reserves and Local Wildlife Sites that are given a level of protection through National and Local Planning Policy.

Internationally designated sites include Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and Ramsar sites. Nationally designated sites include Sites of Special Scientific Interest (SSSIs) and National Nature Reserves (NNRs). There is a need to update this baseline of designated sites, and to update the species and habitat information for which these sites are designated, for example, the important species of the Severn Estuary have been changing over time and with climate change.



Internationally important sites within Gloucestershire

Sites of national importance in Gloucestershire

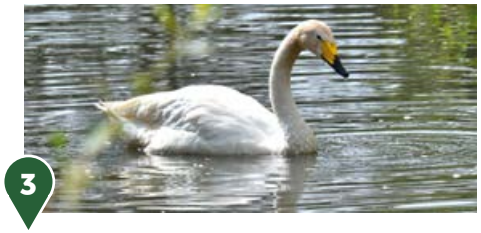
1 The Wye Valley Woodlands SAC 2 The Wye Valley and Forest of Dean Bat Sites SAC 3 Walmore Common SPA 4 River Wye SAC 5 Severn Estuary SA 6 Cotswold Beechwoods SAC 7 Rodborough Common SAC 8 Dixton Wood 9 Cotswold Commons and Beechwoods NNR 10 Highbury Wood NNR 11 Lady Park Wood NNR 12 The Hudnalls NNR

6 Designated sites and information about them can be found on MAGIC Maps– https://magic.defra.gov.uk/

2.2.1 Internationally important sites within Gloucestershire

The Wye Valley Woodlands SAC is designated for its beech forests, lime forests of slopes, screes and ravines and yew woods.

The Wye Valley and Forest of Dean Bat Sites SAC, designated for supporting large populations of breeding lesser and greater horseshoe bats.



Walmore Common SPA is the only significant area of peat in Gloucestershire and the current SPA designation supports over wintering Bewick's swan.

River Wye SAC is designated for the watercourse type and assemblages of aquatic plants. The following species are also qualifying features: white-clawed crayfish, sea lamprey, brook lamprey, river lamprey, Twaite shad, Allis shad, Atlantic salmon, bullhead, otter and aquatic invertebrates.

Severn Estuary SAC, SPA and Ramsar designations. The SAC qualifying features are estuaries, mudflats and sandflats not covered by seawater at low tide, Atlantic salt meadows, sandbanks which are slightly covered by sea water all the time, and reefs. The site also supports sea lamprey, river lamprey, twaite shad, Atlantic salmon, European eel and sea trout. The current SPA designation supports an assemblage of at least 20,000 waterbirds, including overwintering gadwall, greater white-fronted goose, Bewick's swan, dunlin, common redshank and common shelduck. Similarly the Ramsar designation covers the habitats of intertidal mudflats, sand banks, saltmarsh, shingle, and rocky platforms, the invertebrate community, several species of waterbirds and passage and wintering waders, and several species of fish migrating between sea and river via the estuary.

Cotswold Beechwoods SAC is designated for being the most westerly extensive blocks of beech forests in the UK. The woods are floristically richer than the Chilterns, and rare plants include red helleborine, stinking hellebore, narrow-lipped helleborine and wood barley. The woods are structurally varied, including blocks of high forest and some areas of remnant beech coppice. Dry calcareous grasslands interspersed with scrub and rare orchids are also a qualifying feature.

2.2.1 Internationally important sites within Gloucestershire

7

Rodborough Common SAC is designated for its species rich dry calcareous grassland substrates, supporting important assemblages of orchids. Rodborough Common is one of the most extensive area of semi-natural dry grasslands surviving in the Cotswolds, and represents a species assemblage more or less confined to the Cotswolds.

8

Dixton Wood SAC is designated for violet click beetle. It is a small site with a large number of ancient ash pollards, and supports a rich fauna of scarce invertebrate species associated with decaying timber on ancient trees.

North Meadow SAC is in Wiltshire, but borders the Gloucestershire county boundary, and is an exceptional example of lowland floodplain meadow.

2.2.2 Sites of national importance in Gloucestershire

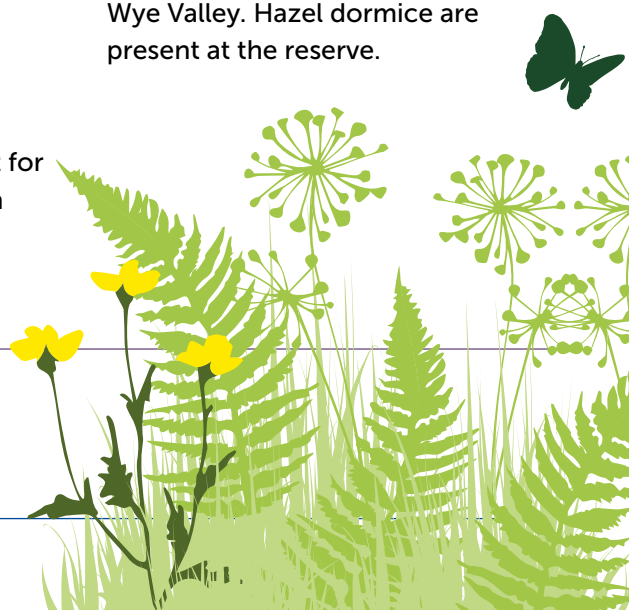
National Nature Reserves in Gloucestershire [7] include:

9

Cotswold Commons and Beechwoods NNR. At 7.5km2, it is the largest nature reserve in the Cotswolds. Consisting of limestone grasslands and woodlands, it follows the scarp slopes of the Painswick valley. It includes the internationally important Cotswolds Beechwoods SAC (described above). Among the wider woodlands Buckholt Wood is of note with over 780 species of fungi recorded. The grasslands support a wide range of flora and insects, including the rare Duke of Burgundy butterfly at Rudge Hill Common. The limestone headwaters on the scarp slopes provide some very good habitat for white-clawed crayfish, and high quality assemblages for aquatic invertebrates and bryophytes.

10

Highbury Wood NNR. Situated on the eastern bank of the River Wye, and part of an almost unbroken chain of ancient woods that link Chepstow (Monmouthshire) to Ross-on-Wye (Herefordshire), the 46 hectare wood is rich and diverse, noted for its variety of woodland types. The large-leaved lime, wild service tree, and whitebeam are examples of rare trees here, with the large-leaved lime particularly important as it is restricted to the Wye Valley. Hazel dormice are present at the reserve.



7 Gov.uk – https://www.gov.uk/government/publications/gloucestershires-national-nature-reserves/gloucestershires-national-nature-reserves

11

Lady Park Wood NNR. An unmanaged and near natural woodland which is part of the Wye Valley Woodlands SAC (above), Lady Park Wood is home to both the UK's native species of lime tree as well as whitebeam. Rare bats have been recorded, especially greater and lesser horseshoe bats which are found in significant numbers.

12

The Hudnalls NNR. Also within the Wye Valley Woodlands SAC, and managed with minimum intervention, the lime-beech-oak woodland on strongly acid soils is of a type virtually unknown outside of the Lower Wye Valley. Alongside the other woodland NNRS, rare plants are found here supporting rich insect and bird communities, including some rare members of the true fly (*Diptera*) family.

There are 123 [8] Sites of Special Scientific Interest (SSSIs) designated in Gloucestershire. Some of the largest are recognised internationally as SACs/SPAs (for example, Severn Estuary, River Wye, Cotswolds Commons and Beechwoods). Other large SSSIs include Minchinhampton Common, nationally important for calcareous grassland plants and fungi, and Cleeve Common, which at 455 hectares is Gloucestershire's largest common comprising an extensive area of biodiverse limestone grassland. Woodchester Park is another large SSSI, with diverse mix of animals plants and fungi associated with the mix of grassland, woodland and wetland habitats on site. A notable species found at Woodchester is the greater horseshoe bat, a rare and highly protected species. The Cotswold Water Park covers more than 170 lakes that support 35,000 waterbirds in winter and a range of aquatic plants, and recently had its designation boundary expanded.

Among the many examples of smaller SSSIs, that are still extremely important biologically, is Badgeworth SSSI. This is one of only two sites in the UK where Adder's-tongue Spearwort can be found, with its own name locally, "Badgeworth buttercup". Wotton Hill is another example of a small site with high value, with the woodland here being one of only two UK sites where the rare limestone woundwort is present.

8 Natural England – https://designatedsites.naturalengland.org.uk/SiteList.aspx?siteName=&countyCode=16&responsiblePerson=&DesignationType=SSSI

2.2.3 Irreplaceable Habitats

Irreplaceable habitats were defined in relation to Biodiversity Net Gain guidance in 2024. The irreplaceable habitats, according to this initial definition, present in Gloucestershire are:

- **Ancient woodland – this includes**
  - Ancient Semi-Natural Woodlands
  - Plantations on Ancient Woodland Sites
  - Ancient Wood Pasture and Parkland
  - Infilled Ancient Wood Pasture and Parkland
- **Ancient and Veteran Trees**
- **Lowland Fens**

Within Gloucestershire 17,928 hectares of the woodland is ancient (6.8% of Gloucestershire), and Gloucestershire currently has 351 [9] identified Ancient and Veteran Trees (Ancient Tree Inventory, Woodland Trust).

2.2.4 Sites of county importance

Local Nature Reserves (LNRs) [10] are declared by local authorities (councils) on land they control that is of importance for wildlife, geology or environmental education and is accessible to visitors for the enjoyment of nature. These specially selected sites number just over 10 in Gloucestershire include well known sites such as Robinswood Hill and Alney Island.

Local Wildlife Sites are designated at a county level [11] , and at date of publication there are 902 Local Wildlife Sites in Gloucestershire. These are part of a nationwide non-statutory site protection system which collectively form the bulk of the county's identified natural heritage. Yet, they cover only about 1% of the county's land area, a clear indication that although we have many biodiversity-rich sites, they are small and fragmented and although they have some policy protection, they have no real legal status. There is an identified need to resource the review and updating of Local Wildlife Site designations and monitoring.

Conservation Road Verges – Road verges can sometimes support remnants of old and species-rich meadows and be bounded by species-rich hedgerows or mature trees. A selection of the most important road verges for biodiversity has been identified by Gloucestershire Wildlife Trust working in partnership with Gloucestershire County Council, and these are designated in the county as conservation road verges [12]. At date of publication there are 109 conservation road verges in Gloucestershire. Road verges can be useful refuges for wildlife and can act as corridors connecting species and habitats across the county.

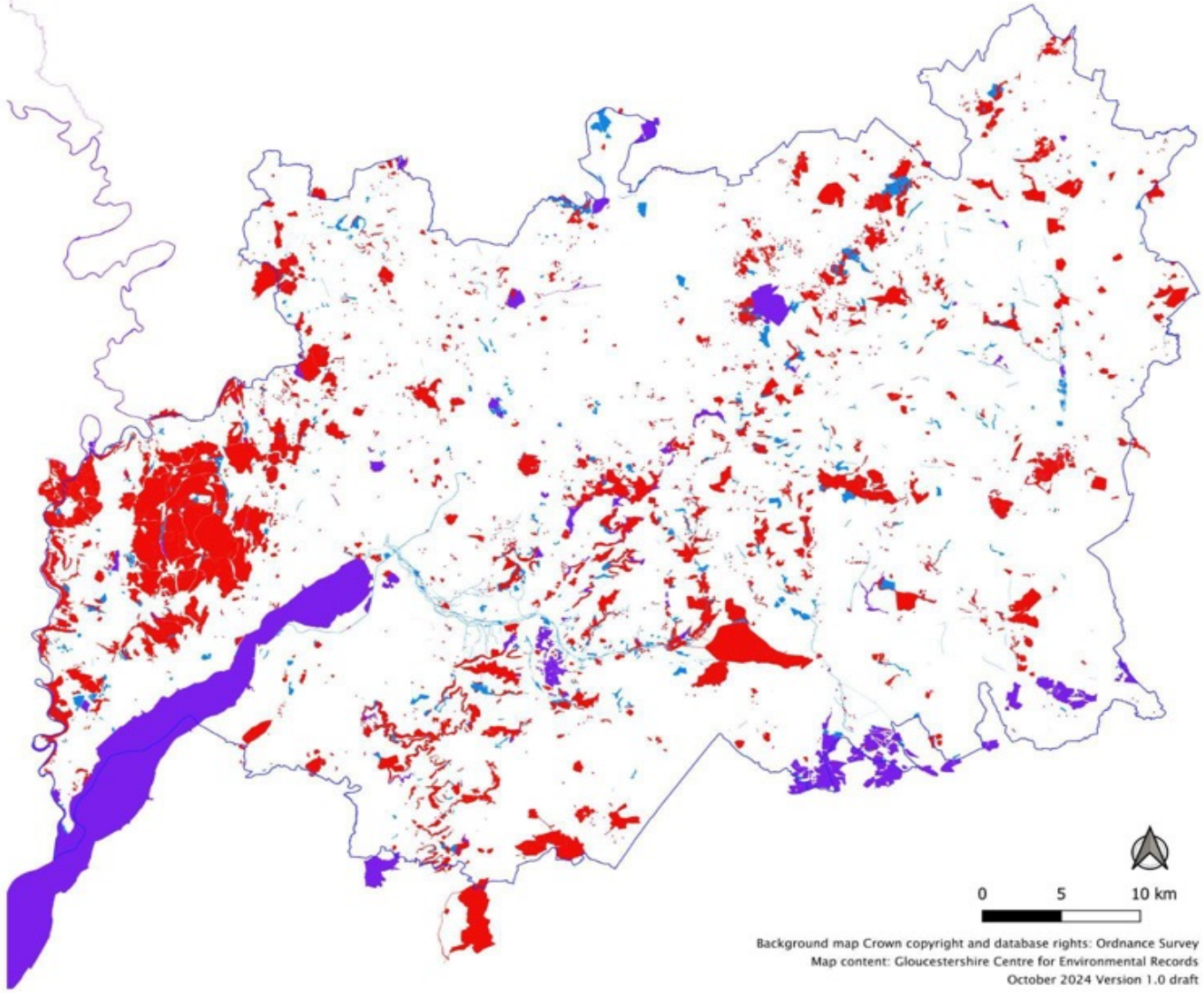
9 The Ancient Tree Inventory is in part, developed through voluntary submissions of ancient trees, so not all existing trees within the county will be included in this figure. This figure also does not include trees that have restricted access, as the data is not publicly available to download.
10 Gov.uk – https://www.gov.uk/guidance/create-and-manage-local-nature-reserves
11 Gloucestershire Wildlife Trust – https://www.gloucestershirewildlifetrust.co.uk/wildlife/local-wildlife-sites
12 Gloucestershire County Council – https://www.gloucestershire.gov.uk/plans-policies-procedures-and-manuals/biodiversity-and-highways/

2.2.5 Areas of Particular Importance for Biodiversity

A key part of the LNRS involves mapping areas of habitat that already have a level of legal protection, to recognise that these areas should be protected and to inform how networks of potential habitat creation should be designed to expand and link these. Combining the internationally, nationally and locally (county importance) designated sites with irreplaceable habitats, forms the **Areas of Particular Importance for Biodiversity** mapping layer.

Priority Habitats [13] – a list of important habitat types recognised for their ecological value – that are not currently classified as "Irreplaceable" can be found within the Local Habitat Map within a range of measures relating to managing existing habitats. They are not, however, included within the Areas of Particular Importance for Biodiversity layer due to the country-wide Local Nature Recovery Strategy guidance. Collectively, these sites cover roughly 15% of the county.

Figure 1 – Areas of Particular Importance for Biodiversity



13 Gov.uk – https://www.gov.uk/government/publications/habitats-and-species-of-principal-importance-in-england

2.3 Biodiversity in each National Character Area

Gloucestershire's rich and diverse habitats are a reflection of the underlying geology and historic land use influences. As a result, the county contains five very distinctive National Character Areas, which follow natural lines in the landscape rather than county or district boundaries:

- NCA 105: Forest of Dean and Lower Wye
- NCA 107: Cotswolds
- NCA 106: Severn and Avon Vales
- NCA 108: Upper Thames
- Clay Vales
- NCA 104: South Herefordshire and Over Severn

Natural England National Character Area profiles [14] (NCAs) describe these landscapes in more detail and demonstrate the continuing connectivity of these landscapes beyond the county boundary. A further three National Character Areas overlap the county by a small amount (Bristol Avon Valleys and Ridges; Herefordshire Lowlands; Malvern Hills).

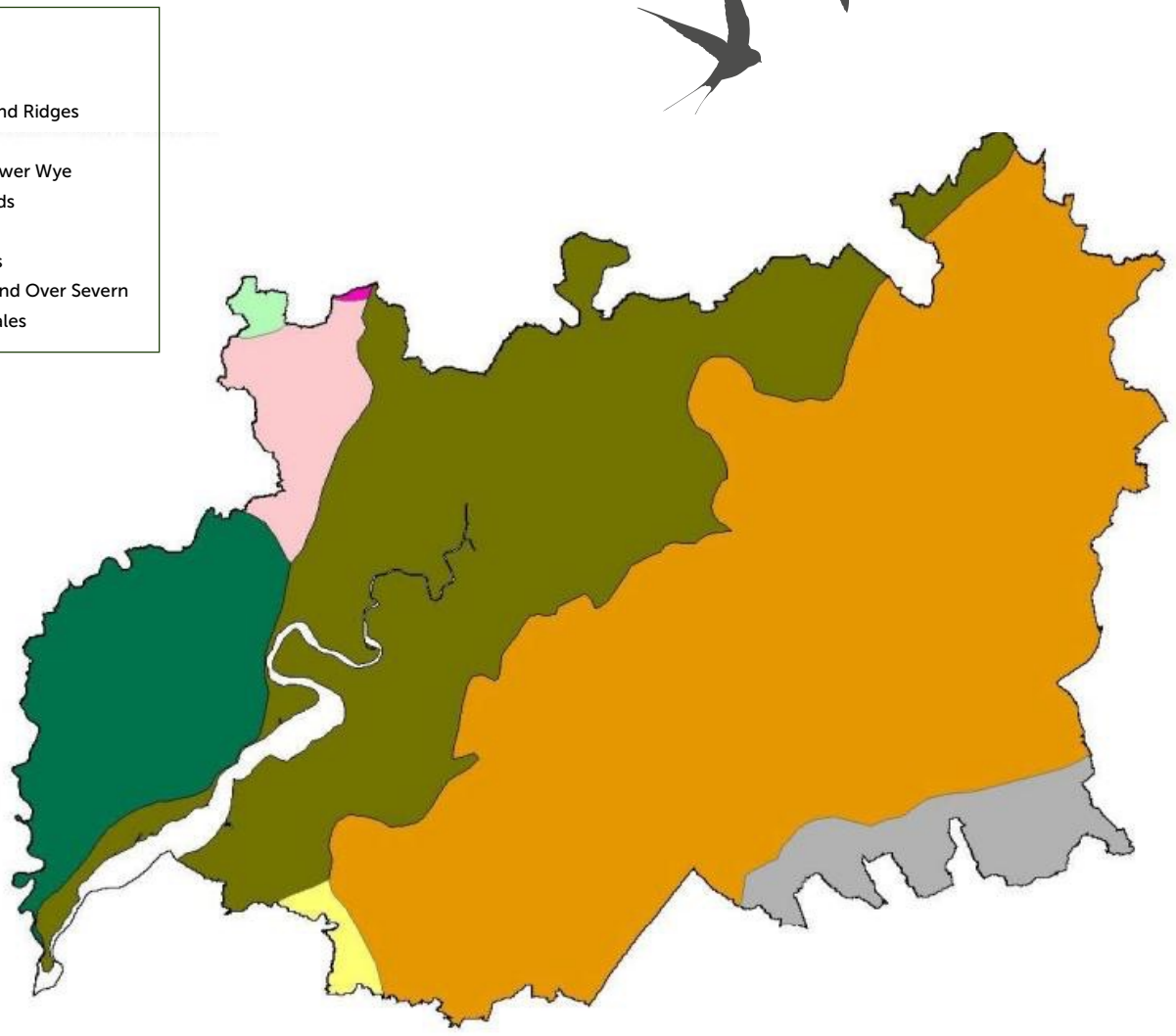


Figure 2 – National Character areas in Gloucestershire

14 Gov.uk – https://www.gov.uk/guidance/national-character-area-profiles-information-for-local-decision-making

This section describes the context of the main priority habitats and species for each of the main National Character Areas that are in Gloucestershire.

2.3.1 Forest of Dean and Lower Wye

The Forest of Dean and Lower Wye (NCA 105) forms a large distinctive landscape in the west of the county bordering Wales and Herefordshire. The Forest of Dean consists of mainly higher ground and ridges with extensive woodland and more open ground that merges into the Severn Vale, Leadon Valley and the Lower Wye Valley which is part of the Wye Valley national Landscape [15].

In the Forest of Dean, the geology, topography and past land use dominate with large impacts evident from past mining, industry, and more recently from forestry and agriculture. The landscape is a mosaic of open and wooded ground characteristic of medieval hunting forests. The location has extensive archaeological remains and historic structures, and forestry tends to be more common on the higher ground. The Forest of Dean is a stronghold for nature [16], with large areas of woodland, including ancient semi-natural woodland, plus open space that provide a mosaic of habitats for a great range of species. Of note are the colonies of greater and lesser horseshoe bats, the largest colonies of these species in Europe. The Forest of Dean has the largest population of lesser horseshoe bats in the UK, at 26% of the UK population. The Forest of Dean is also well known for its diversity of plants, birds, and invertebrates and there is the aspiration for the Forest of Dean to become a UNESCO World Heritage Site.

15 Wye Valley National Landscape – https://www.wyevalley-nl.org.uk/
16 Forestry England – https://www.forestryengland.uk/sites/default/files/documents/Our%20Shared%20Forest%20-%20Forest%20of%20Dean%20Land%20Management%20Plan%20published%20June%202019.pdf

Gloucestershire has a relatively small but important amount of acid grassland and heathland, which is mainly found within the Forest of Dean area, as well as Cleeve Common, and this strategy has a range of Potential Measures relating to these habitats. There is some potential to restore mires and lowland peat in small areas of the Forest of Dean through re-wetting or the actions of beavers – these potential areas are limited in geographical extent but highly important habitats, including for carbon sequestration.

There is a strong water connection between the Forest, the Wye, the Severn and its estuary, so Potential Measures about river re-naturalisation and riparian tree planting, as well as tufa (relatively rare calcium deposits in river headwaters which benefit specialised invertebrate and other species) are important in this area, with the Forest to Sea programme by the Severn Vale Catchment Partnership being a key way these are being progressed. There are also isolated populations of white-clawed crayfish in the Forest of Dean, with the potential to create ARK sites to boost and protect populations.

The Lower Wye Valley part of the National Character Area (NCA 105) sits within the Wye Valley National Landscape Area. The River Wye and its limestone gorge dominate in Gloucestershire and adjoining Monmouthshire. There are steep wooded slopes and in places open pasture and meadow bounded by old hedgerows or stone walls. There is a tidal influence on the Wye in the county and like the Severn, the Wye is important for migratory fish. The Lower Wye Valley has a wealth of woodland and meadow species including rare mammals, plants, and insects.

Traditional orchards, providing an excellent habitat for veteranised wood and a mixed mosaic habitat, and important for species such as the noble chafer beetle, are an important habitat within the Forest of Dean and Lower Wye area, as well as other parts of Gloucestershire, so there is a Potential Measure for traditional orchard management, restoration and creation. Opportunities should be taken to create more landscape scale connectivity of wooded habitats between the Wye and Forest of Dean and Wales, especially to encourage movement of pine marten populations.

The Forest of Dean area owned and managed by Forestry England is a great example of a working forest which is supplying sustainably-sourced timber whilst conserving plant and animal species, recovering vital ecosystems and returning missing species to our landscapes [17]. The Forest has seen some great work in terms of species recovery projects including pine marten and beaver.

*The **Forest of Dean** has the **largest population** of*

lesser horseshoe bats

*in the UK, at **26% of the UK population**.*

17 Forestry England – https://www.forestryengland.uk/the-forest-dean/our-work

35 pine martens

*were reintroduced to the **Forest of Dean** between 2019–2021 through a **partnership of conservation organisations**.*

Under a partnership between Forestry England, Natural England and the Beaver Trust, beavers were reintroduced in 2018 and 2024 into two separate enclosures in the Forest [18] (Greathough Brook and Perry Hay). Beavers are 'ecosystem engineers' and the dams they create can slow the flow of water at times of heavy rainfall, releasing it slowly during dry periods thereby reducing the ecological impacts of drought. They have now settled in and are having multiple positive impacts on biodiversity, habitats, water quality and flow rates. The beavers at Greathough Brook have even managed to reduce flooding in a village downstream.

Also, between 2019 and 2021, a collaboration between Gloucestershire Wildlife Trust, Forestry England, Forest Research and Vincent Wildlife Trust saw 35 pine martens being successfully released into the Forest of Dean [19]. Monitoring shows that they have been spreading via connected nature networks and habitat corridors across the region, with some spreading throughout the Forest, and others venturing across the Wye into Wales, others northwards following the Wye, and one marten was even found in the Stroud Valleys. This project will bolster the expanding Welsh population and help establish a resilient pine marten population in the south-west. The 'Martens on the Move' team is now leading on monitoring as they continue to spread [20]

18 Forestry England – https://www.forestryengland.uk/the-forest-dean/beavers-the-forest-dean
19 Gloucestershire Wildlife Trust – https://www.gloucestershirewildlifetrust.co.uk/project-pine-marten
20 Vincent Wildlife Trust – https://www.vwt.org.uk/projects/martens-on-the-move-a-new-era-of-pine-marten-conservation

2.3.2 Cotswolds

The Cotswolds National Character Area (NCA 107) is extensive and although most of it is located within Gloucestershire it also stretches well beyond the county boundaries to the north, south and east. There are two main areas of semi-natural habitat within the NCA that have been identified previously as local Nature Improvement Areas and form significant parts of the local Nature Recovery Network mapping.

Arable farming is extensive across the high ground and dip slope of the Cotswolds but there is permanent pasture on the steeper slopes. The unimproved calcareous grasslands, lowland meadow in the valley bottoms, ancient woodland, limestone watercourses including tufa formations, and open farmland are of significant biodiversity value.

The Cotswolds are nationally important for unimproved calcareous grasslands, which have become increasingly fragmented over the last 70-80 years. Unimproved calcareous grasslands can be extraordinarily rich in plant species (with up to 40 species per square metre [21]) but this may become more limited in smaller isolated patches. Scattered scrub is an important element for many species including butterflies. There are therefore Potential Measures in this strategy for managing, restoring and creating lowland calcareous grassland as well as a range of measures for some of the species found on calcareous grassland, such as juniper, large blue, Duke of Burgundy and more.

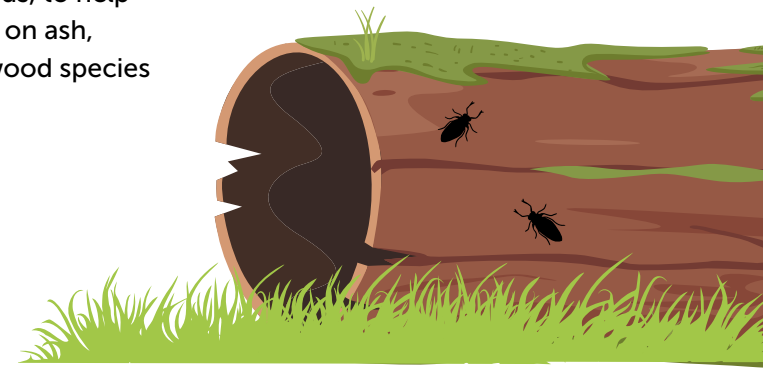
Cotswolds National Landscape's Glorious Cotswold Grasslands project [22] has been running since 2019, working with landowners to create and restore species rich lowland calcareous grassland and lowland meadows. The National Trust's Stroud Landscape Project [23] is taking a landscape-scale approach between Crickley Hill and Wotton-under-Edge in working with landowners to restore, create and connect habitats including species-rich lowland meadow and calcareous grassland. Other projects such as the Grasswolds landscape recovery project proposal will add to this work. Opportunities should be identified to further consolidate this work which will increase the connectivity and resilience of the open habitat network in the Cotswolds.

21 Forestry Research – https://cdn.forestresearch.gov.uk/2022/02/bpg_18.pdf
22 Cotswolds National Landscape – https://www.cotswolds-nl.org.uk/our-work/nature-recovery/glorious-cotswold-grasslands/
23 National Trust – https://www.nationaltrust.org.uk/visit/gloucestershire-cotswolds/minchinhampton-and-rodborough-commons/stroud-landscape-project

Neutral and floodplain meadows are found in the deeper soils of the valley bottoms (often grading into calcareous grassland further up the slope), these require an appropriate cycle of grazing or hay cutting to maintain their species diversity. There are concentrations of this habitat particularly around the east flowing rivers that form the Cotswold rivers Nature Improvement Area. Where possible opportunities should be taken to reconnect rivers with their floodplain to allow the natural cycle of overtopping. Often the meadows are very small and fragmented. As well as increasing patch size, connectivity could be enhanced through flower rich arable field margins.

The steepness of the scarp, and therefore its lack of suitability for arable farming means that there remains a spine of ancient woodland and unimproved calcareous grassland stretching north to south. This forms the Cotswold scarp local nature improvement area and a key part of the nature recovery network. While there is this spine of core habitat, it is significantly fragmented in places and opportunities should be taken to improve the quality of semi-natural grasslands and woodland through appropriate management, increasing the extent of the habitat areas and creating connectivity between them. Care should be taken not to cut off the open habitat network through establishment of woodlands. Where these networks intersect, matrix habitats like grassland with scattered scrub, or woodlands with large glades and rides can form appropriate network intersections.

Veteran ash pollards are characteristic of the Cotswolds area, and their importance as a habitat is increased as ash dieback significantly reduces the number of ash trees. There is therefore a species Potential Measure to conserve veteran ash pollards, to help vulnerable species that rely on ash, such as lichens and dead-wood species especially click beetles.



The rivers represent key examples of oolitic limestone rivers, have high wildlife value and are of national importance. The quality of these rivers is threatened where unsympathetic land management causes diffuse water pollution, and from point source pollution from sewage outfalls during release events. There are opportunities to create habitat next to rivers to help improve their ecological condition, including river buffer strips, riparian tree planting or management or creation of floodplain meadows. Adaptation to climate change, including the need to hold back water, would benefit from relinking watercourses with their floodplain and using in-stream natural flood management techniques, potentially including beaver.

The limestone of the Cotswolds results in a good number of tufa formations. Sensitive land management is needed to ensure that they survive [24] .
They support plants, mosses, liverworts and algae, and specialist invertebrate communities including a number of species of conservation concern.
These tufa springs, slides and steps/cascades are vulnerable to changes in the water table e.g. below water table quarrying and disruption to natural spring lines by drainage works and by overgrowth of vegetation such as invasive non-native species.

By working with landowners, work in recent years has been targeted to create viable habitat for water voles based upon minimum viable area (MVA) methodology. Adjoining flood plain areas, such as at Sherborne Water Meadows, have also been a focus for activity which has benefitted a wide range of plants and animals. There are opportunities to continue this work and replicate the approach further downstream in Oxfordshire.

24 Buglife – https://cdn.buglife.org.uk/2019/08/Sheet-2-General-guidance-web.pdf

Improvement in water quality will need to focus on the management of the adjoining valley sides where there is a great opportunity to create wildlife corridors based on a mosaic of woodland, scrub and limestone grassland running north and west from the rivers Thames and Avon to the Cotswolds scarp. There is a Potential Measure on improving the ecological condition of rivers (**Measure 022**), as well as a number of measures about ways to improve water quality, including **Measures 038**, **044**, **046** and **047**.

Improving water quality will greatly benefit species including white clawed crayfish, water vole and otter and a wide range of invertebrates. There are some small catchments in the Cotswolds where the native white clawed crayfish is withstanding competition from the American signal crayfish, and a Potential Measure on white clawed crayfish aims to bolster efforts to help this continue.

The open arable areas of the Cotswold dip slope are particularly important for farmland birds and rare arable plants. Across the wider farmed landscape, particularly of the dip slope, the opportunity is to integrate wildlife into productive farming through a regenerative or eco-agricultural approach. Management to support good soil structure and the integration of margins, buffer strips, bigger bushier hedgerows, trees, ponds and wild corners, enabling integrated pest management, across the whole farmed landscape would enable many more species to thrive. Agroforestry should also be considered as a farming practice, due to its range of benefits for both productivity, biodiversity and improved climate resilience. Extensive conservation grazing will help support the restoration of species-rich grassland. Where land is marginally productive it may be better to revert to grassland.

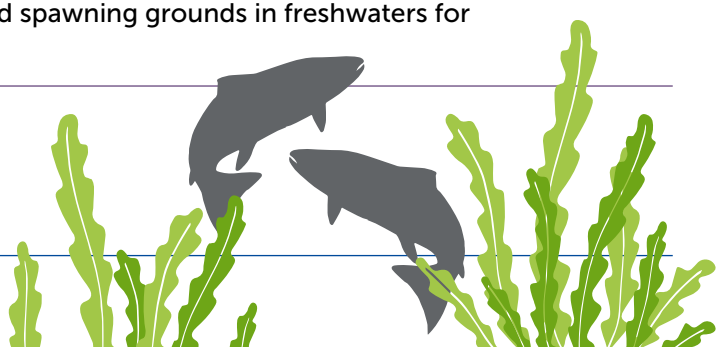
*Improving water quality will greatly benefit species including white **clawed crayfish**, **water vole** and **otter** and a wide range of **invertebrates***

2.3.3 Severn and Avon Vales

The Gloucestershire part of the Severn and Avon Vales, NCA 106, is the **Severn Vale**, an open low-lying agricultural landscape that dominates the central region of Gloucestershire. It is linked to the Avon Vale in the north and stretches from Tewkesbury to the border with Wales at Chepstow in the south. This is the landscape where the City of Gloucester is situated with the M5 motorway running through it and Cheltenham nestling beneath the Cotswold scarp. At the southern end the meandering central River Severn slowly transforms to become the Severn Estuary where the landscape is even more open. The two main aspects of importance for biodiversity in this area are one, the tidal estuarine ecosystems, and two the grasslands, wetlands, hedgerows and orchards of the vale.

The Severn Estuary in Gloucestershire is dominated by the powerful River Severn with an estuary with the second biggest tidal range in the world. A meandering river channel is flanked with extensive banks of sand and mud that are flooded at high tide. Areas of salt marsh vegetation are currently limited in extent. The ecosystem of this estuary is of international importance for birds and migratory fish and is bordered by floodplain grazing land and eroding cliffs and rocks in places [25]. There are two small harbours (ports) in the central zone at Lydney and Sharpness which are accessible only at certain parts of a very large tidal range. Relative lack of human disturbance across the Severn and shoreline helps maintain important habitats for wildlife.

The value of the estuary and floodplain for birds is widely acknowledged and internationally recognised. Large populations of numerous bird species rely on the Severn for wintering and migration, including birds stopping to feed as part of their migration journeys (stopovers), in addition to species that are present year-round. The estuary is of significance for migratory fish, linking breeding, maturing and spawning grounds in freshwaters for



25 See Severn Estuary designated sites in section above.

endangered species including European eel, twaite shad, salmon, lamprey and sea trout. It has the most diverse range of fish species in Britain and some of the country's most important nursery sites [26]. Although invertebrate communities are less well studied they are known to play a key role in supporting the biodiversity of the area, for example attracting bird life. Scarce plants can also be found here, connected to the saltmarshes, such as the Slender Hare's-ear. The overall scale of the ecosystem and it's habitats together are a critical part of it's significance for nature.

It is important to protect the Severn Estuary SPA through careful Strategic Local Development Plans, ensuring the approved mitigation strategy is followed, ensuring suitable sustainable accessible natural greenspace (SANGs) recreation areas are established away from ecologically sensitive sites.

There are important opportunities in the Severn Vale for floodplain meadows, fens and wetlands. We should take opportunities to plan for a landscape scale expansion of wetlands, intertidal habitats, rhines and unimproved grasslands along river floodplains through restoration, expansion and re-linkage of existing remnant areas of semi-natural habitat. Opportunities should be taken to create biodiverse floodplain habitats along the Severn Vale to support recovery of species including European eel and true fox-sedge, for example through the Eelscapes project [27].

The floodplain of the River Severn is highly productive agricultural land. There are a significant number of good sites of species-rich grassland, including floodplain meadows. Much of the area is important for over wintering waterbirds, and a series of core areas which remain wet in summer support breeding waders, as well as actingas drop in locations for migrating waders.

26 Severn Estuary Partnership – https://severnestuarypartnership.org.uk/the-estuary/physical-natural-environment/fish/
27 Gloucestershire Wildlife Trust – https://www.gloucestershirewildlifetrust.co.uk/what-we-do/current-projects/eelscapes

The Severn Vale has limited woodland cover today but has traditional orchards, hedgerows with trees plus important areas of lowland meadow and floodplain grazing marsh. The area is known for its variety of birds, invertebrates, flora and fungi, including the relatively rare native black poplar which is characteristic of the Severn and Avon vales, and globally vulnerable Orchard Toothcrust fungus. It is a significant area not just for biodiversity but also for food production, flood regulation and recreational opportunities.

Regenerative farming principles should be taken up, to incorporate more opportunities for biodiversity into productive farmland and protect ecosystem services, particularly soil and water quality.

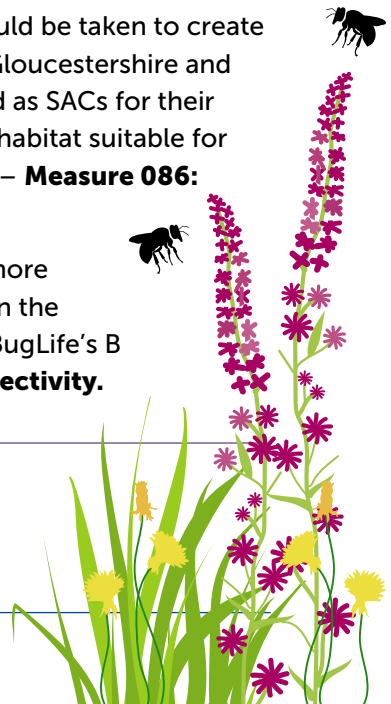
Traditional orchards in the Severn Vale should be retained and restored, and links created through habitat creation, hedgerow management and hedgerow and in field tree planting, with woodlands and veteran trees to create a long term sustainable resource for deadwood fungi, invertebrates and cavity nesting species.

There are important horseshoe bat commuting routes through the Severn Vales, between the Forest of Dean and the Cotswolds. Dark hedgerow and woodland corridors should be safeguarded for horseshoe bats and other bat species, as described in **Measure 075**: **Greater horseshoe bat flightlines**.

The Severn Vale area contains hills which are outliers of the Cotswold oolitic limestone: Bredon, Dumbleton, Churchdown and Robinswood Hills. These hills are the same limestone formation as the Cotswold hills but are separated from them by lower lying land of the Severn and Avon Vales. Robinswood Hill and Churchdown Hill are at particular risk of ecological connectivity being cut off from the main Cotswolds Hills due to urban expansion. Ecological connectivity should be maintained through an undeveloped green corridor to enable genetic exchange to occurbetween populations on the outliers and the main Cotswolds. Between

Gloucestershire and Worcestershire, opportunities should be taken to create greater habitat connectivity between Dixton Wood in Gloucestershire and Bredon Hill in Worcestershire (both sites are designated as SACs for their deadwood invertebrate interest), to expand the size of habitat suitable for the rare violet click beetle and other rare invertebrates – **Measure 086: Strengthen violet click beetle population.**

Other opportunities should also be taken to establish more east-west connectivity of semi natural habitats between the Cotswolds and Leadon Vale, particularly in relation to BugLife's B Lines [28] – **Measure 030**: **Create wildlife corridor connectivity.**



28 Buglife – https://www.buglife.org.uk/our-work/b-lines/

2.3.4 Upper Thames Clay Vales

The Cotswold Water Park is part of the Upper Thames Clay Vales, NCA 108, and covers the south eastern corner of Gloucestershire and extends into Wiltshire and small parts of the administrative areas of Swindon and West Oxfordshire. Amidst this area of open, gently undulating farmland there are around 200 lakes present in this upper part of the River Thames catchment. These lakes have been created since the mid-20th Century primarily for sand and gravel extraction [29] and constitute the most extensive marl lake system (highly calcareous) in Britain.

Alongside the lakes there is other associated wetland habitat and a landscape that supports distinctive aquatic plant communities and significant breeding and wintering water bird populations. The wider mixed farmed landscape has some important species rich lowland meadows and floodplain meadows including North Meadow and Clattinger Farm SAC and NNR but there is little woodland but hedgerows and trees in places. The Cotswold Water Park is well visited with the growing settlements of Swindon and Oxford not far away. This is another important recreational location and a long valued biodiverse part of Gloucestershire.

Species associated with the lakes of the Cotswold Water Park include charophytes, waterbirds, passerines, bats, dragonflies, barberry carpet moth, and black poplar. This area is important for neutral lowland meadows and floodplain meadows, and meadow species such as snakes head fritillary. There are opportunities to create more meadow and grassland connectivity along the Thames and to the Cotswold rivers. There are also opportunities for further creation of wet woodland habitat in the Cotswold Water Park area.

© D Hall – Cotswold Lakes Trust

29 Cotswold District Council 2021 – https://www.cotswold.gov.uk/media/wwferfcb/cotswold-water-park-nature-recovery-plan.pdf

2.3.5 South Herefordshire and Over Severn

The Leadon Vale is part of the South Herefordshire and Over Severn, NCA 104, to the north west of Gloucester, a rural landscape that continues into South Herefordshire. It includes the distinctive high point of May Hill, many woods, neutral and calcareous grassland, traditional orchards, and the River Leadon, and its floodplain, which flows into the Severn. The area is mainly a mix of arable and livestock farming and is well known for its populations of wild daffodils. May Hill is registered as a Site of Special Scientific Interest in relation to acid grassland and heath vegetation on a specific geology of Silurian sandstones which is not found elsewhere in Gloucestershire [30].

It is important for traditional Orchards and their associated species, such as noble chafer, lesser spotted woodpecker and mistletoe marble moth. Opportunities should be taken to create more landscape scale connectivity of wooded habitats through this area, to connect the Wye and Forest of Dean northwards into Herefordshire and Worcestershire towards the Wyre Forest – the Severn Treescapes project.

The River Leadon has extensive poor water quality, with agricultural inputs having a significant impact. Better land and soil management could help to improve this. There are also a number of barriers to fish along the river which could be removed or bypassed to facilitate fish movements. One of the Leadon's key tributaries – the Glynch Brook – also has low flow issues which need to be addressed. Improvements could be made by delivering the proposed Wilder Leadon programme, through the Severn Vale Catchment Partnership.

30 Natural England – https://designatedsites.naturalengland.org.uk/PDFsForWeb/Citation/1001791.pdf

3. Opportunities for recovering or enhancing biodiversity in Gloucestershire

3.1 Why is Nature recovery needed?

The UK is one of the most nature-depleted countries in the world. The regular UK State of Nature reports show how the abundance and diversity of our wildlife have been declining for decades. The 2023 UK State of Nature report states that the abundance of 753 terrestrial and freshwater species has on average fallen by 19% across the UK since 1970 [31].

This average rate of decline is getting worse. Four years earlier the average rate of decline of UK species abundance was reported as 13% since 1970 [32].

Although these statistics use a 1970 baseline, our wildlife habitats and species have been reducing since before that. Examples cited in the 2013 UK State of Nature report [33] include:

- The area of coppiced woodland in the UK fell by at least 90% from 1900 to 1970, affecting invertebrates and wildflowers;
- The area of lowland meadow in England and Wales declined by 97% between the 1930s and 1984, affecting wildflowers and insects;
- Declines in farmland birds, such as corn bunting, were already being recorded during the 19th century. The agricultural intensification changes driven by the 1947 Agriculture Act led to hedgerows being lost as fields became larger, chemical use increased and the quality and quantity of farmland habitats diminished.

*The area of **coppiced woodland** in the UK fell by at least*

90%

from 1900 to 1970

*The area of **lowland meadow** in England and Wales declined by*

97%

from 1930 to 1984

31 State of Nature 2023 – https://stateofnature.org.uk/wp-content/uploads/2023/09/TP25999-State-of-Nature-main-report_2023_FULL-DOC-v12.pdf
32 State of Nature 2019 – https://stateofnature.org.uk/wp-content/uploads/2023/09/State-of-Nature-2019-UK-full-report.pdf
33 State of Nature 2013 – https://stateofnature.org.uk/wp-content/uploads/2023/09/state-of-nature-report-2013-uk.pdf

Not only is our wildlife greatly diminished through direct habitat loss, loss of resources, pollution and factors that lead directly to the death of animals and plants, it also now has to deal with the impacts of climate change. Wildlife can try to adapt to climate change by moving across the landscape to a new climate space, but where habitats and the species that live in them have become isolated, this has become increasingly difficult. In the northern hemisphere this is normally northward, towards cooler parts of the landscape, and to allow species to do this we need ecological networks with habitat corridors, easier "stepping stones" between habitats and features such as field margins, hedgerows and wildflower headlands that make the landscape more permeable. Species will also adapt to climate change through micro-climate opportunities such as slope directions or gradients, height of vegetation and opportunities for shade, and to help this we need larger wildlife sites with a diverse variety of conditions and habitats, sometimes described as mosaic habitats. Gloucestershire is already very important for nature, supported by many land managers, but we need to develop robust nature recovery networks to support adaptation to climate change at the scale required.

3.1.1 Habitat loss and species decline in Gloucestershire – Case Studies

Gloucestershire is home to many rare and important habitats and species, many of which Gloucestershire is a stronghold for. For some, we know we have the potential to improve populations that have declined or lost, but this can only be done through collaborative working and safeguarding areas for nature recovery. Existing work to protect and support these habitats and species demonstrates how with the right measures and a collective effort, these habitats can thrive and species can come back from the brink.

40% *of the Cotswolds Area of Outstanding Natural Beauty (AONB) was covered in wildflower-rich and fungi-rich grassland on calcareous soils,*

and today that has fallen to less than ***1.5%***

© Simon Smith

Calcareous grassland in the Cotswolds

Cotswolds National Landscape Board reports that in the 1930s, 40% of the Cotswolds Area of Outstanding Natural Beauty (AONB) was covered in wildflower-rich and fungi-rich grassland on calcareous soils, and today that has fallen to less than 1.5% [34]. However, many farmers, landowners and organisations such as Cotswolds National Landscape Board, Gloucestershire Wildlife Trust and the National Trust are already managing existing good quality meadows, and restoring and creating new meadow habitat, through agri-environment schemes and projects such as Cotswold National Landscape's Glorious Cotswold Grasslands project and the National Trust's Stroud Landscape Project. This strategy has Potential Measures for both managing, and restoring and creating, lowland calcareous grassland, and there is hope that this will encourage expansion of existing sites, as well as creating connectivity throughout the landscape.

34 Cotswold National Landscape – https://www.cotswolds-nl.org.uk/our-landscape/wildflower-grassland/


© Sarah Meredith, Habitat Designs

Large Blue Butterfly

The large blue butterfly, an iconic species once found in the Cotswolds and a small number of other sites in the South West, became extinct in the UK in 1979, as a result of factors including direct habitat loss and agricultural intensification [35]. The species has a rather niche lifecycle, with the larvae primarily feeding on wild thyme, a plant largely found in calcareous grasslands (which have declined in Gloucestershire), and relies on the red ant species *Myrmica sabuleti* for a key part of its lifecycle, which had also faced huge declines. The species has recently been successfully reintroduced to Daneway Banks nature reserve and other sites in Gloucestershire, by a partnership of Gloucestershire Wildlife Trust and the Royal Entomological Society, thanks to new research and understanding of the grazing and management patterns which best support the food plants and the red ant the large blue depends on. See **Measure 089: Strengthen Large Blue population**.


© Dan Gornall/WWT

Curlews in the Severn and Avon Vales

This migratory species comes to the UK to breed and rear young, preferring wetland, marshes mudflats and moorland habitat. Britain holds a quarter of the world's curlew population, but the success of chick rearing is increasingly low, which poses a major threat to their global population. This decline stems from a range of factors, such as habitat loss, increased predator abundance and climate change, impacting nest location conditions. Gloucestershire Naturalists Society and WWT [36] are working together to monitor and protect curlews in the Severn and Avon Vales. During 2023 they worked with local farmers to protect 27 nests, from which nine curlew chicks fledged. However, this number of new chicks is not enough to maintain overall curlew population numbers in the long-term, and these efforts will need to continue along with expansion of habitat, to boost survival chances. **See Measure 071: Strengthen breeding curlew population**.

35 Centre for Ecology and Hydrology – https://www.ceh.ac.uk/our-science/case-studies/case-study-large-blue-butterfly
36 WWT – https://www.wwt.org.uk/our-work/projects/eurasian-curlew-recovery

3.2 The key messages of this strategy

This strategy has been developed through a range of discussions and input of information from nature conservationists, planners, local authority officers and members, farmers, landowners, land managers, and members of the public in Gloucestershire. From these discussions and information we have drawn out some overall key messages for this strategy.

These six key messages describe the main challenges faced by nature and pose solutions and ideas to help tackle these challenges and recover nature in Gloucestershire:

	Safeguarding, managing and enhancing existing biodiversity-rich sites
	Landscape scale connectivity – Better, bigger, more and more joined
	Climate Emergency
	Our relationship with water
	The value of mixed and wilder habitats
	Biodiversity in our developments and settlements

3.2.1 Safeguarding, managing and enhancing existing biodiversity-rich sites

In 2010, the Making Space for Nature Report [37] (also known as the Lawton Report) was published, setting out aims of Nature Recovery. This report eventually led to the Environment Act 2021 which legislated for Local Nature Recovery Strategies, Biodiversity Net Gain, and the Biodiversity Duty for public authorities.

The recommendations of the Making Space for Nature report can be summarised with the phrase of "bigger, better, more and more joined, in a more permeable matrix". This phrasing has now become an intrinsic part of designing nature recovery projects, both on a small and landscape scale. There is a hierarchy to the recommendations, with "Better" – the maintenance, protection and improvement of existing good wildlife habitat, being the highest priority. Making Space for Nature says:

"In general, the first priority is to enhance the quality of remaining wildlife habitat. Increasing connectivity helps, but first there needs to be high quality sites with thriving wildlife populations to connect."

Landowners and land managers who have already improved habitat for wildlife and who are already maintaining wildlife sites well for biodiversity should be supported, however the resources that are needed to continue good management for biodiversity are not always fully recognised and supported. It is hoped that this strategy can underline the need to fund the maintenance and improvement of existing good quality habitat and support mechanisms to secure ways to resource this.

Many of our existing important wildlife habitats have developed over long periods of time – for example, ancient woodland, traditional meadows, old orchards or heathland – and in relation to ongoing methods of management. The complex ecological relationships between species in a habitat, including the soil ecology, microbes and mycorrhizal fungi, are difficult to recreate quickly once a habitat is degraded or destroyed. Therefore, safeguarding existing high quality sites of importance to biodiversity from harm is a top priority.

Because of the importance of safeguarding, managing and enhancing existing biodiversity-rich sites, for most of the key habitats in Gloucestershire there are Potential Measures about how to manage or safeguard that habitat.

37 Lawton et al 2010 – https://www.gov.uk/government/news/making-space-for-nature-a-review-of-englands-wildlife-sites-published-today

3.2.2 Landscape scale connectivity – Better, bigger, more and more joined

The Making Space for Nature Report 2010 also informed the Government that the existing network of protected sites was not preventing species declines, because sites were too small and too isolated. It advocated the need to create a healthy ecological network operating across the landscape as a whole, to help reverse biodiversity loss and provide resilience to external threats and pressures, including the impact of climate change.

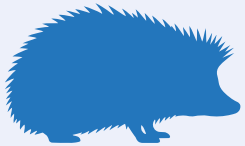
The hierarchy of importance of the five recommendations of "better, bigger, more and more joined, in a more permeable matrix" are shown below:

Making Space for Nature recommendations		
Priority level	**Summary word(s)**	**Recommendation**
1	BETTER	Improve the quality of current sites by better habitat management and maintain them in good condition
2	BIGGER	Increase the size of current wildlife sites to maintain sustainable populations of the species that depend on it
3	MORE JOINED	Enhance connections between, or join up, sites, either through physical corridors, or through 'stepping stones'.
4	MORE	Create new sites
5	A MORE PERMEABLE MATRIX	Reduce the pressures on wildlife and allow more free movement by improving the wider environment

Based on these principles, this Local Nature Recovery Strategy sets out how existing biodiversity sites, priority habitats and species can survive better by making small patches bigger and making sure they are well enough connected for species to be able to move between them. Gloucestershire's Nature Recovery Network mapping [38], was a starting point for the strategy to build towards connected habitats. The Nature Recovery Network map shows the current core areas of good quality wildlife habitats – the focus of the "Better" element of maintaining and improving the quality of current sites. It also expresses the best opportunity zones for extending and buffering habitat, creating new habitat and starting to connect these up – the "Bigger, More and More Joined" elements. There are more details about the Nature Recovery Network mapping in the Technical Appendix – Data, Evidence and Methodology.

The Nature Recovery Network mapping forms a foundation of the mapping of the "Areas which Could Become of Importance for Biodiversity" in this Local Nature Recovery Strategy. These zones are where improved habitat management and new habitat creation will be of the most benefit to our wildlife when taking into account these Lawton principles. They therefore are where we would propose that nature conservation management and habitat creation is focused, where feasible, in order to join up the existing wildlife sites. These zones are the main areas where Potential Measures for restoring and creating key habitats are focused.

In 2020 the UK government committed to protect and conserve a minimum of 30% of UK land and sea for biodiversity by 2030, as part of the international UN 30 by 30 commitment. Creation of new habitat within the recommended areas to create and improve wildlife-rich habitat identified by this Local Nature Recovery Strategy can help contribute towards meeting the goal of 30 by 30.



In 2020 the UK government committed to ***protect and conserve*** *a minimum of*

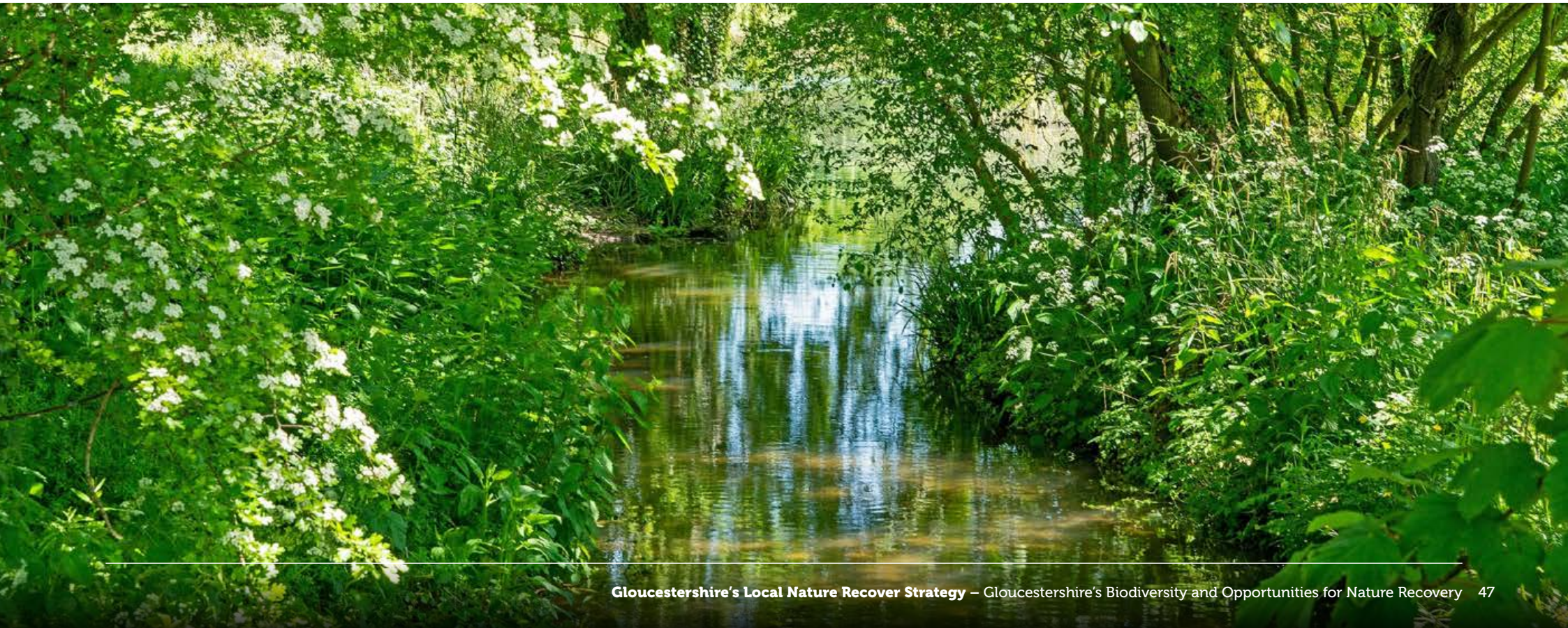
30% ***of UK land and sea for biodiversity by 2030***

38 Gloucestershire Centre for Environmental Records – https://naturalcapital.gcerdata.com/

In these priority map zones for "bigger, better, more and more joined" habitat creation, particularly the areas identified in the strategy map as Areas that Could Become of Particularly Importance for Biodiversity, it would be beneficial to reduce habitat loss and pressure from new developments, where this can be achieved in Local policy.

In relation to the fifth Making Space for Nature recommendation of a more permeable matrix for wildlife across our landscape, by improving the wider environment, actions to increase biodiversity and habitat connectivity in the wider countryside are recommended, such as field margins, river buffer zones, hedgerows and ponds, and strengthening the species populations of farmland birds and rare arable plants. Even in "open" habitats, linear corridors of rough grassland banks, and open wood-meadow provide important stepping stone habitats and corridors through the landscape. Similarly, existing monoculture or derelict woodland can be managed with wildlife in mind, with woodland rides and clearings, and diversifying native tree species like birch and lime in beech woodland, managing for deer and creating a biodiverse understory. Relevant potential measures include:

- **Measure 045:** Field margins, hedgerows, buffer strips, ponds, trees and sustainable farming and forestry
- **Measure 049:** Sustainable forestry and nature recovery
- **Measure 056:** Riparian buffer strips
- **Measure 098:** Individual species needs of farmland birds
- **Measure 106:** Rare arable plants and soil fauna, flora and fungi



3.2.3 Climate Emergency

The global climate and nature crises are inter-linked. With the Wildlife Trusts' Adaptation Report 2022 stating: "Climate change is driving nature's decline, and the loss of wild spaces is leaving us ill-equipped to reduce carbon emissions and adapt to climate change. Meanwhile, degraded habitats are actively emitting carbon instead of storing it. The risk of species extinction is estimated to increase ten-fold for a warming level of 3°C compared to 1.5°C" [39].

In the Gloucester City Council Climate Change Strategy [40], Environmental Consultants and Gloucester City Council used the latest UK Climate projections (UKCP18) and related tools to identify projected changes in climate for Gloucester City, that by the 2080s:

- The average summer day could be up to 5^{oC} warmer
- Increased winter rainfall by over 20%
- Reduced summer rainfall by over 35%
- An increase in the number and severity of wildfires
- Three times fewer frost days and a reduction in snowfall
- A shift in the growing season
- An increased likelihood of surface water and river flooding, influenced by tides and extreme rainfall
- Heatwaves occurring six times more often
- An increase in the frequency and intensity of storms

These changes are likely to be applicable to all of Gloucestershire. In addition, there will be hotter average temperatures in our rivers, water bodies and the Severn estuary. The Cotswolds high wold in particular is expected to experience more dry and drought conditions. Climate change

exacerbates the risk that non-native species (including pests and pathogens) may establish and spread.

There are a range of ways in which the theme of climate change is part of this strategy. These include:

1. How climate change affects nature and how we can respond to that:

- Help species movement through a resilient nature network
- Control spread of pests, diseases and invasive non-native species
- Protect the habitats and species most vulnerable to climate change
- Respond to coast changes from sea level rise

2. How nature can help us adapt to climate change:

- Help to reduce the effects of drought
- Help to reduce the risk of flooding
- Provide shading and micro-climates to reduce the effects of extreme heat and increased fire risk

39 Wildlife Trust 2022 – https://www.wildlifetrusts.org/sites/default/files/2022-06/AdaptationReport.pdf
40 Gloucester City Council – https://democracy.gloucester.gov.uk/documents/s60448/appendix 1 climate change strategy and action plan.pdf

3. How nature can mitigate the effects of climate change through carbon sequestration.

A key impact of climate change is the how temperatures can shift the timings of species lifecycles, such as when they flower, fruit, emerge or hibernate. Where different species have different levels of sensitivity to these changes, this can have a knock on impact to the species that rely on them for food, for example. Increasingly warm and early spring weather, is resulting in early budding and blooming of tree species. Where insects' life cycles are also impacted by the warm weather, they also emerge early, but this has a knock on effect up the food chain when it comes to migratory birds, that arrive too late to forage on larvae and caterpillars. At the other end of the year, warmer winters mean that species who are adapted to go into torpor (a version of hibernation), wake frequently, and subsequently need to forage, when there is no longer food (usually insects or fruits) available.

As average temperatures rise, the geographical range of many species will need to move northwards, or to new areas of less impacted habitat, including higher up slopes. Whilst this can mean the range of some protected or notable species expanding, it will have a negative effect on other species, with them needing the ability to move in response to extreme weather events and other changes. The "Making Space for Nature" vision of larger, less fragmented and better connected wildlife sites will help improve the resilience of wildlife species populations and increase the ability of those species that can move in response to climate change.

Some habitats are particularly vulnerable to climate change. The Natural England and RSPB Climate Change Adaptation Manual 2015 [41] assessed the relative sensitivity of habitats to climate change. Of Gloucestershire's key habitats, these are the ones with high sensitivity to climate change:

- Coastal saltmarsh
- Standing water
- Lowland fen
- Rivers and streams, including ephemeral waterbodies

Of Gloucestershire's key habitats, these are the ones with medium sensitivity to climate change:

- Floodplain grazing marsh
- Lowland Meadows (wet)
- Calcareous grassland
- Reedbeds
- Lowland Heathland
- Intertidal Mudflats
- Lowland beech and yew woodlands
- Wet woodland

41 Natural England 2015 – https://publications.naturalengland.org.uk/publication/5679197848862720

Calcareous grasslands

Invertebrate populations in calcareous grasslands can also be severely impacted by heatwave and drought conditions, as flowering plants respond by reducing or ceasing nectar production and butterflies stop flying over a certain temperature [42].

Woodlands

Climate change will affect the health, growth, survival and reproduction rates of tree species. Current guidance on climate change and future resilience advises growing a mixed and large suite of species (including native and non-native)[43] [44].

This goes for new planting of woodlands and individual trees, but also in restocking after felling of commercial woodlands and in restoration of plantations on ancient woodland sites.

Beech trees, characteristic of the Cotswold scarp, are one of the species whose growth and health could be significantly reduced by climate change [45]. There is likely to be a range shift northwards for beech woodland as well as other woodland types. **See Measure 035: Woodland climate adaptation.**

Decisions about suitable tree species can be made with the help of resources such as Forest Research's Ecological Site Classification [46] tool to incorporate future suitability into planting decision.

Beech trees, *characteristic of the* ***Cotswold scarp****, are one of the species whose growth and health could be* ***significantly reduced by climate change.***

42 Hayes et al. 2024 – https://link.springer.com/article/10.1007/s10841-024-00556-5
43 Forest Research 2022 – https://cdn.forestresearch.gov.uk/2022/05/UKFSPG026.pdf
44 Gov.uk – https://www.gov.uk/government/publications/managing-englands-woodlands-in-a-climate-emergency
45 European Commission 2022 – https://environment.ec.europa.eu/news/europes-beech-forests-threatened-climate-change-2022-10-26_en
46 Forest Research – https://www.forestresearch.gov.uk/tools-and-resources/fthr/ecological-site-classification/

Estuarine habitats

With sea level rise and increased temperatures, there is a risk that saltwater intrusion may start to impact freshwater habitats on the floodplain, that floodplain land will flood for longer or more frequently, and also that increased water temperatures will reduce the levels of dissolved oxygen and increase algal growth, affecting wildlife.

The Severn Estuary Shoreline Management Plans [47] indicate which areas are already intended for Managed Realignment, or for Hold The Line, in relation to likely changes to the coastline from sea level rise. There are opportunities for habitat restoration to help better achieve the managed realignment in the zones where this is recommended – see the Potential Measures in relation to Estuarine habitats.

Adapting to climate change

The Potential Measures recommended in this strategy contain many that will help adapt to, and reduce the effects of, drought, flooding, extreme heat or fire risk. These include measures where trees, scrub or changes in topography can provide more shade to reduce the temperatures of rivers, of urban areas, or of grassland plants, which struggle to maintain sufficient nectar production in higher temperatures. There are other measures that aim to enhance and maintain soil health and resilience to drought, through sustainable and regenerative farming techniques. Natural flood management measures, re-naturalisation of river corridors, and habitat creation measures (such as creating more wet woodland across the county and heath and associated mossy bogs in the Forest of Dean) will help reduce flood risks.

Maintaining and restoring semi-natural habitats, including woodland, wetlands, saltmarsh, heath and unploughed meadow grassland, can actively create carbon sinks that sequester carbon in the long-term, as carbon is captured within biomass and in the soil. WWT's project to recreate saltmarsh habitat within a 148 hectare site on the Awre peninsula, including by engineering a breach in the sea wall, is a great example of such habitat creation that will sequester carbon and help adapt to sea level rise, erosion and flood risk, as well as improving biodiversity.

Regenerative farming techniques which promote healthier soils with living roots and minimal soil disturbance, also help to increase carbon sequestration in the soil – see **Measure 047**: **Soil health and regenerative farming**. The Natural England Carbon Storage and Sequestration by Habitat report 2021 [48] is a good source for information on the different carbon sequestration potential from different habitats.

47 Severn Estuary Coastal Group 2010 – https://severnestuarycoastalgroup.org.uk/wp-content/uploads/sites/4/2023/07/smp2partamainreportfinal-160323161232.pdf
48 Natural England 2021 – https://publications.naturalengland.org.uk/publication/5419124441481216

3.2.4 Our relationship with water

A range of aspects of our relationship with water were key themes emerging in many aspects of the discussions held while developing this strategy.

The challenges...

Un-natural and artificial water systems

As a result of traditional agricultural and land management, Gloucestershire's landscape is heavily drained. This, in conjunction with straightening and further modification of rivers for a wide variety of purposes, has left a legacy of drained fields as well as restricted, culverted and canalised rivers. Weirs, gates and locks restrict the movement of species within our rivers, as well as inhibiting natural processes. Physical barriers also restrict diversity of flow patterns and vegetation structures both within the channel and along the banks.

Pollution

Water pollution is a significant issue, both for our wildlife and the condition of waterways, and subsequently for people. Within Gloucestershire the sources of pollution vary, with some of these being national issues, and some being felt particularly strongly in our county. These include uncontrolled and untreated overflows of sewage and waste water (known as "point" source pollution), as well as excess nutrients, pesticides and herbicides, as a result of run-off from farmland, roads and hard surfaces, or in relation to the disposal of manures (known as "diffuse" pollution). Soil compaction from machinery, or bare earth (associated with ploughing or crops such as potatoes) at times of high rainfall can also lead to soil erosion and sediments entering water courses.

Flood risk

As touched on above, climate change is resulting in increased rainfall, leading to flooding of both rural and urban areas. These straightened and canalised watercourses exacerbate flood risks, including in downstream areas. These are all pressures and threats for our wild species, resulting in a lack of diverse morphology and vegetation structures both within the channel and along the banks.

The solutions...

The challenges we face are all interlinked – with flood risk exacerbating pollution, and artificial waterways increasing flood risk; but this does mean that many of the actions we can take will have wide ranging and knock on benefits.

In February 2024, Chris Uttley of Stroud District Council opened an event called "Flood Management with a Time Machine" [49, 50], that told stories of the changes we have made to rivers over the last 100 years, and how we can repair them, and celebrated wetland habitats in the Stroud Valleys that slow, store and filter water with these words:

"We think we know the stories of flooding. We see them in the news every year. They are stories of grannies being rescued from houses by men in inflatable boats. Helicopters flying over floodplains to show us that they are flooded. People driving cars into floods and inevitably, farmers pulling cars out of floods with tractors. And of course, lives ruined and sometimes sadly lost.

But there are different stories too. Stories we don't hear much about – about how sometimes the best flood defence is a beach, a saltmarsh, a bog or a forest, or a field of healthy soil. About how the choices we make about managing our landscape, about the food we put on our plates will affect how much flooding we get. Stories about farmers and communities helping each other, working together to make many small changes to reduce flooding."

Image from Sound of a River comic by Joe Magee and Chris Uttley

49 Slow the Flow – https://slowtheflow.net/flood-management-with-a-time-machine/
50 Stroud District Council – https://www.stroud.gov.uk/environment/projects/stroud-valleys-natural-flood-management-project/

River or watercourse re-naturalisation

We should take the opportunity to re-naturalise our rivers and floodplains. Rivers need to be dynamic and currently do not have the space to do what they need to do – they are too contained in their linear channels. We should see the land next to watercourses as functionally-linked land, where the river can re-establish its course, provide space for flood-plain habitats, and where some habitats can help reduce water pollution. Getting more water back into Gloucestershire's landscape and soils can help with carbon sequestration and with natural flood management, as well as increase opportunities for biodiversity. Key Potential Measures in relation to this are **Measure 020: River re-naturalisation and Measure 037: Floodplain reconnection**, with a range of other inter-related measures.

In addition to increasing and enhancing the diversity of species, restoring and naturalising watercourses can help to re-wet areas, increasing the recharge of groundwater in the right locations and the storage of water within soils. This increases the resilience of watercourses to drought, and by extension the security of our water resources.

Riparian management and habitat creation

We should improve the connectivity and ecological functionality of the watercourses, through focusing on habitat immediately adjacent to watercourses (known as riparian habitat) By identifying gaps in the presence of good riparian habitat, we can target habitat creation or management that will reestablish a functional "riparian zone". A functional riparian zone intercepts surface water flows before they meet a flowing stream or other drainage channel – forcing the surface water to slow down and filter through the ground vegetation before meeting the main channel, which allows carried sediment to drop out.

Our woodlands can become sponges, holding up sufficient water through natural and human intervention woody debris blockages in the watercourses that flow through them. The wooded flood plains will largely be riparian woodland (wet woodland), with tree species that are appropriate to this wet situation such as willows, aspen and alder.

Regenerative farming

In relation to run-off of nutrients and soils from farms, regenerative farming principles can play a key part in reducing the amount of diffuse pollution even reaching our riparian habitat. For example using cover crops will reduce the amount of exposed soil, and minimising soil disturbance and retaining living roots can also help reduce the level of silt run off. Reduction in use of some key pollutants, such as pesticides will of course reduce the amount that ends up in our waterways, and this can be compensated for my using farming methods that result in natural biological control, such as flower rich margins and good management of hedgerows, increasing the presence of natural predators to pests. There are a range of Potential Measures relating to water quality and soil or nutrient run-off, including:

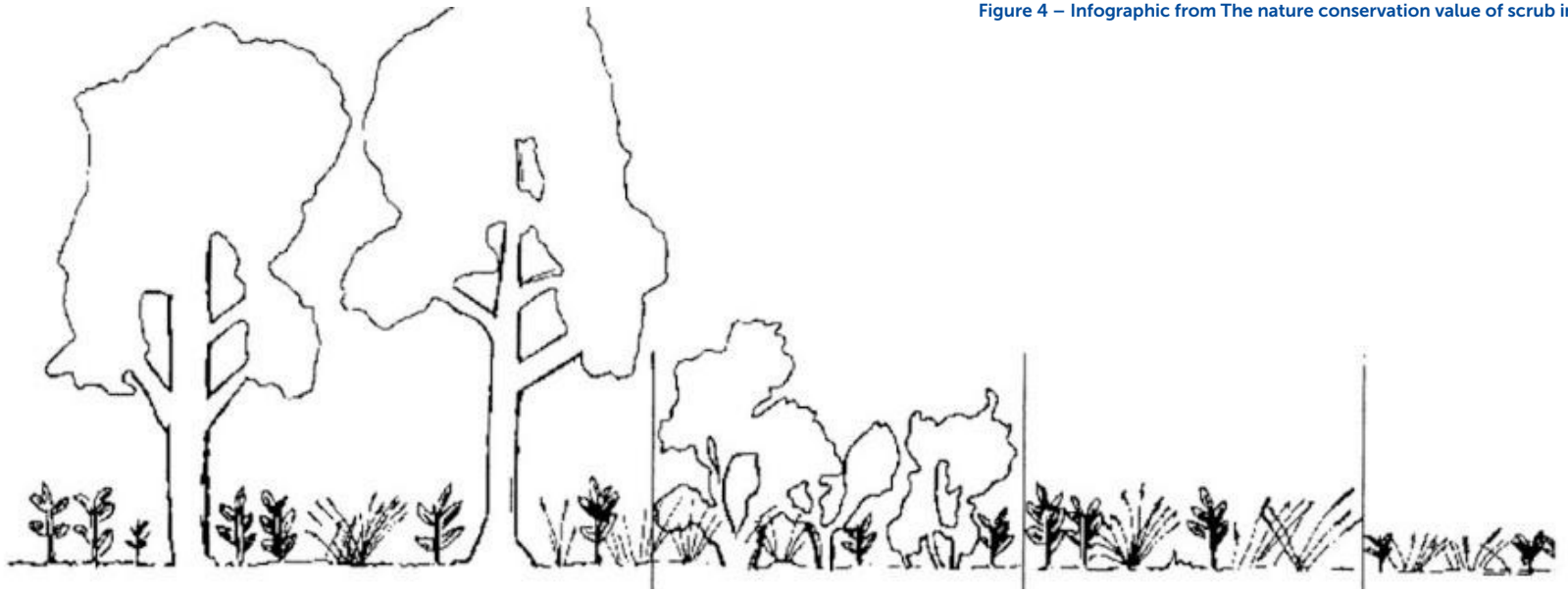
- **Measure 022:** Improve ecological condition of rivers
- **Measure 038:** Water quality
- **Measure 039:** Sewage and wastewater
- **Measure 044:** Limit groundwater abstraction and surface flow abstraction
- **Measure 046:** Reduce pollution from agricultural inputs
- **Measure 047:** Soil health and regenerative farming

3.2.5 The value of mixed and wilder habitats

A strong theme that came through in many strategy discussions, including the Nature Recovery Working Group, the species task and finish group and the public engagement events, was the value of mixed or mosaic habitats of scrub, grassland of different heights and structures, trees and disturbed ground, which can be of great benefit to many species that required a range of habitats and structures to live in. In many places this can be achieved through a mix of allowing natural processes of succession to happen, and manual site management to provide varied habitat structure. **See Measure 014: Create mixed mosaic habitats including scrub, including orchard.**

In some places a mixed or mosaic habitat approach will challenge ideas about what "looks nice" therefore it is important to promote the benefits of "messy" habitats for wildlife. We need to be prepared to evolve our societal views on how green spaces and landscapes should look, if these views restrict biodiversity, climate resilience or sustainability. At the heart of many of the discussions had during the public engagement events [51], was a feeling that for nature to recover, we need to reclaim and celebrate messiness over straight lines, variety over monoculture and the 'wild' over the manicured.

Figure 4 – Infographic from The nature conservation value of scrub in Britain, JNCC 2000 [52]



Zone A
– Woodland lacking grassland plant species

Zone B
– 'Mantel' zone of shrubs many of the Rose (Rosaceae) family. Ground flora consists of woodland and 'Saum' plant species unless grazed where grassland species would predominate

Zone C
– 'Saum' Zone dominated by tall herbs and grasses including rare species. Many typical grassland plants occur as usual large forms.

Zone D
– 'True' grassland in which low growing species are more abundant

51 GLNP 2024 – https://www.gloucestershirenature.org.uk/_files/ugd/5c4a64_7a965c0b0cfb45cb83fcf8e1293dd56a.pdf
52 JNCC 2000 – https://data.jncc.gov.uk/data/39590874-8927-4c42-b02a-374712caccd6/JNCC-Report-308-SCAN-WEB.pdf

A key aspect of this mixed habitat theme is the concept of ecotones between different habitats – see **Measure 033: Ecotones and edges**. Ecotones are gradual changes in habitat structure, for example between woodlands and a neighbouring field, or between hedgerows, field margins and field, to enable a variety of scrub or shrubs and longer grasses and plants, sometimes known as "saum", rather than sharp boundaries between different habitats.

Creating varied ecotones, and creating areas where natural processes are allowed to create a complex and dynamic mosaic of habitats:

- provides a varied habitat structure that benefits many species, including adders and newts and many butterfly species that need a variety of habitat types within a small area;
- provides wildlife corridors to enable movement of species through the landscape, including small mammals and bats;
- provides shade to maintain nectar production in grassland flora and refuge for invertebrates in higher temperatures.
- provides diverse food sources for a range of species including farmland birds.

In many cases, a mosaic habitat could have the following target features:

- a dynamic mosaic of bare or disturbed ground, species-rich grassland, scrub and trees, and/or wetland and ponds where relevant
- an average tree and scrub canopy cover of between 10% and 30% across the site; the closer to 20% the better
- the height and density of scrub and grassland should vary across the site. Scrub should be managed to have complex variation in height and to have gaps in canopy cover to allow other ground flora to grow. The more structural variety, the better.
- varied ground levels with different aspects and gradients can provide different microclimates and species niches.

Mosaic habitat is great for wildlife at any scale but the bigger the better, ideally this should be created on sites large enough for allow "natural regeneration", resulting from the use of low intensity grazing from large herbivores. Whilst manual habitat management can replicate the effects of using animals to shape the landscape, we should strive to use them where possible, with many recent "rewilding" projects showing the benefits of these methods – with pigs being used to disturb the ground, encouraging dormant seeds to germinate, and creating microhabitats, mimicking the habits of wild boar. Use of old native breeds such as English Longhorn cattle to carry out extensive [53] grazing can be an effective tool for creating mosaic habitats too. This breed for example, will pull down small branches with their horns, to rip of twigs and forage on the leaves – providing a natural mechanism for pruning and coppicing [54]. They will also happily rest and lay up in woods, again, creating disturbance and ensuring movement around a large site. GPS collars can be used on grazing animals to control movement and target areas, minimising the occurrence of hard edges and over grazing.

An example of a local project using these techniques is Elmore Farm [55], a 160 hectare site, previously a mix of commercially grazed and arable fields, set in the River Severn flood plains, with a network of drainage ditches to manage water levels for farming. Since 2020 they have started a natural regeneration process, bringing in longhorn cattle, and with plans to also introduce Exmoor ponies and Tamworth pigs in future. Their work to restore wetlands and re-connect the floodplain has resulted in a measurable increase in biodiversity, with a 186% increase in the diversity of bird species on site, and a 125% increase in the number of birds seen.

186%
increase in the diversity of ***bird species on site***

125%
increase in the number of ***birds seen***

©Anselm Guise – Longhorn Cattle at Elmore Farm

53 Extensive refers to allowing a smaller number of livestock to remain on site throughout the year, usually allowed to roam over a large area.
54 Knepp – https://knepp.co.uk/rewilding/free-roaming-herbivores/longhorn-cattle/
55 Elmore Farm Rewilding – https://www.rewildthings.com/rewilding/

3.2.6 Biodiversity in our developments and settlements

Much of the landscape-scale vision of "bigger, better, more and more joined" involves habitat maintenance and creation across our rural and farmed landscape. Urban wildlife, green spaces and blue spaces (water-related) are also part of this potential for habitat connectivity.

Importantly, nature in our settlements and urban areas, such as trees, green spaces and biodiverse sustainable drainage systems (SuDS), brings huge benefits for our health and wellbeing and economy with this collectively known as "ecosystem services". It strengthens our ability to connect and engage with nature, cools the local climate through shading, improves air quality, and supports flood management, through permeable surfaces and storing water.

The importance of this theme was insisted on during the public engagement sessions where it was clear that recovering nature can't just be about our countryside, it also needs to be about our urban spaces. Along with ecosystem service benefits, it was recognised that connection to nature starts with our urban spaces, and in turn nature connection results in increased action for nature by the local community, such as joining volunteer groups or practicing nature friendly gardening.

A systematic meta review of the health benefits of green social prescribing in 202456 concluded that there is clear evidence of the benefit for improving mental health, from engagement with and access to nature. Since 2021 the NHS also trialled a series of initiatives around the country, to boost the use of green social prescribing, recognizing the potential value [57].

*Here is clear evidence of the benefit for improving **mental health**, from engagement with and **access to nature**.*

56 Coventry et al 2021 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8498096/
57 NHS England https://www.england.nhs.uk/personalisedcare/social-prescribing/green-social-prescribing/

In Gloucestershire, there are inequalities of access to nature, with the communities that are in the lowest 20% of the Index of Multiple Deprivation being mainly in the urban areas of Gloucester and Cheltenham, and having a strong correlation with the areas of Gloucestershire highlighted in the Tree Equity Index [58]. that highlights inequitable access to trees in urban and settlement areas:

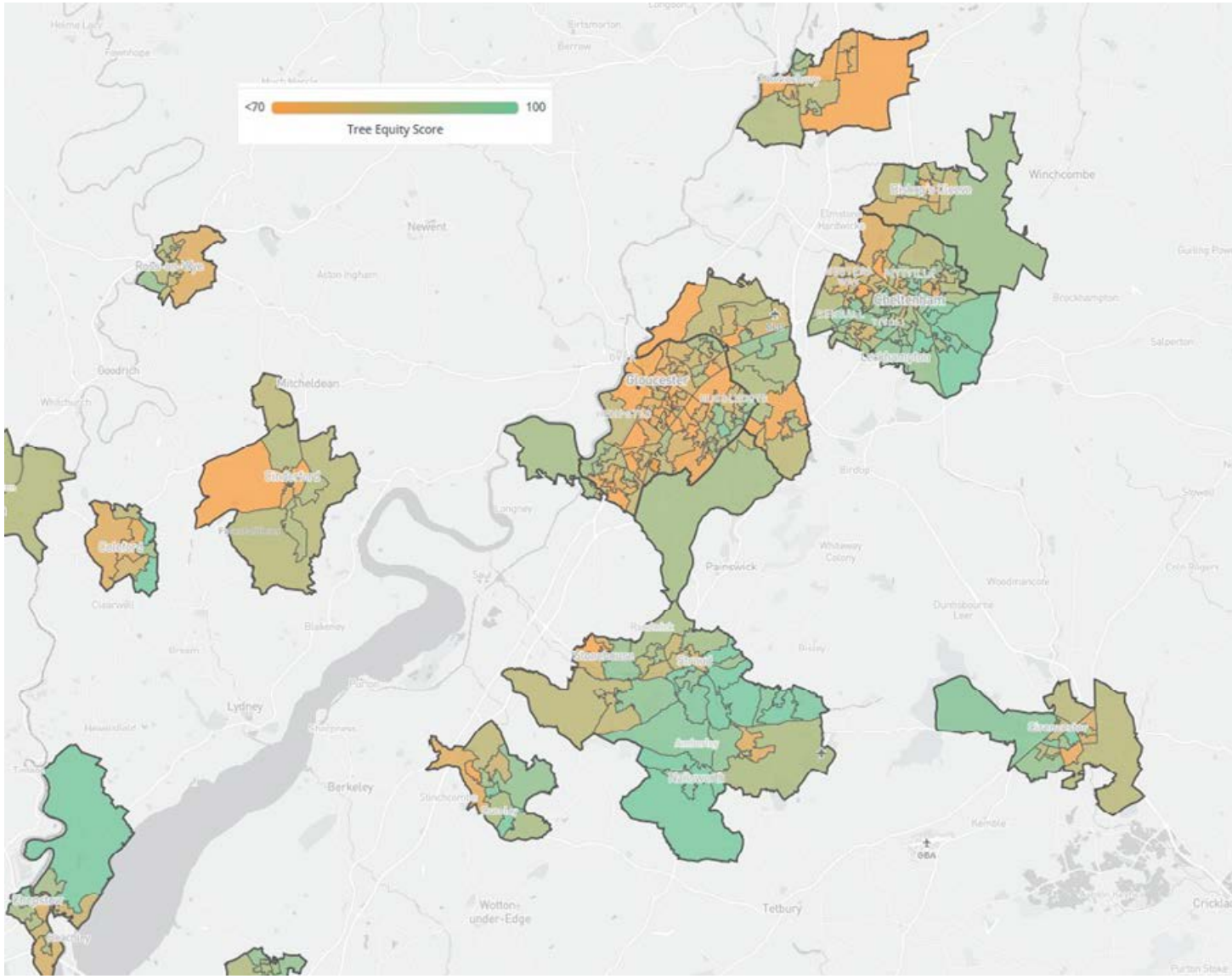


Figure 5 – Tree Equity Index for Gloucestershire. Map data from https://www.openstreetmap.org/copyright

58 Tree Equity Score UK – https://uk.treeequityscore.org/map

The communities in Gloucestershire that are within the most deprived 20% in the Index of Multiple Deprivation:

- Gloucester: Barton & Tredworth, Coney Hill, Kingsholm & Wotton, Matson & Robinswood, Moreland, Podsmead, Tuffley (south part of ward), Westgate (east part of ward).
- Cheltenham: Hesters Way, Oakley, Springbank, St Marks (south-west part of ward), St Pauls, Swindon Village (south part of ward).
- Cinderford West
- Tewkesbury South

Forestry Research have published research [59] showing existing provision of public access to woodlands in England, as well as opportunities for increasing access. Whilst areas like the Forest of Dean have good access to woodlands through public paths, urban areas, such as Gloucester and Cheltenham.

In Gloucestershire, the Local Nature Partnership and Climate Leadership Gloucestershire [60] call for an aim for everyone to live within 15 minutes of biodiversity-rich accessible green space, in order to reduce these inequalities of access to nature, improve health and local economy, and benefit biodiversity.

For areas where new developments are proposed, there is the opportunity, and in most cases the requirement, to create new blue and green infrastructure and wildlife corridors within its design. This strategy advocates for new developments to incorporate wild areas and linear wildlife corridors as wide as possible into their design to encourage species movement and habitat connectivity, with a principle of creating connectivity to areas of Particular Importance for Biodiversity, or areas of good habitat that have been mapped on the Local Habitat Map as areas we should retain and "manage". We endorse the Woodland Trust recommendation for creating 30% tree cover in new developments. Where development falls over Areas that Could Become of Importance For Biodiversity, it is also important that where possible, the target habitats set out on the mapping are considered.

Gardens, allotments, churchyards and urban green spaces and parks can all be managed to be important for wildlife and biodiversity, and to form part of wider habitat connectivity. One of the threats to urban biodiversity and a threat to increasing the likelihood of flooding is the replacing of gardens or green spaces with impermeable surfaces. Planning regulations, development design and choices in the home and garden should aim to avoid replacing gardens and lawns with parking spaces, astroturf or hard landscaping.

Local policies will be required to 'have regard' to this Local Nature Recovery Strategy. In doing so, this will ensure that these policies are based on a shared vision for each town, developed with the community, as recommended by the Urban Design Group's "Achieving good town form" [61] 2024 paper. The restoration of nature and strategies such as the Local Nature Recovery Strategy should be part of the shared local vision for the basis of local planning.

59 Forest Research 2025 https://www.forestresearch.gov.uk/publications/access-to-woodland-in-england/ and https://storymaps.arcgis.com/stories/5451463d27e44e5ca23a0d2a52be20c6

60 Gloucestershire County Council – https://www.gloucestershire.gov.uk/planning-and-environment/greener-gloucestershire-climate-dashboard/our-partners/climate-leadership-gloucestershire-clg/greener-gloucestershire-action-plan/biodiversity/

61 Urban Design Group 2024– https://www.udg.org.uk/sites/default/files/publications/files/Achieving%20good%20town%20form%20Final.pdf

Green and Blue Infrastructure standards, such as Building with Nature [62] standards or Natural England's Green Infrastructure Framework should be used to design and deliver biodiversity in developments and urban areas. Gloucestershire has a Strategic Framework for Green Infrastructure [63] giving an overview for the county.

Biodiversity-rich Sustainable Drainage Systems are important to hold water in the catchment for longer, reducing flooding and draining overflows, while also creating green space and connectivity in urban areas. Along highways, the use of gully pots should be reduced if feasible, and where they are used they should be sited away from kerb edges, and ladders used in gully pots, to help prevent amphibians and other species from getting stuck. Gully pots can cause mortality for wildlife and should not be used if possible. Good Sustainable Drainage Systems (SuDS) design can remove the need for gully pots and this approach should be promoted.
See **Measure 070: Biodiversity-rich Sustainable Drainage Systems**.

There are four over-arching Measures in relation to most settlements and development areas which link to a wider set of Development and Community Measures:

- **Measure 057:** Urban green spaces, blue spaces and wildlife corridors
- **Measure 057:** Biodiversity in gardens
- **Measure 059:** New developments and green and blue infrastructure
- **Measure 060:** Green bridges and wildlife crossings

62 Building With Nature – https://www.buildingwithnature.org.uk/
63 GLNP 2019 – https://www.gloucestershirenature.org.uk/green-infrastructure-pledge

3.3 Other pressures and opportunities

Whilst our key messages cover the main pressures and opportunities we wish to address through this LNRS, the development process identified a range of other pressures or threats to nature, which are just as important to address, along with specific opportunities for actions.

- Recreational pressures and disturbance to wildlife
- Diseases and invasive non-native species
- The pressure on woodland regeneration from an increasing deer population
- Conservation grazing
- The importance of fungi and soil health in nature recovery
- Working with the archaeological and historic environment
- Minerals extraction and restoration
- The need for ecological recording and monitoring

3.3.1 Recreational pressures and disturbance to wildlife

Access to nature is vital for human wellbeing, and we should increase the opportunities for everyone to live within 15 minutes from biodiversity-rich accessible green spaces. However, pressure from outdoor recreational activities and other human activities can create disturbance to wildlife, particularly in more sensitive habitats. Effective nature recovery should address these pressures through informed planning, public engagement, and targeted action. Some examples of these types of pressures include:

- Dogs that enter ponds and waterways can disrupt water plants and the breeding and foraging activities of species such as the great crested newt. In addition, commonly used veterinary treatments like imidacloprid and fipronil –found in anti-flea and tick products used on dog's fur -wash off dogs into ponds and streams, where they are toxic to aquatic invertebrates and insects, which is shown to have knock on effects for animals further up the food chain. Dog poo that is not picked up also leaves harmful pathogens that can be harmful to livestock [64].
- Severn Estuary and floodplain waterbirds can be disturbed by ramblers, dog-walkers, wildfowlers, clay pigeon shooting, sailing boats, jet-skis and low-flying helicopters.
- Ground-nesting birds and their young are vulnerable to off-path walkers, free-roaming dogs, and mountain biking.
- Trampling from pedestrians and cyclists away from designated paths can cause degradation to sensitive groundflora, and erosion of soils.
- On steep slopes in the Wye Valley there are rare ferns, bryophytes, whitebeams and service trees which should be protected from physical damage from recreational activities such as rock-climbing.
- Artificial lighting at night affects the behaviour and survival of nocturnal species, especially bats and insects.
- Bats rely on undisturbed roosts, particularly in old buildings and caves. Development, renovation, or unregulated access to these roosts could cause Gloucestershire's bat populations to significantly drop.
- Wildlife crime, including hare coursing, can directly reduce species abundance.
- The siting of new energy infrastructure should be carefully managed to avoid adverse impacts on wildlife and habitats.

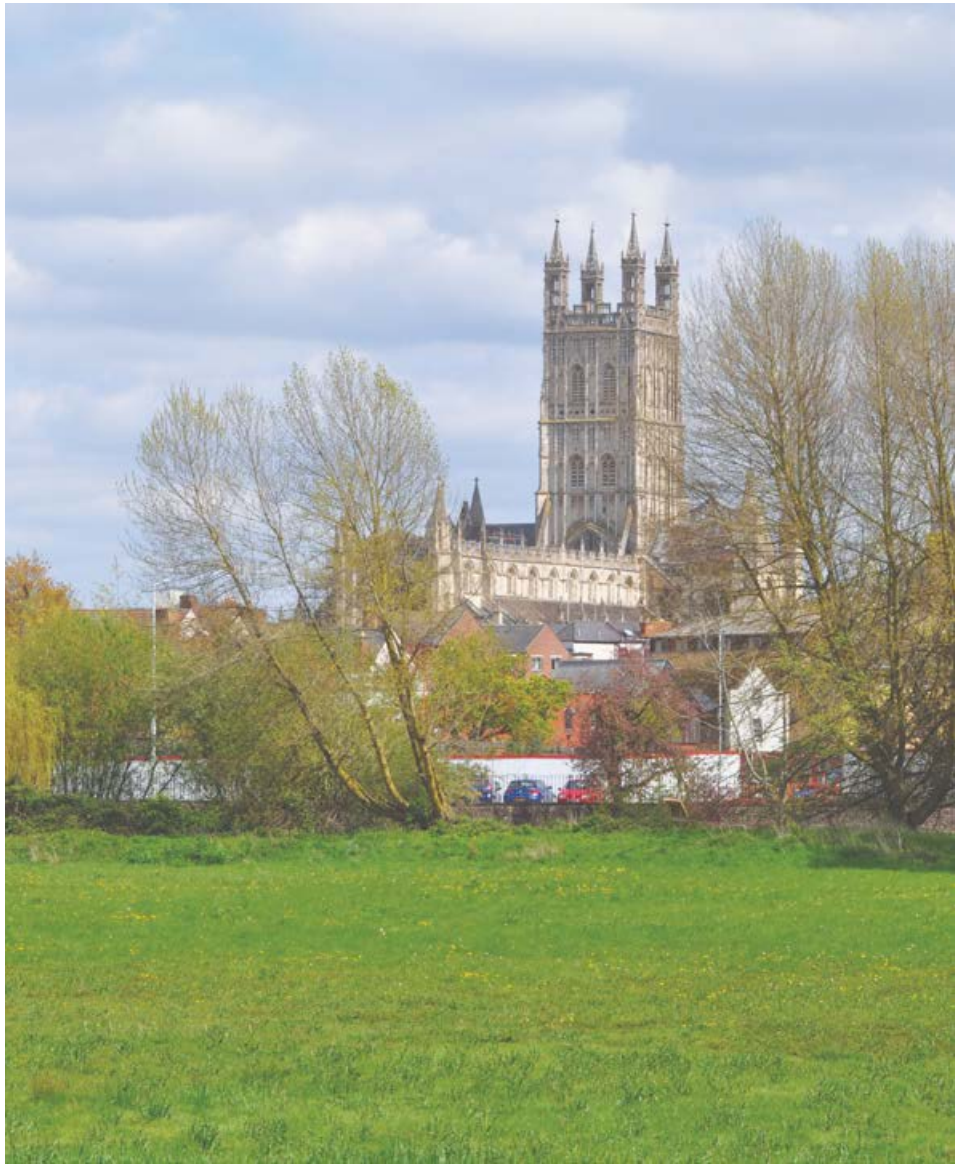
64 Nature Scot 2018 – https://www.outdooraccess-scotland.scot/sites/default/files/2018-09/Risk%20of%20the%20spread%20of%20disease%20in%20livestock%20from%20dog%20faeces%20-%20Briefing%20note%20for%20Access%20Authorities.pdf

Suitable Alternative Natural Green Spaces (SANGS) can be developed in some cases as places which can contribute towards reducing recreational pressures on existing important wildlife sites. The creation of SANGS sites should also be a good opportunity to achieve some new habitat creation. However, it is important to ensure that Suitable Alternative Natural Green Space recreation areas are established away from ecologically sensitive sites.

Existing and potential wildlife sites can also have access that is designed to keep some areas more private or with restricted access – either through simple fencing or creating barriers like scrub.

Relevant Potential Measures include:

- **Measure 018:** Manage, improve and create ponds for wildlife
- **Measure 040:** Reduce impacts from dogs
- **Measure 065:** Dark Skies
- **Measure 066:** Access to biodiversity-rich green spaces
- **Measure 110:** Wye Valley bryophytes and distinctive species
- **Measure 112:** Strengthen Severn Estuary and Floodplain waterbird populations and
- **Measures 074** – 080 about different bat species.



3.3.2 Diseases and invasive non-native species

Climate change exacerbates the risk that new wildlife diseases, pests and invasive species will establish and spread – either from these arriving on migratory species or through our climate becoming more suitable to support them.

A key threat for woodland habitats is the ash chalara disease (commonly referred to ash die-back) causing our ash trees to die, starting from the shoots and crown. The pathogen can be spread through soils, therefore biosecurity (reducing the spread of the pathogen from things like footwear, and wheels/machinery) is key. As well as changing woodland habitats too rapidly and affecting the retention of dead wood to support a range of species, there are some plant and insect species that rely on ash, and attention should be paid to efforts to mitigate the loss of biodiversity from ash dieback. Relevant Potential Measures include **Measure 036: Ash dieback response and Measure 108: Veteran ash pollards**.

The term invasive non-native species refers to plants, animals and microorganisms causing negative impacts (environmental, social or economic) when moved to an area beyond their natural range, intentionally or unintentionally, by humans. Invasive non-native species present in Gloucestershire include Himalayan balsam, giant hogweed, *Crassula helmsii*, American signal crayfish, American mink, Elodea species, American skunk cabbage, muntjac deer and sika deer.

It is important to note that any list of invasive non-native species affecting Gloucestershire is likely to change over time. Water hyacinth, for example, may become more of an issue as climate change progresses, and new species may also be introduced. A small number of new non-native species establish in the UK every year (10-15), with at least one predicted to become invasive [65].

One of the ways invasive non-native species affect local ecology is by outcompeting native species. Himalayan balsam forms dense vegetation across large areas shading out native plants, and by producing high numbers of seeds that disperse up to 7m from each plant, they can spread rapidly [66]. *Crassula helmsii*, a problematic wetland plant, can form a dense matt across water bodies, shading and out-competing native species, and is a considerable issue in the Cotswold Water Park.

Invasive non-native species present in Gloucestershire include ***Himalayan balsam***, ***giant hogweed***, ***Crassula helmsii***, ***American signal crayfish***, ***American mink***, ***Elodea species***, ***American skunk cabbage***, ***muntjac deer*** *and* ***sika deer***

65 UK Parliament Post 2022 – https://post.parliament.uk/research-briefings/post-pn-0673/
66 Gloucester City Council – https://gloucester.gov.uk/environment-waste-recycling/nature-and-conservation/invasive-non-native-species-inns/

As well as competition, invasive non-native species may also impact native species through predation, introducing disease, and altering habitats, or a combination. The American signal crayfish is larger than our native white clawed crayfish, burrows into river banks causing erosion and collapse, and has brought with it a fungal disease called the "crayfish plague", fatal to the native species. White clawed crayfish are primary reason for the selection of the River Wye as a Special Area of Conservation, and have experienced devastating declines throughout the UK with only a few strongholds left.

The American mink was inadvertently introduced to the wild through escaping fur farms in the 1950-60s, but has caused devastation to water vole populations across the country, through predation, as mink are often small enough to enter water vole burrows at the waterline and take their young. There is hope however, and across the country, efforts to control mink have resulted in successful re-establishment of water vole populations. In Gloucestershire there is a stronghold for water vole within the Severn basin [67], as well as more isolated populations elsewhere in the county, such as the stroud canal. These should be monitored and protected from mink to ensure the populations continue to thrive and do not shrink.

Due to their devastating ecological impact on native species and habitats, controlling invasive non-native species in Gloucestershire remains an essential aspect of supporting local nature to flourish. Relevant Potential Measures include **Measure 041: Remove invasive non-native species and Measure 084: Strengthen white-clawed crayfish population**.

67 The Wildlife Trusts – https://www.wildlifetrusts.org/national-water-vole-database-project

3.3.3 Pressure on woodland regeneration from an increasing deer population

To regenerate a woodland, the deer population needs to be approximately 2 to 4 deer per square kilometre [68] for the period of time it takes to establish the woodland, however the deer population in England as a whole is increasing and becoming a significant issue for woodland creation and regeneration. If we want to regenerate our woodlands and wood pastures, as well as create new woods and orchards, management of deer needs to be prioritised, as they have no natural predators to maintain their population levels. Actions include tree protection, fencing, and using drone surveys to monitor and help manage deer movements effectively. Relevant Potential **Measures include Measure 054: Protecting tree growth.**

Muntjac deer are an invasive non-native species [69] that forage on regenerating trees and shrubs, as well as many flowering plants. They breed all year round instead of seasonally like most larger deer, which also results in more rapid population growth than other species. Gloucestershire marks the edge of their distribution, providing an opportunity to prevent further expansion or restrict their distribution, with careful management and collaboration with Herefordshire. Sika deer are also an invasive non-native species and also have a very destructive effect on regeneration and ground flora. There is still a good opportunity for it to be feasible to remove Sika deer herds from Gloucestershire. The Central Cotswold Hills Deer Management Group have experienced an increase in the native deer populations too, impacting ground flora diversity and establishment. Control of herd size is becoming increasingly important.

To regenerate a woodland, the deer population needs to be approximately ***2 to 4 deer per square kilometre***

68 Putman et al. 2011 – https://onlinelibrary.wiley.com/doi/10.1111/j.1365-2907.2010.00173.x
69 British Association of Shooting and Conservation – https://basc.org.uk/invasive-non-native-deer-species-in-the-uk/

3.3.4 The importance of fungi and soil health in nature recovery

Fungi are ecosystem engineers that sustain the health and diversity of almost all ecosystems on the planet, including those of Gloucestershire, and influence almost every aspect of human life. Fungi build soils and maintain healthy soils, and sustain almost all plant life by providing them with crucial nutrients, and defending them from disease and drought. The metabolic activities of fungi also regulate the composition of the atmosphere through facilitating carbon sequestration in soils – which amounts to twice the amount of carbon found in plants and the atmosphere combined.

Despite the vital role of fungi in driving biogeochemical processes and sustaining global biodiversity, they can be overlooked in strategies for nature [70]. There are however, many threats to fungi, each with significant knock-on effects. A large number of species are intimately associated with plants and so are impacted by activities that result in habitat loss, such as deforestation and loss of species rich grasslands to development or agriculture. Fungi are also subject to additional disruptions, from ploughing and the overuse of fungicides and fertilisers, to habitat fragmentation.

The urgent need for fungal conservation is becoming ever more widely accepted among decision makers, with the Fungal Conservation Pledge launched in 2024 by the UK and Chile. The pledge seeks to advance concrete measures to prioritise fungi in national and international legislation, policies, and agreements, and will hopefully be adopted by the UN Convention on Biological Diversity Secretariat at the next COP (Conference of the Parties) of the CBD, paving the way for a new era in fungal conservation. Between 2014 and 2025 an additional 1000 fungi were assessed as part of the Global Red List [71], a stark increase on only 2 species being assessed between 1954 and 2014. there are now over 1300 fungi species on the List, with 77 from the UK.

Work is now being progressed on a Great Britain Red List, which will show which fungi are at risk and need protection.

Fungi in Gloucestershire are under-recorded relative to animals and plants, and we lack thorough baseline surveys at the time of publication. However, lack of data does not mean that fungi aren't present and playing vital roles, and efforts should be made to increase data collection for this group. Habitat management, creation, and restoration projects, together with environmental land management schemes and gardens in Gloucestershire should make an effort to implement the latest guidelines for fungal conservation. Some of the Potential Measures that refer to this include Measure 047: Soil health and Regenerative Farming; **Measure 106: Rare arable plants and soil fauna, flora and fungi; and Measure 107: Dead wood**.

70 IUCN Fungal Conservation Committee – https://www.iucn-fungi.org/recent-work
71 Natural England 2025 – https://naturalengland.blog.gov.uk/2025/10/10/a-landmark-year-for-englands-fungi/

3.3.5 Working with the archaeological and historic environment

Conserving and enhancing the archaeological and historic environment is an integral part of protecting, managing, and planning for nature and landscapes to deliver sustainable nature recovery. Human activity has shaped our nature and landscapes for millennia – from woodlands to water bodies, and calcareous grassland to river valleys, each landscape and habitat has been influenced and shaped by human activity. The natural and historic environment working in synergy can produce multiple environmental outcomes and public benefits, including preserving heritage features, habitats, and landscapes by making them more resilient to change, engaging and enthusing new audiences, boosting value for public money, contributing to a circular low-carbon economy, reinforcing cultural identity, and connecting people with nature.

Heritage assets and historic landscapes are also habitats, and their characteristics will often dictate what species can and cannot thrive, and inform decisions about restoration options and appropriate management. For example, industrial heritage such as the former mines and quarries of the Forest of Dean and Cotswolds, can provide valuable mosaic habitats, as well as open space and fringe habitats in woodland, and therefore be important for protected and priority species such as birds, bats, reptiles and invertebrates, as well as having heritage value. A range of old and historic buildings provide important habitat for bats and for nesting birds. Historic routeways, designed landscapes and other heritage assets are often wildlife rich sites which, if appropriately managed, can help form the essential linkages within biodiversity networks. Heritage can also help us build resilience, understand how people and places have responded to climatic events through history and how earlier solutions may suggest contributions to resolving current problems, for example the management of water meadows of the Cotswold rivers and Severn Vale.

Habitat creation and restoration projects in Gloucestershire should consult the Gloucestershire Historic Environment Record[72] to identify any known archaeological sites within proposed areas for tree planting and seek specialist advice on their management, such as avoiding damage from tree planting, tree roots and forestry operation, informing the design of a planting scheme in relation to the historic woodland character of an area, or considering the use of glades or fire breaks to maximise the protection to archaeological features.

Biodiversity projects should also follow the four core principles of Natural England's guidance for nature recovery and the historic environment [73] including considering the historic environment from the outset as part of maximising environmental benefits, ensuring that the legal, policy and guidance requirements for its protection are abided by and damage to it is avoided wherever possible or harm is minimised and mitigated appropriately.

There is potential to maximise benefits for both the historic environment and nature through:

- Using historic records to understand whether certain habitats and species will prosper and to inform decisions about restoration options and appropriate management.
- managing historic routes, designated landscapes and other heritage assets rich in wildlife as important links in a national biodiversity network.
- understanding how people have responded to climatic events through history to tell the story of climate change as part of the project.
- minimising soil disturbance, reducing erosion and protecting embedded carbon to improve soil health, air and water quality at the same time as protecting and enhancing archaeology.
- using the historic environment as an engagement tool and lens through which to experience nature, by providing access through heritage sites to the countryside and bringing about wider benefits such as tourism and volunteering.

72 Gloucestershire County Council – https://www.gloucestershire.gov.uk/planning-and-environment/archaeology/request-archaeological-data-from-gloucestershires-historic-environment-record-her/
73 World Heritage UK – https://worldheritageuk.org/articles/latest-news/nature-recovery-the-historic-environment/

3.3.6 Minerals extraction and restoration

The Cotswolds Lakes/Cotswold Water Park area of Gloucestershire and Wiltshire is a patchwork of lakes, wetland and floodplain habitats along with agricultural, urban and industrial land uses, largely created or restored after mineral extraction and quarrying. Future mineral extraction, including at the planned Down Ampney quarry site, has the effect of significant landscape change in the short-term, but in the long term, the minerals restoration planning process represents an opportunity for nature recovery and to create a net gain for biodiversity once extraction has finished.

Instead of restoring sites back to a species poor habitat, for example, restoration plans can be ambitious in specifying the creation of high value habitats such as wetlands, and open mosaic habitat (a mix of exposed stone/rubble, bare earth, wetland features and scrub, often naturally formed on old brownfield sites) [74]. This should continue to be applied within Cotswold Lakes/ Water Park area, with input from local communities and nature conservation partners, and should be considered in other parts of Gloucestershire where minerals extraction is taking place. The restoration of minerals workings should take account of the Cotswold Water Park Nature Recovery Plan [75] and take opportunities for wider connections for wetland habitats.

74 Buglife 2020 – https://cdn.buglife.org.uk/2020/01/Identifying-open-mosaic-habitat.pdf
75 https://www.cotswold.gov.uk/planning-and-building/landscape/cotswold-water-park/

3.3.7 The need for ecological recording and monitoring

The evidence base for Gloucestershire's first Local Nature Recovery Strategy has benefited from a huge collaborative effort from the combined skills and knowledge of hundreds of expert naturalists, ecology professionals and dedicated volunteers. Both challenges and opportunities for improving the evidence base were identified at an early stage. Challenges mostly concern gaps in skills, recording effort or geographic coverage of information, both for species and habitats. Opportunities relate strongly to human resources, both in terms of experts and new opportunities for volunteer input and Citizen Science projects.

Species recording

Verified records from local volunteer naturalists, professional ecologists and national recording schemes have built a historical database within Gloucestershire which was used by the Species Task and Finish Group to create the Priority Species list of rare and/or threatened species in Gloucestershire. It is recognised, however that species records are indicative of surveyor effort and may not truly reflect the biodiversity within Gloucestershire as many taxa have been under-recorded, such as fungi, soil fauna, fish and mustelids (weasel family), along with geographic areas. The process not only identified gaps in recording effort, both geographically and for particular species groups, but also gaps in our understanding of species life-cycles and management needs, particularly for fungi and invertebrates.

The gaps in knowledge raised during the work of the Species Task and Finish Group revealed a need for a county-wide monitoring strategy, and a need to identify opportunities for broadening the geographic reach of monitoring, along with targeting less recorded species. This can be done in part, by making efforts to encourage delivery partners of the LNRS, to consider carrying out their own monitoring of sites, or linking them with volunteers that can do so. This will increase the geographical range of species monitoring, with the inclusion of private land in monitoring efforts, and result in gathering meaningful data on the success of projects. Future iterations of the Local Nature Recovery Strategy should incorporate these species once additional scientific research has been conducted and more informed management requirements have been established.

Habitat recording

New local habitat survey information, including from Gloucestershire Wildlife Trust's Habimap [76] project and from Farming and Wildlife Advisory Group South West [77], and commercial / development projects has helped to improve the accuracy of the national datasets of information about habitats in Gloucestershire. These habitat records in turn helped to update and improve the basis of the Nature Recovery Network mapping which formed the basis for many of the mapped focus areas for Habitat Potential Measures and for the Areas that Could Become of Particular Importance for Biodiversity. However, there is still a long way to go to record comprehensive and fully up-to-date habitat information across Gloucestershire. New schemes such as BNG mandate monitoring of habitat creation sites, and more can be done to pool existing data around existing and proposed habitats, through working with local authorities, developers and landowners in Gloucestershire.

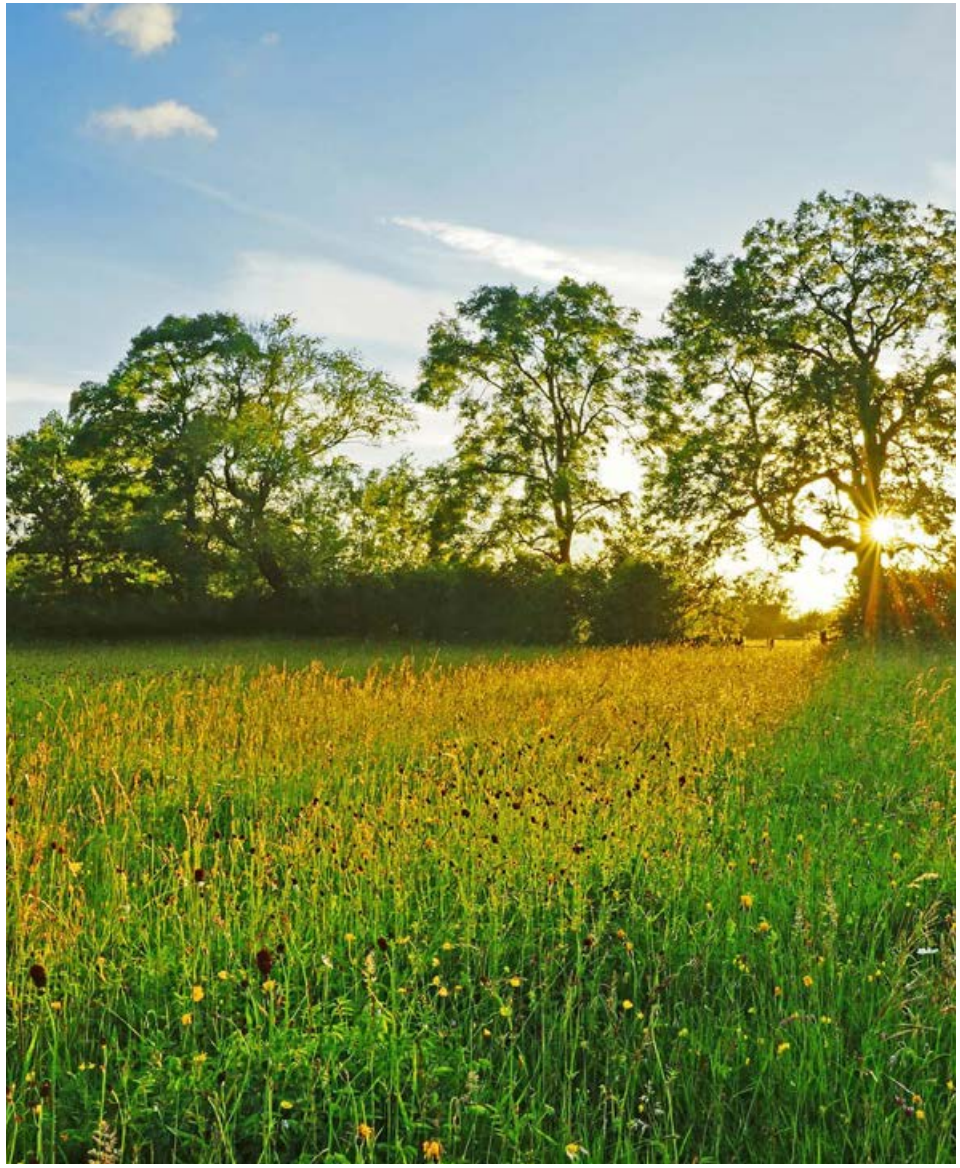
Training

Both species and habitat recording are crucial to maintaining a robust and relevant Local Nature Recovery Strategy. Local expertise and an increasing interest in Citizen Science have combined well in Gloucestershire to provide a good baseline for the Strategy. The process has however highlighted a need within the monitoring strategy to develop and train experts in specific taxonomic groups to address recording gaps and ensure that under-represented taxa are effectively surveyed and understood over time. These skills are vital for accurate recording and also for ensuring that data from Citizen Science projects can be verified and kept to the highest standard. The ongoing process of training, supporting and inspiring habitat surveyors for Habimap and other projects mirrors the need for expert species knowledge and identification skills.

Delivery of recording and monitoring

The delivery phase of this Strategy should have a strong focus on prioritising and resourcing high quality ecological recording and monitoring of habitats and species in Gloucestershire and growing the expertise needed to achieve an excellent evidence base for practical nature restoration.

76 Gloucestershire Wildlife Trust - https://www.gloucestershirewildlifetrust.co.uk/habimap
77 ELM 3 Test and Trial project by FWAG South West: Creating an on-farm assessment and analysis methodology for Landscape Recovery that helps farmers become investment ready



3.4 Ecosystem services and biodiversity

Although our species and habitats have their own intrinsic value, our natural environment also provides us all the resources we need for survival, and mechanisms for ensuring the places we live in are functioning and habitable (ecosystem services). Biodiversity (the variety of living things) underpins the delivery of all ecosystem services, that is, without biodiversity we would not have the resources we need to live.

Some examples of these ecosystem services are shown below. For some of these we show a symbol, used with permission from the Natural Capital Team at the Environment Agency. The Environment Agency's Natural Capital Team has developed a set of natural capital icons for use in their own tools, guidance, and products, as well as those of their partners, that support a natural capital approach. These icons are designed to give natural capital a strong, recognisable identity, making it easier for people to identify and engage with it. These symbols will appear next to Potential Measures in Part 2, to show how different measures contribute to these wider environmental benefits:

Many of these ecosystem services are benefits that a number of Potential Measures of this strategy contribute to, such as new woodland and tree cover increasing carbon sequestration, and shading and local climate regulation. However, some ecosystem services are directly referenced by Potential Measures of this strategy, examples being Potential Measure **024: Natural Flood Management and Potential Measure 065: Access to biodiversity-rich green spaces.**

		Symbol
Provisioning services	Food provision	
	Water supply	
	Raw materials including wood and fibres	
	Energy – hydro or biomass	
Regulating services	Carbon storage and sequestration	
	Air pollutant removal	
	Water quality	
	Water flow regulation / flood management	
	Local climate regulation / shading/ urban cooling	
	Pollination	

		Symbol
	Soil erosion prevention	
	Soil health	
	Biological pest and disease control	
	Waste decomposition	
Cultural services	Recreation	
	Education	
	Interaction with nature /health and wellbe-ing	
	Landscape beauty /Sense of place	

4. Wider Ecological Connections beyond Gloucestershire

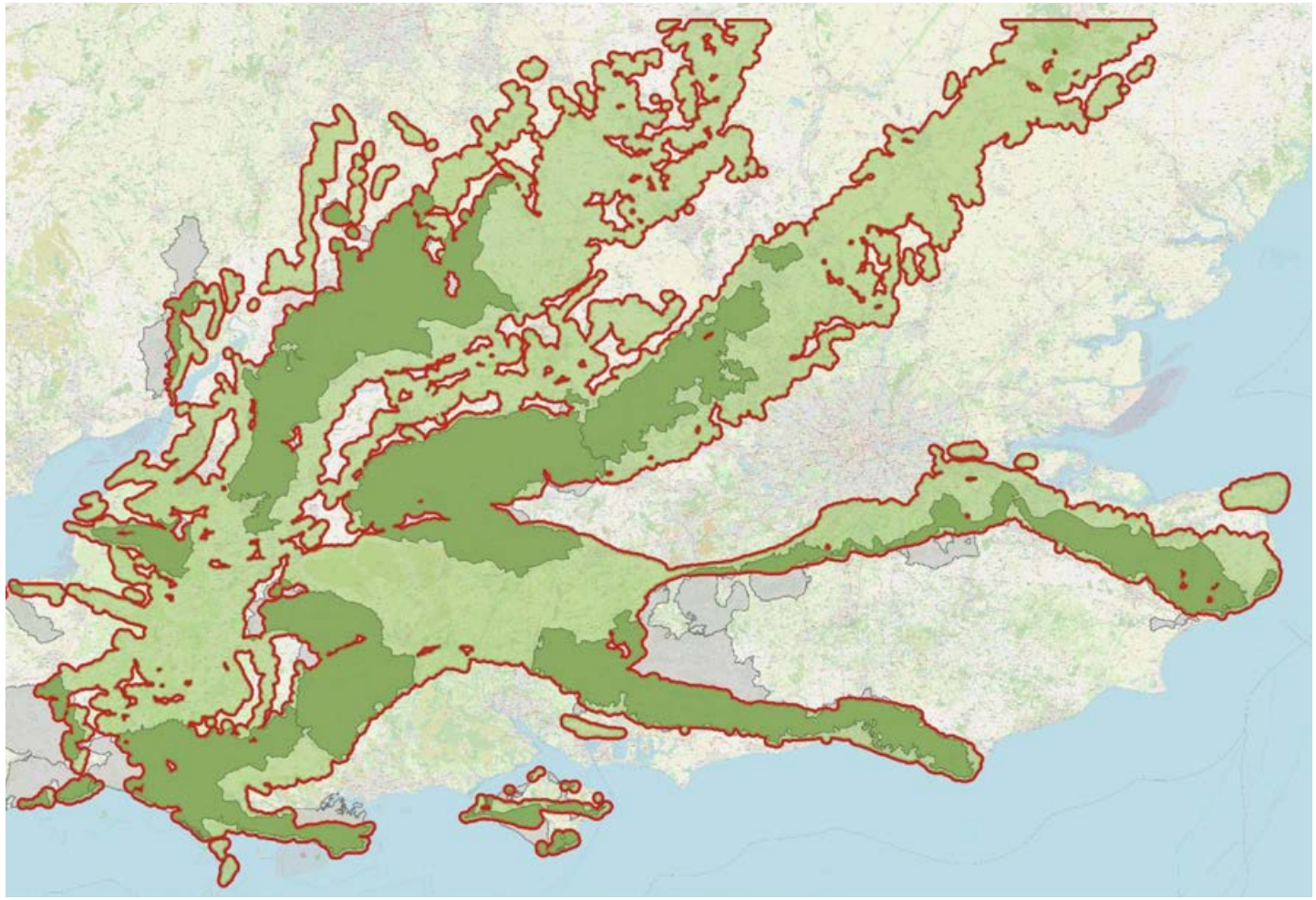
In order to secure the recovery of nature in the face of climate change we need to plan and act to help nature move through the landscape as it adapts to a warming climate. We need to think about Gloucestershire's future wildlife. What species will be living here in 10, 50 and 100 years time and how will they get here? More mobile species are already moving at a scale greater than an individual county and Gloucestershire has a number of features that make it important for supporting movement at this scale.

4.1.1 Limestone and Big Chalk

Calcareous (limestone and chalk) landscapes in the south of England contain the most species-rich habitats within the UK. When combined across the whole landscape, these habitats make the calcareous landscapes one of the best places to allow wildlife to recover and adapt to climate change.

With a north south reach of 171 miles, Big Chalk [78] represents one of the best opportunities offered by the English landscape to support the northward movement of species to a new climate space. Gloucestershire plays an important role as both a destination for these species and as part of a route further north.

78 Big Chalk - https://www.big-chalk.org/



Big Chalk is a pan-England partnership programme designed to facilitate this recovery and movement across the calcareous (chalk and limestone) landscapes of southern England. It seeks to amplify the efforts of partners to create a robust ecological network on a scale hitherto unimagined.

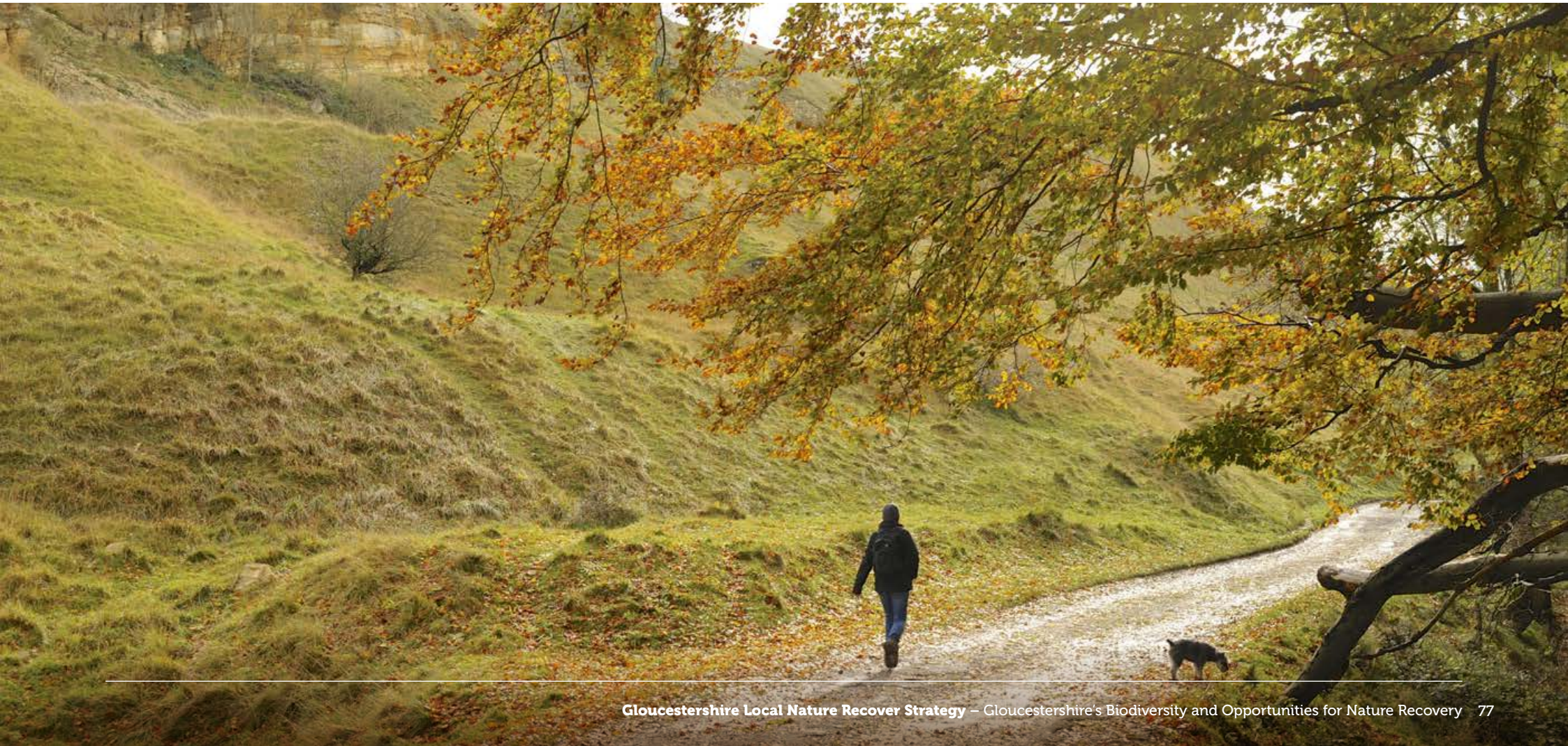
The Big Chalk area is huge, covering some 259,317 km2, or 20% of England and there are many people, organisations and partnerships striving to deliver the Big Chalk vision in a variety of ways. It is important that the Big Chalk partnership champions and supports these efforts rather than competes with them.

Big Chalk seeks to do this in two main ways:

- Championing and connecting the contributions of partners across political and institutional boundaries.
- Defining priorities, influencing funders and policy makers to support and secure resources for new activities.

The partnership is headed by a Board and topic groups and conferences bring partners together across an array of subject areas. A wider membership list keeps people in touch. Individual projects can apply for Big Chalk accreditation through a project registration scheme.

The Big Chalk Partnership is already proving to be influential with funders and policy makers. As nature recovery effort continues to grow Big Chalk can combine our voices and efforts to better create and realise opportunities for the recovery of nature.



4.1.2 Migrating Birds

Gloucestershire already plays an internationally important role in supporting migratory birds. The Cotswolds scarp functions as a north-south route rich in cover and food utilised by many birds. The regular seasonal sightings of the mountain nesting ring ouzel at Cleeve Common whilst on migration illustrates this well.

The Severn Estuary is recognised internationally as important for numerous species of migrating and wintering birds, through its Ramsar site designation. Birds visiting the Severn Estuary seasonally include populations of Bewick's swan, greater white-fronted goose, common shelduck, gadwall, dunlin and common redshank [79] amongst many others. The habitats of the Severn Estuary provide a key refuelling point where birds will stop and rest as they travel the "North Atlantic Flyway", a bird migration route linking Siberia, Europe and Africa [80].

It is likely that the number and type of birds visiting the Severn and the wider county will change over time, with southerly-distributed waterbirds likely to benefit as the climate warms, meaning their populations may increase and expand their range. Overall, however, migratory bird populations, already declining widely around the world at a rapid pace, are one of the bird groups thought most likely to be affected by climate change in a negative way [81]. This means whilst the species migrating through Gloucestershire are likely to change, perhaps significantly, its natural habitats will continue to play an important role for birds.

In addition to the climate-caused changes in distribution and abundance of species, the Severn Estuary can play an important role in particularly cold years in the UK, where the temperatures negatively affect more northern and easterly bird populations. In these years numbers of migratory birds in Gloucestershire and the Severn are likely to increase.

79 Natural England – https://publications.naturalengland.org.uk/publication/5601088380076032
80 RSPB – https://www.rspb.org.uk/helping-nature/what-we-do/influence-government-and-business/casework/the-severn-estuary
81 British Trust for Ornithology 2021 – https://www.bto.org/our-science/publications/research-reports/climate-change-and-uks-birds

4.1.3 River Catchments

Rivers and tributaries link Gloucestershire to surrounding counties and parts of England and Wales further afield. Rivers act as wildlife corridors, providing paths through the landscape and a flow of resources including food sources. They are one of the richest freshwater habitats, supporting plants and animals that need running water to survive. The longest river in the UK, the Severn, starts in Wales and flows through the English counties of Shropshire and Worcestershire before flowing through Gloucestershire. Near Tewkesbury, the Warwickshire Avon meets the Severn, as its easternmost and largest tributary.

The Severn tributaries are particularly important for connectivity with regard to migratory fish in the River Severn. Some major barriers to fish passage for the Severn have been addressed in Worcestershire in the River Severn itself. However, Gloucestershire needs to address the barriers posed by Upper Lode weir and Maisemore weir for species needing to complete upstream and downstream migrations, opening up access to and from the Warwickshire Avon as well as the Severn. Other significant barriers need to be addressed in the Frome and Leadon catchments as well as across the Forest of Dean and through our urban areas of Gloucester and Cheltenham. The majority of the tributaries that discharge into the Severn and Severn estuary have flapped outfalls, restricting access to fish, eels and lamprey, denying access to more suitable habitat for their respective life stages. Fish passage needs to be enabled at all confluences to the Estuary.

The River Thames catchment is also a significant feature of the Gloucestershire landscape. The source of the River Thames is near Kemble, and several Cotswolds rivers feed into the Upper Thames: the Churn, Coln, Leach, Windrush, and Evenlode. Cotswold Water Park, a series of 180 lakes formed in sites of gravel extraction, is located in the Thames catchment, with around 23 miles of the Thames River running through the area.

The Catchment Based Approach (CaBA) and local Catchment Partnerships bring together organisations from all sectors to work towards a healthy water environment [82]. Those catchment partnerships that include part of Gloucestershire include the Severn Vale, The Upper Thames, Windrush, Evenlode, Warwickshire Avon, and Bristol Avon Catchment Partnerships. The Severn Vale Catchment Partnership has developed a number of flagship programmes that if delivered could significantly improve a large number of waterbodies – these are the Wilder Frome, Wilder Leadon, Forest to Sea, Our Living Rivers (Gloucester and Cheltenham) and Flourishing Floodplains Programmes.

82 Catchment Based Approach - https://catchmentbasedapproach.org/about/

5. National Environmental Objectives

The Environment Act 2021 and the government's 2025 Environmental Improvement Plan [83] created a range of national environmental objectives which each local nature recovery strategy should contribute to. These are summarised below, with indications of the main ways this strategy helps to contribute.

5.1 National targets set under the Environment Act (2021)

Objective	Main Relevant Potential Measures
Biodiversity on land – Restore or create more than 500,000 hectares of a range of wildlife-rich habitat outside protected sites by 2042, compared to 2022 levels. An interim target to restore or create a 250,000 hectares of wildlife-rich habitats outside of protected sites by 2030.	All Potential Measures about restoration or creation of habitats.
Biodiversity on land – Halt the decline of species abundance by 2030. Ensure that species abundance in 2042 is greater than in 2022, and at least 10% greater than 2030.	All Potential Measures contribute to this main aim.
Biodiversity on land – reduce the risk of species' extinction by 2042, when compared to the risk of species' extinction in 2022.	All Potential Measures about habitat quality, resilience, size and connectivity, and priority species measures supporting recovery of additional rare and threatened species.
Woodland cover – Increase total tree canopy and woodland cover in England from 14.9% of land area in 2022 to at least 16.5% by 2050, and increase by 0.33% (an increase of 43,000 hectares) by 2030.	Main relevant Potential Measures: **Measure 010: Expand and buffer ancient semi-natural woodland, semi-natural woodland and broadleaved woodland.** **Measure 011: Establish new woodland and tree cover.** **Measure 050: Agroforestry** **Measure 067: Urban tree planting and management**

83 Environmental Improvement Plan 2025 – https://www.gov.uk/government/publications/environmental-improvement-plan-2025/environmental-improvement-plan-eip-2025

Objective	Main Relevant Potential Measures
Improve water quality and availability – Reduce nitrogen (N), phosphorus (P) and sediment pollution from agriculture into the water environment by at least 40% by 2038, compared to a 2018 baseline.	Main relevant Potential Measures: **Measure 047: Soil health and regenerative farming** **Measure 046: Reduce pollution from agricultural inputs** **Measure 038: Water quality**

5.2 Key additional (relevant) commitments from the revised Environmental Improvement Plan (2025)

Commitment or Goal	Main Relevant Potential Measures
Commitment 86: Make sure that everyone has access to green or blue spaces within a 15-minute walk from home.	**Measure 066: Access to biodiversity-rich green space**
Commitment 63: Restore approximately 280,000 hectares of peatland in England by 2050.	**Measure 026: Restore and create wetland and floodplain wetland mosaic** **Measure 027: Manage and restore fens, mires and lowland peatland sites**
Goal 3: Water – Ensure English waters are clean, resilient and plentiful.	Main relevant Potential Measures: **Measure 018: Manage, improve and create ponds for wildlife** **Measure 019: Manage lakes for biodiversity** **Measure 022: Improve ecological condition of rivers** **Measure 038: Water quality** **Measure 039: Sewage and wastewater** **Measure 044: Limit groundwater abstraction and surface flow abstraction** **Measure 046: Reduce pollution from agricultural inputs**
Commitment 7: Effectively conserve and manage 30% of the UK's land by 2030 (30by30).	All Potential Measures about management of habitats and about restoration or creation of habitats.
Commitment 12: Support farmers and land managers to create or restore 48,000km of hedgerows by 2037 and 72,500km of hedgerows by 2050.	Main relevant Potential Measures: **Measure 045: Field margins, hedgerows, buffer strips, ponds, trees and sustainable farming and forestry** **Measure 053: Hedgerows**

Commitment or Goal	Main Relevant Potential Measures
Goal 6: Resources – Ensure that natural resources are produced, managed and consumed sustainably.	**Measure 049: Sustainable forestry and nature re-covery**
Commitment 8: By December 2030 50% of SSSI features to have actions on track to achieve favourable condition.	All Potential Measures about management of habitats.
Commitment 65: Integrate climate resilience into decision making across the EIP programme to support the delivery of our outcomes in the context of climate change. Commitment 66: Enhance the adaptive capacity and resilience of the treescape by increasing its extent, connectivity and diversity, improving its condition and conserving the genetic diversity within and between species.	Main relevant Potential Measures: **Measure 024: Natural Flood Management** **Measure 030: Create wildlife corridor connectivity** **Measure 032: Physical structure** **Measure 035: Woodland climate adaptation** **Measure 037: Floodplain reconnection** **Measure 047: Soil health and Regenerative Farming** **Measure 048: Drought resilient farming techniques**
Goal 8: Reducing environmental hazards – Reduce the risk of harm to people, the environment and the economy from natural hazards.	**Measure 024: Natural Flood Management**
Commitment 13: By 2043, increase saltmarsh by 15% compared to 2009 levels, seagrass by 15% compared to 2024 levels and create functional oyster reef habitat at ecosystem scales in 5 to 8 suitable English water bodies.	Main relevant Potential Measures: **Measure 028: Protect and manage saltmarsh and mudflats** **Measure 029: Restore and create saltmarsh** **Measure 042: Severn Estuary marine biosecurity**
Commitment 19: Deliver 2030 emissions targets to reduce anthropogenic emissions for the following pollutants against a 2005 baseline level: ammonia (NH3) 16% reduction; nitrogen dioxide (NO2) 73% reduction.	Main relevant Potential Measures: **Measure 038: Water quality** **Measure 046: Reduce pollution from agricultural inputs** **Measure 047: Soil health and Regenerative Farming** **Measure 056: Riparian buffer strips**

Commitment or Goal	Main Relevant Potential Measures
Commitment 81: Reduce the rate of establishment of INNS by at least 50% by December 2030, compared to 2000 levels.	Main relevant Potential Measures: **Measure 041: Remove invasive non-native species** **Measure 042: Severn Estuary marine biosecurity** **Measure 054: Protecting tree growth** **Measure 084: Strengthen white clawed crayfish population**
Commitment 16: By 2030, double the number of farms providing sufficient year-round resources for farm wildlife, compared with 2025.	All Potential Measures about management of habitats and about restoration or creation of habitats, as well as: **Measure 045: Field margins, hedgerows, buffer strips, ponds, trees and sustainable farming and forestry** **Measure 098: Individual species needs of farmland birds** **Measure 106: Rare arable plants ad soil fauna, flora and fungi**

Gloucestershire
Local Nature Recovery Strategy

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