Cotswolds Nature Recovery Plan

October 2021

Cover illustration by Rachel Hudson with thanks to Back from the Brink/Butterfly Conservation

Produced by a Working Group of the Cotswolds Nature Recovery Forum and the Cotswolds National Landscape*

**The new public name for both the Cotswolds Conservation Board and the Cotswolds Area of Outstanding Natural Beauty*

Executive Summary

Introduction
The story of our loss of wildlife is well documented and understood. This plan is about how we can turn this around and most importantly turn it around now. Climate change is a well-recognised driver threatening the loss of our already diminished wildlife at an even greater scale and pace. The need for action is urgent.

We know what we have to do to allow our wildlife to flourish and adapt to climate change. We need to create a robust and resilient nature recovery network - a landscape rich in joined up and well managed habitats as described in the report "Making Space for Nature".

A robust nature recovery network is not only good for wildlife, it provides a range of "ecosystem services" such as clean water or food or a beautiful place to get away from it all and enjoy some peace surrounded by nature. These ecosystem services are critically important to the wellbeing and economy of people living in and around the Cotswolds. Furthermore a robust nature recovery network can help solve some of the issues faced by wider society, particularly concerning climate change and health and wellbeing.

Species and Habitats
The Cotswolds is widely recognised as nationally and internationally important for an exceptionally wide range of species and habitats. It is also strategically located to support species in adapting to climate change by moving to a new climate space. This is illustrated by increasing occurrences of many species including wasp spiders and blue underwing moths (*Clifden nonpareil*) in the area. The Cotswolds has an essential contribution to make to a national nature recovery network. Strategic links for wildlife through neighbouring landscapes and beyond are also considered.

The development of large areas of extensively grazed and diverse habitat where natural processes are allowed to take place is actively promoted. Management can aim to provide a variety of conditions that fit into the landscape. Such areas of mosaic habitat are ideal for locations that can contribute to both woodland and grassland habitat connectivity. Similarly marginal habitats such as woodland, water and scrub edge are of particular value and should be encouraged.

A habitat led approach to nature restoration is taken but the need to include measures for priority species and to consider species in habitat based decision making is recognised. Measures for priority species have been integrated throughout the plan.

The current extent of wildlife rich habitats within the Cotswolds is 48,000 Ha which is 23% of the area of the National Landscape. The extent of these habitats needed to form a robust nature recovery network that will enable wildlife to flourish and adapt to climate change is 82,000 Ha, 40% of the area. Some of the actions for the creation of this network include:

- Ensure existing wildlife rich habitats are well managed.
- Restore 17,500 Ha of species rich grassland including 11,600 Ha of species rich limestone grassland.
- Create 4,000 Ha of broadleaved woodland by extending and linking existing woods.
- Create 10,000 Ha of mixed grassland, scrub and tree mosaic habitats include large extensively grazed areas.
- Create 1,600 Ha of wetland habitat in river valleys.
- Bring 69,000 Ha of arable land into schemes with environmental measures.
- Ensure that creating one habitat does not compromise another, in particular retain the grassland corridor along the scarp from Bath to Mickleton.

- Ensure that new habitats are rich in marginal habitats such as dense scrubby edges.

The new extents for woodland and limestone grassland reflect the Cotswolds share of national targets and where based on a scientific rationale. The remaining figures were estimated in comparison to limestone grassland and woodland adjusted according to local knowledge. The 40% of area comprising of good habitat is consistent with a recommended target for designated landscapes in the scientific literature.

Delivery

These area targets will only achieve the desired outcomes for nature recovery if they are delivered in the appropriate locations to best increase habitat connectivity. Maps have been produced by local partners to guide this work and a mapping exercise to provide consistency across the Cotswolds has been undertaken. The Cotswolds wide mapping reflects the priorities within this plan. In high priority locations for calcareous grassland connectivity grassland restoration is given priority over woodland restoration and in areas of medium priority for both mosaic habitat is recommended.

The overall target is for the nature recovery network described in this plan to be fully in place by 2050. Intermediate targets have been set at 5 yearly intervals as a roadmap towards the overall target. Achieving these targets will depend on many strategies and delivery mechanisms delivering for the Cotswolds. The production of this plan is timed to influence these delivery mechanisms, in particular but not exclusively:

- Local Nature Recovery Strategies
- Environmental Land Management Schemes
- Biodiversity Net Gain
- Payment for Ecosystem Services

This plan is about nature recovery but it is not about turning back the clock. We do need to look back and learn from traditional land practices but then we need to look forward and apply these lessons in a modern and changing context. Above all we need to create the conditions for wildlife to increase in abundance and spread across the landscape and we need to do it in ways that are embedded in the economy and support livelihoods in a lasting way. This will create new landscapes full of wildlife that reflect the distinctive character of the Cotswolds but are also dynamic and changing.

Everyone has a role in delivery: policy makers and decision takers, individuals, communities, businesses, countryside visitors and access managers and most of all farmers and land managers.

Nature recovery in the Cotswolds will only happen if farmers and land managers choose to deliver the measures recommended within this plan over the appropriate land. We need to change the management of over 34,000 Ha of land in order to create a robust nature recovery network. The figure rises to over 103,000 Ha if arable fields containing environmental measures are included. This requires a farmer and land manager led approach to nature recovery to deliver the necessary scale of change and they need to be properly supported. Getting this right over the next few years is the key challenge for delivering nature recovery across the Cotswolds and beyond.

Contents

List of Illustrations

1. Introduction

This plan reflects a new focus on nature recovery on behalf of the Cotswolds National Landscape. This is part of a wider movement with all AONBs undertaking the production of Nature Recovery Plans as a shared commitment under the Colchester Declaration. This declaration was in turn a response to the finding that all national landscapes need to be doing more for nature within the Landscapes Review undertaken by Julian Glover in 2019.

This plan was adopted as guidance by the Board of the Cotswolds National Landscape in October 2021. As such it forms part of a suite of documentation that is supported by the statutory Management Plan for the Cotswolds National Landscape. While this Nature Recovery Plan focusses on nature recovery the Management Plan takes a more holistic look at the social, economic and environmental factors operating within the Cotswolds landscape.

Statutory Local Nature Recovery Strategies[1] are going to be developed over the next few years. We do not yet know all the details but they will be very important in guiding nature recovery and this work will take place on a Local Nature Partnership/unitary or county local authority boundary basis. It is likely that six such areas will overlap with parts of the Cotswolds National Landscape and it will be important to ensure that they link up across their boundaries. One of the reasons for producing this plan now is to provide a focussed Cotswolds wide look at nature recovery to inform the development of these strategies.

This plan has been developed as a partnership project between the Cotswolds National Landscape and the Cotswolds Nature Recovery Forum. The Forum is an informal group which has been working to deliver nature conservation at a landscape scale across the Cotswolds since May 2010. It currently has over 70 members representing 35 organisations including local authorities, community organisations, landowners, the private sector and conservation organisations. This plan has been developed under the guidance of a working group drawn from the Forum's membership. It was widely consulted on over the summer of 2021 in order to provide a consensus view on the best things we can do to aid nature recovery in the Cotswolds and beyond.

Its delivery too can only succeed through collective effort. Whether you manage land or rivers, develop policy or direct resources, volunteer to conserve or better understand species and habitats or simply want to share a love of wildlife, this plan is here to help you make the best choices for wildlife in the Cotswolds.

This plan takes the approach of describing the current situation, what is changing and the potential for nature recovery before outlining policy in the form of priorities and outcomes. It goes on to outline how nature recovery can be delivered across the Cotswolds:

- It sets area targets for habitat restoration in five year intervals
- It links to maps to show where this can best be done
- It describes what we can all do to contribute
- Four broad habitats are then considered individually and practical measures recommended: woodland and trees, grassland and scrub, rivers and wetlands and cropland.

Concise tailored versions of the plan are available for two key audiences. A version for policy makers and fund holders focusses on priorities, desirable outcomes, targets and strategic recommendations.

[1] Included within the current Environment Bill

A version for farmers and land managers and their advisors focusses on practical measures. Both versions will refer back to this full version to provide their evidence base.

Key mechanisms for resourcing nature recovery such as support for farmers and land managers through the new Environmental Land Management schemes and development through biodiversity net gain are being developed. We do not yet know the details for all of these mechanisms so this is the perfect time to collectively outline what is best for Cotswold's wildlife to help the local prioritisation of these and other mechanisms.

After years of watching our wildlife decline we are going to be bringing it back at a hitherto unimagined scale, and creating new opportunities for businesses and people to benefit as we do so. It may be challenging but it really couldn't be more exciting.

2. A vision for natures recovery

In 2050 the Cotswolds is a place where local people and visitors actively support and benefit from the widespread recovery of nature, restoring and enhancing a distinctly Cotswolds mosaic of habitats and species that fit within the landscapes' character.

Farmers, other land managers and local communities are actively engaged and inspired and find new ways of working together. Farm and other businesses and livelihoods are protected and new ones created and sustained through environmental schemes, sustainable farming practices and visitor/tourism enterprises.

Wildlife and rare species have returned in abundance to the Cotswolds across a robust nature recovery network. Enlarged areas of semi-natural grassland, woodland, and wetland habitat, are knitted together into well managed, well-connected dynamic mosaics that are in good condition. Arable areas, their connecting hedgerows, drystone walls and small woodlands are managed to enhance permeability for wildlife and incorporate measures to support farmland birds and arable plants.

The management of land has evolved to tackle the causes of climate change and deal with its consequences. It supports fully functioning ecosystems that provide nature based solutions to address wider social and environmental issues.

Carbon is captured and stored in woodland and grassland soils and arable soils are better managed to store carbon.

The Cotswolds provides good quality water and natural flood management for communities downstream.

The Cotswolds offers increased opportunities for visitors and locals to connect with nature and a sense of place, improving health and wellbeing through cultural, nature and heritage rich landscapes and increased encounters with wildlife.

Generalised view of the Cotswolds scarp and outliers, without and with nature recovery features.

Some of the features shown

- Continuity of calcareous wildflower grassland along steeper scarp slopes.
- Conversion of semi-improved grassland to wildflower grassland on the scarp slopes and at its bottom. Extending and linking the current wildflower grasslands.
- Targeted grazing using local breed and new “virtual fencing” technology to accommodate species with different sward height requirements.
- Reduction of scrub where it threatens to overwhelm existing calcareous grassland. Additional scrub introduced through habitat creation.
- Increase in overall scruffiness and scrub grassland edge area.
- Habitat corridor linking the scarp and outlier.
- Tall and thick hedgerows in the vale area.
- In field trees, orchard and agro-forestry in the vale.
- Access management reducing the lateral spread of rights of way.

Generalised view of the high wold without and with nature recovery features

Some of the features shown

- Managed wildflower grassland margins around arable fields.
- Restoration of drystone walls.
- Measures in arable fields for farmland birds such as skylark plots.
- Agro-forestry and hedgerows growing taller and thicker.
- Measures in arable fields for arable flowers such as poppies.
- Creation of a large area of extensively grazed mosaic habitat.
- Overwinter stubble and cover crops providing year round cover and conserving soils.
- Local breed – the Cotswold Sheep or “Lion”.
- Woodlands extent increased through natural regeneration extending an existing wood.

Generalised view of the river valleys without and with nature recovery features

Some of the features shown

- Conversion of arable to wildflower pasture and hay meadows on slopes adjacent to river, particularly in areas prone to flooding. Wildflower grassland restoration incorporated into natural flood management measures.
- Conversion of semi-improved grassland to wildflower grassland on the slopes of the valley sides. Extending and linking the current wildflower grasslands.
- Arable measures such as contour ploughing to conserve soils.
- Hedgerows managed to become taller and thicker.
- In field trees and agro-forestry.
- River reconnected with its floodplain allowing the development of wetland habitats including wet woodland.

These images are still being revised with the illustrator

3. Context

Much of the context of a Cotswolds nature recovery network is defined by the physical conditions dictated by the underlying geology. This has combined with a long history of land use to provide us with the rich legacy of species and habitats we have today. This is briefly summarised in appendix 7.2.

3.1. Drivers for change

How drivers for change impact on particular habitats are described under the appropriate habitat sections. The underpinning drivers for change across all habitats are climate change and social and economic. All are increasingly interlinked and it is difficult to tease them apart. This plan recognises that the Cotswolds landscape will continue to change but aims to ensure that this change both supports the recovery of nature and is consistent with the character of the place.

3.1.1. Climate change

Climate change effects species in a number of ways

- The climate space (the area on the planet where suitable conditions exist) moves, usually northwards and/or to higher altitudes.
- The timing of natural events such as spring blossoming can change. This can lead to a lack of synchronicity for example the emergence of invertebrates becoming out of sync with nectar sources.
- Changing weather patterns with warmer dryer summers and warmer wetter winters occurring are likely to become the norm.
- Extreme weather events such as floods and droughts are likely to become more frequent.

Climate change will also increasingly impact on the viability of land management options and the decisions taken by land managers.

3.1.2. Social

Changes to the public perception and use of the countryside cuts across all of the habitats listed below. Following the experience of lockdowns in 2020 and 2021 the nation has an increased awareness and appreciation of local nature and natural spaces. As the realities of the urgent need to mitigate climate change are increasingly realised, casual air travel is likely to become less frequent and domestic visits will increase. There will be business opportunities for those combining nature restoration with eco-tourism on their land.

Levels of use of open spaces and public rights of way are expected to increase. Newer forms of countryside access particularly off road cycling are likely to continue to grow in popularity. The use of e-bikes for off road cycling will continue to open up the countryside to new people and this will happen at a greater scale than is currently foreseen by many.

Many of the Cotswolds best wildlife sites such as the large commons also have open public access and several are already very heavily used. Additional attractive and accessible wildlife rich places both within the Cotswolds and in the vicinity of adjacent communities will be needed to help manage increasing visitor pressure.

Encouraging, welcoming and informing new audiences in higher numbers for countryside recreation will require advice, guidance and education. All this will place increased demands on both countryside managers, farmers and landowners and the recreational fabric of the countryside. Both will need adequate resourcing in order to avoid damage and disturbance to habitats and species.

The Cotswolds has long benefited from conservation volunteers undertaking a wide variety of practical conservation tasks as well as maintaining public rights of way, engaging people through walks and talks and collecting biological records. Both their work and the resources to support it will become even more important.

3.1.3. Economic

Rural economies are continuing to change and nature recovery will only succeed in the long term if it is embedded into economically viable and sustainable forms of land management.

Government policy including agricultural support has been and will continue to be a powerful driver for change. Environmental Land Management (ELM) will be based on the public payment for public goods including nature recovery. It will need to both deliver nature recovery and help to maintain livelihoods.

Both the public and private sectors are increasingly valuing nature and are more willing to invest in its recovery. The nature of government support for land management, ways of mitigating development and of paying for ecosystem services are just some of the coming opportunities for resourcing nature recovery.

3.2. Potential for nature based solutions

Many of the things that the natural environment of the Cotswolds does for us (ecosystem services) are described in appendix 7.3. In addition to these ecosystem services and as well as directly supporting the recovery of wildlife a robust nature recovery network offers opportunities to address a number of important issues faced by wider society.

3.2.1. Climate change mitigation and adaptation

Just over half of this area's land cover is either permanent pasture or woodland and will play a role in sequestering and storing carbon. Trees in particular can contribute towards the capturing of more carbon. The amount of carbon captured and stored in grassland is less than that of woodland and varies with the type of grassland with seasonally wet grasslands on deeper soils storing more. The capturing and storing of carbon across the Cotswolds is likely to increase with more trees, the creation of new woodlands and hedgerows and an increase in extensively managed wetlands and permanent grasslands. The majority of carbon captured by a tree is stored in the soil, which has implications for how we manage soil, and the significant carbon stored in areas with undisturbed soils including ancient woodland.

The natural capital evaluation of the Cotswolds undertaken in 2021 maps the carbon stored by different habitats and their efficiency at carbon storage. It estimates that over 23 million tonnes of carbon are stored across over 204,000 Ha in Cotswolds soils, 724,000 tonnes of that being stored in

over 6,300 Ha of species rich grasslands[2] and 6.4 million tonnes in 24,300 Ha of woodland habitats. 16,800 Ha of mixed and edge habitats such as hedgerows, scrub, scattered trees, wood pasture and parkland store a further 2.5 million tonnes.

It also calculates the increase in stored carbon from converting different habitats to species-rich grassland. For example converting intensive arable produces a gain of 28 kilograms per Ha and semi-improved grassland 1.2 kilograms per Ha.

This evaluation and its maps can be interrogated via a dashboard here. (Insert link to appropriate new Cotswolds National Landscape nature recovery webpage.)

The shift from more intensive to more extensive livestock systems associated with the development of a nature recovery network will reduce carbon and methane emissions.

There is potential to better use wood fuel from the area particularly woodchip. If replacing fuel types that do not capture carbon, as part of a varied energy mix this will also assist with climate change mitigation. Woodchip from coppicing would also bring significant benefits to wildlife if implemented well. Cut scrub from grassland habitat management works could also enter this fuel chain rather than being burnt on site.

The use of arisings from areas of wildflower grassland managed by cutting as feedstock for anaerobic digesters could both provide renewable energy and provide an economic incentive for this form of management. This would support the creation of wildflower grasslands in locations such as road verges where grazing is not possible.

To realise benefits for nature recovery and avoid wider environmental impacts it is important to focus on these local sources of arisings along with crop residue and to avoid growing crops for digesters.

There is scope to increase carbon capture and storage through improving the management of arable soil.

A robust nature recovery network will help farming to adapt and become more resilient to the effects of climate change. For example taller hedges and open growth hedgerow trees will provide shade for livestock during hotter dryer summers. A healthy natural environment also helps communities adapt to climate change. Street trees and shaded green spaces provide shade and the health benefits of accessing greenspace make individuals more resilient to temperature extremes.

Flooding is predicted to increase as a result of climate change and there is a lot of potential in taking a nature based solutions approach to flood control. River restoration works can simultaneously address multiple issues including nature recovery, water quality, flood management, carbon sequestration and quiet recreation. How this can be done is explored further in section 6.4.

3.2.2. Health and wellbeing

The mental and physical health benefits of accessing greenspace (including rural natural areas and “bluespace” rivers and lakes) are increasingly understood as is the unequal access to greenspace

[2] Defined as grassland types: species rich limestone, wildflower rich lowland meadow, other neutral species rich and floodplain/marshy

with disadvantaged groups and communities facing particular barriers. These are also the very groups and communities who accrue the greatest health benefits from such access.[3]

There are significant numbers of people living within the vicinity of the Cotswolds who do not realise the mental and physical health benefits of accessing this landscape. The Cotswolds is surrounded by urban communities on all sides including: Birmingham, Cheltenham, Gloucester, Bristol, Bath, Swindon, Oxford and Banbury. According to the 2011 census there are over 2,400,000 people living within these communities of which over 800,000 are in the top 20% of the indices of multiple deprivation and nearly 500,000 in the top 10%[4] (Appendix 7.4). There are also people within the National Landscape who would benefit from improved access as there is hidden deprivation and issues of social isolation. People living in villages and small rural towns, particularly those with no gardens can face issues accessing good quality greenspace.

The potential for broadening engagement in this high quality landscape is enormous as are the individual and societal benefits, including savings to the National Health Service. It is estimated that nationally, universal access to good-quality greenspace would save the NHS £2.1 billion a year[5]. Much of the Cotswolds is remote with few facilities and can only be reached by car. Broadening engagement will require investment, proactive project work and wider changes such as improved public transport links.

Actively engaged populations in and surrounding the Cotswolds are essential to the recovery of nature throughout the area. Their support is critical in securing the policy and financial measures required as well as through helping to directly deliver nature recovery through volunteering.

3.3. Opportunities for recovering or enhancing wildlife

3.3.1. Habitat mosaics

Although the tremendous scope for recovering or enhancing wildlife offered by habitats in the Cotswolds is described within their own chapters it is when they are combined in a dynamic mosaic rich in marginal habitats that they best support nature recovery. The steeper slopes of the scarp and valley sides are already rich in limestone grassland and woodland and are particularly well suited to the creation of mosaics based on these habitats. The high wold could contain large areas of new extensively grazed mosaic where there is considerable scope to explore combining trees and wildflower grassland in new “wood pastures”. There is a spectrum with more heavily grazed open areas at one end and very lightly grazed more wooded areas at the other and many stages in-between. Management can aim to provide a variety of conditions that fit into the landscape. Linear wetland and wet grassland mosaics reconnected to the rivers could be developed in the river valleys.

The terms “wilding” and “rewilding” have deliberately been avoided throughout this plan as to many they can be confused with abandonment. This plan does however actively promote the development of large areas of extensively grazed and diverse habitat where natural processes are allowed to take place. This is a form of land management that is not neglect but is within the rewilding spectrum.

[3] Improving access to greenspace. A new review for 2020. Public Health England 2020
[4] Based on the 2015 index of multiple deprivation data release
[5] An estimate of the value and cost effectiveness of the expanded Walking the Way to Health Initiative scheme. Natural England 2009.

3.3.2. Integrating species into habitat management

The measure of successful nature recovery will be an increase in the abundance and distribution of species. This applies to both the widespread and common species but also those characteristic of the Cotswolds that will make the most significant contribution to nature recovery nationally. A habitat led approach to nature restoration needs to both include measures for priority species and to consider species in habitat based decision making.

Achieving the recovery of species using a habitat led approach can often be more complicated than simply creating more habitat. Issues of how to increase the reproductive success of small, isolated populations are compounded by a lack of knowledge of where all populations are and the resources they need in order to survive, reproduce and spread. Species requirements are often complex for example foraging areas and requirements can vary from breeding areas and both can vary throughout the seasons.

Much species information is available that can be used to inform what the most valuable wildlife gains might be from emerging habitat creation opportunities. The flora and fauna of the Cotswolds is well known, having been studied by local naturalists for many years. Some species have already been the subject of species-led conservation efforts such as the recent Back from the Brink project and summary sheets for these species can be found here. (Insert link to appropriate new CNL nature recovery webpage &/or Butterfly Conservation website)

Different species will respond over different timescales and geographical scales. For instance, by 2030, significantly greater increases in populations of rare, and very sedentary species such as Adders may have been achieved by smaller scale, more intensive habitat management options, building on increasing their known distribution at certain locations. Whereas Brown hares or farmland birds may have responded more quickly to larger-scale, widespread interventions reflecting their wider-ranging behaviour and more widespread distributions.

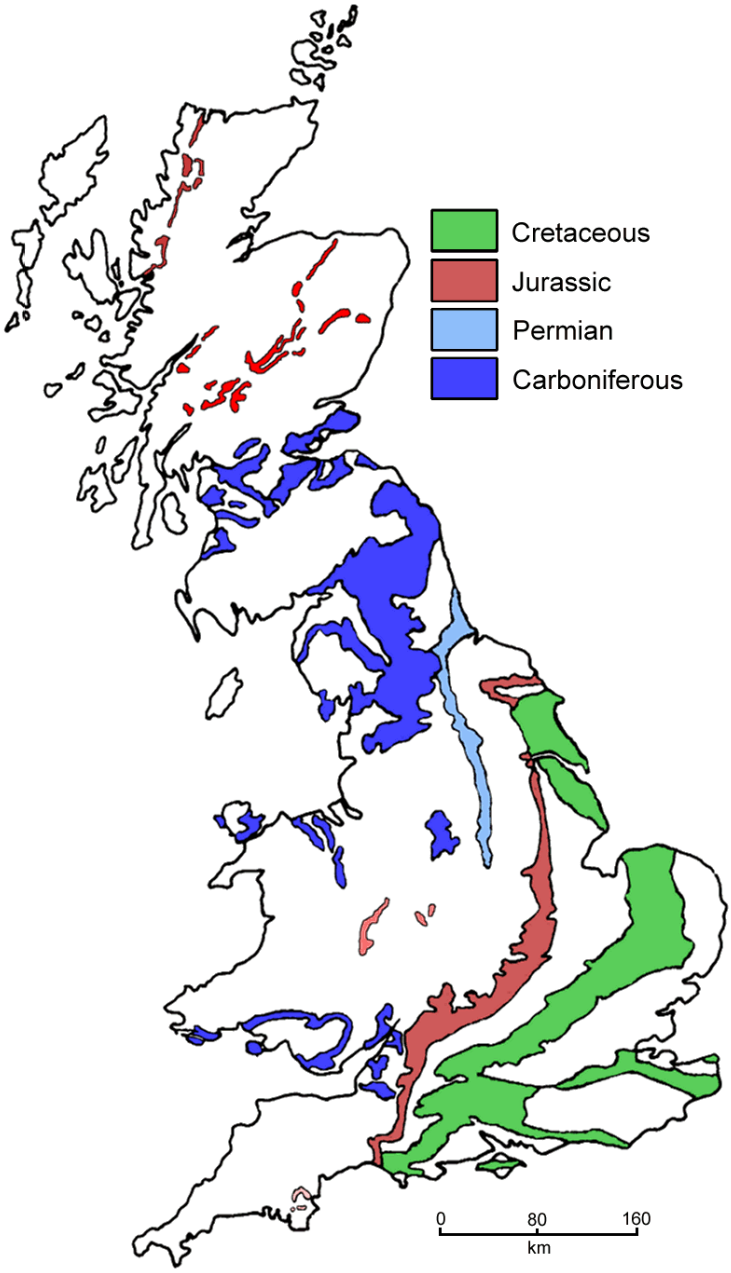
3.4. Connections with and through surrounding landscapes

3.4.1. The Cotswold's wider context

National protected landscapes have to look across their boundaries to understand and develop the links with surrounding landscapes in exactly the same way that land managers such as farmers and nature reserve managers have to. As wildlife moves northwards to a new climate space where will it be coming from and where will it go? Most importantly, does it have the connected nature recovery network across our boundaries that it needs?

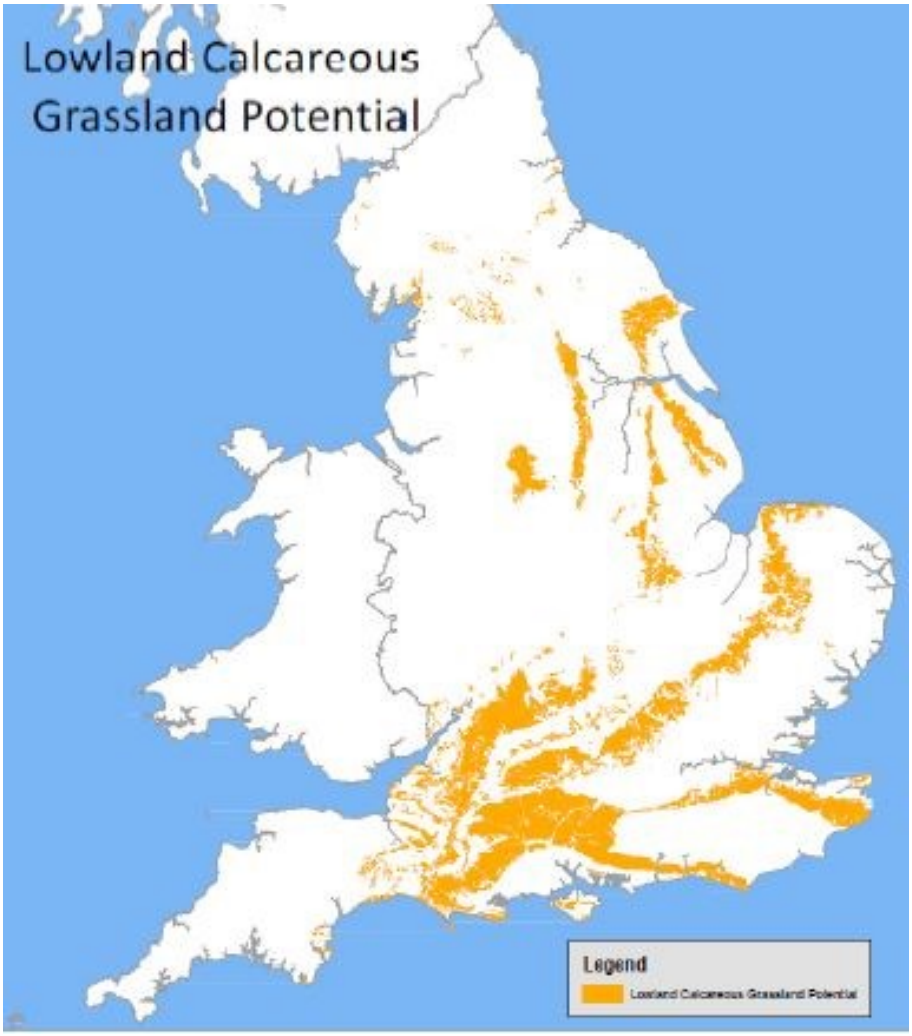
This bigger perspective both helps us appreciate the true significance of nature recovery work within the Cotswolds and to identify the key linking or "bridging areas" with neighbouring calcareous landscapes.

The UK geological map shows us the distribution of the Cretaceous chalk and Jurassic limestone bedrocks amongst others that heavily influence the habitats of calcareous landscapes.



Using lowland calcareous grassland as a proxy for a range of calcareous habitats (it is the only widely distributed and surveyed habitat that is restricted to calcareous landscapes) we can gain a better understanding of the habitat links to and from the Cotswolds.

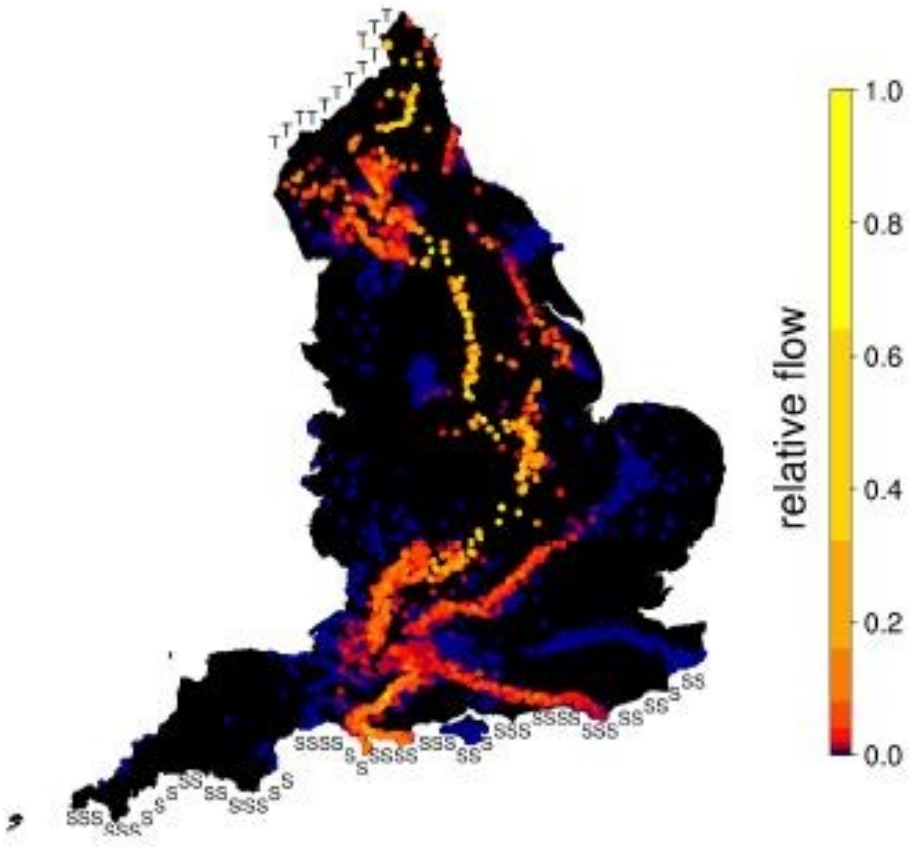
Natural England have produced habitat potential maps which show areas where appropriate conditions exist to support the creation of habitat, i.e. the area has qualities relating to a particular habitat that suggest that creation and/or restoration is likely to be successful. Habitat potential is assessed through the identification of physical conditions, often soil type, that support the creation of particular habitats.



Habitat Potential Map for Calcareous Grassland. © Natural England 2019. Soils Data © Cranfield University (NSRI) and for the Controller of HMSO 2019. © Crown Copyright and database rights 2019. Ordnance Survey 100022021.[6]

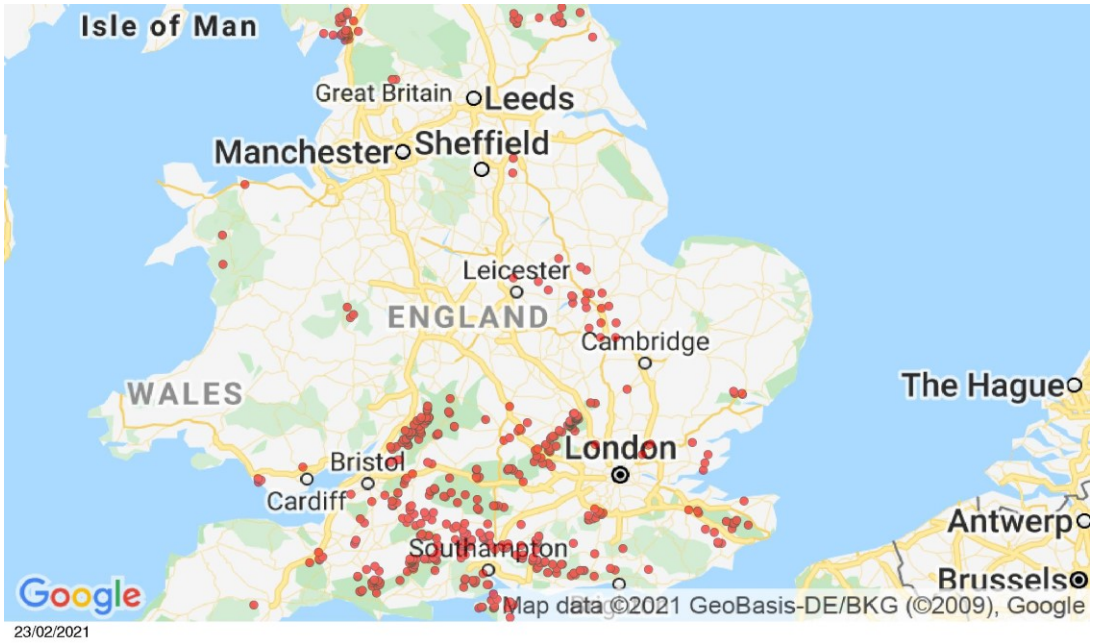
***"Condatis*[26]:** (Hodgson *et al*. 2012) is a decision support tool that helps identify the best locations for habitat creation to increase connectivity across landscapes. Condatis is based on the analogy of electrical circuit boards (wires and resistors) as a way to represent landscapes and model the way a species moves through them. The ability of species (the electrical current) to move through the landscape (the circuit board) varies depending on the configuration of the habitat patches (the wires and resistors). The tool uses a source/destination approach that replicates the movement of a species across latitudes or altitudes in response to climate change."[7]

[6] Nature Networks evidence handbook. Natural England. Page 55
[7] Nature Networks Evidence Handbook. Natural England. Page 65



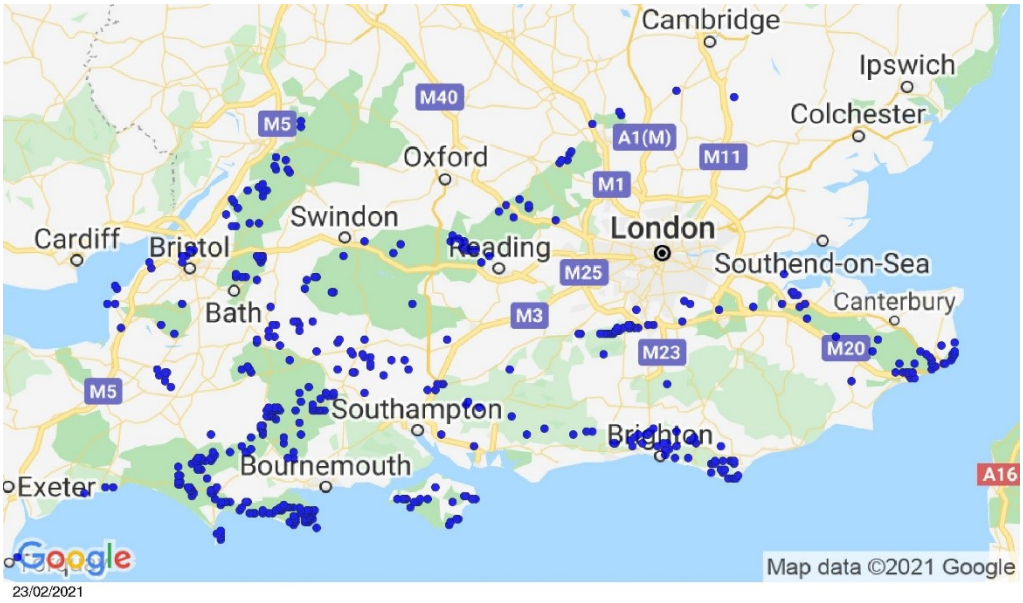
Flow output from Condatis for Lowland Chalk Grassland Habitat using a 4 km dispersal distance with the source defined as the south coast of England (S) and the destination the border between England and Scotland (T), using only priority habitat data for England (Source: Alison et al. 2018). © Natural England 2019. Map produced using Condatis (Wallis, D.W. & Hodgson, J.A. (2018) Condatis 0.6.0. http://wordpress.condatis.org.uk/). Contains public sector information licensed under the Open Government Licence v3.0.

The distribution of selected species can also provide an insight into the larger picture. The Duke of Burgundy butterfly is not a calcareous specialist but it is a species of marginal grassland and open woodland habitats requiring large cowslip or primrose leaves for egg laying that have grown in partial shade. It demonstrates the importance of the calcareous landscapes and the links between them to species with diverse habitat requirements.



Duke of Burgundy butterfly distribution, source: National Biodiversity Network Atlas, February 2021.

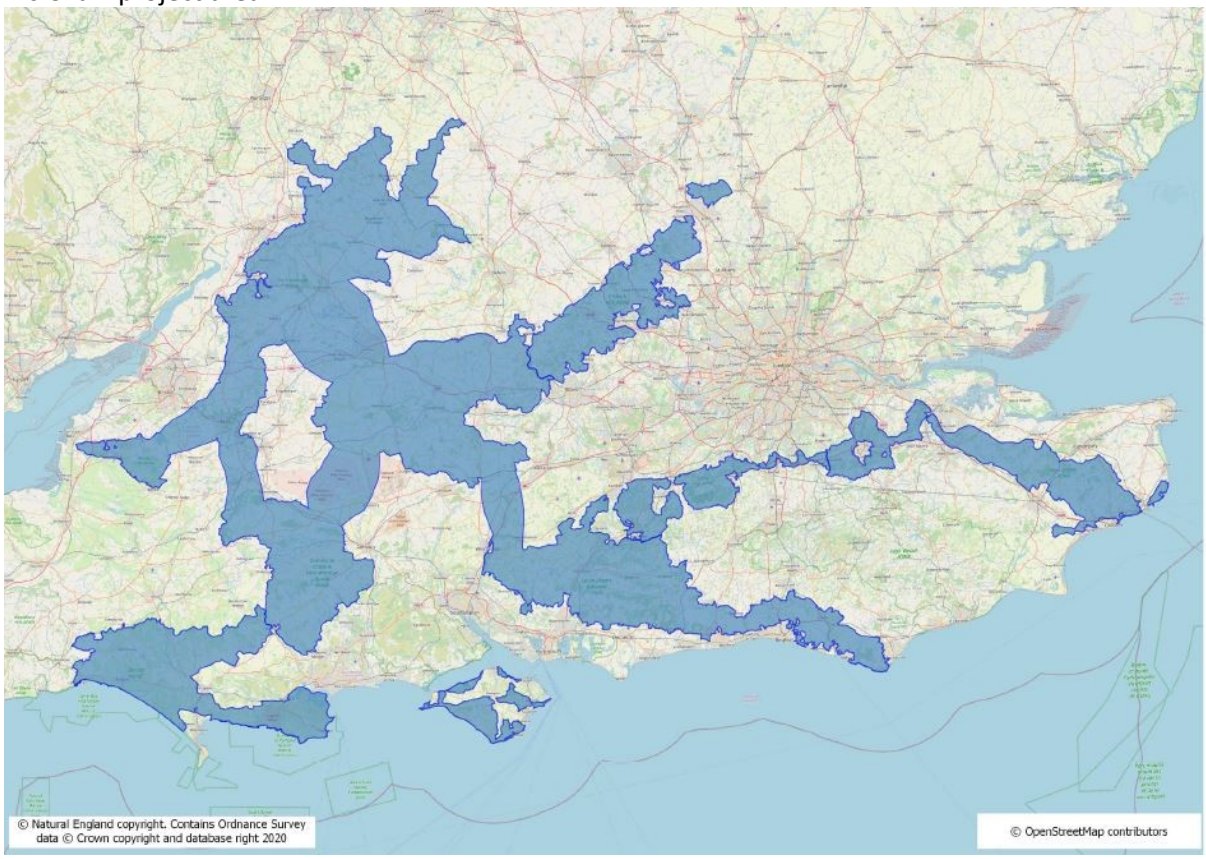
The Adonis blue butterfly is a calcareous grassland specialist even relying on an association with a calcareous species of ant for its larvae to overwinter. It has extended its range northwards and is occupying a wider range of sward heights and aspects in recent years as a result of climate change



Adonis blue butterfly distribution, source: National Biodiversity Network Atlas, February 2021.

The Big Chalk programme is a coming together of all the calcareous (chalk and limestone) protected landscapes across southern England. They believe that together and when combined with “bridging areas” that link them they offer the best opportunity to help nature recover and adapt to climate change offered by the English landscape. This is a result of the exceptional species richness of calcareous habitats combined with their collective geographical reach.

Bic Chalk project area.



The bridging areas in this map are tentative and have not been formally defined.

3.4.2. Identified bridging areas

The Big Chalk project has identified three bridging areas for the Cotswolds.

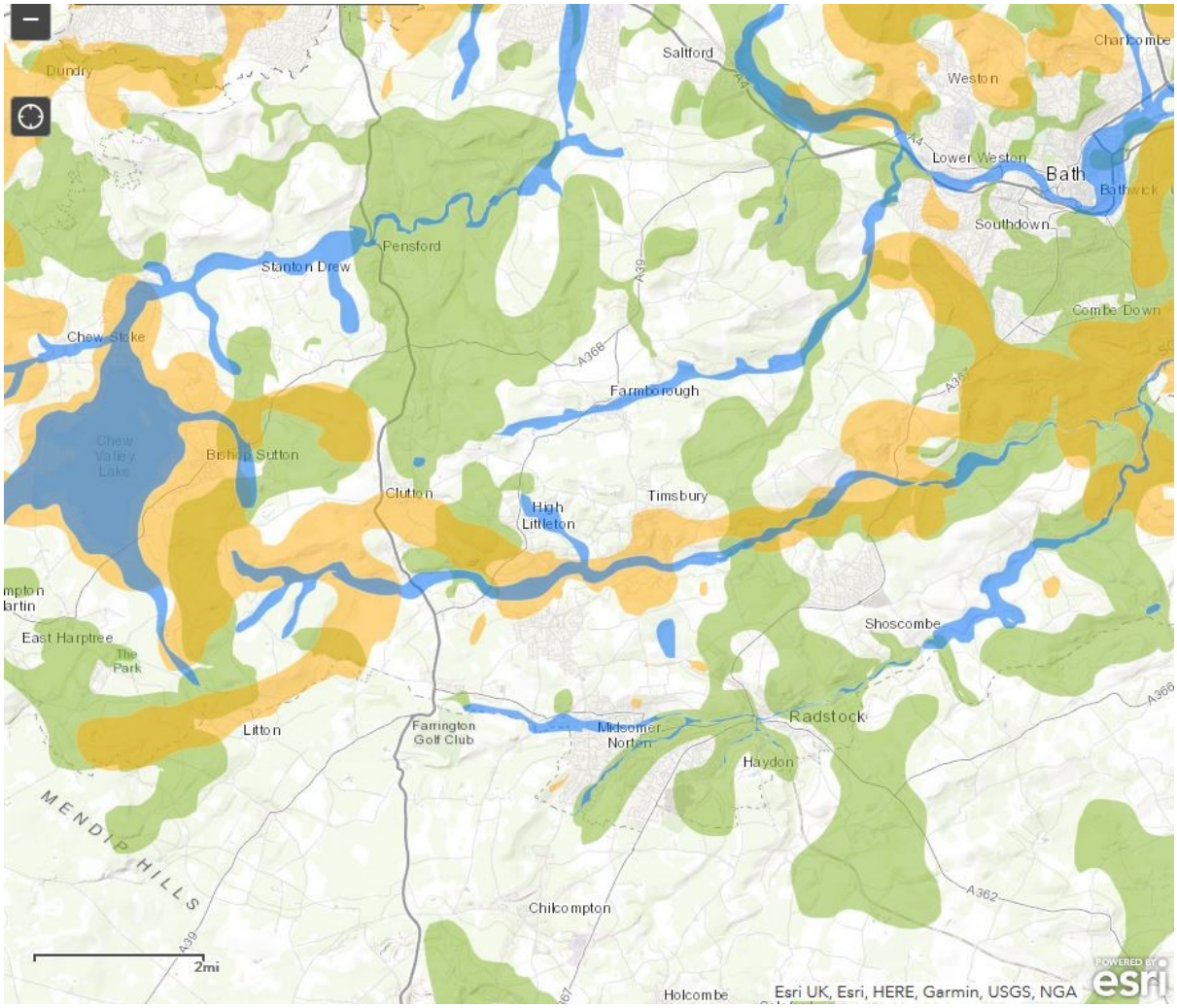
Cotswolds to Mendips bridging area
The proximity of these two national landscapes and the good existing links between them have long been recognised. The Bath and North East Somerset Council's Green Infrastructure Strategy (2013) identifies an "AONB Linkway" as an emerging project. It states:

"To some extent these two AONBs are linked naturally by existing east west river corridors of the Wellow and Cam. In terms of recreation and active access they are connected by the Limestone Link."

This area is also included in the West of England Nature Recovery Network Prospectus: and is one of the seven strategic green infrastructure projects in the region (which stem from the West of England Joint Green Infrastructure Strategy.)

The Nature Recovery Network Map[8] developed by the West of England Local Nature Partnership also recognises the importance of this bridging area and shows a strategic grassland network corridor directly linking the two AONBs.

[8] https://www.wenp.org.uk/nature-recovery-network/#1559231675720-c429bd50-86ac



Strategic networks taken from the West of England Nature Partnership's Nature Recovery Network map. Blue = water, green = woodland, beige = grassland.

A working group of local stakeholders has been brought together by Natural England to develop project work aimed at further strengthening these links.

Cotswolds to North Wessex Downs bridging area

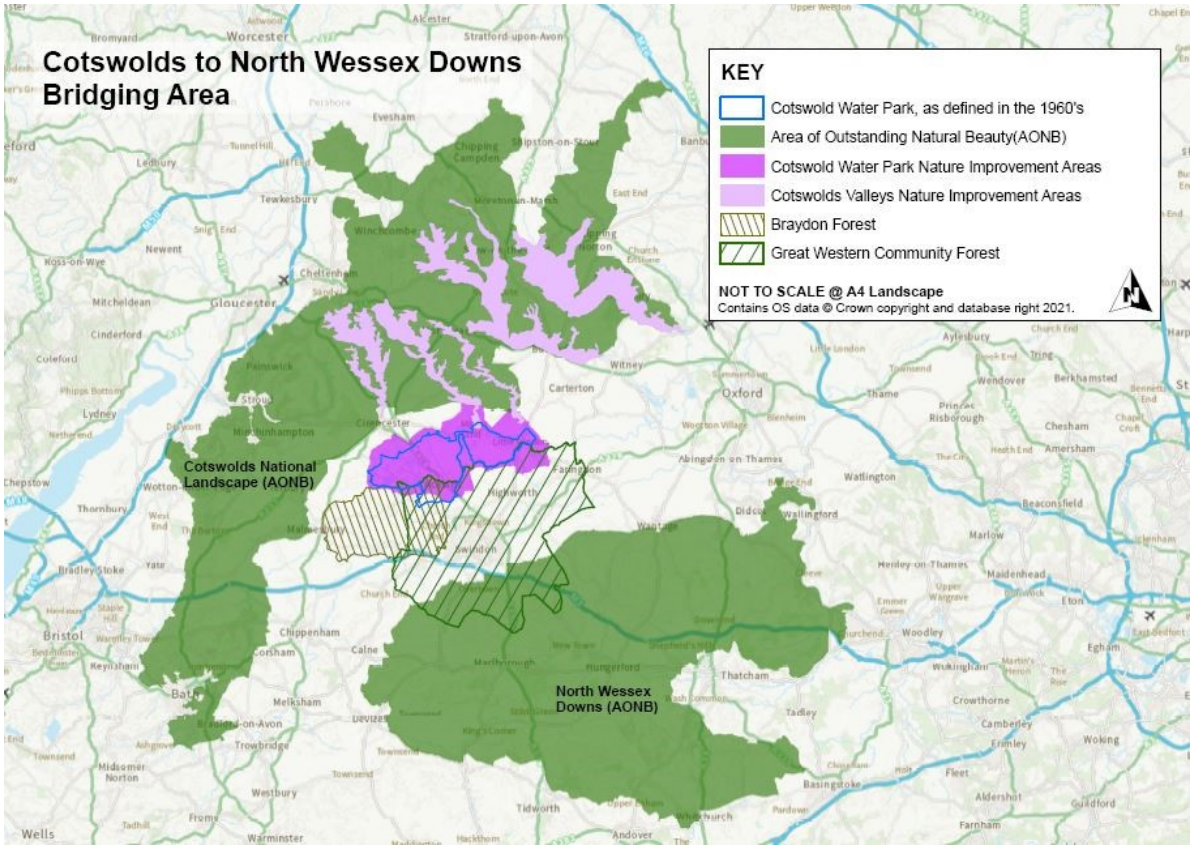
A strong link exists from the North Wessex Downs through Swindon and the Great Western Community Forest across Braydon Forest and the Cotswolds Water Park to join the Cotswolds in the Cirencester area. To the east of Swindon the Cotswolds and North Wessex Downs can be clearly seen from each other across the Vale of the White Horse which also links these two landscapes.

Swindon itself retains much ancient woodland and wildflower meadows which is unusual in an urban setting. As a result of a "green fingers" policy dating back to the 1930s followed by a long standing green infrastructure approach to development it has an exceptionally well connected habitat network.[9] The town and its surroundings have also seen a great deal of habitat creation over recent decades through the Great Western Community Forest. A "Forest Meadows Project" is currently running which seeks to create, restore, enhance, and better manage up to 170 hectares of meadows, grasslands and associated habitats within the Community Forest.

[9] Swindon's Urban Area Landscape-scale Conservation Framework. Wiltshire Wildlife Trust, Wiltshire Council & Swindon Borough Council. 2013

Braydon Forest is a long recognised ecological hot spot and has been the focus of countryside management and ecological restoration projects since the late 1980s. It is a landscape with a high density of hedgerows, ancient woodlands and wildflower meadows. It includes some of the most important lowland grassland sites in the country including the North Meadow and Clattinger Farm SAC as it merges into the Water Park on the Thames gravels.

The Cotswolds Water Park and Cotswolds National Landscape have strong ecological links. This is illustrated by the Nature Improvement Areas (NIAs) for both areas. The Cotswolds valleys NIA crosses the National Landscape boundary to join the Cotswolds Water Park NIA. Both areas also join through Cirencester linking with the north and south of the town respectively. These links are based on similar habitats as they reflect river valleys joining with the plain of the upper Thames gravels. The Cotswolds Water Park is also publishing a Nature Recovery Plan the production of which has been coordinated with this plan to ensure alignment. This collaboration will continue into delivery.



Cotswolds to West Wiltshire Downs bridging area

This is a complex and habitat rich area, illustrated by the fact that up to six Natural Character Areas meet there. The three that cover most of this area are: the Cotswolds (NCA 107) the Mendips (NCA 141) and Blackmore Vale and the Vale of Wardour (NCA 133). All of these include limestone areas rich in calcareous habitats making for strong ecological links. There doesn't appear to be a specific project looking at this area at the moment.

Links to the North and West

The mapping above indicates the importance of the nature recovery network running in a north easterly direction from the north of the Cotswolds to join the calcareous landscapes running further north. This bridging area has not received the attention of those associated with the Big Chalk

project and is a priority for further development. Links across the Severn Vale and beyond towards the Wye Valley AONB based primarily on a woodland habitat network are also important and need further consideration and development.

An important local link based on the Carrant Valley joining Bredon Hill to the Cotswolds scarp has long been recognised within the Cotswolds Scarp Nature Improvement Area (Appendix 7.7.1) and is the subject of a proactive conservation project the Carrant Catchment Area Restoration Project (CCARP) (Appendix 7.7.2)

4. Policy

4.1. Desirable outcomes for nature – broad policy statements

4.1.1. Farming and land management

Farmers and local communities are inspired and actively engaged in nature recovery. They adopt a farmer led approach to nature recovery they find new ways of working together. Farm and other businesses and livelihoods are protected and new ones created and sustained through environmental schemes, sustainable farming practices and visitor/tourism enterprises

Land Management addresses climate change adaptation and mitigation and the delivery of ecosystem services through nature based solutions. Carbon is captured and stored in undisturbed wetland, woodland and grassland soils, and arable soils are better managed to store carbon. The Cotswolds provides good quality water and natural flood management for communities downstream

Nature recovery is undertaken in accordance with the Cotswolds Area of Outstanding Nature Beauty Management Plan[10] and associated guidance including the Landscape Strategy and Guidelines[11]

4.1.2. Habitats

Habitat management, restoration and creation is undertaken in accordance with the Lawton principles of more, bigger, better and joined (Appendix 7.1). Practitioners consider how wildlife moves around and how their work contributes to a wider nature recovery network at all scales from individual sites to whole landscapes.

Irrespective of the habitats being managed or restored, marginal habitats are included. Woodland edge, scrub in grasslands and waters edge can all be particularly valuable.

“Scruffy” habitats are not only tolerated but valued for the variety of wildlife they house.

The distinction between woodland, scrub and grassland is blurred through the creation of new extensively grazed dynamic habitat mosaics.

The creation of new woods extends and connects woodland habitats whilst avoiding replacing other important habitats particularly flower rich grasslands. Sites where new woodland creation would

[10] Cotswolds Area of Outstanding Nature Beauty Management Plan 2018-2023. Cotswolds Conservation Board. 2018.
[11] Cotswolds AONB Landscape Strategy and Guidelines. Cotswolds Conservation Board 2016.

damage the potential for improving connectivity between existing flower rich grasslands or sensitive species such as corn bunting are also avoided.

Sites of geological importance are preserved to retain their inherent scientific value and maintained so that their educational and aesthetic value can be exploited, whilst also supporting the specialist flora and fauna found on them.

4.1.3. Species

There is a focus on the management of habitats to achieve the best outcomes for nature recovery and individual measures for important species and species assemblages are integrated into this.

Assisted migration is implemented where natural dispersal is not sufficient. Reintroductions are planned in accordance with the International Union for the Conservation of Nature guidelines.

Indicator species are the tools that measure and explain ecological recovery in a way that is meaningful to the public and all stakeholders. Expansion in species' range and abundance are the tangible proof of nature's recovery. Expansions in range and abundance are simple measures accessible to all. This information is recorded by a wide range of people including well supported volunteers.

4.1.4. People

A wide range of people contribute directly to nature's recovery through conservation volunteering. This occurs both within communities on local public sites and further afield through managed species and habitat focussed programmes.

All people living in and around the Cotswolds can access the mental and physical health and wellbeing benefits gained by experiencing the area's nature. People facing barriers to doing this are supported to overcome those barriers. People are informed as to how to visit wildlife rich locations without causing harm and physical access infrastructure is in good condition and well maintained.

There is a widespread culture where people feel connected to nature, including through recreation, education and rural livelihoods and as a result are willing to contribute to its recovery.

4.2. Nature conservation priorities statement

As this is a nature recovery plan these priorities are set from the perspective of achieving the recovery of our wild species and habitats in a protected landscape. Consequently landscape features that deliver valuable ecosystem services but fail to go that extra mile to also deliver benefits for wildlife are prioritised accordingly. This is a deliberate choice to promote the idea that new measures delivering ecosystem services should also be designed to benefit wildlife from the outset.

4.2.1. Priority habitats

Highest priority
Habitats within the Cotswolds where their extent is recognised as being of international importance for example through the designation of Special Areas of Conservation.

- Veteran trees for their deadwood invertebrates.

- Ancient woodlands, particularly the beech woods for their exceptional flora and the restoration of ancient woodland from plantations on ancient woodland sites.

- Ancient unimproved limestone grassland for their exceptional flora and invertebrate assemblages.

High priority
Habitats or components of habitats where the Cotswolds extent is recognised as being of national importance.

- Woodland edge and/or scrub ecotone, hedgerows and hedgerow and field trees for their resident species and/or species that use them for migration or overwintering.

- Long Established Woodland' (growing since 1840[12]) for their structural diversity and long continuity of habitat.

- Scrub and scrub edge habitats associated and in balance with ancient unimproved limestone grassland for their resident species and species that use them for migration or overwintering.

- Areas of thin soils, rocky areas, disturbed ground and drystone walls for their specialised flora and fauna.

- Ancient wildflower rich neutral grasslands particularly ancient wildflower rich floodplain meadows.

- Arable fields containing measures that support existing populations of important arable plants and farmland birds

- New large extensively grazed areas that include wildflower grassland and other habitats within a dynamic matrix that allows natural processes to take place.

Medium priority
Locally important habitats that make a significant contribution to the nature recovery network

- Wetland habitats including wet woodlands

- Secondary woodland including recently established or planted woodlands where they have a varied physical structure and/or contribute towards ecological connectivity. They can also improve over time with creative design and positive management.

- Restored or recreated wildflower rich grasslands that improve ecological connectivity between existing sites.

- Arable fields with managed wildflower rich margins and wildflower rich arable lays particularly where they improve ecological connectivity.

[12] England Trees Action Plan, UK Government, May 2021.

Currently low priority
Habitats that deliver ecosystem services but currently make a limited contribution to the nature recovery network. These are habitats with the potential to be improved from a nature recovery perspective which would increase their priority.

- New woodland planting that currently lacks physical and /or species variety and/or is not located so as to improve ecological connectivity.

- Agriculturally "improved" species poor grasslands. Such grasslands have the potential to become wildflower rich.

- Arable fields with no in-field measures for target species and/or no margins or margins containing few wildflower species.

4.2.2. Priority species

Locally significant species have been mentioned throughout this plan to support or illustrate a variety of points. These tend to be visible and well known species, usually plants, birds and butterflies. It is important to recognise that there are hosts of equally important but less well known species particularly but not exclusively invertebrates and fungi that face the same issues and will benefit from the same measures as the better known species.

There are a number of existing lists that indicate the importance of individual species found in the Cotswolds.

- National lists. Species of principal importance listed in section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 and the "Red Lists" drawn up using guidelines developed by the International Union for Conservation of Nature (IUCN).
- Priority species identified in the AONB Management Plan 2018-2023
- Species identified within nationally important assemblages such as Important Plant Area or Farmland Bird Target Areas.
- Target species identified from the Back from the Brink programme.
- Cotswolds Key Indicator Species identified through earlier work.

The national lists are more fully described in appendix 7.5.2. The local lists are outlined below and all of the lists have been compiled into a single searchable spreadsheet which can be downloaded here (insert link to appropriate new CNL nature recovery webpage)

Highest priority

Species identified within the Cotswolds Management Plan

The priority species identified in the AONB Management Plan 2018-2023 are the highest priority species for conservation action within the Cotswolds. These are species which are considered to be both characteristic of the Cotswolds and species for which the Cotswolds is considered to be a stronghold. This list undergoes interrogation on five-yearly cycles with each management plan revision. These species are

Farmland birds such as skylark,	Water vole	Bath asparagus
Lapwing and corn bunting	Brown hare	Common box
Pearl-bordered fritillary	Limestone grassland	Rockrose pot beetle

Arable plants	butterflies	Rugged oil beetle
Juniper	Marsh fritillary	Ancient woodland ground flora such as helleborines and angular Solomon's seal
Cotswold pennycress	Violet click beetle	
Bats	White clawed crayfish	
Dormouse	Native brown trout	

Key species identified for this Cotswolds Nature recovery Plan

All the lists above were compared against the following criteria to identify "key species" for this plan. These are a small number of species that are well suited to both demonstrating progress through conservation action and engaging key audiences. This broader range of criteria has produced a list that is different to the AONB Management Plan and others. This process inevitably included a subjective element. Key Cotswolds species are species which are:

- In need of conservation effort. Considered to be critically endangered, endangered or vulnerable
- Actionable – able to respond to achievable conservation action on the ground
- Characteristic/representative of an important habitat either individually or as part of an associated assemblage of species
- Flagship – popular or iconic, able to act as a champion for a key habitat
- Recordable – suitable for the public to identify, useful for citizen science
- Indicator – liable to reflect environmental changes across the landscape

The key species identified are:

Adder	Cotswold pennycress	Pasqueflower
Brown hare	Duke of burgundy butterfly	Small-leaved lime
Corn bunting	Juniper	

High priority

"Species of principal importance for the conservation of biodiversity in England" listed in section 41 of the Natural Environment and Rural Communities (NERC) Act 2006

A subset of these species are the primary species identified for action by the Back from the Brink Limestone's Living Legacy project. Completing in 2021 - Back from the Brink was a national programme with funding from the National Lottery Heritage Fund. It aimed to ensure the recovery of 20 species nationally. The primary species for the Limestone's Living Legacy project each have a summary sheet produced by the project which can be downloaded here (insert link to appropriate new CNL nature recovery webpage). They are:

Basil thyme	Grey long-eared bat	Pasqueflower
Cotswold pennycress	Juniper	Purple milk vetch
Duke of burgundy	Large blue	Red-shanked bumblebee
Fly orchid	Large garden bumblebee	Rockrose pot-beetle
Greater horseshoe bat	Marsh fritillary	Rugged oil beetle

Species that have an important ecological effect or are a part of an important habitat are also of a high priority. A full list has not been developed but examples include yellow rattle, important for assisting grassland wildflowers by supressing vigorous grasses as a parasite and devils-bit scabious

which is important as the larval food plant for the marsh fritillary butterfly and a late season nectar source for many invertebrates.

Medium priority

Widespread and common species that are not part of an important habitat. These species are still an important component of a nature recovery network. There are too many to list but an example is the many common invertebrates that provide pollinating services and/or are important food source for insectivorous birds.

Low priority

There are no low priority species within an ecosystem.

5. Delivery

5.1. Quantitative targets for recovering and enhancing wildlife

5.1.1. Existing national and local targets

A wide range of organisations at different levels have made policy statements concerning the creation or restoration of habitats. Below is a selection of current targets that involve at least a part of the Cotswolds. Inclusion in this list does not necessarily mean that the Cotswolds National Landscape or the Cotswolds Nature Recovery Forum supports the statement.

Scientific Literature

- The area of suitable semi-natural habitat at which the ecological connectivity of a network in a landscape changes from unconnected to sufficiently connected is commonly reported as 30%.[13]
- A paper in the Journal of Applied Ecology published under 22 names from 19 academic institutions, includes a potential target for AONB and National Parks to have high quality semi-natural habitat coverage of over 40% of their area. [14]

UK Government

- Creating or restoring 500,000 Ha of habitat in England by 2042[15]
- The Government has a national aspiration to increase England's woodland cover to 12% by 2060 which it published in its 25 Year Environment Plan in 2018.
- Protect at least 30% of land by 2030 to support the recovery of nature. The government is counting the entire area of the Cotswolds National Landscape as contributing towards this target[16]

[13] Stand-alone summary primer for the rebuilding biodiversity methodology South West Biodiversity Partnership. Henrik. A. Oikos 1994 Effects of Habitat Fragmentation on Birds and Mammals in Landscapes with Different Proportions of Suitable Habitat: A Review.

[14] Defining and delivering resilient ecological networks: Nature Conservation in England. Isaac. N.J. et al 2017. Journal of Applied Ecology

[15] A Green Future: Our 25 Year Plan to Improve the Environment. HM Government. 2018

[16] Government press release 28 September 2021

- The 25 Year Environment Plan has a target of improving at least 75% of our waters to be close to their natural state, based on the water body status objectives in the current (2015) river basin management plans (75% of surface water bodies have an objective of reaching good ecological status).

Natural England – Definition of Favourable Conservation Status for Lowland Calcareous Grassland.

- "Favourable status will require an increase in the current extent of the habitat by 149,000 Ha (c. 390 % above baseline of c. 38,687 Ha)." The nearest actual whole % to give 149,000 Ha is 385% giving 148,945 Ha. Applying the same increase to the Cotswolds extent of 3,031 Ha (AONB natural capital dashboard) gives a figure of 11,668 additional hectares of lowland calcareous grassland to achieve favourable conservation status.

National Association for AONBs – the Colchester Declaration

- By 2030, that at least 100,000 Ha of wildlife-rich habitat outside of protected sites will have been created/restored. This is equivalent to 2,174 Ha per AONB though as the Cotswolds is the largest AONB it should have a bigger target.
- AONBs are committed to creating 36,000 Ha of new woodland by 2030

Gloucestershire Local Nature Partnership[17]

- 20% tree and Woodland Cover across Gloucestershire. For Cotswold District this means an additional 6,600 Ha and 2,607 Ha for Stroud.

Stroud District Council [18]

- A doubling of the area of 'natural' habitats from 11% land cover to 22% by 2030
- 20% woodland cover (doubling of current 10%) by 2030

Cotswold District Council[19]

- Promote tree/woodland planting and re-wilding… in line with the Gloucestershire Local Nature Partnership Gloucestershire Tree Strategy.

West of England (Local Authorities and the West of England Nature Partnership[20])

- Create 5,108 Ha of wildlife-rich habitat outside the protected site network by 2043
- Double semi-natural tree and woodland cover, including open wooded landscape and mosiac habitats by 2050
- Close the connectivity gaps with 580 Ha of new native woodland and 660 Ha of new species-rich grassland by 2050
- Double the amount of land managed for environmental gain from 2018 levels by 2050

Oxfordshire's Nature Recovery Network[21]

- Double the area of land well-managed for nature in the County by 2050.

[17] Gloucestershire Tree Strategy. Gloucestershire Local Nature Partnership 2020.
[18] The 2030 Strategy Master Plan… Draft for Consultation. Stroud District Council 2020.
[19] Ecological Emergency Action Plan. Cotswold District Council 2020.
[20] Towards a Nature Recovery Network for the West of England A Methodology. West of England Nature Partnership 2019. & The Forest of Avon Plan: A Tree and Woodland Strategy for the West of England 2021.
[21] Non-technical summary of the Nature Recovery Network for Oxfordshire. Wild Oxfordshire et al. 2019.

5.1.2. Cotswolds target habitat extents (2050).

Even if achieved these targets for additional areas of habitat will only support the recovery of nature if they are located in the best places to do so. It is important to refer to the nature recovery maps listed in section 5.2

	Current Extent					Additional Habitat and % increase					New Total				
Habitat	Scarp and outliers	High wold and dip slope	River valleys	Cotswolds National Landscape	% of area of Cotswolds National Landscape	Scarp and outliers	High wold and dip slope	River valleys	Cotswolds National Landscape	%	Scarp and outliers	High wold and dip slope	River valleys	Cotswolds National Landscape	% of area of Cotswolds National Landscape
Arable in government environmental schemes Inc. SFI	3,541	17,609	16,892	38,041	19	11,681	25,654	31,705	69,039	181	15,222	43,263	48,596	107,081	53
Grassland Species-rich limestone inc. recent	454	2,257	320	3,031	1	1,748	8,688	1,232	11,668	385	2,202	10,945	1,552	14,699	7
Grassland other species rich inc. recent	500	226	2,265	2,991	1	974	441	4,417	5,832	195	1,474	666	6,683	8,823	4
Waterbodies	4	0	308	312	0	0	0	0	0	0	4	0	308	312	0
Wetlands	4	1	324	329	0	18	4	1,622	1,645	500	22	5	1,946	1,974	1
Hedgerows	1,517	1,327	3,528	6,372	3	152	133	353	637	10	1,669	1,460	3,881	7,010	3
Mixed grassland and tree/shrub habitats	2,929	1,887	5,571	10,387	5	2,929	1,887	5,571	10,387	100	5,858	3,773	11,142	20,773	10
Woodland	5,574	6,263	12,586	24,422	12	948	1,065	2,140	4,152	17	6,521	7,327	14,725	28,573	14
Total excluding arable with environmental options	10,981	11,960	24,903	47,844	23	6,768	12,216	15,335	34,321		17,749	24,176	40,238	82,164	40
Total including arable with environmental options	14,521	29,569	41,795	85,885	42	18,449	37,871	47,040	103,360		32,971	67,439	88,835	189,245	93

All area units are hectares

Habitat definitions.

Habitats selected from the natural capital evaluation of the Cotswolds 2021 dashboard to define the broad habitats in the table. *(Insert link to appropriate new CNL nature recovery webpage).*

- Arable current extent: arable with agri-environment schemes and field boundaries. Arable new extent: all arable classes, arable grass rotation, intensive, low intensity and with agri-env schemes and field boundaries.
- Grassland other species rich including recent: wildflower rich lowland meadow and neutral species rich including recent.
- Wetlands: grassland - floodplain/marshy and fen + new wetlands and braided rivers.
- Mixed grassland and tree habitats: mosaic, scattered trees, scrub, traditional orchards wood pasture and parkland
- Woodland: ancient, semi-natural, broadleaved not ancient, coniferous, felled mixed and newly planted

How the figures have been arrived at and comparison with existing targets.

The current extent figures were taken from the Natural Capital Evaluation of the Cotswolds 2021 dashboard *(Insert link to appropriate new CNL nature recovery webpage).* Some of the target figures were derived from national information where it had a rational and scientific basis.

The woodland cover in the Cotswolds already matches or exceeds the government's aspiration to achieve 12% woodland cover in England by 2060 depending on the definition of woodland used. However this target is about an additional increase in woodland cover and can inform a figure for the Cotswolds by allocating a share of the additional land required to achieve it across England.

The current woodland cover of England is 10% so a 2% increase is required. The area of England is 13,027,900 Ha and 2% of that is 260,550 Ha. That equates to an increase of 0.02 Ha per Ha of England (260,550 ÷ 13,027,900). That figure applied to the 203,805 Ha of the Cotswolds is 4,076 Ha. The nearest full % increase for use in the table is 17% giving a slightly higher figure. This figure is based on the premise that the Cotswolds will deliver its portion of the national target despite its already relatively high levels of woodland cover and other landscape and ecological constraints.

The woodland figures in this plan vary from some other sources because pasture woodland and similar partly wooded mosiac habitats have been allocated to their own separate category of habitat. This is deliberate in order to value and promote mosiac habitats but it also needs to be born in mind when comparing the targets in this plan to partner's targets. As this plan has a strong emphasis on promoting mosiac habitats it contains the target of doubling the extent of mixed grassland and tree/shrub habitats.

Using the narrow definition of woodland in this plan this target lifts the area of woodland in the Cotswolds from 12% to 14%. If combined with the figures for other partly wooded habitats (mosaic, scattered trees, scrub, traditional orchards wood pasture and parkland) the increase is from 17% to 24%. This is a level of tree planting/regeneration and woodland creation that with careful planning can both ensure a robust nature recovery network and be accommodated in the Cotswold landscape without unduly harming the areas distinctive character. For the purposes of this plan there is a strong preference for broadleaved planting rather than conifer though some conifers are used as nurses and mixed plantings will occur.

The only places in the country where lowland calcareous grassland can be restored are the lowland chalk and limestone landscapes. Consequently any national targets for these habitats have to be delivered in these landscapes. The increase in species rich limestone grassland is derived from the Natural England "Definition of favourable Conservation Status for Lowland Calcareous Grassland". It states that favourable status will require an increase in the current extent of the habitat by 149,000 Ha. This is 390 % above the current extent of 38,687 Ha. The nearest actual whole % to give 149,000ha is 385% giving 148,945 Ha. Applying the same increase to the Cotswolds current extent of 3,031 Ha gives a figure of 11,669 additional hectares of lowland calcareous grassland across the Cotswolds to achieve favourable conservation status.

The remaining figures were considered partly in comparison to the limestone grassland and woodland figures and also in the context of arriving at an overall area that will deliver a viable and connected nature recovery network. 30% of the area being suitable semi-natural habitat is the figure commonly reported in the literature at which the ecological connectivity of a network in a landscape

changes from unconnected to sufficiently connected[22]. Excluding arable areas in environmental schemes this plan is proposing the creation of over 34,000 Ha of new habitat raising the proportion of the Cotswolds National Landscape that is suitable semi-natural habitat from 23% to 40%. For further comparison a paper in the Journal of Applied Ecology[23] contains a potential target for AONB and National Parks to have high quality semi-natural habitat over 40% of their area. This is the area predicted to deliver more, bigger, better and joined wildlife sites and enhance network resilience in these landscapes. If arable fields within environmental schemes are included 93% of the Cotswolds would fall within the nature recovery network.

Other species rich grassland was allocated an increase half that of limestone grassland reflecting both the need to increase this habitat but also its lower priority locally compared to limestone grassland. The wetlands had the highest % increase by a large margin reflecting the low area of current habitat and the drive to create new multifunction wetlands in the river valleys.

The current extent of arable in government environment schemes was taken from the natural capital assessment dashboard which recorded arable fields containing options that would benefit biodiversity. The new total was based on all arable land as we should aim to have all arable land included in at least the Sustainable Farming Incentive scheme. A reduction was made to allow for the conversion of arable to other habitats. It was assumed that half of the area of other habitats would be taken from arable, the remainder being primarily from other grassland such as semi-improved grassland.

The increase in the extent of hedgerows excludes locations where hedgerows grow up to replace drystone walls as in these circumstances restoration of the wall is preferred.

5.1.3. Timescale.

Nature recovery takes place over a wide range of timescales. A butterfly population may recover over a few years, habitat restoration commonly takes decades and the development of the next generation of veteran trees will take centuries (although this will vary with species and measures can be taken to introduce veteran features to younger trees). It is important to both have a long term vision and to also take action as rapidly as possible.

This plan's targets reflect the areas required that if delivered in the right places (see section 5.2) will achieve a robust and fit for purpose nature recovery network. The overall target is for this network to be in place by 2050. Targets set by partners vary from 2030 to 2050.

We urgently need to develop a nature recovery network as soon as possible, consequently we should aim to have delivered the bulk of habitat restoration by the earlier portion of this timeframe. The table below sets interim targets for habitat extent at five-yearly intervals by combining the need for urgency with an estimate of when supporting mechanisms such as Environmental Land Management will have an effect on the ground.

[22] Stand-alone summary primer for the rebuilding biodiversity methodology, South West Biodiversity Partnership. Henrik. A. Oikos 1994 Effects of Habitat Fragmentation on Birds and Mammals in Landscapes with Different Proportions of Suitable Habitat: A Review.

[23] Defining and delivering resilient ecological networks: Nature Conservation in England. Isaac. N.J. et al 2017. Journal of Applied Ecology

Interim targets for habitat extent

Habitat	Current extent	% 2050 Target	2025	% 2050 Target	2030	% 2050 Target	2035	% 2050 Target	2040	% 2050 Target	2045	% 2050 Target	2050
Arable in government environmental schemes Inc. SFI	38,041	36	53,540	50	74,956	70	85,664	80	91,018	85	96,373	90	107,081
Grassland Species-rich limestone inc. recent	3,031	21	6,615	45	8,819	60	11,759	80	12,494	85	13,229	90	14,699
Grassland other species rich inc. recent	2,991	34	3,970	45	5,294	60	7,058	80	7,499	85	7,941	90	8,823
Waterbodies	312	100	312	100	312	100	312	100	312	100	312	100	312
Wetlands	329	17	888	45	1,184	60	1,579	80	1,678	85	1,777	90	1,974
Hedgerows	6,372	91	6,659	95	6,729	96	6,799	97	6,869	98	6,939	99	7,010
Mixed grassland and tree/shrub habitats	10,387	50	12,464	60	16,619	80	17,657	85	18,696	90	19,735	95	20,773
Woodland	24,422	85	25,716	90	26,573	93	27,145	95	27,716	97	28,288	99	28,573
Total excluding arable with environmental options	47,844	58	56,625	69	65,531	80	72,310	88	75,265	92	78,220	95	82,164
Total including arable with environmental options	85,885	45	110,165	58	140,487	74	157,975	83	166,284	88	174,593	92	189,245

All area units are hectares

For the purposes of this plan additional habitat is counted towards the interim targets from the point at which it can be identified through the analysis of the satellite images. In practice is takes many more years of appropriate management for new woodlands and wildflower grasslands to mature and fully benefit species.

5.1.4. Monitoring the targets

The satellite based methodology used to identify the current extent of habitats is constantly being refined and it can be repeated to monitor the progress of this plan. As this will provide both quantitative and spatial data, it will be possible to calculate the new extent of habitat and also the extent to which the new habitat coincides with the recommended locations.

5.2. Nature recovery network maps

The priorities, outcomes and practical measures within this plan provide guidance on the best things to do to aid nature recovery in different locations, largely according to local conditions, what is already there and the habitats nearby. Maps can help further and nature recovery network maps are being produced to encourage the adoption of measures where they will do the most good. This work is closely linked to the coming Local Nature Recovery Strategies and is being undertaken by a combination of Local Nature Partnerships and county or unitary local authorities. There are six areas undertaking this mapping that coincide with the Cotswolds National Landscape. These areas are at different stages of production and their maps are presented differently. To provide a consistent picture, habitats across the whole of the Cotswolds have been mapped and analysed using a consistent methodology to create a Cotswolds nature recovery map.

Cotswolds
Habitats have been remapped using satellite imagery analysis aligned with existing national habitat data and a nature recovery map has been produced based on habitat connectivity. The nature recovery map has been produced using the priorities within this plan. For example where a location is of high importance for grassland habitat connectivity it has been prioritised over woodland connectivity and where a location is of medium importance for both the creation of mosaic habitat is recommended. Opportunity maps for grassland, wetland, woodland and mosiac habitats have been produced. *(Insert link to appropriate new CNL nature recovery webpage).*

The methodology and priorities used for the Cotswolds map are similar to the local maps below but there may still be differences at the field level. In time the mapping of the coming Local Nature Recovery Strategies will provide greater consistency.

Gloucestershire
The Gloucestershire Local Nature Partnership natural capital mapping page which shows the nature recovery network opportunity areas, habitat connectivity and resilience and a series of Ecosystem Service maps https://naturalcapital.gcerdata.com/

Oxfordshire
A draft nature recovery network map has been published on the Wild Oxfordshire website.

West of England – includes Bath and North East Somerset and South Gloucestershire.
The West of England Nature Partnership has published a nature recovery map on their website. Additionally the Forest of Avon Trust has produced The Forest of Avon Plan: A Tree and Woodland Strategy for the West of England which is endorsed by the West of England Nature Partnership.

Warwickshire
The Warwickshire Coventry and Solihull Local Nature Partnership will be developing a nature recovery map for the coming Local Nature Recovery Strategy.

Wiltshire
The Wiltshire and Swindon Biological Records Centre has started working on a map for the coming Local Nature Recovery Strategy.

Worcestershire

A habitat inventory mapping tool which includes habitat network expansion zones has been published on the Worcestershire County Council website. Members of the Worcestershire Local Nature Partnership are in the early stages of preparing further mapping for the coming Local Nature Recovery Strategy.

Much of this work is draft until more nationally consistent mapping is agreed for the coming Local Nature Recovery Strategies.

Features of a nature recovery network include:

- Core areas, the existing wildlife rich habitat.
- New habitat buffering the core areas and better connecting them through corridors and stepping stones
- Large areas of habitat, they can be either existing or new.
- The remaining landscape also includes measures to make it wildlife friendly. There are no "empty areas" on a nature recovery map.

Historical data can help point towards land which may be particularly well suited to the restoration of habitats. Old commons or historic "waste" were frequently used for rough grazing and or woodland as they were unsuitable for more intensive management due to low fertility or difficult conditions. Modern natural capital and habitat mapping combined with historical maps can indicate areas that would respond particularly well to habitat restoration.

5.3. Strategic recommendations – what we can all do to help nature recovery

Nature recovery is too big and important a task for it to be the concern of any single organisation or sector. This section contains some suggestions as to how we can all contribute towards enabling wildlife to flourish and spread across the Cotswolds. It is not an exhaustive list and many new as yet unforeseen opportunities will emerge.

5.3.1. Farmers, land managers and their advisors.

Nature recovery in the Cotswolds will only succeed if led by Farmers and other land managers. This plan has calculated the need to change the management of over 34,000 Ha of land in order to create a robust nature recovery network. The figure rises to over 103,000 Ha if arable fields containing environmental measures are included (section 5.1.2). Nature recovery can only happen if landowners and managers choose to deliver the necessary measures over the appropriate land. They often know their land and the wildlife found there better than anyone else. They are best placed to combine their knowledge with the priorities and targets in this plan and deliver the most appropriate practical measures in the places where they will have the most success.

These measures have to be built into long term financially sustainable business models if they are to achieve long term results. Agents and advisors can play a critically important role in supporting farmers and land managers in achieving this. Farmers and land managers will need to be supported with impartial business and environmental advice. Funding sources will need to both support the recommended measures in this plan and make business sense

Farmers and other land managers can realise nature recovery, operating and financial benefits by working together in local groups or clusters. New business models such as collaborative grazing can also play a role in supporting nature recovery

Other approaches such as organic or regenerative agriculture can also support nature recovery.

5.3.2. Policy makers and decision takers

Those who seek to influence or are responsible for the development and approval of policy documents can draw on and refer to this plan when setting policy that will affect nature recovery across the Cotswolds. Examples of policy documents that this plan can inform include:

- Local Plans
- Neighbourhood Development Plans
- Green Infrastructure Strategies
- Tree and Woodland Strategies
- Ecological Emergency and Climate Change Strategies
- Local Nature Recovery Strategies
- AONB Management Plan

This plan supports the inclusion of strong policies for nature recovery within these plans but does not seek to replicate their content. For example, Local Plans should contain policies on biodiversity net gain, how development should contribute to nature recovery networks and the protection of designated sites particularly locally designated wildlife sites.

Locally designated wildlife sites contain a greater area of important habitat than other designations and as such are essential to the development of a nature recovery network. Measures should be in place to ensure that they are monitored and that their managers receive suitable advice.

This Cotswolds Nature Recovery Plan can be used to inform the development of funding mechanisms that will provide resources for nature recovery. Examples include:

- Environmental Land Management
- Biodiversity net gain
- Payment for Ecosystem Services e.g. carbon sequestration and storage, flood management, water supply and water quality improvements.

This plan can help in the development of project proposals. It is full of policy statements and practical measures that can be used to construct convincing cases to present to funders or budget holders.

This plan supports developing projects in collaboration across complimentary subject areas. For example combined historic heritage and nature conservation projects.

Innovative measures such as the development of mosiac habitat that blurs the boundary between grassland and woodland are included. A flexible approach to regulations and funding mechanisms will aid in their implementation.

5.3.3. Individuals

There are many opportunities for individuals to support nature recovery

A better understanding of our wildlife is essential to the nature recovery effort and there are lots of opportunities to create valuable biological records. A few examples include:

- National wildlife counts designed for everyone with a garden or access to open space to participate in. Examples include the big garden birdwatch organised by the RSPB and the big butterfly count run by Butterfly Conservation.
- There are a number of long term national wildlife monitoring schemes that rely on volunteers undertaking consistent surveys. Examples include
    - The Breeding Bird Survey organised by the British Trust for Ornithology.
    - The UK Butterfly Monitoring Scheme run by a number of partners.
    - The National Plant Monitoring Scheme run by a number of partners
- There may also be a locally organised monitoring scheme in your area for example the habitat monitoring scheme currently run by the Gloucestershire Wildlife Trust.
- Individual biological records are also important. Each area has a local records centre, (some are called biological records centre, others environmental) where records can be submitted. Check the website of your local records centre to find out how. Records can also be submitted nationally through the National Biodiversity Network webpage.

Practical conservation volunteering is a great way to do something physical to help wildlife or maintain access infrastructure. Practical conservation tasks are very varied but common examples include coppicing in woodlands or managing scrub on wildflower grasslands. There is no better feeling than returning to a site and seeing wildlife benefiting from physical work which you have undertaken yourself. The Cotswolds Voluntary Wardens, National Trust, Wildlife Trusts and local projects such as the Wychwood Forest Trust and Glorious Cotswold Grasslands are just some organisations and projects that offer local practical conservation volunteering opportunities.

Nature recovery needs support from politicians, policy makers and budget holders in both public and private organisations. We all need to make a lot of noise about how important nature is to our happiness and quality of life. Supporting national and local conservation charities and groups is an organised way to get these messages across. Ultimately nature recovery needs the support of people. Take friends and family out into the Cotswolds, show them the wildlife there and share your love of it.

Help promote the Countryside Code and pro-environmental behaviours. All action we take to mitigate climate change is also helping wildlife.

If you have a garden then you can contribute directly to nature recovery. There are many books and on-line resources on wildlife gardening but in brief the more habitats in your garden the better for wildlife. If you can aim for native trees and shrubs, nectar rich flowers, a pond and wetland and the most frequently forgotten, a rotting wood habitat pile. Capture rainwater for garden use to avoid contributing to low flows in rivers and try not to use chemicals.

5.3.4. Communities

There is a great deal local communities can do together to help wildlife. Several Oxfordshire based organisations have come together to produce a comprehensive Community and Parish Guide to Biodiversity. It is an excellent starting place to get inspiration and help and can be downloaded here.

South Gloucestershire Council have written a guide for town and parish councils on developing a local nature action plan. It can be downloaded here

A key role for local communities is in producing neighbourhood plans and other similar town or village documents. These plans can include policies for nature recovery with content specific to the area.

District, Town and Parish Councils can designate Local Nature Reserves.

Many community groups have formed to adopt and manage sites for people and wildlife, often called “friends of” sites such as community woodlands. An example is the Friends of Leckhampton Hill and Charlton Kings Common who help with the area’s management and public enjoyment in many ways including regular work parties. Parish and Town Councils also frequently lead on local site based projects often based on local public open spaces such as village greens.

A common activity local communities can undertake to improve their areas for wildlife is to restore wildflower grasslands on road verges (within the 30 mph area) and other public open spaces. Nailsworth and Stow-on-the-Wold Town Councils are both managing the areas surrounding the pitches on their playing fields as wildflower grasslands. In Nailsworth a local farmer cuts and removes the cuttings and they now have wild orchids growing. Stow-on-the-Wold Town Council are developing their wildflower grasslands with support from the Glorious Cotswolds Grasslands project. Further guidance on wildflower grassland restoration and details of the Glorious Cotswolds Grasslands project can be found in appendix 7.9.

5.3.5. Businesses

Nature recovery can only be achieved in the long term if it is embedded in the local economy and supports livelihoods. Nature recovery offers new opportunities for businesses to secure income in uncertain times. This will be challenging and further support will be necessary but this plan can provide insights into the sorts of practices and activities business owners could start considering. Visitors and local people can help by supporting the businesses that help deliver nature recovery. Examples include meat from grazing important habitats and paid for environmental experiences.

Businesses and their customers can contribute to nature recovery through the Cotswolds visitor giving scheme, Caring for the Cotswolds.

Businesses can also review their procurement policies and work with their supply chain to reduce their carbon footprint and impact on nature.

5.3.6. Countryside visitors & access managers

The Cotswolds is lucky to have the Parish Warden system operated by the Cotswold Voluntary Wardens. Parish Wardens check their area’s public rights of way and report any work needed to the Volunteer Wardens practical conservation teams. The Cotswold Way National Trail has a similar system.

This plan has identified drivers for change that are likely to lead to increased levels of use for informal recreation and also a need to broaden engagement so more people can access the health and wellbeing benefits of visiting and appreciating nature in the Cotswolds. Accommodating this increased use will require increased levels of resources and management to avoid damage to habitats and disturbance to wildlife. Budget holders involved in countryside management and rural support will need to plan for this.

Everyone can help manage the impacts of visitors to the countryside by sharing the messages within the Countryside Code.

5.3.7. Cotswolds National Landscape

The Cotswolds National Landscape has two key purposes:

- Conserve and enhance the natural beauty of the Cotswolds AONB
- Increase understanding and enjoyment of the special qualities of the AONB, ensuring that these complement the conservation and enhancement of the area

In fulfilling these roles, the board seeks to foster the social and economic well-being of local communities within the AONB.

The Cotswolds National Landscape will continue to provide leadership and work as a champion for nature recovery across the Cotswolds and beyond. It will:

- Promote and communicate the content of this plan to key audiences to encourage its delivery.
- Use this plan to help inform plans and strategies developed by partners, in particular but not exclusively Local Nature Recovery Strategies.
- Use this plan to inform the development and targeting of funding mechanisms to best benefit nature recovery across the Cotswolds and beyond.
- Support nature recovery through its own funding mechanisms for example through the Cotswolds visitor giving scheme, Caring for the Cotswolds and the Defra funded Farming in Protected Landscapes programme.
- Work with partners outside of the AONB to support the Big Chalk vision and the development of robust nature recovery networks in identified bridging areas.
- Directly deliver practical measures on the ground to support nature recovery, for example through the work of the Cotswold Voluntary Wardens and the Cotswolds Glorious Grasslands Project.
- Work with partners to develop new nature recovery project proposals and secure funding for their delivery.
- Work with partners to improve our knowledge and understanding of species, habitats and natural processes throughout the Cotswolds and beyond.
- Monitor and report on progress towards the delivery of this plan.

6. Broad habitats

6.1. Viewing habitats together

Although in order to aid readability this plan treats woodland/trees, grassland/scrub, arable and rivers/wetlands separately within their own sections this is to a large extent a false distinction. Much of the value of these habitats lies in their close proximity and overlapping features. Grassland flora can be found within the rides and glades of woodlands and trees and scrub can be an important feature on grasslands. The dense scrub found where these habitats meet is particularly important for a wide range of species. Some important species rely on different habitats for different stages in their life cycles, for example open growth hawthorn is a key source of nectar for deadwood invertebrates that need energy before flying to other veteran trees. Hedgerows and grassy margins in arable fields can increase connectivity between existing woodlands and grasslands. Drystone walls

originally created to manage livestock now also form a part of important wildlife corridors through arable areas.

The creation of new, dynamic extensively grazed habitat mosaics can maximise the potential of edge habitats further blurring the distinction between woodland and grassland. This theme will reoccur throughout the individual habitat sections

6.2. Woodland and trees – including hedgerows

6.2.1. Woodland and trees – current condition

Cotswolds ancient woodlands, (continually wooded since 1600, see the glossary - Appendix 7.10) are exceptional for their botanical value. The vernal (spring) flora which includes wood anemone, bluebell and herb paris amongst others is found throughout the ancient woodlands. Later in the summer the beech woods in particular are home to an exceptional suite of more shade tolerant species including birds nest orchid and many species of helleborine. The Cotswolds contains one of only three sites nationally for the red helleborine. This species richness is reflected in other groups, particularly fungi.

It is the quality of this woodland flora that has in part led Plantlife to identify the Cotswolds as an Important Plant Area (IPA). There are 757 Ha of woodland Special Area for Conservation (SAC), 581 Ha of woodland NNR, 52 Ha of woodland LNR and a further 2,083 Ha of woodland SSSI. This area includes the Cotswold Beech Woods SAC and the Cotswold Commons and Beechwoods National Nature Reserve.

1,186 Ha of broadleaved mixed and yew woodland SSSIs are in favourable condition, 904 Ha are unfavourable recovering and 22 Ha of both unfavourable no change and unfavourable declining condition.[24]

The Cotswolds has been identified as one of 12 national priority areas for woodland conservation and reinstatement of management to restore the internationally important ancient beech woodlands, and nationally important mixed and oak woods and parks in response to deteriorating condition.[25] Native box wood is another rare habitat that has been identified in the Cotswolds.

Woodland edges frequently contain dense thicket type vegetation and shrub species which in places merge into adjacent scrub. This ecotone (edge habitat) is particularly important for nesting, migrating and wintering birds and many invertebrates.

A small number of actively coppiced woodlands benefit woodland flora, nesting birds and invertebrates.

Some ancient woodlands in the Cotswolds have been planted up with conifers. These are called plantations on ancient woodland sites (PAWS) and can also include broadleaved plantations. There are 2,162 Ha of PAWS in the Cotswolds.[26]

[24] The State of the Cotswolds 2017. Cotswolds Conservation Board.
[25] Preliminary nature conservation objectives for Natural Areas – Woodland and Forestry, English Nature Research Report 239, Reid, C.M. and Kirby, K.J (1997).
[26] The State of the Cotswolds 2017. Cotswolds Conservation Board.

More recent woodlands tend to form solid blocks with little structural diversity limiting their current value for wildlife.

Veteran Trees within old pasture woodland and parklands are rich in exceptionally rare deadwood invertebrates. Two of the scarp outliers are recognised for this in particular. On Bredon Hill they have "*one of the best assemblages of invertebrates associated with ancient trees (known collectively as saproxylic invertebrates) in Britain*." (SSSI Citation). These invertebrates include the violet click beetle and have led to the area being designated as an SAC. Dixton Wood on Dixton Hill has also been designated an SAC for the same reason although both sites have become isolated from the main scarp. The cavities of veteran trees, particularly ash are favoured nesting sites for several species of birds of prey such as barn owl, little owl and kestrel.

Although unusual on the high wold, hedgerows and hedgerow trees play an important role for many species including nesting, migrating and wintering birds throughout many parts of the Cotswolds. They are also important in linking habitats to form networks important to many species such as bats. Hedgerow trees can be particularly valuable as a result of their broad "open growth" canopy compared to trees grown within woods where they are constrained by their neighbours. The Bath and Bradford-on-Avon Bats SAC holds 15% of the UK greater horseshoe bat hibernating population and bechstein's bats also hibernate in the area. Hedgerows with open growth trees play an important role in providing commuting corridors and foraging areas throughout the SAC and beyond.

6.2.2. Woodland and trees – drivers for change

Inappropriate or a lack of management has led to a dramatic decline in much of our woodland wildlife. Just 7% of Britain's native woodlands are currently in good ecological condition[27]. The species associated with the open and thicket conditions of actively managed woodland rides and glades and the compartments of coppice woodlands have been particularly affected. This is illustrated by the pearl bordered fritillary which has undergone a decline in abundance of 71% between 1976 and 2014 nationally[28] and is now only found in a limited area to the west of Cirencester in the Cotswolds.

The potential of woodland management, particularly coppicing produce for energy has yet to be fully explored and could become a powerful driver for active woodland management. In order to achieve this the difficulties of extraction need to be overcome for example through the creation of forest tracks along rides.

Although they seem to change at a slower rate the "high forest" woodlands (tall trees with little shrub layer) such as the beech hangers also require periodic management such as thinning in order to maintain their condition.

Deer populations continue to grow in the absence of natural predators and comprehensive coordinated deer control. The high deer population is particularly damaging to coppice regrowth and the development of new woodland through natural regeneration. Squirrel damage to trees affects the viability of tree planting and beneficial forestry operations such as thinning. Being thin barked, beech is particularly vulnerable to squirrel damage. Feral boar may also become an issue,

[27] State of UK's Woods and Trees 2021. The Woodland Trust

[28] The State of the UK's Butterflies 2015 (Fox et al, Butterfly Conservation and the Centre for Ecology & Hydrology)

particularly in uncontrolled numbers where they have the capacity to greatly damage ancient woodland ground flora.

Some ancient woodlands have been replanted with inappropriate species such as conifers and inappropriate shrub layer species introduced such as laurel and snowberry as cover for gamebirds. Gamebird pens can also cause nutrient enrichment leading to the replacement of woodland ground flora with nettles.

Many wet valley bottom woodlands have lost their wet characteristics or been lost entirely due to drainage.

There are also examples of positive woodland management in the area. Many private owners and conservation bodies manage their woodlands with great care and there are good examples of coppice management such as Lineover and Littleworth Woods.

There is concern that the current stock of veteran trees will become lost as a single generation and as there is a 200-300 year age gap there are few older trees of an age to replace them by developing the characteristics of a veteran. This loss of continuity could spell disaster for the species particularly invertebrates that rely on veteran trees.

The tree disease ash dieback (Chalara) is present across the Cotswolds and could result in up to 95% of ash trees being lost over time. Ash is a predominant tree in the Cotswolds and the impact will be considerable. Many of the open grown and veteran trees in the area are ash and although older trees appear to be slower to succumb to the disease their coming loss is of great concern.

Ash dieback may also bring some benefits to wildlife. Deadwood in all of its forms, standing and fallen is uncommon and if left the dead and dying ash trees could provide valuable if temporary habitat to deadwood invertebrates and the species that feed on them such as the lesser spotted woodpecker. Ash dieback will also create many areas of open canopy benefiting the ground flora and shrub layer in many unmanaged woodlands. This will create opportunities for the creation of glades or wood pasture in some locations. Many of these benefits could be lost if the human response to ash dieback includes an overreaction based on a desire to tidy up the affected woods.

Ash dieback forms part of a wider pattern of increasingly prevalent invasive tree pests and diseases. It follows on from Dutch elm disease which had a devastating effect across the Cotswolds and due to a warming climate there is a growing risk of further tree pests and diseases.

Hedgerows and hedgerow trees have been lost or significantly reduced as a result of inappropriate management and through neglect. Hedgerows have also been lost through the amalgamation of fields. Many of the remaining hedgerows have a tall profile though in places the continuous trimming of hedgerows into a small box profile reduces their value to wildlife.

New woodlands are being created in the area and the need to mitigate for climate change is expected to drive an increase in tree planting and woodland creation. Much of this planting to date lacks structural diversity both within its original design and subsequent management.

Being thin barked, beech is vulnerable to squirrel damage and this is leading to it being avoided in the selection of species for woodland creation.

Climate change will affect different species in different ways. Some species, such as pedunculate oak, are expected to fare better than others. The Cotswolds are on the boundary between the south

east where beech is predicted to struggle, particularly on drought prone soils and the north and west where it is expected to thrive and its natural range expand. Climate change is also affecting the timing of natural events (phenology) which can cause disruption to ecological relationships such as food supply, for example, blue tit chicks starving when the caterpillars they feed on are unavailable in years of early leaf emergence[29].

There is an increasing use of non-native and non-local tree species in planting as a result of climate change, e.g. Italian alder, hornbeam, rowan and walnut. This could have a negative impact on wildlife. Not all woodland planting in response to climate change is as carefully planned as it should be. New woodlands are being planted in locations where greater gains for nature recovery would be achieved through the restoration and improved connectivity of other habitats, particularly wildflower grassland.

There are also likely to be changes in the timing of seasonal events leading to a loss of synchrony between species and the resources that they depend on, notably for food and pollination.

6.2.3. Woodland and trees - recovering or enhancing wildlife

The first best measure to ensure ecological resilience for woodland species within this area is to ensure that the existing woodlands and veteran trees, particularly the species rich ancient woodlands are suitably managed.

The high forest woodlands (tall trees with little shrub layer) particularly the beech woodlands should be maintained in good condition for the species they are important for.

The condition of unmanaged woodlands and woodland features particularly rides, glades and areas previously coppiced should be improved through the reintroduction of active management.

Plantations on ancient woodland sites should be restored to ancient woodland.

Ash dieback offers an opportunity to promote the creation of wood pastures and glades where appropriate.

Similarly, rotational hedgerow management can be optimised for the benefit of wildlife including the promotion of new hedgerow trees. Allowing some hawthorn in hedges and on slopes to grow on, to become trees and to flower, would provide a valuable spring nectar source.

New hedgerows and woodlands can contribute significantly to nature recovery and should be created where appropriate to extend existing woods and improve connectivity between existing hedgerows and woodland edge habitat. New woods in these areas should be designed to maximise their beneficial dense shrubby edge habitats. There is also an opportunity to create distinctive new box woods.

The creation of new woods must avoid replacing existing important habitats particularly flower rich grasslands. Sites where new woodland creation would damage the potential for improving connectivity between existing flower rich grasslands should also be avoided. Similarly the impact on open landscape species such as corn bunting, skylark and lapwing should be considered.

[29] State of the UK's Woods and Trees 2021, Woodland Trust

This means that there are opportunities for new woodland creation ideally through natural regeneration but the steeper slopes with shallower soils more suitable for wildflower grassland restoration should be avoided.

There is potential for more naturally regenerating trees and small woody areas as an element of dynamic, large extensively grazed habitat mosaics. As they would be rich in marginal habitats such areas would bring greater benefits for wildlife than uniform blocks of new planting. There is also potential for integrating more trees to both arable and pasture farming systems.

New open woodland conditions created by ash dieback offer opportunities for the creation of wood pasture and glades where appropriate.

There are opportunities to restore wet woodlands on the valley bottoms. Wet woodland corridors alongside rivers and streams provide corridors for wildlife as well as shade and shelter. They also reduce bank side erosion and act as a barrier to silt entering the river.

Species of the woodland core (the inner wood) are less mobile than the species associated with woodland edge and hedgerows. This particularly applies to flora, fungi and deadwood invertebrates. They are less suited to the strategy of relocating to a new climate space. Consequently translocations to more northerly sites should be considered as a form of assisted migration. Ash dieback offers an opportunity to increase the amount of deadwood within our woodlands assisting species benefitting from deadwood in the short term. Techniques can also be applied to introduce veteran tree characteristics to a number of tree species.

A diversity of tree age can be provided both within and outside of woods and the veteran trees of the future can be identified and managed. The generational gap in the habitat offered by veteran trees can be overcome by pollarding and the introduction of veteran features such as jagged limbs and cavities to younger trees.

6.2.4. Woodland and trees – practical measures

This section is a quick guide to the things that if applied at scale across the Cotswolds would allow wildlife to flourish, gain abundance spread and adapt to climate change. Sources of more detailed guidance on practical measures and funding, including the UK Forestry Standard and design techniques for forest management are listed in appendices 7.8 & 7.9. The Cotswolds National Landscape's landscape strategy and guidelines are also listed in appendix 6.6.1. These contain measures which should be followed tailored to particular landscape character types. Guidance on dealing with ash dieback has recently been issued and is also included.

Periodically thin "high forest" (tall trees with little shrub layer) type woodlands to maintain structural diversity and a varied age structure where appropriate.

Create and maintain rides and glades within woods where appropriate. Strategically locate rides and glades to encourage greater continuity and connectivity of grassland and grassland edge habitats.

Where appropriate use new open woodland areas caused by ash dieback to create new wood pastures or glades.

Maintain existing coppice rotations and reintroduce coppicing to suitable areas of previous historic coppice. Retain at least one hawthorn in each coppice compartment as a spring nectar source for the adult stages of woodland invertebrates.

Remove conifers from plantations on ancient woodland sites to restore to ancient woodlands.

Avoid placing game bird pens in woodland areas with a high botanical value.

Deadwood, especially standing deadwood should be retained. Where safe to do so leave dead and dying ash trees in situ. Where ash trees have to be removed retain standing deadwood stumps. Implement measures to introduce veteran tree characteristics to a range of tree ages and species.

Maintain hedgerows in a thick and tall condition. Lay or coppice them (with protection from livestock) on a long rotation to regenerate them when they show signs of becoming gappy.

Avoid trimming hedgerows if possible by allowing them to grow before coppicing or laying on rotation. Trimming can considerably prolong the period between the need to lay or coppice. If necessary trim to a high “A” profile or just trim one side a year. Avoid trimming during the nesting season and before the berries have been eaten.

Promote and retain hedgerow and field trees. Consider including native fruit species as hedgerow trees to provide nectar for insects in the spring and food for birds in the summer and autumn.

Allow some hawthorn in hedges and on slopes to grow on, to become trees and flower, providing a spring nectar source.

Broaden the age diversity of trees inside and outside of woods.

Consider creating new wood pastures, extensively grazed mosiac habitats which include trees, scrub and small woody areas rich in edge habitats.

Favour natural regeneration over the planting of trees in the creation of new woodlands especially near existing ancient woodland. Consider natural regeneration as the preferred method for the creation of new woodland habitats or mosaic habitats that include trees and small woody areas. Direct seeding is an option for sites remote from existing seed sources.

Design new woodlands to maximise beneficial dense shrubby edge habitats. They should be small (within the context of the landscape), structurally diverse with rides and glades and have shrub species planted around the edges of their perimeters and inner open areas. Use a variety of species to create a diverse habitat. Species planted should be native and of local or a more southerly English provenance. Consider planting new box woodland.

Collaborate across land ownership boundaries to control deer and squirrels at a scale that will enable natural regrowth, regeneration and woodland management. Ensure natural regeneration and planting are protected during establishment. Avoid plastic tree tubes.

Locate new woodlands and trees where they extend existing woods and improve ecological connectivity without damaging existing priority habitats or their potential ecological connectivity. Consider their impact on sensitive species such as corn bunting. The nature recovery network mapping undertaken by the Cotswolds National Landscape, local nature partnerships and/or local authorities can provide detailed guidance (section 5.2).

Locate new woodlands where they fit in with the landscape. The Cotswolds Landscape Strategy and Guidelines can help with this (Appendix 7.6.1).

Implement the northward assisted migration of woodland core species through the translocation of deadwood and flora and the inoculation of sites with woodland soil.

6.3. Grassland and scrub, including drystone walls

6.3.1. Grassland and scrub – current condition

Most of the wildflower grasslands (unimproved "priority habitat" flower rich and mainly ancient) found in the Cotswolds are limestone grassland although there are also tracts of wet grasslands in valley bottoms and below springs.

Steep slopes and thin soils, particularly on the scarp, outlier slopes and valley sides, have protected grasslands from ploughing resulting in the survival of a great deal of wildflower grassland of the highest quality. Some protection is also the result of registration as common land. Sometimes referred to as 'the tropical rainforest of Europe', up to 45 species of flowering plants can be found in 1sqm of limestone grassland. Typical calcicole (lime loving) species include rock rose, wild thyme and bastard toadflax. The Cotswolds contains several types of limestone grassland including 52% of the UK's upright brome and tor grass grassland (called CG5 in the national vegetation classification).

Variation in grazing pressure has allowed scrub to establish on many grasslands. The character of this scrub varies including large areas of single species particularly gorse or hawthorn and also areas containing a wide variety of shrubby species. Depending on the overall condition of an individual site scrub can either contribute greatly to its wildlife value or represent a threat to important wildflower grassland by growing over it completely. The shrubby species in this area include juniper which is both rare in its own right and supports a particularly wide range of invertebrate species. Its occurrence is rare and the surviving individuals are old so it requires conservation effort if it is to remain in the Cotswolds.

Scrub is important for invertebrates and nesting, migrating and wintering birds. Where it adjoins wildflower grassland it forms a particularly wildlife rich edge habitat, an "ecotone". This is illustrated by the iconic sight of the male green hairstreak butterfly perched on the edge of a shrub overlooking the grassland, one of the many species that thrives where both habitats meet. The mixture of insect, seed and berry rich grassland and scrub means that the scarp is a well-recognised migration route for many species of bird including the rare ring ouzel.

Old quarries and less formal workings called delves add physical variety making these old workings particularly valuable for wildlife. Hollows and bare ground provide temperature variations that are vital for some invertebrate species. They are also notable for very thin "skeletal" soils and disturbed rocky ground important for "ruderal" or colonising plants such as kidney vetch that struggle to survive in more established grasslands. One of the places this can be observed is Leckhampton Hill. These rocky areas will include sites of geological importance and especially when designated for this purpose their value for geology should be reconciled with management for species and habitats. Other historic features such as hillforts and strip lynchets add physical variety too as do natural processes such as solifluction (soil creep) which causes terracettes (the small ridges frequently called sheep tracks).

The scarp slopes are characterised by the dynamic geological processes of landslip and cambering. When allowed to proceed naturally, they create the important habitats of bare ground and thin soils needed for specialist flora and fauna

The long operational phases of quarry activities throughout the Cotswolds have provided extensive bare ground habitat that can be colonised by "ruderals", e.g. Cotswold pennycress at the Naunton quarry complex

Drystone walls were originally built as stock proof barriers and although they still fulfil this function in many locations they are also now found as a boundary feature in arable fields. Drystone walls are similar to rocky outcrop or scree type habitats which are otherwise rare in the Cotswolds so they are important for associated species. Drystone walls are constructed to shed water and are full of nooks and crannies making them a valuable habitat for a wide range of wildlife. Aspect plays an important role in what wildlife benefits. Hotter dryer southerly wall faces tend to be better for lichens while northerly faces tend to be mossier. They can be very rich in invertebrates particularly insects and spiders which brings benefits along the food chain providing hunting grounds for reptiles and amphibians as well as hibernation sites. They also provide excellent conditions for snails which in the Cotswolds includes the roman snail and they provide cover for many small mammals. Their linear nature allows for movement.

Understandably for an area so rich in ancient wildflower grassland there are many sites designated for this habitat. There are 95 Ha of grassland Special Area for Conservation (SAC), 51 Ha of grassland NNR and a further 1,200 Ha of grassland SSSI. Rodborough Common has been designated as an SAC as an internationally important site for the limestone grassland CG5 and associated scrub habitats. It is one of a number of large sites, often commons running along the western edge of the Cotswolds. Other notable examples include Painswick Beacon, Barrow Wake, Crickley Hill, Leckhampton Hill and Cleeve Common

1,067 Ha of grassland SSSIs are in favourable condition, 489 Ha are unfavourable recovering and 36 Ha unfavourable with no change and 23 Ha unfavourable declining condition.[30]

The Cotswolds has been identified by Plantlife as an Important Plant Area of European importance for its assemblage of dry calcareous grassland species (together with Broadleaved Woodland species). It boasts a vascular plant flora with a total of 123 nationally rare, scarce, near threatened and threatened species, of which 33 are grassland specialists, making the area the third richest area in the UK for this group of plants. Of these, some 13 species are national priority species[31] including the frog, fly and musk orchids.

Butterfly Conservation has identified the area as a hotspot for grassland butterflies, in particular the Duke of Burgundy. Amongst many others dark green fritillary, dingy skipper and chalkhill blue are also found. The Adonis blue has returned and the large blue has been successfully reintroduced.

The floodplain wet grasslands in the valley bottoms are largely agriculturally "improved" only rarely containing a wildflower rich sward. They also tend to be drained and disconnected from any associated river leading to dryer conditions. Consequently species associated with wet grassland such as nesting redshank have been lost. There are a small number of nationally important flower rich floodplain meadows, particularly in the Bourton-on-the-Water area.

6.3.2. Grassland and scrub – drivers for change

[30] The State of the Cotswolds 2017. Cotswolds Conservation Board.
[31] Listed in Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 as being of "principal importance for the conservation of biodiversity in England".

The primary reason for the damage to or loss of wildflower grasslands has been when their management moves away from the optimum regime needed for their maintenance.

Wildflower grasslands require management to prevent vigorous grasses from dominating the sward leading to the loss of the wildflowers. This management takes two main forms - pasture management (grazing) which can vary by stock type, density (number of animals by area) and timing, and meadow management involving the removal of vegetation often as hay by machine frequently followed by a period of grazing. Meadow management can vary in terms of the number and timing of cuts.

The predominant form of grassland management in this area is pastoral particularly on the steeper slopes. Some meadow management also occurs on the gentler slopes. Undergrazing is an issue and has led to the loss of wildflower grasslands and the invasion of scrub and Tor grass. Although less common in the Cotswolds overgrazing, particularly at the wrong time of year can also damage wildflower grasslands.

Agricultural intensification has led to the loss of wildflower grasslands as the application of herbicides and/or artificial fertilisers leads to domination by a few grassy species. On gentler slopes grasslands have been ploughed and reseeded or impacted by equine grazing. 75% of the UK's lowland calcareous grassland has been lost in the last 70 years[32]

Grassland in urban fringe areas such as around Bath suffer from fragmentation and are frequently either undergrazed or turned into horse paddocks and overgrazed. The management of small fragmented sites particularly around settlements can be challenging as grazing stock can be difficult to source and the fields can be contaminated with dog faeces and litter making the taking of hay difficult.

In the absence of positive management the Cotswolds road verges are developing into coarse species poor grassland, together with scrub, trees or secondary woodland.

Wildflower grasslands on the limestone are considered comparatively resilient to climate change. Their flora is adapted to dry conditions as a result of the well-draining nature of the limestone so they are equipped for the predicted hotter dryer summers and drought events. Drought events may have an adverse effect on invertebrates as recent research has indicated that the flora responds by producing less flowers and/or flowers with no nectar[33]. The presence of scrub and solitary shrubs can increase the tolerance to extreme heat events. These dryer summer conditions may support diversity by holding back the vigorous grasses although conversely the predicted wetter winters may encourage them.

Quarry management, especially in sites of geological interest exposes features of particular geological interest and supports specialist flora and fauna.

The restoration of quarries following closure has created opportunities for wildflower grassland creation and quarry restoration plans include or start with bare ground areas and scree/rock exposures which are often left for gradual colonisation or long-term exposure. However these habitats require active long-term management which is only enforceable through the planning system for a certain period of time after restoration is complete. Restored quarries with bare ground for "ruderal" colonising plants such as Cotswold pennycress and associated invertebrates can lose these habitats over time.

[32] Save Our Magnificent Meadows Conservation Management Plan. Plantlife. 2013.
[33] Drought reduces floral resources for pollinators. Phillips B. Shaw R. Global Change Biology. 2018.

Over time Cotswold stone “laminates”. As a result of water ingress and freezing it splits along internal plains, falling apart and crumbling. This means that even well-built Cotswold drystone walls that shed water will eventually decline. This is a slow process and the walls retain much of their wildlife value as it progresses but eventually the wall will become swamped in vegetation and disappear into the ground. Drystone walling is a skilled and labour intensive activity making the walls expensive to maintain and restore. As many have lost their original agricultural purpose they are being lost to the landscape.

Lowland meadow is the most threatened type of wildflower grassland, 97% have been agriculturally improved or lost since 1940.[34] There are very few wet wildflower grasslands remaining in the Cotswolds vales and valleys. A good example are the meadows of Greystones Farm on the edge of Bourton-on-the-Water.

Species are responding to climate change and Cotswolds grasslands are well located to act as receptor sites for species moving northwards to a new climate space. A good example of this is the adonis blue butterfly. Once extinct in the Cotswolds it has recently returned from the south. Unlicensed releases are suspected but they are flourishing and spreading. Continental species such as the wasp spider are also colonising England. This demonstrates the potential of Cotswolds grasslands given a robust nature recovery network that connects across and between England’s chalk and limestone landscapes.

The adonis blue butterfly is also a good example of a species able to occupy a wider niche as a result of climate change. Once limited to short swards on south facing slopes the warmer dryer conditions allow it to occupy a wider variety of sward heights and aspects.

Wildflower grassland restoration is gaining in popularity. The techniques involving survey, soil analysis, seed collection, harrowing, over-sowing and follow on management are well understood. The Cotswolds National Landscape have been undertaking this work since 2014 and have restored over 800 ha of wildflower grassland (as at June 2021).

Pressure to plough up permanent pasture to integrate it into rotational arable management is leading to its loss as an opportunity for wildflower grassland restoration.

The growth of interest in historic and rare breeds of livestock is another helpful development as many of these breeds are particularly well suited to the management of wildflower grasslands. For example Cleeve Common is grazed by belted Galloway cattle. More local breeds such as Gloucesters and shorthorns are also suitable.

6.3.3. Grassland and scrub - recovering or enhancing wildlife

The geography of the Cotswolds grasslands represents an outstanding opportunity to help our grassland wildlife adapt to climate change by moving northwards to a new climate space. Both the scarp and the dip slope valleys have steep sides and are rich in existing wildflower limestone grassland, grasslands ready for wildflower restoration and arable suitable for reversion to wildflower grassland.

Calcareous (chalk and limestone) grassland habitats contain more species than any other habitat in the United Kingdom. At 790 square miles the sheer size of the Cotswolds combined with its

[34] Natures Tapestry. The Grasslands Trust. 2011

calcareous nature and north south orientation means that the Cotswolds presents one of the best opportunities to deliver nature recovery and wildlife adaptation to climate change offered by the English landscape.

Keeping the grassland corridor along the scarp from Bath to Mickleton intact is of high importance. It has great potential to become wildflower rich and runs for 80 miles with a variety of aspects and gradients and an overall north south reach of 50 miles.

Natural England have published a "Definition of favourable Conservation Status for Lowland Calcareous Grassland[35]" and it indicates that the scale of the task for the Cotswolds is considerable. 11,668 additional hectares of lowland calcareous grassland are needed across the Cotswolds to achieve favourable conservation status. (The calculations are included in section 5.1.2).

The management of wildflower grasslands should maintain their wildlife interest through grazing and/or cutting according to the specific habitat and species requirements of each site. The Cotswolds can offer the scale of connected habitat to allow a variety of management regimes to provide variety and continuity of habitat across the landscape and throughout the seasons.

The high wold is suitable for the creation of large scale extensively grazed habitats which would become a dynamic mosaic of wildflower grassland, scrub, trees and small woody areas. Grazing could be managed to ensure both the best results for nature recovery and a good fit with an open landscape character. The very distinction between grassland and woodland itself could become meaningless in these areas.

Many habitats such as woodland can be created across a wide variety of landscapes but apart from a small number of dune systems, it is only possible to create calcareous grasslands on calcareous landscapes.

The creation of new wildflower grassland also offers opportunities to create associate habitats particularly scrub, skeletal soil, bare ground and drystone walls. There are also opportunities to create new grassland areas with a variety of gradients and aspects mimicking the historic delves.

After allowing for the specific needs of priority species on a site by site basis, in general it is important to create a variety of grassland conditions. Many butterflies from the blue family (chalk hill, adonis and large) are good indicators for short sward and heat loving plants and insects whereas the duke of burgundy butterfly needs longer turf and marginal habitats similar to the needs of adders and other reptiles. The presence of a mix of long and short sward species will demonstrate a healthy habitat mosaic best suited to aid nature recovery.

Agriculturally improved permanent grasslands are common along the valley bottoms creating many opportunities for wet grassland restoration often linked to river restoration and wetland work. Where these meadows are allowed to flood and are then managed by grazing and or cutting with the removal of the cuttings they contribute to river quality by allowing silt to be removed from the river channel, whilst at the same time retaining their potential as wildflower grassland as the nutrients are in turn removed as meat or hay.

The techniques to diversify existing permanent pasture by scarification, over sowing and subsequent management and to revert arable land to wildflower grassland are now well understood. These are already being practiced locally using seed of local provenance by projects such as the Glorious Cotswold Grassland Project.

[35] Definition of favourable Conservation Status for Lowland Calcareous Grassland. Natural England. 2020.

Although temporary, rotational herb-rich leys can support pollinators, farm birds and soil organisms, particularly mixed herb leys.

The Cotswolds road verges offer a very visible opportunity to develop a species rich grassland and scrub mosaic that contributes significantly to the nature recovery network. New and developing technology such as machinery and grass to electricity initiatives are improving the prospects for positive verge management.

The restoration of quarries provides opportunities to create significant areas of high quality grassland, thin soil and scrub habitats.

There is potential for well-planned reintroductions or the assisted migration of grassland species to assist with changes in distribution in response to climate change. The successful reintroduction of the large blue butterfly to the Cotswolds is a case study in how to do this well. This could also help with plant species. One possibility is the pasque flower which has only been recorded on 5 sites within the Cotswolds since 2000 and despite being adapted for wind dispersal only spreads a few metres without help. Historically this may have been via livestock moving between connected sites.[36] Another possible candidate for assisted migration is juniper.

6.3.4. Grassland and scrub – practical measures

This section is a quick guide to the things that if applied at scale across the Cotswolds would allow wildlife to flourish, gain abundance spread and adapt to climate change. Sources of more detailed guidance on practical measures, some linked to funding are listed in appendices 7.8 and 7.9. The Cotswolds National Landscape's landscape strategy and guidelines are also listed in appendix 6.6.1. These contain measures which should be followed tailored to particular landscape character types.

Manage wildflower grasslands according to the broad requirements of the habitat whilst allowing for the specialist needs of any priority species. Ensure that grazing and or cutting with the removal of the cuttings prevents nutrient levels from building. Winter grazing or light grazing all year round will suit many sites. Consider the use of traditional breeds for conservation grazing.

Consider utilising rare breeds particularly the Cotswolds sheep known locally as the lion which require conservation effort in their own right. Many rare breeds such as Gloucester Cattle are hardy and well suited to conservation grazing. Further guidance can be sourced in appendix 7.9.

Collar based virtual fencing is a rapidly developing technology which provides greater control over grazing animals enabling grazing to be focussed where and when it is needed to achieve the best conservation outcomes.

Prevent scrub from overrunning wildflower grasslands.

Manage scrub to create a varied age and physical structure including glades and scalloped edges. Encourage Juniper where it is present and introduce it to new sites where appropriate.

Create new wildflower grasslands where they best improve ecological connectivity. Arable can be reverted to wildflower grassland through seeding and "semi-improved" permanent pasture can be

[36] Walker. K. Pinches. C. Too steep for the plough? The history of the Pasqueflower in Britain. British Wildlife. Vol 29.

diversified by harrowing and over seeding. Wildflower limestone grasslands can be restored on the slopes and high wold and wildflower rich wet grasslands in the valley bottoms.

Create new large areas of extensively grazed grassland where natural processes are allowed to create a complex mosaic of habitats.

Value dynamic scrub and complex grassland/woody mosaic habitats and resist the perception of them as being unmanaged, neglected, messy or overgrown.

Use seed sources of local provenance for the creation of new wildflower grasslands. Consider growing and planting plugs for species such as devil's bit scabious that do not respond well to introduction as seed.

Within the creation of new grassland sites consider the creation of a more varied physical ground structure similar to the lumps and bumps of historic delves. Seek opportunities to include areas of bare ground and thin skeletal soils along with rocky bare and disturbed ground and a variety of aspects and gradients. The restoration of quarries provides opportunities to do this although it can also be done on any new habitat. Check with your local Historic Environment Record (HER) or Local Authority Archaeology Service before undertaking ground works.

Maintain and restore drystone walls.

Look for opportunities for wildflower grassland and scrub restoration and management on road verges and avoid using topsoil for new verges. Further guidance can be sourced in appendix 7.9.

Incorporate the creation and management of wildflower meadows into river restoration and natural flood management projects.

Consider assisted migration for appropriate species, for example pasque flower and juniper.

6.4. Rivers and wetland

6.4.1. Rivers and wetland – current condition

Water in the Cotswolds percolates through the permeable limestone to collect in an aquifer emerging through springs to create rivers and other wetland habitats. The emerging water is calcium rich and in places forms tufa springs and streams.

There are many small wetland habitats created on or just below the spring lines and marshes at the bottom of valley slopes such as Cockleford Marsh SSSI.

Known locally as slads or winterbournes the upper reaches of many watercourses only flow seasonally when there is sufficient water in the aquifer.

Ponds are not a common or characteristic feature of the Cotswolds although they are found in some localised concentrations such as the Shurdington area. Similarly peaty habitats are very rare although they can be found and peaty soils indicate where they once occurred.

The condition for wildlife of rivers in the Cotswolds is largely dictated by their physical structure and the supply and quality of water. They have commonly been subject to previous engineering works and dredging for gravel leading to deeper, uniform, vertical sided channels disconnected from their

flood plains. This lack of structural variety represents a degraded habitat missing many important features such as fast flowing clean gravelly areas (riffles), slower deeper areas and marginal vegetation. Physical structures such as weirs create barriers to migratory fish.

Intensive grazing of stretches of river bank up to water's edge has led to the loss of marginal habitat and bank instability leading to erosion and the widening of river channels which in turn leads to low flows and silt deposition.

Low flows caused by abstraction from the aquifer combined with dry periods cause ecological harm particularly in the seasonal stretches. Low flows are experienced in rivers such as the Evenlode and Glyme.

Most Cotswolds rivers have good chemical and ecological quality, except for the upper Evenlode, mid Windrush, the rivers Coln and Glyme and the Ampney Brook. Some smaller tributaries of the Thames in the south of the catchment also have problems associated with diffuse pollution. Around half of the area's groundwater is classed as being of poor quality, particularly in the north and west, due to pollutant inputs.

The main sources of pollution are from wastewater treatment works followed by agricultural runoff. Water discharged from wastewater treatment works contains phosphate, nitrogen and ammonia and at times of peak flow raw sewerage is discharged directly into rivers. Agricultural runoff contains phosphates bound to silt and nitrogen. Cotswolds soils are easily eroded if they lose their vegetation cover and soil run off into water courses further reduces the habitat quality of rivers. Runoff from intensively managed arable land contains pesticides which can negatively impact river invertebrates.

Polluted surface water runoff from roads and urban areas can be a problem. Increasing traffic and larger vehicles have damaged roadside drainage in places and a lack of maintenance and management can lead to polluted runoff discharging into rivers, which would have been intercepted by ditches in the past. This can lead to increased silt loads and 'flashier' streams, exacerbating the effects of the more intense storms resulting from climate change.

The nitrates and phosphates cause eutrophication where algae rapidly grow to form blooms taking up the oxygen in the water. Eroded soil in the water creates silty conditions reducing light penetration for aquatic plants, clogging up river gravels used by fish for spawning and choking marginal habitats.

Deepened river channels have lowered the water table in the flood plain leading to a loss of wetland habitats including old water meadow systems. Where rivers are allowed to spread out onto their floodplain a variety of wetland and wet grassland and woodland habitats form although these are currently uncommon and fragmented. Silt contains carbon and potentially invasive species so dredging also releases the carbon and can cause problems downstream.

Important river and wetland species populations are present in the Cotswolds including white clawed crayfish, water vole, otter, brown trout and bullhead.

6.4.2. Rivers and wetland – drivers for change

The warmer drier summers predicted as a result of climate change will add further pressure on the water levels in the aquifer. There will be both less topping up occurring over the summer months and a potential increase in the domestic and agricultural demand for extraction. Unmanaged this would increase the damage to river and wetland habitats caused by low flows which leads to the

drying out of marginal habitats, concentrates pollutants and creates pooling and stagnation which causes algal blooms. Additional development both within the area and downstream will add further to the demand for water through extraction from the aquifer.

In their currently fragmented state wetland habitats are more susceptible to the predicted extreme heat events and drought conditions.

Without new river and land management practices wetter winters and more extreme storm weather events will cause more soil erosion, sedimentation in rivers and river bank erosion. This will lead to the loss of riverside shrubs and trees. More extreme flooding events and more frequent overflow storm discharges from water treatment works will also occur.

Natural flood management is an approach that incorporates many of the measures recommended in this plan as they can bring both flood management and wildlife benefits. The increasing interest in and application of natural flood management is creating opportunities for nature recovery.

Some arable land adjacent to rivers is becoming inundated with water more regularly leading to a rethink of the most appropriate form of land management for these areas. This creates an opportunity to implement river and land management practices designed to both deliver nature recovery and adapt to climate change.

The arrival of invasive non-native species such as Himalayan balsam has caused ecological damage by displacing native flora. The signal crayfish poses a threat to the endangered white clawed crayfish through both competition and as a carrier of disease. They also affect other invertebrates and fish and cause bank erosion and turbidity.

A catchment based approach is increasingly being applied to water management and quality issues through Catchment Partnerships and these are also delivering nature recovery benefits.

6.4.3. Rivers and wetland - recovering or enhancing wildlife

The wetlands in the Cotswolds valley bottoms are well placed to contribute to a wider wetland ecological network as most of the valleys run in a south easterly direction to join the wetlands of the Thames gravels and the Cotswold Water Park. Managing and extending wetland habitats would also make them more resilient to climate change.

There are many opportunities along the valley bottoms to both improve the physical structure of the rivers and create new wetlands through physical works. Reconnecting the rivers to their floodplains and giving them room to behave according to natural processes can create valuable habitats contribute towards flood management and improve water quality by removing silt from the water channel. Beavers would achieve the same result as river restoration works undertaken by machinery in many locations. Any peaty soils should be a priority for rewetting.

Habitat improvements can also have the added benefit of reducing opportunities for signal crayfish burrows. Their numbers tend to be highest where there are steep clay banks. Historic dredging has created most of these steep banks, so raising beds, re-profiling banks, adding riffles, etc. can significantly reduce crayfish numbers.

Allowing migratory species to overcome barriers would bring added ecological benefits. For example there are low numbers of eels in the Cotswolds due to the number of barriers they need to negotiate. It would appear that nearly all the eels present in the Cotswolds are from historic

stocking. Increasing eel numbers by helping them overcome barriers helps a species that is both endangered and a favourite food source of otters. They are also an effective predator of signal crayfish.

The water in Cotswolds rivers flows from agricultural land either via the aquifer or directly. Changes to the management of agricultural land offers important opportunities to improve water quality and hence the habitat value of these rivers by keeping soil on the land and reducing pollution. In particular habitat restoration through the creation of wildflower grasslands on the adjoining valley sides and floodplain will improve water quality.

Improving water quality will greatly benefit species including white clawed crayfish, water vole and otter and a wide range of invertebrates. The restoration of wetland habitats including wet grasslands could bring back nesting waders particularly lapwing, redshank and curlew.

6.4.4. Rivers and wetland – practical measures

This section is a quick guide to the things that if applied at scale across the Cotswolds would allow wildlife to flourish, gain abundance, spread and adapt to climate change. Sources of more detailed guidance on practical measures, some linked to funding are listed in appendices 7.8 & 7.9. The Cotswolds National Landscape's landscape strategy and guidelines are also listed in appendix 6.6.1. These contain measures which should be followed tailored to particular landscape character types.

Restore river and wetland habitats to a structurally diverse condition through:

- Reintroducing meanders and other physical features such as pools.
- Narrowing low flow channels to clean silt from the river bed and create marginal habitats
- Raising the channel bed and reconnecting the river with the floodplain to form mosaics of wetlands, riparian woodlands and wet meadow wildflower grasslands.
- Giving the river room to change naturally by allowing it to spread out over its floodplain through many ever changing channels. This approach is sometimes called stage zero.
- Consider achieving the above through the introduction of beavers where appropriate
- Avoid dredging wherever possible

Remove in stream barriers to migratory species through weir removal or where flow allows, bypass channels. Modifications such as the introduction of notches in small weirs can have the same result. Where these measures are not appropriate introduce fish passes.

Minimise soil erosion and run off by implementing soil conservation measures such as cover crops, contour ploughing, margins and buffer strips across slopes. Avoid arable cropping on steep slopes feeding into watercourses and intensive grazing along river banks.

Identify existing and create new wildflower grasslands and ensure their retention and favourable management particularly on the valley sides and the scarp slope to aid water interception and retention.

Minimise pesticide and artificial fertiliser use and put in place measures to reduce pollution from agriculture including the relocation of gates and associated gapping up, watercourse fencing, cross drains, sediment ponds and traps, livestock and machinery tracks and associated livestock fencing, pesticide handling and biobed options, roofing of manure, slurry and silage storage and livestock gathering areas and help reduce runoff from yards, tracks and gateways

Site new wetland habitats to intercept runoff from roads.

Ensure that water leaving wastewater treatment works is low in pollutants and that storm events do not result in the discharge of untreated sewerage.

Create reedbeds to filter potentially polluted water from settlements before it is discharged to rivers.

Manage agricultural and domestic water use to minimise low flows in rivers. Ensure that abstraction from the aquifer is capped at a level that has no negative impact on river and wetland habitats through low flows.

Establish new trees and woodland where it will help 'slow the flow' and support water catchment management. Includes promotion of riparian woodland corridors as appropriate.

Implement and promote individual measures and behaviours in the home and workplace that protect water volume and quality in rivers:

- Only paper, pee and poo go down the loo
- Water saving measures
- Only rain down the drain (no paints, waste or oils etc.)

6.5. Cropland

6.5.1. Cropland – current condition

A large part of the wildlife value of arable is as part of a mixed farmed landscape where species utilise the variety of opportunities provided by the special complexity offered by mixed farming. Brown hare is a good example utilising both pasture and arable as is the lapwing which requires a nesting site on bare ground near to pasture for foraging. Boundary features such as hedges and dry stone walls bring further wildlife value.

Arable wildflowers are annuals that require regularly disturbed ground. Due to the widespread application of herbicides within crops they have become one of our most threatened groups of wildflowers.

The Cotswolds National Character Area is of medium richness in arable wildflowers: 72 out of 121 rare and threatened species have been recorded since 1987 including 17 of the 22 national priority arable plants listed under section 41 of the NERC Act 2006. Of these, nine plants have recent post-2000 recorded populations.[37] Important arable species found within the National Landscape include red hemp nettle, corn buttercup and shepherd's needle.

The Cotswolds has been identified as a priority area for farmland birds. The priority farmland bird species found in the National Landscape include: grey partridge, tree sparrow, yellow wagtail, skylark and corn bunting.

A comparatively new practice that supports wildlife in a mixed farming landscape in that of herb rich leys introduced within rotations as part of regenerative farming practices. Although they will never develop into wildflower grasslands they do increase the amount of nectar and invertebrates present in the landscape at any one time.

[37] 107 Cotswolds Arable Plants. Plantlife & Natural England 2014

6.5.2. Cropland – drivers for change

With the post war intensification of agriculture supported by government policy, particularly involving the application of pesticides and artificial fertilisers arable wildlife has undergone a dramatic decline with arable wildflowers becoming one of the nation's most endangered groups. Farmland birds have also been greatly impacted. Grey partridge and corn bunting have declined by more than 80% between 1970 and 2007[38] Overall farmland bird numbers declined by 55% between 1970 and 2018[39].

Recently grave concerns have been raised about a loss of invertebrate abundance. It is an area where more research is needed and is not limited to the arable environment but indications are that it is a serious problem

The best UK data are for butterflies and moths which are broadly in decline, particularly in farmland and in the south. UK bees and hoverflies have also shown marked range contractions. The causes of insect declines are much debated, but almost certainly include habitat loss, chronic exposure to mixtures of pesticides, and climate change.[40]

Mixed farming so valuable to wildlife is also in decline. There were 247 mixed farms in the Cotswolds in 1990 falling by 80 to 167 in 2013 (32%)[41]. This figure reflects the decline but not accurately as it also includes the consolidation and merger of farm units.

Integrated pest management and organic farming are long established farming systems that are gaining in popularity. New farming movements such as regenerative agriculture and Agri-ecology could also contribute much to nature recovery.

There are now indications of positive change. With the support of agri-environment schemes landowners have made a concerted effort to incorporate conservation measures into their operations, particularly for important farmland birds.

Modern technology is also increasingly being used to reduce the application of artificial pesticides and fertilisers.

6.5.3. Cropland - recovering or enhancing wildlife

The inclusion of conservation measures can be particularly valuable in arable fields within a mixed farmed landscape.

In-field measures for farmland birds and arable wildflowers are essential for the conservation of important species.

Overwinter stubble, seed rich winter cover crops using wild bird seed mixtures and unsprayed and unharvested arable headlands help farmland birds such as linnets, skylark, yellowhammer, corn bunting and grey partridges bridge the "hungry gap" of mid-February to mid-April. Cultivated arable

[38] Farmland Bird Indicator 1970-2007. British Trust for Ornithology
[39] UK Biodiversity Indicators 2020. DEFRA 2020.
[40] Insect Declines and Why They Matter. Goulson. D. South West Wildlife Trusts. 2019.
[41] Monitoring Environmental Outcomes in Protected Landscapes. Natural England

headlands can help arable wildflowers too. Supplementary feeding can assist important farmland bird species until sufficient habitat has been developed.

Wildflower field margins support invertebrates, farmland birds and predators, particularly birds of prey such as barn owls and kestrels. Their siting can improve ecological connectivity considerably across a mixed farmed landscape. Margins managed as meadows are important for wildflowers and invertebrates and less frequently managed margins have high small mammal populations and are important for birds of prey. It is important to have both throughout the landscape. Arable nectar strips and leys sown with native species can also increase both the amount of available habitat and its connectivity.

Grading margins up to a thick hedgerow creates nesting sites for linnets and yellowhammers who seek long grass at hedgerow bases. Wide margins draw corn buntings and yellow wagtails to nest in them avoiding incidents of nest damaging that can occur within the crop. Yellow wagtails have a tendency to nest in the tramlines.

All the measures that provide nectar for invertebrates also help with farmland bird nesting success as the invertebrates are an important protein rich source of food for the chicks. In-field measures can further improve nesting success. Double drilling a patch of the crop and avoiding harvesting it will draw corn buntings into it to nest safely as will skylark and lapwing plots.

Where appropriate integrating more trees into agricultural systems can help nature recovery.

Arable operations can also support nature recovery beyond areas where specific measures are applied by minimising the application of pesticides and artificial fertilisers. This is increasingly supported by technology and techniques such as organic principles, integrated pest management and greater use of natural predators through features such as beetle banks. New practices such as the use of herb-rich rotational lays will bring wildlife benefits as well as deliver a range of ecosystem services. Minimum till and no till arable farming improve soil biology building populations of soil organisms such as earth worms which in turn provide more food for wildlife. Overwinter stubbles left in minimum till fields provide excellent habitat for wintering farmland birds.

Similarly regenerative agricultural techniques build soils, prevent erosion and support wildlife.

6.5.4. Cropland – practical measures

This section is a quick guide to the things that if applied at scale across the Cotswolds would allow wildlife to flourish, gain abundance spread and adapt to climate change. Sources of more detailed guidance on practical measures, some linked to funding are listed in appendices 7.8 and 7.9. The Cotswolds National Landscape's landscape strategy and guidelines are also listed in appendix 6.6.1. These contain measures which should be followed tailored to particular landscape character types.

Create and manage arable field margins as wildflower grasslands. Variable mowing regimes can be employed to ensure cover for small mammals and refugia over winter for invertebrates. Arisings will need to be removed after mowing to avoid the build-up of fertility and the loss of wildflowers to vigorous grasses.

Consider managing strips within field margins differently with annual cutting of the strip nearest the crop and less frequent cutting nearer the field boundary. Variety could also be introduced by managing blocks of strips or whole margins at different intervals.

Different strips within a field margin can be sown with different species mixes to reflect their different management.

Consider incorporating nectar strips and or herb-rich arable leys into arable rotations.

Leave areas unsprayed to support arable wildflowers, particularly in areas where important species are present. Manage arable fields with important populations of arable flowers present for those species.

Implement measures to assist farmland birds survive across the hungry gap (mid-February to Mid-April): overwinter stubble, seed rich winter cover crops using wild bird seed mixtures, unsprayed and unharvested arable headlands and supplementary feeding (as a measure until sufficient habitat has been provided)

Implement measures to improve farmland bird nesting success.

- Provide graded margins up to a thick hedgerow to create nesting sites for linnets and yellowhammers who seek long grass at hedgerow bases.
- Provide wide margins to draw corn buntings and yellow wagtails to nest in them avoiding incidents of nest damaging that can occur within the crop.
- Double drill a patch of the crop and avoid harvesting it to draw corn buntings into it to nest safely.
- Create skylark plots, unsown squares in the field. Skylarks land on bare earth and walk to the nest. This avoids siting nests near tramlines which are used by mammalian predators – e.g. foxes.
- Create lapwing plots, they need large stony areas to nest in. These must be sited near to pasture which lapwings use for foraging and ideally on or near to traditional lapwing nesting areas.

Implement measures such as integrated pest management and minimise the use of artificial fertilisers and pesticides.

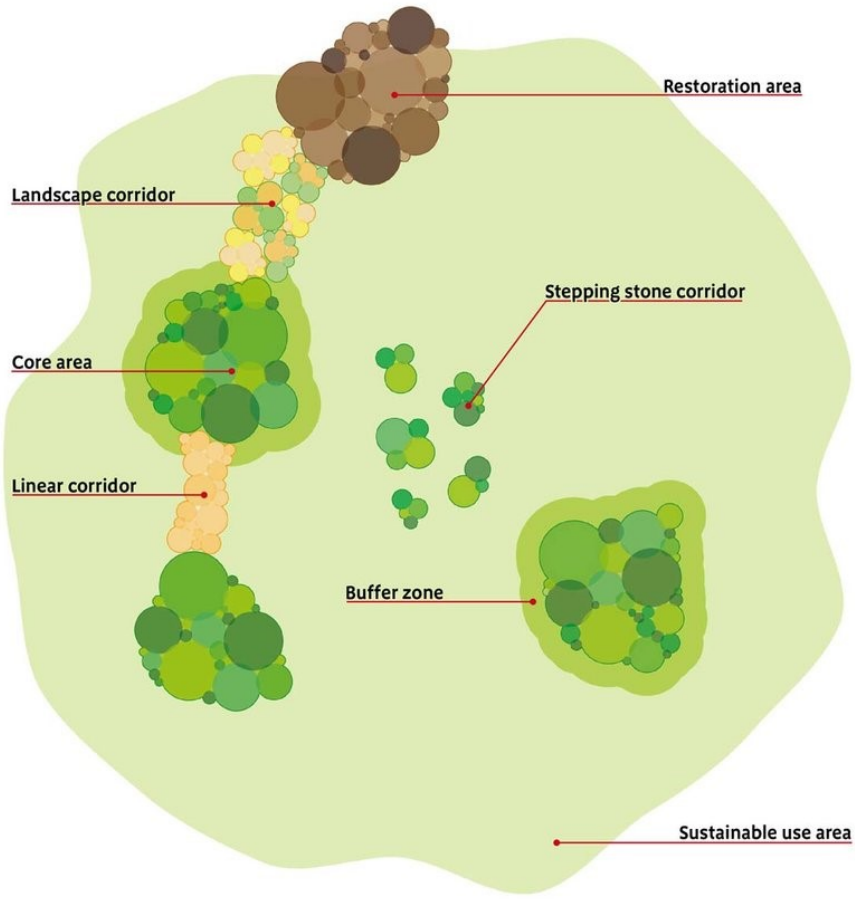
Adopt techniques that align with the five principles of regenerative agriculture: keep the soil covered, minimize soil disturbance, maximize crop diversity, maintain living root in the ground year-round, and integrate livestock.

Consider converting arable land on steep scarp or valley slopes and the high wold to extensively grazed wildflower grassland or mosaic habitats. Select locations that optimise strengthening the nature recovery network, improvements in groundwater quality, and that address nitrate and phosphate issues and aquifer recharge.

7. Appendices

7.1. Components of a Nature Recovery Network

In order to adapt to climate change wildlife needs to be able to move to a new niche (ecological home) and/or to move, usually northwards to a new climate space. Two things are required for this to happen, large "core" areas of varied habitat rich in different gradients and aspects offering new niches and a robust nature recovery network that allows wildlife to move across the landscape. Such a network was described by Sir John Lawton in the report Making Space for Nature[42].



The components of an ecological network as described in Making Space for Nature.

The 'Lawton Report' goes onto to describe what we need to do to create a network that will allow wildlife to recover and adapt to climate change.

What needs to be done… can be summarised in four words: ***more, bigger, better and joined****. There are five key approaches which encompass these, and also take account of the land around the ecological network. We need to:*

I. *Improve the quality of current wildlife sites by better habitat management.*
II. *Increase the size of current sites.*

[42] Making Space for Nature: A review of England's Wildlife Sites and Ecological Network. Lawton, 2010.

III. *Enhance connections between, or join up, sites, either through physical corridors, or through 'stepping stones'.*
IV. *Create new sites.*
V. *Reduce the pressures on wildlife by improving the wider environment, including through buffering wildlife sites.*

7.2. Physical Description

Add a map showing the three broad landscape character areas

The Cotswolds landscape character assessment[43] breaks down the Cotswolds into 19 landscape character types and 68 landscape character areas. By grouping together similar landscape character types this plan looks at three broad landscape areas that have distinctive ecological characteristics.

7.2.1. The Scarp and Outliers

The scarp is a dramatic landscape feature that defines the outcrop of Jurassic limestone. Running in a virtually unbroken line for 52 miles, from Bath in the South north eastwards to Mickleton, the scarp defines the western edge of the Cotswolds. Its highest point is at Cleeve Hill, 330 metres above sea level. The scarp is surprisingly narrow, rarely exceeding more than half a mile in width. Its summit is often marked by a narrow belt of trees which, when viewed from the vales below, can occupy the skyline and form a dramatic silhouette.

Beyond Mickleton the scarp becomes broken and a second narrow section runs from Tysoe to Edgehill in the north east of the National Landscape.

Progressive erosion of the scarp over many thousands of years has resulted in its retreat south-eastwards. The retreat has followed lines of weakness, causing breaches in the scarp and carving deep, wide valleys around Stroud and Bath, and to a lesser extent, at Winchcombe.

At the base of the scarp are the oldest rocks in the Cotswolds. These are easily weathered and, as a result, have been eroded to form hummocky ground where the lower escarpment slopes form a transitional area between the vale and escarpment.

Seven outliers, once part of the scarp, became detached from it as it retreated and they are now left isolated as distinct hills. Erosion of the scarp continues and new outliers, such as at Langley Hill, are becoming detached from it.

Between Hillesley and Uley a series of valleys encroach into and breach the escarpment. As a result, it is less well defined than other stretches to the north and south, appearing as a complex of rolling hills and ridgelines separating numerous deep valleys.

The outstanding ecological feature of the scarp is a mixed mosaic of grassland and ancient woodland running along its length. Much of the grassland is ancient wildflower grassland and there is much wildflower poor grassland suitable for restoration.

Within the Cotswolds landscape character assessment this area is defined by landscape character types 1. Escarpment outliers, 2. Escarpment, 3. Rolling hills and valleys, 18. Settled unwooded vale and 19. Unwooded vale.

[43] Cotswolds Landscape Character Assessment. Cotswolds Conservation Board. 2004

7.2.2. High Wold and Dip slope

The principal areas of this broad, expansive plateau extend from the north of Stroud then sweep north-eastwards to Chipping Campden. This large-scale, windswept landscape gives a great feeling of elevation and openness and offers unrestrained views across the countryside. Indeed, from the highest point on the plateau at Cleeve Common you can see Shropshire, 45 miles away. Deep valleys incised into the plateau are not visible when looking across the tops, so the impression is of one long stretch of land. Large-scale, regular fields of arable farming and improved pasture are mainly enclosed by a network of drystone walls. With its thin, stony soil few trees have managed to establish themselves except on unmanaged road verges. Elsewhere almost all of the trees that exist have been planted.

Settlement on the plateau is confined mainly to small villages and hamlets within the more sheltered valleys. The exception is the town of Stow-on-the-Wold which is located on the plateau and has been a favoured meeting place since Roman times. The landscape is covered with numerous small-scale local quarries or 'delves'. Often no more than shallow, surface excavations, these delves have provided material for stone walls and, perhaps, a few local buildings.

Within the Cotswolds landscape character assessment this area is defined by landscape character types 7. High wold, 9. High wold dip slope and 13. Low limestone plateau.

7.2.3. River Valleys

A series of rivers rise on the upper sections of the high wold within close proximity of the scarp edge. Their courses display a radial progression from the south-easterly flowing tributaries of the Thames and those that flow south and south-westwards into the Frome, a tributary of the Severn. Some rivers flow west or north such as the Chelt, a tributary of the Severn, and the Carrant and Isbourne which flow into the Warwickshire Avon.

These river valleys cut into the high wold deepening and broadening as they develop through the dip slope and beyond and as their rivers grow larger. There is a predominance of pastoral farmland of improved grassland extending between small woodlands on slopes, and along valley bottoms, together with pockets of arable land, particularly on the shallower slopes.

In the southern fringes of the Cotswolds to the south, east and north of Bath, the valleys form part of a wider system of rivers and streams that feed into the Bristol Avon. Physically enclosed, these moderately broad, steep-sided river valleys support sparse settlements. The steep valley sides and woodland create a sense of seclusion and generally inhibit views along the valley. The upper slopes can be quite open, however, allowing views across the valley. Farming is both arable and pastoral but there are wide areas of rough pasture and scrub. On the steeper slopes of the valley sides and valley tops there are some significant blocks of woodland

In the Stroud area the narrow, steep-sided valleys of the River Frome and its tributaries have a strong sense of being enclosed. Pastoral land covers the valley sides interspersed with scattered areas of scrub, rough pasture and arable land. Deciduous woodlands clinging to the valley sides combine with the hedgerow network to create a relatively well wooded character.

Away from the plateau the landscape falls gently south-eastwards. This area forms the transition from plateau to lowland. Although this rolling landscape is still elevated and exposed, it feels distinctly more sheltered and intimate and offers less open views. It is dissected by an increasing

number of deep dry valleys and streams, creating a more secluded ambiance. Intensive arable farming gives the landscape a productive, well maintained character, simple and smooth in texture. The large fields are separated by stone walls, some of them obscured by overgrowing vegetation and hedges. Although woodland cover is limited, areas of ancient woodland survive in the parkland settings of Wychwood, the remains of an ancient royal hunting forest, and at Cirencester Park.

Lowland landscapes comprise broad tracts of land on the edge of the Cotswolds next to the flatter Thames basin to the South East. Much of the land is farmed as mixed arable and pasture. This well-managed mosaic of medium and large, regular fields is contained not by stone walls but by hedgerows. It has a strongly organised and productive character compared with many of the other Cotswolds land forms. A notable feature of this area is its historic parks, gardens and 'landscaped' areas. A number are very extensive, notably Badminton Park and Westonbirt Arboretum. Extensive woodlands and planned features, such as avenues and vistas, impart impressive scale to the landscape. Coniferous plantations are occasional conspicuous elements.

Within the Cotswolds landscape character assessment this area is defined by landscape character types 4. Enclosed limestone valley, 5. Settled valleys, 6. Ironstone hills and valleys, 8. High wold valley, 10. High wold dip slope valley, 11. Dip slope lowland, 12. Dip slope lowland valley, 14. Cornbrash pastoral lowlands, 15. Farmed slopes, 16. Broad floodplain valley, 17. Pastoral lowland vale.

7.3. Wider environmental & economic benefits

The ecosystems services approach provides a useful framework for describing the wider environmental and economic benefits of a landscape. The nature recovery network will protect and enhance many of the services. The National Character Area profile for the Cotswolds[44] (Appendix 7.6.2.) includes a fuller analysis of the ecosystem services provided by the wider Cotswolds area. Two additional pieces of work investigating selected aspects in greater detail have been undertaken.

A Natural Capital Atlas for the Cotswolds

A series of county natural capital Atlases were published by Natural England in 2020. These are of interest as they compare an area's habitat based natural capital assets to a national average giving an indication of the comparative strengths and weaknesses of an area's natural capital assets. They can be downloaded here.

These atlases were only produced on a local authority boundary basis making it impossible to gain an overview from a Cotswolds perspective. The data package and a methodology guide were also published and in 2021 the Cotswolds National Landscape engaged a master's student to source and cut the data to create a single atlas for the Cotswolds. This atlas can be viewed here (insert link to appropriate new CNL nature recovery webpage).

2021 Natural Capital Assessment for the Cotswolds

Throughout 2021 funding from Natural England was accessed by the National Association of AONBs to engage a company to undertake a fresh Cotswolds wide analysis of selected natural capital assets and present them through a simple to use dashboard. Areas investigated include habitats, nature

[44] Natural Character Area profile 107. Cotswolds. Natural England 2015

recovery, carbon storage, farming land use, water flow and water quality. The dashboard can be viewed here (insert link to appropriate new CNL nature recovery webpage).

7.3.1. Regulating services (maintaining soil, air and water quality)

Regulating services are the benefits obtained from the regulation of natural processes. They commonly include things like: regulating local climate, filtering pollutants, regulating water flows and nutrient recycling in soils. The most important regulating services in limestone landscapes are associated with soils and water.

The cover provided by permanent grassland and woodland over much of the Cotswolds land surface protects the thin soils from erosion particularly on the steep slopes and helps act as a natural sponge to slow the flow of water. This is through two main mechanisms, evapotranspiration (catching rain on the leaves and evaporating so the water never reaches the soil, and increased infiltration rates into the soil. Trees and shrubs are particularly effective at both.

The water emerges from the underlying aquifer through springs and is of high quality. Most of the land supplying the aquifer is within a Nitrate Vulnerable Zone.

Areas within the National Landscape are susceptible to flooding, for example Milton-under-Wychwood, Castle Coombe and Bledington as are nearby areas such as Shipston-on-Stour and Cirencester. The aquifer also causes flooding to the east of the National Landscape during periods of heavy rain. Rivers which supply the headwaters of the Thames can cause flooding of communities along the valleys and further downstream in the Thames catchment. A significant number of waterbodies rise on the Cotswold Escarpment and then flow outside of the boundary into the towns and cities of the River Severn catchment, many of which are impacted by flooding, particularly Stroud, Gloucester and Cheltenham. Flooding events are exacerbated by rivers being constrained within artificially deepened channels where flows can be very fast following heavy rain. Where rivers can more easily escape their channels and spread out over the floodplain the flow of water is slowed helping to avoid flooding events downstream. This is only one type of many natural flood management measures.

7.3.2. Provisioning services (food, materials and water supply)

The main products from the National Landscape are beef and lamb with some dairy from grazing (6,300 Ha) and crops, mainly wheat, barley and oilseed from arable (93,000 Ha): a further 31,000 Ha of arable and grass in rotation produces both. Historically wool was a very important local product playing a huge role in the shaping of both the economy and the landscape. Although still produced it is less important today.

The local breed of sheep is the Cotswold, known locally as the Cotswold Lion. It is still found and numbers are recovering after a long period of unpopularity. By the mid-20th-century there was just one large breeding flock and a handful of small flocks left but since then numbers have slowly built back up. According to the Cotswolds Sheep Society there are still only around 1350 breeding ewes in the country[45] and it is categorised as at risk by the Rare Breeds Survival Trust[46].

Cotswold stone is probably the best known material product of the area with Leckhampton Hill being a famous example of the many quarries not least because of the devil's chimney, an iconic pillar left

[45] https://www.cotswoldsheepsociety.co.uk/the-society/save-the-cotswold-lion/
[46] https://www.rbst.org.uk/Pages/Category/sheep-watchlist?Take=27

behind by quarrying. Historically Cotswold stone was used for building and walling with some burning for lime according to its quality. The best stone was suitable for carving for interior use and some of this can, for example, be found in the Cheltenham College Chapel. In modern times much of it is crushed for gravel although due to its varying colour across the Cotswolds a spread of quarries is still important to provide walling and building stone that matches locally. Cotswold stone is a unifying element of the landscape, used to build pretty much everything: drystone walls, cottages, grand houses and churches, all built in a locally distinctive style.

The 24,000 Ha of woodland produces a number of woodland products, mainly firewood although there is also small-scale production of more specialised products such as charcoal, timber, pheasants and venison. A good example is the pride taken by the volunteers coppicing Littleworth Woods in the fact that everything cut is used. The products produced include binders and stakes for hedgelaying and brushwood bundles for use in river restoration. A case of one conservation activity providing the materials for two others!

The area is underlain by a limestone aquifer, and both this and the rivers that flow from it are a key supply of high-quality water for this and the surrounding areas, including the Cotswold Water Park. The Cotswolds provide drinking water for populations as far away as London. Hotter, drier summers affect flow in aquifer fed rivers and many of the rivers and parts of the aquifer are classified as having no more water available for abstraction.

7.3.3. Cultural services (inspiration, education and wellbeing)

The Cotswolds makes a significant contribution to the wellbeing of visitors and residents alike through informal quiet recreation (not involving significant motorized activity). The area is rich in cultural, natural, geological and historic heritage which combine within a truly iconic English landscape that is a joy to explore. Tolkien enjoyed exploring the Cotswolds from Oxford and it is arguably one of the areas that inspired him to write about The Shire. The nature of the Cotswolds also provided inspiration to William Morris and the arts and crafts movement.

There is a dense network of 3,013 miles of public rights of way, nearly four miles of public right of way per square mile and walking, horse riding and cycling are all popular activities. The condition of the rights of way network within the Cotswolds is noticeably better than in the wider countryside due to the thorough monitoring and maintenance programme delivered by the Cotswolds Voluntary Wardens.

The Cotswold Way runs the length of the area for 102 miles from Bath to Chipping Campden and there are at least 17 other named routes within the National Landscape.

Two million people live within a 20-minute car journey of the Cotswolds[47] and it is estimated that 23 million people a year visit, many of whom come for the day[48].

7.4. Deprivation in communities within the vicinity of the Cotswolds

Populations in the vicinity of the Cotswolds within the top 10% & 20% of the Indices of Multiple Deprivation (IMD) 2015 (2011 census data).

[47] Assessment of the economic value of the Cotswolds AONB. Cumulus Consultants Ltd for the Cotswolds Conservation Board.
[48] Destination Management Plan for the Cotswolds. Cotswolds Conservation Board. 2014

Local Authority Area	Est Population*	Pop in top 10% of IMD	Pop in top 20% of IMD
Birmingham	958,500	379,500	525,000
Bristol, City of	394,500	63,000	168,000
South Gloucestershire	247,000	0	1,500
Swindon	198,000	12,000	45,000
Bath and North East Somerset	172,500	1,500	7,500
Cherwell (Banbury)	139,500	0	6,000
Oxford	124,500	3,000	15,000
Cheltenham	112,500	4,500	19,500
Total	**2,464,000**	**478,500**	**816,000**

* Based on 1,500 per local super output area

7.5. Additional biological information

7.5.1. Designations by area

Designation	Extent Ha			
	Scarp and outliers	High wold and dip slope	River valleys	Cotswolds National Landscape
Country Park	59	14	8	81
Local Nature reserve	54	0	0	54
National Nature Reserve	111	277	338	725
Special Area of Conservation	598	94	489	1,181
Site of Special Scientific Interest	1,050	1,372	1,697	4,119

Sites of Special Scientific Interest include sites designated for their geological and geomorphological interest as well as wildlife interest.

The Natural capital assessment of the Cotswolds spatial analysis used to generate these figures was unable to access consistent data for locally designated wildlife sites (exact names vary across different local authority areas) and Regionally Important Geological Sites. It is recognised that locally designates wildlife sites contain a greater area of important habitat than the other designations and that more work is required to bring this data together across the Cotswolds.

7.5.2. Lists of species of importance

National Lists

Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 , requires that lists be drawn up of the habitats and species that are of principal importance for the conservation of biodiversity in England.

There is also a "red list" of species which are considered to be critically endangered, endangered or vulnerable. Species on the red list are additionally considered to be a priority for conservation action.

Red lists are a globally recognised way of identifying the threat of extinction to species, using the internationally accepted Red List guidelines developed by the International Union for Conservation of Nature (IUCN). Red lists are produced globally and nationally. In Great Britain, red listing is overseen by an inter-agency working group co-ordinated by JNCC (Joint Nature Conservation Committee)

The Birds of Conservation Concern list published by the British Trust for Ornithology is commonly referred to as the UK Red List for Birds. It can be downloaded here.

Natural England specialists are also working on Favourable Conservation Status (FCS) definitions for a range of priority species and habitats. Only a few species are currently covered including two Cotswolds species (Duke of Burgundy butterfly and white clawed crayfish). As the list grows these definitions will help to inform our understanding of the importance of Cotswolds populations.

Natural England have helpfully produced a spreadsheet containing all Section 41 species by Natural Character Area (NCA). This also includes details of any red listing for these species along with the red listing category (vulnerable, endangered or critically endangered).

Species identified within nationally important assemblages

In addition to lists of species and habitats some conservation bodies have identified groups or assemblages of species which are collectively both important and based on a particular habitat. As they can often benefit from common conservation measures inclusion in such an assemblage should also be considered in the selection of key species.

Assemblages for which the Cotswolds is considered important are:

- Plantlife have identified the Cotswolds as an Important Plant Area for "An exceptional diversity of vascular plants growing in dry limestone grassland and deciduous woodland."
- Farmland Bird Target Areas were drawn up by Natural England to guide the Cotswolds and South West Farmland Bird Initiatives. These projects focussed on specific actions for six endangered farmland bird species, five of which are found in the Cotswolds.

A searchable spreadsheet compiling of the species lists for the Cotswolds can be downloaded here *(insert link to appropriate new CNL nature recovery webpage).*

7.6. Review of existing environmental information

7.6.1. Landscape Character Assessment & Landscape Strategy and Guidelines

The Cotswolds landscape character assessment breaks down the Cotswolds into 19 landscape character types and 68 landscape character areas.

The full assessment including the map can be downloaded here.

By grouping together similar landscape character types this plan looks at three broad landscape areas that have distinctive ecological characteristics. These are the scarp and its outliers, the high wold and the river valleys. Information and maps of habitats and designations can be examined by both individual landscape character types and broad landscape character areas on the Cotswolds Natural Capital Dashboard *(insert link to appropriate new CNL nature recovery webpage).*

Detailed Landscape Strategies and Guidelines have been drawn up for every landscape character type. They look at forces for change and their potential implications for the landscape before listing the strategies and guidelines. These are the dos and don'ts for each landscape character type which should be followed to maintain landscape character. They can be downloaded here.

7.6.2. National Character Area Profiles

Published by Natural England the National Character Areas divide England into 159 distinct natural areas. Each is defined by a unique combination of landscape, biodiversity, geodiversity, history, and cultural and economic activity. Their boundaries follow natural lines in the landscape rather than administrative boundaries. National Character Area 107 Cotswolds covers most of the Cotswolds National Landscape and additional land to the south and east but excludes the foot of the scarp and its outliers which are in National Character Area 107 Severn and Avon Vales. All the National Character Area Profiles can be viewed here.

7.6.3 River Basin Management Plans

River Basin Management Plans (RBMPs) contain a great deal of information relating to the water environment and set out how organisations, stakeholders and communities will work together to improve it.

7.7. Review of work on improving ecological networks

7.7.1. Earlier work on ecological networks

Regional Nature maps

In the mid 2000s a series of regional nature maps were produced to encourage and guide the targeting habitat restoration and creation.

The South West Nature Map was produced by Biodiversity South West. It contains landscape scale blocks called Strategic Nature Areas (SNAs). Created using the rebuilding biodiversity methodology SNAs contain a mosaic of habitats, building on existing core areas and co-existing with other land uses, such as agriculture and recreation. More details can be found in the Rebuilding Biodiversity in the South West report which can be downloaded here. This report was published in 2005 and the Gloucestershire SNAs were revised in 2007. They can be viewed on the nature map page of the Gloucestershire Local Nature Partnership website

In 2006 Thames Valley Environmental Records Centre (TVERC) was funded by Oxfordshire County Council to identify the best areas of biodiversity and priority habitat across Oxfordshire, mapping areas that became known as Conservation Target Areas (CTAs). They are still actively used and were last updated in 2019. They can be downloaded from their page on the Wild Oxfordshire website where there is also a lot of further information on their use.

Nature Improvement Areas (NIAs)

As a result of a recommendation in the 2010 report by Sir John Lawton "Making Space for Nature", Nature Improvement Areas (NIAs) were established to create a series of joined up and resilient ecological networks at a landscape scale. A competitive process was held resulting in government funding 12 NIAs from 2012 – 2015.

The Cotswolds Nature Recovery Forum (then called the Cotswolds Ecological Networks Forum) decided to develop two NIAs for the Cotswolds without this funding.

The NIAs are large areas and flow across the landscape. They were identified drawing on the South West Nature Map's Strategic Nature Areas or in Oxfordshire, Conservation Target Areas. Local expertise, wildlife site designations, habitat data and landscape character assessment were also used. A map and summary of the Cotswolds NIAs can be downloaded from the Forum's web page here. *(This link may change when the new CNL nature recovery web pages are created.)*

7.7.2. Nature recovery projects

There are already an array of projects at the national regional and local levels seeking to build the nature recovery network. These are just a few examples and more can be found on the web pages of Local Nature Partnerships.

B-Lines
Led by Buglife B-Lines are a national series of 'insect pathways' running through our countryside and towns, along which they are restoring and creating a series of wildflower-rich habitat stepping stones. These link existing wildlife areas together, creating a network, like a railway, that will weave across the British landscape. Further details can be found here.

Big Chalk
Big Chalk is the coming together of all the calcareous (chalk and limestone) protected landscapes across southern England. They believe that together and when combined with bridging areas that link them they offer the best opportunity to help nature recover and adapt to climate change offered by the English Landscape. This is a result of the exceptional species richness of calcareous habitats combined with their collective geographical reach (*insert link to appropriate new CNL nature recovery webpage).*

Stroud Landscape Project
Led by the National Trust this project aims to create and improve grassland habitats, restore woodlands and establish wildlife corridors that allow plants and animals to move. With the town of Stroud at the centre, the project extends as far as Crickley Hill in the north to Wotton-under-Edge in the south. Details can be found here.

Carrant Catchment Area Restoration Project
This project is a partnership of local conservation bodies, landowners and farmers cooperating to restore natural habitats and create corridors for wildlife within the catchment of the Carrant Brook.

The project aims to share knowledge, improve land management for wildlife and access funding for conservation work. There is a focus on water management, in order to mitigate flooding and improve water quality on the brook, but the project also works with landowners to link other key local habitats (in particular the Special Areas of Conservation at Bredon Hill and Dixton Wood), restore existing and create new wildlife sites and to support collaboration on a landscape scale. A summary of the project can be downloaded here

7.8. Funding schemes

Agri-environment schemes

Countryside Stewardship

Countryside Stewardship (CS) is the current scheme that provides financial incentives for farmers, woodland owners, foresters and land managers to look after and improve the environment. More information can be found here.

A supplement to the Cotswolds Nature Recovery Plan that lists its practical measures and cross references them to the appropriate Countryside Stewardship options can be found here *(insert link when supplement produced and on the web site).*

Environmental Stewardship

This is the previous agri-environment scheme which has been encouraging and supporting environmental measures since 2005. It still has some live schemes

Environmental Land Management

This is made up of three schemes that are intended to support the rural economy whilst delivering environmental outcomes.

- Sustainable Farming Incentive (SFI)
- Local Nature recovery (LNR)
- Landscape Recovery

They are based on the premises of public payments for public goods that contribute to:

- clean and plentiful water
- clean air
- thriving plants and wildlife
- protection from environmental hazards
- reduction of and adaptation to climate change
- beauty, heritage and engagement with the environment

The **Sustainable Farming Incentive** will reward farmers for managing their land in an environmentally sustainable way and help them create greener landscapes and improve biodiversity. The full scheme will launch in 2022, initially for farmers in England who currently receive payments under the Basic Payment Scheme (BPS). SFI will support directly and indirectly and number of measures in this plan.

Local Nature Recovery is the scheme that will encompass most of the practical measures in this plan. LNR will pay for actions that support local nature recovery and deliver local environmental priorities. The scheme will also encourage collaboration between farmers and land managers

The **Landscape Recovery Scheme** will support the delivery of landscape and ecosystem recovery through long-term land use change projects, including projects to restore wilder landscapes where that is appropriate. The measures in this plan which it is most likely to support are large areas of dynamic habitat mosiac managed through extensive grazing.

The three schemes are currently under development through a programme of tests, trials and pilots. They will all be in place to start in 2024. Further details are available here.

Forestry Commission Grant Schemes

There are a variety of government funding schemes for woodland creation and management managed by the Forestry Commission, some are part of the Countryside Stewardship programme. The primary scheme for new woodland planting is the England Woodland Creation Offer. Details of all the national schemes are summarised here and an overview of tree planting and woodland creation schemes can be found here.

There are also regional Forestry Commission schemes such as the regional woodland restoration innovation fund. These tend to open and close on an annual basis.

An ever changing plethora of local authorities and charities are also seeking to support tree planting locally.

Farming in Protected Landscapes

This is a grant scheme restricted to protected landscapes and being run locally by the Cotswolds National Landscape until 2024. Eligible projects must aim to achieve something that fits into at least one of the following themes: nature, climate, people, and place.

This may include projects that:

- Support nature recovery – e.g. habitat restoration and conservation skills training
- Mitigate the impacts of climate change - e.g. natural flood management and reductions in greenhouse gas emissions
- Provide opportunities for people to discover, enjoy and understand the landscape and its cultural heritage – e.g. replacing stiles with gates and hosting community events
- Support nature-friendly, sustainable farm businesses – e.g. land management planning and local food supply

Further details are on the Cotswolds National Landscape website here.

Biodiversity Net Gain

Mechanisms are starting to emerge where landowners can put forward land for the delivery of off-site wildlife benefits as part of planning agreements resulting from development.

National metrics for calculating payments have been developed by Natural England. The best places to start to find out about local mechanisms are your local Planning Authority or Local Nature Partnership.

7.9. Practical guidance

The Landscape Strategies and Guidelines

Detailed strategies and guidelines for each of the 19 landscape character types found in the Cotswolds. Published by the Cotswolds National Landscape here to guide any proposals that may affect the landscape. They should be followed to maintain landscape character.

The United Kingdom Forestry Standard

The UK Forestry Standard is the reference standard for sustainable forest management in the UK. It outlines the context for forestry, sets out the approach of the UK governments to sustainable forest management, defines standards and requirements, and provides a basis for regulation and monitoring. It covers woodlands as well as large forests and includes guidelines for biodiversity. It can be downloaded here.

Design techniques for forest management planning: practice guide

Guidance for the creation of new forests and woodlands - by planting or encouraging natural regeneration - and the management of existing forests and woodlands. Although it is mainly focused on larger forest areas you'll also find information on how to follow aspects of forest planning for small woods. It can be downloaded here.

Ash Dieback

The Cotswolds and Vale Ash Dieback Forum has issued two helpful leaflets "Ash Dieback information for farmers and land managers" and "Replacing ash trees, principles and practice". Both can be downloaded here .

Rare breeds for conservation grazing

The Grazing Animals Project hosted by the Rare Breeds Survival Trust provides a lot of resources here to help with the selection and management of rare breeds for conservation grazing.

Species and habitat action plans

Detailed action plans were published for priority species and habitats between 1995 and 1999. They can all be downloaded from the Joint Nature Conservation Committee (JNCC) website here

Species summary sheets from the Back from the Brink Project.

Completing in 2021 - Back from the Brink was a national programme with funding from the National Lottery Heritage Fund. It aimed to ensure the recovery of 20 species nationally. The Cotswold's element led by Butterfly Conservation was called Limestone's Living Legacies and it focussed on these key species for the Cotswolds.

Basil thyme	Grey long-eared bat	Pasque flower
Cotswold pennycress	Juniper	Purple milk vetch
Duke of burgundy	Large blue	Red-shanked bumblebee

Fly orchid	Large garden bumblebee	Rockrose pot-beetle
Greater horseshoe bat	Marsh fritillary	Rugged oil beetle

Summary sheets for these species can be found here *(insert link to appropriate new CNL nature recovery webpage &/or Butterfly Conservation website).*

Wildflower grassland management, creation and restoration

The Save Our Magnificent Meadows web page has brought together lots of information in one place here.

Glorious Cotswolds Grasslands is a local project with the aim of creating the largest network of wildflower rich Jurassic limestone grassland in the country. Details including a downloadable advice pack can be found here.

The project can be contacted through an enquiry form here.

River, wetland and water management

Catchment Partnerships can help address water quality and habitat issues and also allow landowners to access funds like the Water Environment Investment Fund (WEIF). They also provide opportunities for landowners together to work on a larger, catchment scale.

Road verges

The Cotswolds National Landscape has published a position statement on the management of roadside verges, it can be downloaded here.

Plantlife have produced a set of resources to encourage and support the management of road verges for wildlife including management guidelines and the Good Verge Guide. These and more can be downloaded here.

Community action for wildlife

Many guides to community action for wildlife have been published. One of the best is also a local one. The "Community and Parish Guide to Biodiversity" published by BBOWT (Berkshire, Buckinghamshire and Oxfordshire Wildlife Trust), Oxfordshire County Council and TVERC (Thames Valley Environmental Records Centre) can be downloaded here

South Gloucestershire Council have written a guide for town and parish councils on developing a local nature action plan. It can be downloaded here

7.10. Glossary of terms used

Ancient and Veteran Trees
Ancient and veteran trees can be individual trees or groups of trees within wood pastures, historic parkland, hedgerows, orchards, parks or other areas. They are often found outside ancient woodlands. They are irreplaceable habitats with some or all of the following characteristics.

Ancient trees

An ancient tree is exceptionally valuable. Attributes can include its: great age, size, condition, cultural and heritage value and biodiversity value as a result of significant wood decay and the habitat created from the ageing process. Very few trees of any species become ancient.

Veteran trees
All ancient trees are veteran trees, but not all veteran trees are ancient. A veteran tree may not be very old, but it has decay features, such as branch death and hollowing. These features contribute to its biodiversity, cultural and heritage value.

Ancient Woodland
Ancient woodland takes hundreds of years to establish and is defined as an irreplaceable habitat. It's any area that's been wooded continuously since at least 1600 AD. It includes:

- Ancient semi-natural woodland mainly made up of trees and shrubs native to the site, usually arising from natural regeneration
- plantations on ancient woodland sites - replanted with conifer or broadleaved trees that retain ancient woodland features, such as undisturbed soil, ground flora and fungi

16,000 has been selected because tree planting was rare before then. It is also the furthest back in history that we can go in order to obtain reliable maps on which the ancient status of woods can be confirmed.

Ancient Unimproved Grassland
Unimproved' grassland is a semi-natural habitat, and typically would never have been ploughed, reseeded or heavily fertilised. They have developed as a result of sustained grazing, and they are species rich in both associated plants and animals. Ancient grasslands pre-date the introduction of modern agricultural practices. These ancient habitats only realise their full meaning when they are found in the location in which they developed. An ancient habitat is the result of the unique conditions and story of that place. Habitat translocation and recreation is important work but it can never make up for the destruction of ancient habitats.

Calcareous
Applied to soils, it describes a soil with a high calcium carbonate content over chalk or limestone

Climate Space
The physical area of the planet over which the correct climatic conditions exist for a species or habitat. Under conditions of a warming climate the latitude of a climate space in the northern hemisphere moves northwards hence the importance of nature recovery networks with strong north south links.

Coppicing
One of the ways broadleaved trees and shrubs will respond to being cut down, is to send up new shoots from the stump. This ability has been exploited throughout history as a form of woodland management with compartment being coppiced on cycles of between seven and 20 years.

Ecological Network
A grouping of high quality biodiversity sites and associated ecological linkages. These linkages provide the connectivity between the sites that enable species to move

Ecosystem
A community of organisms and their physical environment interacting as an ecological unit.

Ecosystem Services
The benefits people derive from the natural capital of ecosystems, e.g. provision of clean water. The services are commonly categorized into supporting, provisioning, regulating, and cultural services.

Ecotone
The boundary zone where two habitats meet. Ecotones may combine features of both habitats along with special conditions of their own and often contains species not found or infrequent in either. For example, the light at the edge of woodlands often produces dense thicket vegetation that is particularly berry and nectar rich and therefore of benefit to invertebrates and nesting, migrating and wintering birds. Another example of an ecotone that is particularly good for wildlife is the water's edge.

Extensive (grazing)
The process and management of less intensive food production. For grazing animals for example, it would normally involve lowering the stocking rate, and using less fertilizer or pesticides.

Greenspace – includes blue space
Greenspace refer to types of green infrastructure that is partly or wholly covered in grass, trees or other vegetation that includes parks and gardens, amenity green space, allotments, cemeteries, accessible countryside in urban fringe areas. Green infrastructure also includes blue space for example rivers, ponds, and sustainable urban drainage systems (SUDS).

Habitat
At the simplest level it refers to the place an organism lives. More commonly, the term has broadened to cover an identifiable assemblage of plants with their associated animals. For example, the habitat of the adonis blue is lowland calcareous grassland, yet it is also acceptable to describe lowland calcareous grassland as a habitat in its own right without referring to any of the species that live there.

Local Nature Partnership
County based partnership comprising representatives from statutory and non-statutory organizations whose aim is to work at strategic scale to improve multiple benefits for nature, people and the economy

Local Nature Recovery Strategy
The Local Nature Recovery Strategies (LNRS) will be produced by local authorities or local nature partnerships usually at the county or unitary scale. They are a flagship measure in the Environment Bill. LNRSs will put spatial planning for nature on a statutory footing, and will also support the delivery of a Nature Recovery Network by acting as a key tool to help local partners better direct investment and action that improves, creates and conserves wildlife-rich habitat.

Natural capital
The stock of biodiversity, soil, air, water, and all natural assets contained within, for example, a particular area, catchment or habitat. Primarily an economic definition to describe the base resource for derived benefits that people obtain from the natural capital, i.e. ecosystem services.

Natural Flood Management
Using natural processes to reduce the risks of flooding by implementing measures that help to protect and restore the natural functions of catchments, floodplains, rivers and the coast. Examples

include restoring bends in rivers, leaky dams in streams, bunds in fields and appropriate land management practices so soils can absorb more water.

Nature based solutions
A more integrated approach that can address and provide benefits for both people and biodiversity. A common example is a well-designed tree planting scheme that can benefit nature recovery and address climate change by carbon sequestration. There is a danger that nature based solutions are designed to only address a key issue and not realise multiple benefits.

Nature Recovery Network (NRN)
The NRN is a major commitment in the UK Government's 25-Year Environment Plan. It will be a national network of wildlife-rich places intended to improve, expand and connect habitats to address wildlife decline and provide wider environmental benefits for people.

Niche
A Species "home" within a habitat. Defined by its ecological relationships such as its location in the food web along with the physical and geographical factors that define its distribution.

Nitrate Vulnerable Zone
Areas of land that are designated as vulnerable to agricultural nitrate pollution. There are a number of rules and management activities that farmers in NVZs have to adhere to.

Priority Habitat
They are a range of semi-natural habitat types that were identified as being the most threatened and requiring conservation action. The list of Priority Habitats has been used to help draw up statutory lists of Habitats of Principal Importance for the conservation of biodiversity in the UK.

Ruderal
Plants that are often the initial colonizers of disturbed ground, which maybe as a result of human activity (e.g. construction, agriculture) or natural (e.g. disturbance by grazing animals or even ants)

Special Area of Conservation (SAC)
An area designated to protect rare and threatened wildlife under the European habitats directive. They are part of an important and internationally recognized network of European sites of particular ecological value.

Sites of Special Scientific Interest (SSSIs)
A range of statutorily protected areas of the best examples of Britain's biodiversity, geological and physiological features. It is important to recognise that SSSIs are a representative suite and do not include all of the best sites.

Vernal spring
Vernal refers to the strategy employed by some woodland plants which flower before the trees overhead come into leaf. These plants include bluebells, wood anemone, primroses, lesser celandine and violets which form attractive carpets making the vernal spring one of the great sights of English wildlife.

Veteran Tree
See "Ancient and Veteran Trees".

7.11. Acknowledgements

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