Full Report

STATE OF NATURE IN OXFORDSHIRE 2017
A Wild Oxfordshire Report

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Foreword by Professor David Macdonald

Ecologists are familiar with the intricacy with which elements of a jigsaw puzzle fit together, and how the parts of the picture can look different from close and far – after all, natural communities are comprised of a myriad interacting parts, and the processes that unite them differ between scales, the field, the farm, the landscape and ecosystem. So, it comes as no surprise that plans to understand and to conserve nature should also fit, one inside another, like Russian dolls. The big picture, nationally, took shape in 2013 when the first national State of Nature report took stock of the pattern of change for nature in the UK since the 1960s: the losses had been shocking. Three years on, and thanks to a remarkable partnership of organisations in Oxfordshire, and at a much finer scale, I am thrilled to congratulate the hundreds of volunteers and professionals whose expertise and effort is celebrated in this State of Nature in Oxfordshire. Indeed, I hope my own team at the WildCRU has played its part in the quest for the evidence on which to base conservation action and policy. The national picture may have been a grim documentation of declines, but in this county stock-taking we see signs of the super-tanker turning. Rejoice, for example, at the return of breeding bitterns and marsh harriers to Otmoor after an absence of two centuries, and, between 2008-16 the more than trebling of the expanse of Local Key Areas for Oxfordshire’s water voles.

The news, however, is mixed. Losses continue and the hob-nailed imprint of the human footprint sinks deeply into the countryside. The pressures of modern agriculture, of development and transport all now play out against a forbidding backcloth of climate change. These pressures operate, of course, at scales greater than a county, so how are we doing in context? Oxfordshire spans 2598 km² and is the most rural county in the South East. While two thirds of people live in urban environments, 74% of the county is agricultural land. And for Nature, 111 SSSIs protect 4495 ha, and 362 Local Wildlife Sites, although lacking legal protection, further safeguard another 5648 ha (totalling about 2% of the county). Looking ahead 36 Conservation Target Areas, amounting to 526.2 km², identify the most important areas for wildlife conservation. Within the county 146 species are legally protected and 260 are recognised as priorities for conservation. As we sit in a country that is often strident in the advice it offers others regarding their own back yards, a few reflections on scale might offer an inspiring perspective. Speaking personally, when not enmeshed in such local controversies as brought down on us by the benighted ‘B’s, such as badgers, beavers, bats and buzzards, I’m often busy in Africa where the WildCRU team had been tracking, amongst many other lions, the notoriously newsworthy Cecil. Cecil lived, and sadly died, on the border of Hwange National Park in Zimbabwe, where we work hard to encourage farmers to live alongside wildlife, just as we do in Oxfordshire. Some cock-eyed comparisons offer perspective: Hwange is given over entirely to wildlife, and measures more than five times the area of Oxfordshire (part of a network of Protected Areas that sets aside 27% of Zimbabwe for wildlife). Along Hwange’s borders, wildlife issues are spookily familiar to our Oxfordshire team: where a fox may kill chickens, badgers trample corn or roe deer nibble saplings, so a lion kills cows, elephants flatten maize or pull out trees. Here in the UK, we are asking more and more of our farmers, and many are rising to the challenge, but we ask at least as much, if not more, of their peers in the poorest countries of the world. In both, the future lies in research to find better ways of coexisting, and a combination of education, regulation and financial mechanisms to give Nature value.

Returning to Oxfordshire, what does this State of Nature Report tell us, and what use is it? First, it is a compendiously assembled baseline and in an era when baselines can shift and facts can be alternative, this
has huge value: you need to know what you’ve got to be sure of the losses and gains that follow. The report, organised into major sections on grasslands, freshwater and wetlands, woodland and trees, and farmland sets out clearly for each the headline facts. Next come the Case Studies, such as the successful creation of a 0.5 ha wildflower meadow at Barton Fields thanks to Lottery funding. Some of these vignettes are pleasingly quantitative, emphasising the critical importance of monitoring and surveying relative to those carefully established baselines. Sadly, some of these graphs, such as that for the poor house sparrow, have been vertiginously in descent.

What the report shows above all is that partnership is at the heart of what has been achieved in Oxfordshire. Water voles, mentioned earlier, are a perfect example. In WildCRU we have been privileged to work with this species for three decades and, while research can tell us what it is that water voles need, this is of little use unless it is translated into practice by the combined efforts of farmers, landowners, advisors and volunteers. When conservation management happens not only on individual sites but is joined up across landscapes, the outcomes can be dramatic. Our studies have shown that similar principles apply to many species. Moths, for example, vital food for bats and birds, and stunningly beautiful in their own right, are fostered on farmland by the presence of hedgerow trees: when these hedgerow trees are in landscapes where more farmers are engaged with agri-environment schemes, the positive effects of hedgerow trees are strikingly magnified.

In conservation, as in all societal choices, it is clear not only that everything is complicated, but that everything is related to everything else, and nothing is really free. It’s always important to value Nature, and sometimes it helps to put a value on nature. Of course, monetising nature is not the whole solution, indeed, sometimes it can be the problem, but this Report makes some powerful economic points. Strategically scattered through the text, the reader is reminded that, for example, properly nurtured roadside verges are not only lovely, they provide succour for pollinators including honey bees that contribute an ecosystem service worth millions to the agricultural economy. Similarly, the 23,203 ha of woodland (73% of it deciduous) that cloak 8.9% of the county help forestall a bill to the health service worth £6.5m pa through removing the 400 tonnes of air pollutants they suck up that would otherwise be suffusing our lungs.

Looking ahead, the woodland strategy for Oxfordshire, neatly encapsulated In a Nutshell, estimates that if 80% of the county’s woodland could be brought into management and support forest-based business, this could add £37m pa directly to the county’s economy along with, indirectly, £42m pa of ecosystem services. A green economy shimmers ahead. Remember the 74% of the county under agriculture, of which 4207 ha earned payments for ecosystems services under agri-environment schemes between 2006-14: if what the taxpayer wants is Nature alongside food security, then farmers can provide it.

These futuristic financial thoughts that coil through the naturalistic DNA of this report highlight the question, what next? Of course, a report this thorough does not leave the question unanswered. An appendix offers a list of actions but concludes “These proposed actions are not just aimed at the conservation sector” — if they were, if that sector simply talked to itself, then future stock-takings will surely tumble dismally down the graphs of decline. On the other hand, if this remarkable document is part of the fuel for societal change, for holistic conservation that engages and transforms planners, developers, decision-makers and an ever-wider constituency, the next edition will hopefully look back from lofty heights as the 2016 baseline recedes happily into history.

Prof. David W. Macdonald, CBE, FRSE, DSc
Professor David Macdonald CBE DSc FRSE is the Director of the Wildlife Conservation Research Unit (WildCRU) in the Department of Zoology, which he founded in 1986. He researches aspects of fundamental biology relevant to solving practical problems of wildlife conservation and environmental management, and thus to underpin policy formation and public debate of the many issues that surround the conservation of wildlife and its habitats. He has published over 800 papers in refereed international journals, and written or edited more than a dozen books. His research developed from spatial aspects of carnivore social behaviour, including long-term studies of badgers, lions and Ethiopian wolves, to embrace highly inter-disciplinary approaches to conservation biology. He has published two taxonomically-based volumes that consolidate much of his research on carnivores: 2004 The Biology and Conservation of Wild Canids, 2010 The Biology and Conservation of Wild Felids and a third, The Biology and Conservation of Wild Musteloids is underway. Two volumes cover Key Topics in Conservation Biology, 2007 and 2013. His most recent book Wildlife Conservation on Farmland 2015 is a synthesis of WildCRU’s work on British wildlife over the last 25 years. He is well known for his outreach to the general public through popular films and books as well as a wide scientific community in which he is frequently invited to give prestige lectures. David was awarded a CBE for services to natural sciences in the Queen’s Birthday Honours in 2010 and the Queens Anniversary Prize for Higher Education in acknowledgement of WildCRU’s outstanding work in wildlife and environmental conservation in 2011. In 2015 he was voted in the top 3 most influential conservationists by the BBC’s Wildlife Magazine.
Summary

If we wish to be the first generation to leave the natural environment in a better state than that in which we found it, we must first assess its condition. The State of Nature in Oxfordshire 2017 draws together a wealth of expertise from the county’s professional and volunteer base in biodiversity and nature conservation. The best information currently available has been used to paint a picture of the state of Oxfordshire’s natural habitats and species, including long-term trends as well as more recent losses and gains. Of necessity, there is a focus on those species groups (e.g. birds and butterflies) for which there are substantive amounts of data that have been collected in a consistent manner over an extended period. Other species groups would benefit from additional resources to improve the extent and consistency of species recording effort.

The report looks at five broad habitat categories that encompass the full diversity of habitats found across the county. For each habitat headline findings are presented including the current and historic extent and condition of specific habitat types, and recent changes and trends for characteristic species (where these are known). Relevant case studies are also presented, reflecting the breadth of work that is underway across the county.

Key findings include:

- Despite widespread historic loss of species-rich semi-natural grasslands (an estimated 97% of lowland meadow lost in England and Wales between 1930s and 1980s (Fuller, 1987)) Oxfordshire still has some of the rarest and finest grasslands in the country.
- Our rivers are much cleaner than they were 30 years ago, and targeted action has helped the recovery of local populations of threatened species, such as water vole and otter, but over 90% are only at best in “moderate ecological status” as defined by the Water Frameworks Directive.
- Long term declines in farmland and woodland biodiversity continue with some associated species at serious risk of extinction, such as the turtle dove. The area of woodland recorded in the county over the last 30 years has increased, but between 1911 and 2016 over 80% of orchards disappeared.
- Our fragmented woodland resource combined with an increase in size of farm holdings and increased areas of developed land, indicate a continuing fragmentation of areas of good habitat and a loss of connectivity across the county.
- Recent initiatives show that targeted investment and effort can reverse local loss of wildlife.

The report not only outlines the losses and gains in Oxfordshire’s biodiversity, but is also a serious “call to action”. We must encourage a greater, collective ambition for increasing our network of wild spaces, reducing devastating pressures on the environment, and halting the continued loss of biodiversity in the county if we are to secure a ‘net positive’ direction of travel in the future. The principles highlighted in the 2010 report “Making Space for Nature” (Lawton et al., 2010) are fundamental and can be summarised in four words: more, bigger, better, joined. Furthermore, several key actions are identified that will help to re-build nature in Oxfordshire. These can be seen in the ‘Improving Nature’ section of this report.
Introduction

Oxfordshire’s State of Nature

In light of the publication of the 2013 and 2016 national State of Nature reports (Hayhow et al., 2016) Wild Oxfordshire sought to produce a more local State of Nature report for Oxfordshire. This would bring together the breadth of the county’s volunteer and professional expertise in biodiversity and nature conservation and summarise some of the best information currently available, to paint a picture of the overall state of the county’s natural environment. The aim was to set this report in the context of current and historical data, and give an understanding of long-term trends, as well as more recent losses and gains in habitats and species. To do this we used:

- Base-line data held by Wild Oxfordshire and datasets compiled by key local recording groups and experts (such as Freshwater Habitats Trust (FHT), RSPB - Midlands, Berkshire, Buckinghamshire and Oxfordshire Wildlife Trust (BBOWT), Banbury Ornithological Society (BOS), Upper Thames Butterfly Conservation (UTBC) and Oxfordshire Flora Group (OFG)).
- Current information of area of Priority Habitat in the county, as supplied by Thames Valley Environmental Records Centre (TVERC) with additional information from the local Forestry Commission (FC), Natural England (NE) and Environment Agency (EA) teams.
- An analysis of change in land cover provided by TVERC.
- Information from the Local Wildlife Sites project, jointly run by TVERC and BBOWT.

Where gaps existed in local data, or we were unable to gather such data in the time-scale of this report, we refer to the national data and trends used for the 2016 national State of Nature report. In some cases, we have could compare local to national data give a more locally relevant picture, whether that means following the national trends or challenging them.

There are some major differences in how data has been used between the Oxfordshire and the national reports. With greater available resources the national report has provided quantitative assessments of the change in population or occupancy for 3,816 terrestrial and freshwater species over the long term, and 3,794 over the short term. This means they could detect whether the rate of change in nature has altered in more recent years. The national reports show trends in species from around 1970 to 2015 (the “long term”) and 2005 to 2015 (the “short term”).

This report compiles available data on the current extent of the main habitat types that exist in Oxfordshire and are also reported against in the national State of Nature. Where possible it looks at changes in their extent over time, with parameters as close to the term defined in the national report. Partner organisations such as the RSPB have provided more local data sets, for example that relating to the Breeding Waders of the Upper Thames. Other data provided was collected by local experts, many of whom are listed at the end of this report along with links to websites where more detailed information can be accessed.

When considering trends over time it has only been possible to assess population trends relating to a relatively small percentage of Oxfordshire’s species. Species indicators provide clear, quantitative assessments of biodiversity change and can be used to evaluate the effectiveness of policies and to understand ecological responses to environmental change. Local data have been used where available, and in all cases data sources have been acknowledged and referenced.

Compiling this report has enabled a focused look at the main pressures on Oxfordshire’s natural environment, what is currently being done to address these pressures, and what we urgently need to do to reverse the worrying trends that have emerged.

The information in this report has also been used to produce a short report aimed at influencing:

- Local, district and county council senior staff, councillors and MPs
- Key individuals from other sectors such as land managers, utilities companies, planners, developers
- A range of key economic decision makers including Oxfordshire LEP, South East Midlands LEP, Oxfordshire Health & Wellbeing Board
- Other partners organisations including local and regional government agencies (such as NHS, Forestry Commission, Natural England and the Environment Agency) and conservation practitioners

Many local recording groups, larger conservation organisations and businesses have supplied case studies aimed at demonstrating and inspiring positive action. Many case studies also provide information on locally important species and illustrate links between particular habitats and the species that depend on them.

This report is a baseline from which to assess future trends and will need to be periodically updated.
Policy context

The importance of the natural environment is widely recognised at national and international levels, and there is a substantial body of legislation and policy relating to its protection generally as well as for specific species and habitats.

In 2011 the government published a Natural Environment White Paper *The natural choice: securing the value of nature* (Department for Environment, Food & Rural Affairs [Defra], 2011). Amongst several recommendations the white paper identified the need to “…move from net biodiversity loss to net gain, by supporting healthy, well-functioning ecosystems and coherent ecological networks”. This built on a 2010 report *Making Space for Nature: a review of England’s wildlife sites and ecological network* (Lawton *et al*, 2010), key recommendations of this report included:

- That we better protect and manage our designated wildlife sites
- That we establish new Ecological Restoration Zones
- That we better protect our non-designated wildlife sites

*Making Space for Nature* identified some basic principles for improving habitats:

**MORE**   **BIGGER**   **BETTER**   **JOINED**

Further key policy initiatives arising from the White Paper include *Biodiversity 2020: A strategy for England’s wildlife and ecosystem service* (Defra, 2011) which sets out the strategic direction for biodiversity policy for the next decade on land, freshwater habitats and at sea.

Our understanding of the condition of our natural environment has been supported by several major cross-cutting studies in recent years. Notable amongst these is the 2011 *National Ecosystem Assessment* (UNEP-WCMC, 2011) and the Natural Capital Committee’s [NCC] first *State of Natural Capital* (2013) report.

Most recently, following on from recommendations of the third report *The State of Natural Capital: Protecting and Improving Natural Capital for Prosperity and Wellbeing* (NCC, 2015) the government committed to working with others to develop a strategy and 25-year plan for protecting and improving the benefits we get from our natural resources.
Oxfordshire’s Areas of Strategic Value for Nature

KEY TO MAP (Note: many sites have multiple designations, so the most appropriate is shown here)
- Major settlement
- Oxfordshire boundary
- Major river
- Area of Outstanding Natural Beauty
- Conservation Target Area
- World Heritage Site
- Special Area of Conservation
- National Area of Conservation
- National Nature Reserve
- Large Site of Special Scientific Interest

Map illustrated by Helen Walsh. Contains Ordnance Survey data © Crown copyright and database right 2016
An Overview of Nature in Oxfordshire

Covering an area of 2598km² (1003 sq. miles, 259800 ha) Oxfordshire has a diverse and interesting geology, criss-crossed by eight rivers systems, that creates a gentle yet complex landscape. As such, it supports a variety of habitats, from fragrant chalk grasslands scented with wild thyme to fungi-strewn beech woods; from pockets of damp, reedy fen and acid grassland to marshy meadows full of birds. Indeed, it is home to many rare and threatened plants and animals, and has a high proportion of locally, nationally and internationally important sites. Agriculture has a strong influence on the landscape yet, despite its rural character, more than 66% of the county’s population live in urban settings; a number that is expected to rise in the future.

All of England’s landscape-types have been divided into Natural Character Areas [NCAs] (Natural England, 2014); broadly speaking Oxfordshire consists of:

- The Berkshire downs and Chilterns: Steep slopes and dry valleys on chalk with the Chilterns topped by more acidic clay with flints.
- The southern clay vale: Greensand gives way to gault and other clays in a broad band running from Thame to Wallingford and Abingdon and then encompassing the Vale of White Horse to the western county boundary.
- The mid vale ridge: Also known as the Oxfordshire Heights, is a low ridge of limestone hills running from Shrivenham, through Faringdon to Oxford and then to the Buckinghamshire border near Brill.
- The northern clay vale: Oxford Clay and alluvial deposits along the Upper Thames Valley and Ray Valley.
- The Cotswolds and north Oxfordshire: Limestone cut through by many rivers and streams with lias clays and sands becoming more predominant further north, where ironstone is also found.
- The limestone plateau: east of the Cherwell Valley and north of Bicester, a wide limestone plateau.

The geology of the county has enabled a thriving mineral industry to develop, with stone quarrying and gravel extraction supporting businesses for many centuries. Former mineral working sites such as quarries and gravel pits have the potential to provide massive opportunities for wildlife. Oxfordshire has several outstanding examples including the award-winning Gill Mill quarry extension, the Lower Windrush Valley Project and Ardley Quarry.

The quality of Oxfordshire’s landscapes is recognised by the designation of three Areas of Outstanding Natural Beauty, the Chilterns and North Wessex Downs on the chalk in the south and the Cotswolds on the limestone in the north-west. Together these designations cover over one quarter (26%) of the county by area. Further details on the character of each AONB in Oxfordshire are provided in Appendix 1.

Oxfordshire is the most rural county in the south east. Agriculture makes up approximately 74% of the county’s land use (NFU, 2014), shaping the countryside as a place to live and visit as well as producing food and supporting local businesses. Despite this rural character many peoples’ experience of Oxfordshire is dominated by the built environment and more than 66% of the county’s population live in urban settings¹. With the county’s population forecast to grow by 13% up to 2026 (Oxfordshire County Council, 2015) the associated increase in housing, combined with the current predominately intensive arable land use, is likely to put increasing pressure on the available places for nature to thrive.

¹ As defined by HM GOV: Areas are defined as rural if they fall outside of settlements with more than 10,000 resident population.
Important Species and Designated Sites in Oxfordshire

Oxfordshire’s natural habitats support plant species of importance at a European level, and others of national and local importance. 146 UK legally protected species have been recorded in the county with more than 260 species recognised as being a priority for conservation (Section 41 NERC/UK Priority Species)\(^2\). Of some 1700 native and long established plants which were present in Oxfordshire between 1968 and 1998, 50 have not been found since 2000. And 288 are either listed as nationally important or occur in 10 or fewer localities in the county. Thirty-two species are listed under Section 41 of the 2006 Natural Environment and Rural Communities (NERC) Act as requiring monitoring and enhancing. Of 146 nationally listed plant species two are so rare they are listed as European Protected, two are Critically Endangered in England, 25 are Endangered in England, 56 are Vulnerable in England and 55 are Near Threatened in England. Additionally, seven are rare or scarce or Near Threatened in Great Britain (Oxfordshire Flora Group & TVERC, 2016).

The value of individual areas of the county’s habitat are recognised with a range of statutory designations which aim to protect the best examples of places for nature. Oxfordshire has parts of three Areas of Outstanding Natural Beauty (AONB) totalling some 25% of the county. AONBs are nationally and statutorily protected landscapes designated to conserve and enhance their natural beauty. The International Union for Conservation of Nature (IUCN) designates AONBs as Category V Protected Landscapes: ‘a protected area where the interaction of people and nature over time has produced an area of distinct character with significant ecological, biological, cultural and scenic value’

\(^2\) TVERC data supplied 25 November 2016. Includes mostly data since 1980 and rare and potentially lost species
Oxfordshire’s three AONBs are:

1. **The Cotswolds Area of Outstanding Natural Beauty**, of which an area of 248km\(^2\) (9.5% of the county and 12% of the AONB) lies within Oxfordshire. Of note in the Oxfordshire Cotswolds are areas of open High Wold, the Evenlode and Windrush river valleys, the Wychwood Forest, areas of unimproved limestone grassland and floodplain meadows. A good population of farmland birds still exists on arable land in the county.

2. **The Chilterns Area of Outstanding Natural Beauty**, of which 233 km\(^2\) (8.9% of the county and 28% of the AONB) lies within Oxfordshire. Of note in this part of the Chilterns are the ancient woodlands, chalk downland and scrub communities (including important juniper scrub).

3. **The North Wessex Downs Area of Outstanding Natural Beauty**, of which 186.5km\(^2\) (7.2% of the county area) lies within Oxfordshire. Amongst the habitats represented in the county are chalk grassland, restored grassland, woodland plantations, veteran trees and arable land.

Blenheim Palace and Park was awarded World Heritage Site status in 1987. Just one of the 17 registered sites in England (30 in the UK). Blenheim Park is also an important SSSI, containing one of the finest areas of ancient oak-dominated pasture woodland in the country with lakes of regional importance for breeding and wintering birds.

Oxfordshire has seven internationally designated Special Areas of Conservation (SAC) which fall partly or entirely within the county. SACs are designated where they support internationally important habitats and/or species listed in the EC Habitats Directive:

- **Aston Rowant**: One of the best remaining examples in the UK of lowland juniper scrub on chalk
- **Chilterns Beechwoods**: Beech forests on neutral to rich soils, stag beetle *Lucanus cervus*, dry grassland and scrublands on chalk
- **Cothill Fen**: Largest surviving example of alkaline fen in central England, alder woodland on floodplains
- **Hackpen Hill**: Significant population of early gentian *Gentianella anglica*, dry grasslands and scrubland on chalk
- **Hartslock Wood**: Yew woodland and chalk grassland supporting one of only three UK populations of monkey orchid *Orchis simia*
- **Little Wittenham**: One of the best studied great crested newt *Triturus cristatus* sites in the UK
- **Oxford Meadows**: Lowland hay meadows including the larger of only two known sites in the UK for creeping marshwort *Apium repens*.

There are 111 Sites of Special Scientific Interest (SSSI) wholly or mainly within Oxfordshire (4449.6ha in total). SSSIs are divided into one or more monitoring ‘units’. Oxfordshire has 162 such units which contain habitats that support unusual or endangered flora, fauna or geological features. Of these sites 45% are listed as in ‘Favourable’ condition, 53% ‘Recovering’ and 2% ‘Unfavourable’. However, it is likely that these condition assessments will not be a true reflection of the site conditions; according to a Natural Audit Office report (2008) it is uncertain how far from unfavourable some SSSIs may be, because (at that time) a quarter had not been assessed within the 6-year period prescribed by national guidance.
Local Wildlife Sites (LWS) are recognised by local authorities for their high wildlife value and are a material consideration in the planning system, but have no legal protection. Like SSSIs LWS are also surveyed on a rolling programme, with most sites being reassessed approximately every 10 years. Since 2005, the number of LWS has remained reasonably stable with 33 sites removed and 60 sites added during that period. Oxfordshire currently has 362 Local Wildlife Sites (5648ha) with a further 101 proposed new or proposed extensions to LWS (1880ha in total) under assessment (TVERC, 2017). Currently the percentage of the county covered by LWS is 2%, much lower than in some neighbouring counties such as Berkshire (8%), and much lower than England (5%) (The Wildlife Trusts, 2016). In 2014-15, 245 of the then 412 Local Sites in Oxfordshire (59%) (BBOWT, 2015) qualified as being in positive management.

Landscape-scale Priority Areas for Nature

The wildlife of important habitats such as that found on SSSI and LWS cannot survive indefinitely in isolation, but need to be part of a wider network of habitats connected at a landscape scale. This allows populations to move, adapt to changing conditions locally and maintain genetic diversity. The Oxfordshire Wildlife and Landscape Study (OWLS) (Blackwell & Nikolakaki, 2004) which investigated the landscape character and biodiversity resource of the county was a precursor to the development of Oxfordshire’s Conservation Target Areas (CTAs) in 2006. CTAs identify the most important areas for wildlife conservation in Oxfordshire, where targeted conservation action will have the greatest benefit (Wild Oxfordshire, 2014). Currently 36 CTAs cover just over 20 % of the county by area (526.2 km²) and contain 95% of the SSSI land area in Oxfordshire. They provide a focus for coordinated delivery of biodiversity work, agri-environment schemes and biodiversity enhancements through the planning system.
The river valleys of the Upper Thames and its tributaries have been recognised for their nature conservation importance for several decades in Oxfordshire and neighbouring counties. In 1994 it was established as an Environmentally Sensitive Area (ESA), and more recently has become a focus for landscape-scale conservation initiatives: two ‘Living Landscape’ project areas promoted by BBOWT covering the Thames valley and the Upper Ray valley, and one ‘Futurescape’ promoted by RSPB covering the old ESA area and a section of the Thames valley. The waders in the area have been surveyed by the RSPB Lapwing Landscapes project since 2005 (see case studies). In 2015 BBOWT and the RSPB set out a framework agreement on joint-working to promote and achieve projects which contribute to a landscape-scale approach to nature conservation within the area, or within influence on the area (BBOWT & RSPB, 2015).

In 2007 Plantlife, an international conservation NGO, announced the establishment of 150 Important Plant Areas (IPAs) across the UK. These are areas nominated for their internationally important wild plant populations. There are three IPAs in Oxfordshire: the Chiltern Woodlands, Oxford Meadows and the Cotswolds grasslands and woodlands. These IPAs developed out of a previous report (Stewart, 2004) identifying Important Stonewort Areas (ISAs). That report identified ISAs at Otmoor and the Stanton Harcourt area. Stoneworts are exceptional indicators of good water quality.

The valley grasslands in west Oxfordshire form part of the Cotswolds Valleys Nature Improvement Area (NIA). NIAs were established to create joined up and resilient ecological networks at a landscape scale. They are run by partnerships of local authorities, local communities and landowners, the private sector and conservation organisations.

**Nature and Local Communities**

An invaluable characteristic and resource of Oxfordshire is the number and diversity of community groups with an interest in wildlife and the natural world. Wild Oxfordshire lists ~132 conservation groups on its web-site (http://www.wildoxfordshire.org.uk/directory/) with an additional ~30 recording groups listed on the TVERC website (http://www.tverc.org/cms/content/recording-wildlife-groups) and ~60 Low Carbon Groups (http://cagoxfordshire.org.uk/oxfordshire-groups/). Oxfordshire has several active Catchment Partnerships that are primarily supported by the EA but also link across to FC and NE; these are the Evenlode (hosted by Wild Oxfordshire), Ock (FHT), Windrush and Oxon Ray/Cherwell (BBOWT) and the Thame (River Thame Conservation Trust & FHT). A small part of the Upper Thames Catchment Partnership also falls within Oxfordshire.

This level of community engagement, in combination with supporters of the larger conservation organisations with a local presence (such as FHT, EarthWatch, RSPB and BBOWT) provides many opportunities for a wide audience to appreciate nature and the contribution it makes to our lives. It is also a massive resource that can be called upon to help protect and enhance our important habitats and species for future generations. Community action is supported by a range of funding by local charities, trusts and individuals, including the Trust for Oxfordshire’s Environment (TOE2) a local organisation that actively seeks to secure and disburse funds for conservation in the county.
A wealth of locally-based organisations and centres of learning are leading the way in our understanding of human impacts on habitats and species, such as the Centre for Ecology and Hydrology (CEH) and EarthWatch. Research sites include Wytham Wood, which has been a leading centre for conservation management of woodland and forest ecosystem research over the last 60 years. More recently Paradise Wood was established by Earth Trust and partners as a research centre for improved broadleaved forestry, including improved resilience to disease, form and growth rate for increased timber productivity. This site also has trees which are part of the British Ash Tree Genome Project (http://www.ashgenome.org/).
HABITATS

Lowland Semi-Natural Grassland and Heathland

Overview

The key grassland habitats for nature conservation in Oxfordshire include floodplain grazing marsh (4189 ha), hay meadows (1250 ha), limestone and chalk grasslands (779 ha) and acid grasslands (55 ha). Oxfordshire has some of the rarest and finest grasslands in the country.

Species-rich grasslands are an intrinsic part of our natural and cultural heritage. The county’s grasslands range from the nationally important floodplain pastures and meadows of Pixey and Yarnton Meads, to the scarce and more fragmented dry acid grassland of Frilford Heath, and the nationally important chalk (calcareous) and limestone grassland of the Chilterns, Cotswolds and North Wessex Downs (in particular by White Horse Hill and Hackpen Hill). Calcareous and acid grasslands are a key feature of disused limestone, chalk and sand quarries.

Oxford Meadows Special Area of Conservation (SAC) is considered to be one of the best lowland hay meadow areas in the UK, with vegetation communities that are perhaps unique in reflecting the influence of long-term grazing and hay-cutting on lowland hay meadows (Defra, 2005; Rothero & Gowing 2016). They
also contain almost 6% of the UK’s total *Alopecurus pratensis* - *Sanguisorba officinalis* meadow foxtail - great burnet mesotrophic grassland (MG4) of the British National Vegetation Classification (NVC), (Rodwell 1992).

**Oxfordshire Grassland Headlines**

- 44% of a sample of grassland LWS in Oxfordshire have declined in condition since they were first selected (BBOWT, 2010)
- The marsh fritillary *Euphydryas aurinia* and wall butterflies *Lasiommata megera*, both grassland specialists, are now considered extinct in the county
- Apart from at the RSPB’s Otmoor reserve, curlew *Numenius arquata* numbers decreased by 51%, lapwing *Vanellus vanellus* by 21%, snipe *Gallinago gallinago* by 88% and redshank *Tringa totanus* by 50% in Oxfordshire between 2005 and 2015.
- Oxfordshire’s chalk grasslands support nationally important rare plants, including the bulk of the UK populations of downy woundwort *Stachys germanica*, meadow clary *Salvia pratensis*, early gentian *Gentianella anglica* and Chiltern gentian *Gentianella germanica*.
- Our wet grasslands support the vast majority of the UK’s population of creeping marshwort *Apium repens* and fen violet *Viola persicifolia*.
- Acid grassland at Shotover SSSI is home to some of the largest and densest aggregations of solitary bees and wasps in Oxfordshire.
- Loss of wet grassland habitat and predation impacts have led to dramatic declines in populations of wading birds such as curlew *Numenius arquata*, declining by 51% since 2005
- Aston Rowant NNR and Watlington Hill are locally important for their colourful suite of low nutrient grassland fungi of the chalk grasslands and the more neutral to acid clay cap grassland (Webb, 2016)

**The State of Grassland and Heathland Nature**

Traditional meadows and pastures characteristically rich in flowering plants are an important resource for pollinators and provide vital habitat for many rare and threatened species. The huge loss of semi-natural grassland, nationally and locally, has led to corresponding declines in species associated with the entire range of grassland habitats. Noting the past great losses of this habitat, the total area of grassland of nature conservation value in Oxfordshire appears to have remained relatively stable since 1998, with wet grassland and flower-rich grassland increasing as a result of targeted management (at sites such as RSPB’s Otmoor reserve and BBOWT’s Chimney meadows). However, monitoring and repeated survey has shown that many sites have declined in species richness (The Woodland Trusts, 2016). In common with the UK the vast majority of grassland in the county has been improved for grazers by the use of fertilisers, herbicides and through re-seeding. As a result, nationally only 2% of grasslands now have a high diversity of species (Hayhow *et al.*, 2016). Grasslands soils
have the highest carbon stock of any UK broad habitat (UNEP-WCMC, 2011) and semi-natural grasslands, with their less disturbed soils, are most important in terms of grassland carbon storage (Alonso, 2012).

**Chalk and Limestone Grassland**

Calcereous grasslands are often important sites for butterflies, a group of insects long recognised as valuable environmental indicators, whose short life cycles result in quick responses to subtle habitat or climatic changes. Data collected under the UK monitoring scheme, along with data from another 21 countries, contributes to the European Grassland Butterfly Indicator (Van Swaay, 2013). This indicator shows a 30% decline in grassland butterfly abundance between 1990 and 2013. This rate of loss had slowed in the last 5-10 years and is not consistent across all seventeen species that contribute to the Indicator. Part of the deceleration in the loss is down to better targeted management at key sites (Bowles, 2016). Data collected for the Upper Thames Butterfly atlas 2016 (Asher et al., 2016) shows a similar trend in Oxfordshire, where concern is mounting, with most of the wider countryside species now experiencing the same sort of drop in abundance that the habitat specialists suffered 30 years ago.

The wall butterfly *Lasiommata megera*, a grassland specialist which was considered a widespread but rapidly declining species in 1998 (ONCF, 1998), has not been recorded here since 2009. The effects of climate change are thought to have particularly impacted this species, with bad summer weather severely affecting populations (Asher et al, 2016). Two of Oxfordshire’s rarest butterfly species, the Adonis blue *Polyommatus bellargus* and silver-spotted skipper *Hesperia comma*, are chalk-grassland specialists, as is one of the UK’s most threatened butterflies, the Duke of Burgundy *Hamearis lucina*. All three of these species can still be seen in small numbers in the county, and Upper Thames Butterfly Conservation are working with landowners to maintain and enhance areas of good habitat for them, for example at Aston Upthorpe Downs in south Oxfordshire. The distribution and abundance of the silver-spotted skipper has increased over the long-term, from a low point in 1980, and seems to have been stable in the short-term. There is also some evidence of a short-term increase in distribution of Adonis blue, but the three known colonies are all on the county border and are partly dependent on good habitat in Buckinghamshire and Berkshire. The marsh fritillary *Euphydryas aurinia* which depends on both calcereous and wet grassland habitat was rapidly declining in 1998 and is now considered extinct in Oxfordshire. However, increasing temperatures (resulting from climate change) has enabled the brown argus butterfly *Aricia agestris*, to make use of new food plants, with the extra warmth allowing digestion of a food source it was previously unable to digest; in turn this has facilitated its spread into new areas (Bowles, 2016); colonies are typically found on chalk or limestone downland, but it can also be found can also be found on heathland and in open woodland.

Oxfordshire’s limestone and chalk grassland is of national importance as it supports the bulk of the UK population of meadow clary *Salvia pratensis*, Chiltern gentian *Gentianella germanica*, early gentian *Gentianella anglica* (an endemic European Protected Species of chalk downland) and downy woundwort
Stachys germanica. All these species show both long and short-term declines; Downy woundwort Stachys germanica is found nowhere else in the UK and the Oxfordshire populations have been struggling.

The unimproved calcareous grassland of Westwell Gorse supports one of the largest UK populations of the nationally rare downy-fruited sedge Carex filiformis (Natural England, Westwell Gorse SSSI citation). These lime-rich, free draining soils also support two nationally scarce and locally declining snail species Abida secale and Helicella itala (Gregory, 2000). Some airfields in the county, both used and disused, support areas of calcareous grassland which are now under threat of loss and fragmentation from housing developments.

**Wet Grassland**

Wet grassland is periodically flooded pasture or meadow and is an important habitat for breeding waders, such as lapwing Vanellus vanellus, curlew Numenius arquata, redshank Tringa totanus and snipe Gallinago gallinago which rely on the damp soils, open pools and muddy hollows of the county’s wet grassland and hay meadows, for feeding and rearing young chicks during spring.

Loss of wet grassland habitat combined with predation impacts have led to dramatic declines in populations of some of our wading birds. Curlew Numenius arquata, IUCN Red Listed3 and one of our most rapidly declining breeding bird species, showed a 51% decline in the Upper Thames area between 2005 and 2015 (Kinnear, 2015). This is a particularly poignant decline considering that the UK holds 40% of the European curlew population, for which the Upper Thames is one of the important lowland breeding sites. Eaton et al. (2015) cites Brown et al. (2015) arguing that the curlew should currently be considered the UK’s most pressing bird conservation priority, given the global concern (Near Threatened) for the species, the significance of the UK’s breeding population and its rapid decline. The Red List for Birds (Eaton et al., 2015) also retains snipe Gallinago gallinago and redshank Tringa totanus on the Amber list; and lapwing Vanellus vanellus moved to the Red List for the first time in 2015.

The county’s wet grasslands support the vast majority of the UK’s population of creeping marshwort Apium repens, which is threatened in Europe. Monitoring by the Oxfordshire Flora Group (OFG) since 1995 shows that it is eliminated by prolonged summer flooding which reduces soil oxygen, but reappears from the seedbank. It requires long, warm summers for seed set and can be impacted by inappropriate grazing. Despite attempts to protect and enhance the populations of creeping Marshwort by the Oxfordshire Flora Group they appear to be increasingly endangered, probably as a result of its precise hydrological and climate requirements.

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3 Red-list criteria IUCN: Global conservation status. Species that are Globally Threatened (Critically Endangered, Endangered and Vulnerable, but not Near Threatened) under IUCN guidelines, as assessed by BirdLife International, the IUCN Red List Authority for birds, in 2015 (www.iucnredlist.org).
Fen violet Viola persicifolia, perhaps the rarest and most beautiful of our native violets, has its major UK population in Oxfordshire (Lambrick C., 2016). Always rare in the UK it is a low-growing perennial of fens and wet meadows. It is currently found at only three sites in the country including Otmoor. The Oxfordshire Flora Group organises the national Steering Group for this species and is working with Natural England and the local land manager to monitor and increase the local population.

**Acid Grassland and Heathland**

The geology of the county means that acid grassland and heathlands have always been relatively scarce, and long-term declines have resulted in only approximately 4 ha of lowland heathland remaining in the county. Associated species of plants and animals are therefore also rare locally. Oxfordshire’s largest and best area of acid grassland is at Frilford Heath, where the SSSI (Natural England Frilford heath, Ponds and Fens SSSI Citation) is largely contained within Frilford Heath Golf course. Frilford Heath is a well-known entomological site, with ten species of beetle recorded that are otherwise known in Britain only from the Breckland district or the coast, although this figure might increase if any of the proposed restoration on the Chiltern Commons proves successful. Shotover Hill SSSI has a smaller area of acid grassland and heathland, which is home to some of the largest and densest aggregations of solitary bees and wasps in Oxfordshire. In addition to at Frilford Heath and Shotover, there are surviving and improving areas of acid grassland and heathland to be found at Cumnor Hurst near Oxford and on the clay cap and sandy soils of the Chilterns, for example the Nettlebed Commons. Most areas are small and have survived by chance as open habitats where they have a particular function e.g. shooting glades.

The adder Viperus berus is typically found in heathland but is now very rare (all but extinct) in the county, with the last confirmed record from the Chilterns in 2015 (D’Ayala, 2016). This species was listed as having a stable population in the 1998 Review of Oxfordshire Wildlife and Habitats.

**Verges**

Oxfordshire has 35 Roadside Nature Reserves (RVNRs), representing the most biodiverse parts of the green network of verges running alongside roads in the countryside (Oxfordshire County Council, 2016). A number of Oxfordshire’s very scarce plants, and many on the Rare Plants Register, have important populations on road verges and edges of trackways. These include Cotswold penny-cress Thlaspi perfoliatum, meadow clary Salvia pratensis, wild clary Salvia verbenaca, corn parsley Petroselinum segetum, hare’s foot Trifolium arvense and Knotted coves Trifolium striatum, spiny restharrow Ononis spinosa, downy woundwort Stachys germanica and lizard orchid Himantoglossum hircinum (Oxfordshire Flora Group, 2015). Lizard orchid was considered to have a stable but rare and isolated population in 1998, but has recently shown short-term declines.
Verges can preserve the last areas of dry meadow-like grassland in parts of the county dominated by arable farming. Verges on damper soil that receive arable fertilizer drift, or next to roads with a lot of traffic and thus a lot of nitrogen (NOX) deposition (Taylor, 2010), tend to be monotonous with tall perennials, especially tall fescue *Festuca arundinacea*. Where soil is drier and receives less nitrogen enrichment from traffic, good populations of shorter commoner species like oxeye daisy *Leucanthemum vulgare*, cowslip *Primula veris*, knapweeds *Centaurea*, clovers *Trifolium*, bird’s foot trefoil *Lotus corniculatus*, field scabious *Knautia arvensis* and wild carrot *Daucus carota* are found. All are important summer insect nectar sources. Pyramidal orchids *Anacamptis pyramidalis* and bee orchid *Ophrys apifera* can also have important verge populations.

Salt application for de-icing along bigger roads and motorways kills the native flora but has favoured the great increase of a couple of halophyte species which used to be confined to coastal areas. The most predominate being Danish scurvy grass *Cochlearia danica*, which is quoted by Dr. Trevor Hines as being one of the fastest spreading plants in Britain (NBN Gateway, 2010).

### Causes of Change

The huge loss of meadows and species-rich grasslands is amongst the most dramatic stories in the history of nature conservation in the UK. Losses of semi-natural grasslands and floodplain meadows are mainly due to agricultural intensification from the mid-20th century onwards. This was further exacerbated by losses through sand and gravel extraction, urban and industrial development and hydrological changes to river floodplains (Rothero et al., 2016).

Climate change causes changes in temperature and rainfall leading to shifts in species composition. Summer flooding, predicted to increase as a result of climate change (Gowing, 2008), compromises the meadows important management regime and can impact below ground invertebrate communities (Lock, 2015). Regular summer flooding in Oxfordshire on the scale of 2007 could threaten the conservation value of these grasslands (BBOWT, 2010).

The losses and fragmentation of our semi-natural grasslands, in combination with climate change impacts, are thought to have contributed to the losses and declines of some invertebrate species, including butterflies (Van Dyck et al., 2015) and bumblebees (Rothero et al., 2016). However climate warming is thought to have positive impacts on some butterfly species enabling them to extend their ranges further north (Asher et al., 2016) and on some migrant species such as the ivy bee *Colletes hederae*, a recent migrant from the continent which is now locally abundant in Oxfordshire.

A lack of appropriate management such as a decline in grazing on unimproved grassland (including by rabbits) has caused a natural succession to scrub and woodland at some sites (Fuller, 1987), with over-grazing causing damage at others. Mowing regimes that fail to collect grass cuttings cause enrichment and favours coarser, more dominant grassland species. Survival of important plant populations on road verges may become increasingly difficult in the future with restrictions on funding impacting on the County Council’s ability to tailor specific mowing regimes to selected sites.
Some plant species rely on a degree of soil disturbance for their survival, originally done by animals in Oxfordshire this has occasionally been undertaken by volunteers for small rare annuals such as Cotswold penny cress *Thlaspi perfoliatum*. Conversely the disturbance (by humans and dogs) of sunning and breeding sites in grassland and heathland (D’Ayala, 2016), along with the loss of safe hibernation sites, is thought to have had a negative impact on the breeding success of adders *Vipera berus* in the county.

The creation of new grasslands has been funded in the past by agri-environment schemes. This has provided additional habitat but often of less ecological richness than traditional meadows. Despite this, the continuing fragmentation of the landscape through the removal of hedgerows, and increase in infrastructure and other development, has increased the isolation of remaining patches of good habitat and the species they support. In turn this increases the probability of further extinctions of the county’s rarer species (Butaye et al., 2005).

**Case Studies**

**Chimney Meadows: A Wildlife Haven**

Shaped by centuries of farming, the Upper Thames Living Landscape is a mosaic largely of pasture fields and meadows, interlaced by a network of ditches and hedgerows that cover the floodplain of the River Thames, from Lechlade-on-Thames to Northmoor, in West Oxfordshire. Internationally important plant communities still thrive, together with scarce wading birds that make their home here.

At the heart of this Living Landscape is Chimney Meadows National Nature Reserve (NNR), which the Berkshire, Buckinghamshire and Oxfordshire Wildlife Trust (BBOWT) started to manage in 1999. Four years later, BBOWT purchased the neighbouring commercial farm. With careful management, this tranquil place is being transformed into a haven for wildlife.

**Restoring the Landscape**

In 2004, funded by an agri-environment scheme grant, BBOWT reverted 70 ha of arable fields back to hay meadows, using ‘green hay’ from the NNR.

‘Green hay’ is the cut material from a meadow, that instead of being dried and baled, is collected, transported and spread across a prepared field and acts as a source of wildflower seed to diversify a site. Green hay strewing can be undertaken using conventional farm machinery and can be a very effective method for creating or enhancing meadows.

Ten years on, monitoring of the arable reversion fields has shown ‘a dramatic and positive shift in the botanical and invertebrate communities towards the NNR target community’ (Earth Trust 2015). More recently, BBOWT has turned their attention to diversifying some of the species-poor grassland at Chimney Meadows. Several different techniques have been trialled and the success of this work is being closely monitored. BBOWT is also selling ‘green hay’ to landowners, elsewhere in the Living Landscape. It is cheaper than buying seed and is of local provenance, so plants are adapted to the local conditions and more likely to thrive.

**With Our Partners**

In partnership with Natural England, RSPB, Wild Oxfordshire, Floodplain Meadows Partnership and the Environment Agency, BBOWT has welcomed over 80 farmers and landowners to events at Chimney...
Meadows, looking at meadow and wetland creation, sustainable water supplies and ways to reduce diffuse pollution. Farmers were able to see pasture pumps, devices which enable cattle to drink from the water course without entering the water and trampling the banks.

This work was particularly timely, as the summer floods of 2007/8, along with wet weather during hay cutting in 2010 and 2012, meant that not all the fields on the NNR had been subject to the traditional hay cut and aftermath graze, so vitally important to the maintenance of the internationally important meadows.

Consequently, the species diversity on the NNR had declined. However, because of work to create new meadows from the old ones, the vulnerability of these plant communities to extinction had been reduced and with infrastructural improvements BBOWT has been able to carry out restorative management and the NNR plant communities are now recovering, despite changing weather patterns.

For more information see http://www.bbowt.org.uk/reserves/chimney-meadows

For more studies demonstrating what’s being done to conserve and enhance our grasslands see:

1. Grassland Enhancement at Barton Fields, Abingdon (© David Guyencourt)
2. Earth Trust: Sinodun Hills Grassland Restoration Project (© Hilary Phillips)
3. The Shotover Wildlife Acidic Grassland Project (© Shotover Wildlife Group)
4. Breeding Waders in the Upper Thames River Valleys (© John Bridges/rspb-images.com)
5. Suck Seed and Sow, Wychwood Project restoring Roadside Nature Reserves (© Hilary Phillips)
6. Heathland and Acid Grassland Restoration at Nettlebed and District Commons (© Clive Ormonde)
7. Fen Violet and the Oxfordshire Flora Group (© Phil Cutt)
8. Aston Upthorpe Downs and Other Conservation Work: Butterfly Conservation’s Upper Thames Branch (UTB) (© Hilary Phillips)
Rivers and Wetlands

Overview

Oxfordshire’s landscape is defined by its river network, including eight major rivers (Leach, Windrush, Evenlode, Glyme, Cherwell, Oxon Ray, Ock, and Thame) and many smaller tributaries that flow through the county and into the Thames. Rivers and streams in semi-natural landscapes are typically associated with complexes of wetland habitats including floodplain wetlands, fens, wet grassland, oxbow lakes, permanent and temporary ponds and wet woodland. Along the roughly 73km of River Thames within Oxfordshire the river drops in elevation by around 30 metres over 26 Locks and their associated weirs. Weirs and locks can act as barriers to fish, eels and other species, preventing free movement up and downstream. This river network has been a major determinant of settlement and land use since long before Oxfordshire was created as a county, and continues to be a major influence on both current and future development. For example, the Eco-Bicester masterplan aims to ‘Seek a network of open spaces incorporating river corridors and linking not only to existing space within the town but also the wider countryside’ (Eco Bicester Strategic Delivery Board, 2010).

Oxfordshire has two canals. The Oxford Canal which is navigable and fully open and the Wilts & Berkshire Canal, which is in the early stages of restoration from a derelict state. The Oxford Canal runs from Banbury to Oxford where it connects at two points with the River Thames. At intervals along its course it uses the River Cherwell as the navigational route. The Wiltshire and Berkshire Canal runs from Abingdon to the county border near Shrivenham and will eventually link with the navigable Kennet and Avon Canal at Semington, near Trowbridge. Both canals form linear habitats linking natural or managed wildlife areas.
There have been great improvements in water quality over recent decades, but there are still significant pressures:

**Ecological status of waterbodies in Oxfordshire as defined under the European Water Framework Directive (WFD) September 2016:**
- 101 waterbodies fully or partly in the county:
  - 5% at Good Status
  - 55.5% at Moderate Status
  - 32.5% at Poor Status
  - 7% at Bad Status

Groundwater provides 40% of our water supply, and at least 50% of groundwater used for public supply is showing significant long-term deterioration in quality through elevated nitrate levels as a result of the legacy of agricultural fertiliser use.

Rivers and freshwater habitats have recently undergone an increase in activity to control pollution, manage habitats and protect against threats. The Environment Agency, conservation charities, anglers, action groups and the wider community are delivering hands-on river conservation, and promoting campaigns to raise public and political awareness. Initiatives based on citizen participation in monitoring (like the Thames Water-Blitz and FreshWater Watch) have shown that data acquired are complementary to Environment Agency data. Such initiatives help to generate knowledge around small streams and still water environments which are frequently overlooked at a larger scale, but are often key clean water habitats (such as in Freshwater Habitats Trust’s ‘Clean Water for Wildlife’ survey). There have also been advances at policy level for example, the development of the Catchment Based Approach (Defra, 2013) and the recent changes to the Water Act 2014 (Defra, 2014) which will effectively enable water company over-abstraction to be more comprehensively addressed.

**Oxfordshire’s Wetlands Headlines**
- Between 1900 and 1998, water voles *Arvicola amphibius* suffered a 95% reduction in their range in the UK. Targeted conservation action in Oxfordshire has resulted in a three-fold increase in their Local Key Areas.
- The banning of toxic chemicals, improvements in water quality and legal protection have all helped to bring otters back to the Thames catchment, including in urban rivers.
• After an absence of about 200 years, bittern *Botaurus stellaris* and marsh harrier *Circus aeruginosus* have returned to breed in the new reedbed at RSPB’s Otmoor reserve.
• Oxfordshire hosts a complex of calcareous species-rich fens that forms the largest remaining group of such habitats outside East Anglia and North Wales.
• Oxfordshire holds the major UK population of the rare fen violet *Viola persicifolia*, which is found at only three sites in the country.
• 15 invasive non-native species of most concern to the environment agency are found in Oxfordshire, including the demon shrimp *Dikerogammarus haemobaphes*.
• Reedbeds were once a common habitat in the low-lying areas of Oxfordshire, but today no large remnants remain.
• Once complete, the gravel pit restoration at Gill Mill in the Lower Windrush Valley will deliver one of the largest connected priority wildlife habitats in Southern England.

**The State of Wetland Nature**

Oxfordshire has a range of wetland habitat types of great importance for a range of plant and animal species, with waterside habitats providing some of the richest environments for wildlife. Unfortunately, many wetland habitats are in a degraded state due to a lack of appropriate management, historical dredging that has disconnected rivers from their floodplain habitat, pollution and habitat loss through sand and gravel extraction, urban and industrial development (Rothero et al, 2016).

At a national level, slightly more freshwater species have declined than increased over recent decades (Burns et al. 2013). Currently we have no readily accessible data demonstrating local population trends apart from that relating to species with targeted projects to aid their recovery, such as the water vole *Arvicola amphibius*. At a national level water voles have suffered a 95% decline in range since 1900. Concerns over the rapidly declining species in 1998 led to the development of a water vole recovery programme in Oxfordshire, headed by BBOWT. During the period 2008 to 2016, against the backdrop of a national decline, the total water vole Local Key Areas in Oxfordshire increased more than three-fold from 137 to 433km² (see case studies).

A certain amount can be inferred about the status of a few habitats and species from national datasets, and the Water Framework Directive (WFD) status (a measure of physical, chemical and biological parameters) tells us something about the ecological status of our rivers. Generally, our rivers are very much cleaner than they were 30 years ago, which has aided the recovery of generalist species such as otter *Lutra lutra*, but those species that require a higher standard of water quality are still suffering declines in many places.

In 1998 otters were regarded as a rare species, on the edge of its range in Oxfordshire, but increasing in number. Otters are now widespread across the county and can be seen in urban as well as rural areas. The cessation of use of certain toxic agricultural chemicals, improvements in water quality and legal protection, has over the years resulted in the number of sites with evidence of...
otters [in the Thames catchment] increasing from 0% in 1984-86, 2% in 1991-1994, 8% in 2000-02, to 53% in 2009-10 (Scholey, pers. Comm.).

**Rivers and Flowing Water**

The wildlife our rivers support is influenced by their form, underlying geology, flow patterns and the quality of water that feeds them, as run-off (from fields or urban areas) or groundwater. The county’s varied geology results in a wide range of river habitats, from fast flowing chalk streams to sluggish, deep main rivers. There is an estimated 1265 km of main river and 637 km of non-main river. Several streams arising from chalk aquifers such as the Letcombe Brook, Chalgrove Brook and Ewelme Stream support characteristic species such as brown trout *Salmo trutta*, bullhead *Cottus gobio* and other species dependant on clear, fast flowing water and gravel substrates. Chalk streams are a globally rare habitat, with only 161 in the UK. Ewelme Cress Beds, which Ewelme Stream runs through on its way to the Thames, is a Local Nature Reserve (LNR) and County Wildlife Site. Letcombe Brook, a tributary of the river Ock, runs through the 7.5Ha Letcombe Valley nature reserve.

Nutrient-poor rivers of upland areas support sparse vegetation and insects such as stoneflies *Plecoptera*, mayflies *Ephemera* and caddisflies *Trichoptera*, which are hunted by brown trout *Salmo trutta* and birds such as white-throated dipper *Cinclus cinclus*. In contrast the lower reaches of our rivers tend to be nutrient-rich and more sluggish in their flows, and plant diversity increases providing more cover for coarse fish species, the predominant fish community within Oxfordshire. Our most common coarse fish species include roach *Rutilus rutilus*, chub *Leuciscus cephalus* and perch *Perca fluviatilis*. Less common species through, for example, decline or lack of suitable habitat include barbel *Barbus barbus*, grayling *Thymallus thymallus*, eel *Anguilla Anguilla*, ruffe *Gymnocephalus cernuus*, lampreys *Lampera sp.* and rudd *Scardinius erythrophthalmus*. The zander *Sander lucioperca* and, to some degree, the common carp *Cyprinus carpio*, are also less common, being non-native species, though now naturalised in the UK (EA per comm., 2017). Barbel, *Barbus barbus* appeared to have declined significantly on the Thames and its tributaries in Oxfordshire throughout the 90’s, but has recently been re-appearing along some river stretches. Numbers are still very low though and habitat enhancements, along with stocking of juvenile fish, are still carried out by the EA as part of a strategy to bolster stocks. The River Thames between Ifley and Benson has been surveyed for fish annually since 1994. Trends from here appear to show a slight decrease in density of the roach *Rutilus rutilus* population, however this is offset by a slight increase in their biomass. This is reinforced by the length frequency data collected, which appears to show a trend of increasing average size within the surveyed individuals for each year – over 25mm the period 1994 to 2012 (EA per comm., 2017).
The length of the River Thames in Oxfordshire is one of the few strongholds of the common club-tail dragonfly *Gomphus vulgatissimus*, probably the nationally most important species of dragonfly occurring in the county (Tompkins, 2016; Brownett, 1996). Other Priority freshwater and riparian specialists include water vole *Arvicola amphibius*, Thames ram’s horn snail *Gyraulus (Gyraulus) acronicus*, depressed river mussel *Pseudanodonta complanata*, our native white clawed crayfish *Austropotamobius pallipes* (rapidly declining in 1998 and now very rare), Daubentons bat *Myotis daubentonii* and soprano pipistrelle bat *Pipistrellus pygmaeus*. Kingfishers *Alcedo atthis*, that most iconic of river birds that hunts along slow moving or still waters, is now Amber listed because of their unfavourable conservation status in Europe. The River Ray floodplain is a stronghold for the rare true fox-sedge *Carex vulpina* (Feber, 2013).

Invasive non-native species have a major impact on freshwater biodiversity (Millenium Ecosystem Assessment, 2005). Thirty-eight of the 135 invasive non-native species listed by the EA (Environment Agency, 2016) are found in Oxfordshire. These include 15 species of most concern to the EA, such as the demon shrimp *Dikerogammarus haemobaphes*. Prior to 1990, invasive American signal crayfish *Pacifastacus leniusculus* were recorded at only three locations in the Upper Thames, and large populations of the native white-clawed crayfish *Austropotamobius pallipes* were present throughout the area. By 2000 signal crayfish had spread to the majority of water-courses, and white-clawed crayfish were increasingly restricted to upstream locations, tributaries, or remnant populations encroached by enclosing signal crayfish populations (Moorhouse, 2015). In September 2016, the EA surveyed eight small Oxfordshire watercourses which have had white-clawed crayfish records in the last 15 years. Of the eight surveyed, only one was found to have evidence of white-clawed crayfish. Three of the sites had no evidence of either species of crayfish.

**Ponds**

Oxfordshire has an outstanding pond resource with a wide range of pond types, which support some of our rarest and most vulnerable aquatic plants and animals as well as providing an important stronghold for amphibians. Since the 1980’s numbers of common toad *Bufo bufo* in the UK has fallen by more than two-thirds, with the south-east of England suffering the greatest declines. Oxfordshire currently has five widespread and one rare / localised species of amphibian; the widespread species include the common frog *Rana temporaria*, common toad *Bufo bufo*, smooth or common newt *Lissotriton vulgaris*, palmate newt *Lissotriton helveticus* and great crested newt *Triturus cristatus*. The rare / localised species is the natterjack toad *Bufo calamita*. With its specialist habitat requirements, the natterjack toad has always been rare in the county, found only in the Oxfordshire Heights (D’Ayala, 2016). This species went extinct in the twentieth century but was more recently re-introduced into the county by Amphibian and Reptile Conservation (ARC) as part of national programme and survives at the [private] re-introduction site.
Little Wittenham is one of three Oxfordshire Flagship pond sites (http://freshwaterhabitats.org.uk/projects/flagship/) and is of European Importance, designated as a Special Area of Conservation (SAC) as a result of the resident population of great crested newt *Lissotriton vulgaris*. High quality ponds are generally located in sites managed for nature conservation, like the fen ponds at BBOWT’s Cothill Fen NNR (part of the Cothill Fen SAC), the woodland ponds at Wytham Woods, ponds at Otmoor SSSI and the Pinkhill Meadows pond complex at Farmoor. The county’s numerous village ponds are often degraded by pollution, but they can provide important habitats for plants and animals less sensitive to poor water quality, such as grass snakes *Natrix natrix*, Daubenton’s bats *Myotis daubentonii* and a range of water birds.

**Fens, Reedbed and Marshes**

Species rich calcareous fens have declined dramatically over the past century (JNCC, 2015) largely due to land drainage and agricultural intensification and now, like ponds, are largely confined to designated sites and nature reserves. Cothill Fen SAC (JNCC, 2016) is the largest surviving example of alkaline fen in central England. The loss of the waterlogged, anaerobic conditions of these habitats has resulted in a decline in the rate at which they capture and store carbon, and in the case of some fens this activity has even been reversed (Alonso, 2012). Urban fen sites in particular, such as the Lye Valley in Oxford, are under threat from hydrological change resulting from development pressures (Webb, 2016).

Fens hold a disproportionately high number of rare plant species considering the current, tiny area of the county they occupy (Oxfordshire Flora Group, 2014). Twenty-two of our rare plant species can be found at Lye Valley for example, including the grass-of-Parnassus *Parnassia palustris*. Three dragonfly species that are very scarce in the county are found only in the calcareous fen habitat at the Cothill complex of reserves (Dry Sandford Pit, Cothill Fen NNR and Parsonage Moor). These are the keeled skimmer *Orthetrum coerulescens*, southern damselfly *Coenagrion mercuriale*, and small red damselfly *Ceriagrion tenellum*. The southern damselfly, considered to be rapidly increasing in 1998, still only exists in low numbers in isolated populations. Also found at this site are some extremely rare, endangered soldier flies (all RDB1 or RDB2 (Falk, 2005)) including the clubbed general *Stratiomys chamaeleon* (recently listed as Critically Endangered), orange-horned green colonel *Odontomyia angulata* and silver colonel *Odontomyia argentata* (Porter, 1991 & 2011) and with many other rare flies. Both the clubbed general and the scarce forest horsefly *Hybomitra solstitialis* (Critically Endangered) were recently listed by NE along with 44 other flies among species ‘most likely to be lost from England by 2020’. Other rare species associated with local fen habitat, and vulnerable to
degradation of the habitat, include water penny beetles *Eubria palustris*, the locally scarce whirl snail *Vertigo antivertigo*, the nationally rare *Perforatella rubiginosa* (Gregory, 2000), fen violet *Viola persicifolia* and greater water parsnip, *Sium latifolium*. The status of all these species in the county is hence very vulnerable.

Reedbeds were once a common habitat in the low-lying areas of Oxfordshire but no large remnants remain today. Otmoor currently has the only sizeable reedbed at 22ha although small areas of reed do occur, fringing gravel pit lakes (such as the Cassington complex) and river channels. They are among the most important habitats for birds in the UK, and three amber listed Birds of Conservation Concern can now be seen in Oxfordshire’s reedbeds: bittern *Botaurus stellaris* (regarded as extinct in Oxfordshire in 1998), marsh harrier *Circus aeruginosus* (considered extinct at the end of the 19th century) and common crane *Grus grus*. Common cranes were once a widespread breeding species in the UK, before hunting and habitat loss drove them to extinction around the 1600’s. All three species have very recently started or attempted breeding at RSPB’s Otmoor reserve, highlighting the importance of both large areas of reedbed and good habitat management.

Reedbed habitat also provides roosting and feeding sites for migratory species and several raptors including the marsh harrier *Circus aeruginosus*. Along with the 31ha reedbed currently found in Oxfordshire (TVERC 2016) there are smaller areas of sedge beds, one of the largest being 7. Enslow Marsh LWS near the river Cherwell; also Cholsey Marsh, Minster Lovell Marsh and Jubilee Fields at Wootton.

**Causes of Change**

The ecology of rivers and other waterbodies in Oxfordshire is impacted by a range of issues, a measure of which is reflected in their status under the European Water Framework Directive (WFD). Many of our rivers have been heavily modified through historic dredging, canalisation and impoundment by weirs and other structures. This has led to considerable reduction in the variety of habitats available for a range of species, and prevented the river connecting to its floodplain in all but the most severe of flood events, restricting the extent and quality of associated wetland habitat. To date at least twenty fish passes exist with a minimum twelve more planned for the future, encompassing the main rivers and some smaller tributaries.

Our rivers also suffer from nutrient pollution and in some locations, low flows caused by abstraction, although many of our rivers receive much of their flow back via sewage treatment works. Although much has been done to address many of these impacts over the last two decades, some of these pressures will be exacerbated by climate change.

Lack of good, appropriate management has led to a number of Oxfordshire’s freshwater habitats, including calcareous fens, losing value for the more specialist wetland plants and animals. At some sites they have degraded to primarily wet woodland or solid reed bed, for example: SSSIs Weston fen, Spartum Fen and Barrow Farm Fen (Webb, 2016). Sydlings Copse fen has lost a great number of species, very few of which are returning despite improved grazing and scrub removal. One of the very few currently known sites in the

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Common crane, *Grus grus* © Mike Pollard
county for small red-eyed damselfly *Erythromma viridulum* is at Shellingford Pit, near Stanford-in-the-Vale. This small site is not actively managed and is severely threatened by recent decreases in water level (Burch, 2016). Cothill fen ponds no longer support the range of rare stoneworts they once did, with recent searches failing to find *Chara contraria* and *Chara fragilis*, although small quantities of the uncommon *Chara hispida* and *Chara virgata* were found (Webb, 2013). Many of these impacts are difficult to either quantify (Rothero et al, 2016) or address.

Targeted conservation action, including enhanced management techniques, is taking place for some species in the county and has been demonstrated to benefit some of our iconic wetland species. For example, at a national level water voles *Arvicola amphibius* suffered a 95% reduction in their range between 1900 and 1998, with continued declines since then. In Oxfordshire BBOWT developed a water vole recovery programme in 1998 and during the period 2008 to 2016, against the backdrop of a national decline, the total water vole Local Key Areas in Oxfordshire increased more than three-fold from 137 to 433km². Habitat restoration to improve water quality and for natural flood management, alongside efforts such as the reintroduction and protection of the scarce greater water-parsnip *Sium latifolium* by local specialist groups, demonstrates further positive change. Regarded as having a stable population in 1998 the greater water-parsnip has more recently suffered a huge decline, being susceptible to grazing and shading of the fens and wet ditches it favours.

There have been some positive changes in our freshwater resource in recent years, such as an increase in gravel pit lakes restored for nature (see Gill Mill case study) and a range of river and wetland creation projects presenting new opportunities for water quality and wetland species. Work at the RSPB’s Otmoor reserve to increase reedbed habitat has also brought common cranes *Grus grus*, marsh harriers *Circus aeruginosus* and bitterns *Botaurus stellaris* back to the area. Landowners, farmers, businesses, conservation organisations and government bodies are coming together in Catchment Partnerships to improve the ecological quality and flow, and biodiversity of our freshwater systems. For example, in the Evenlode catchment, where farmers and landowners are working with a partnership of the Evenlode Catchment Partnership, the EA and West Oxfordshire District Council (WOxDC) to deliver the first demonstration project for Natural Flood Management in the Thames river basin (see case studies).

**Case Studies**

**Pinkhill Meadow Flagship Pond Site**

The Pinkhill Meadow pond complex was created in 1990/91 through a collaboration between Thames Water, The Environment Agency and Freshwater Habitats Trust, to demonstrate new advances in pond design and creation for freshwater wildlife. The site is located between Farmoor Reservoir and the River Thames, and now sits adjacent to two smaller pond complexes that were created much later: Shrike Meadow is about 10 years old, and the Buckthorn Meadow pond complex created in 2011. The Pinkhill wetland area is relatively small, only 3.2 hectares, but it includes some 40 permanent, semi-permanent and seasonal ponds, ranging from less than 1 m² to 0.75 hectare in surface area. A wide drawdown zone was
created around many of the ponds with extensive microtopography to mimic natural floodplain wetland mosaics (Figure below).

Plant and invertebrate monitoring at Pinkhill, showed that the site rapidly became exceptionally species rich (Williams et al, 2008). After 7 years, approximately 20% of all UK wetland plant and macroinvertebrate species had colonised the complex. This included eight invertebrate species and one plant species, clustered stonewort *Tolypella glomerata*, that are Nationally Scarce in the UK. The site also supported three breeding species of wading bird and was used by an additional 54 species of waders, waterfowl and other wetland birds - all through natural colonisation. Further monitoring showed that from 7 to 18 years, the Pinkhill pond complex had on average continued to accumulate one species of wetland plant and one species of macroinvertebrate every year. A pond quality assessment showed that the four ponds surveyed in more detail over a 20-year period had become Priority habitat just a few years after creation (Figure below, from Williams et al, 2009).

So why is the Pinkhill wetland mosaic so diverse? The design and the location are both very important of course, but the key ingredient is clean water. The ponds are fed by surface water draining semi-natural catchments or groundwater and infrequent flooding from the nutrient-enriched River Thames.

The Pinkhill Meadow pond mosaic was to be the inspiration for the Million Ponds Project – a 50-year national partnership initiative which began in 2008 and aims to create clean water ponds for freshwater wildlife. Oxfordshire has been a focal point for pond creation with some 100 ponds created over the past 8 years, including 30 small ponds near Pinkhill at Buckthorn Meadow, a site that also supports the Nationally Scarce Clustered Stonewort. Many of these new ponds are now being studied as part of a PhD research project – there is still much to learn about what makes a good wildlife pond. Indeed, the Pinkhill plant and invertebrate monitoring dataset is almost certainly unique in Europe.

As a result of the monitoring work at Pinkhill, in 2008 the site was recognised by the Pond Biodiversity Action Plan steering group as one of 70 Flagship Sites representing the most important Priority Pond sites in the UK. As part of the People, Ponds and Water project, with funding from the Heritage Lottery Fund (HLF) and TOE2, Freshwater Habitats Trust is now working in collaboration with Thames Water to involve the local community in the monitoring and management of the site, to ensure that the Pinkhill pond complex and the other wetlands around it, remain full of wildlife in the future, and continue to provide an inspiration for the creation of clean water ponds, both in Oxfordshire and further afield.


For more information see http://freshwaterhabitats.org.uk/a-pick-me-up-for-pinkhill-meadow/

For more studies demonstrating what’s being done to conserve and enhance our rivers and wetlands see:

1. RSPB Otmoor: Nature Reserve Reedbed (© Ben Andrew/rspb-images.com)
2. Earth Trust River of Life Project: Restoring Floodplain Connectivity and Function (© EA)
3. Gill Mill Quarry Extension, Smiths Bletchington (© Stephen Burch)
4. Water Vole Recovery Project (© Jo Cartmell)
5. Nettlebed Pond Restoration/Creation (© Clive Ormonde)
6. Lye Valley Project (© Heather Armitage)
7. Enslow Marsh LWS (© Oxfordshire Nature Conservation Volunteers)
8. BBOWT: Cothill Fen Project (© BBOWT)
9. Evenlode Catchment Natural Flood Management (© Hilary Phillips)
Woodland and Trees

Overview

From ancient woodlands and Royal Hunting Forests to modern-day plantations, all of Oxfordshire’s woodlands have been shaped by human activity to some extent. Generally, we are not well wooded in comparison with other counties in the South East of England and existing woodlands have a noticeably varied distribution. The Chilterns AONB is our most well-wooded area, with stunning beechwoods one of its defining features. Three Oxfordshire woodlands are designated as SACs for their international importance: Aston Rowant, the Chilterns Beechwoods and Hartslock Wood.

The National Forest Inventory (Forestry Commission, 2012) estimated that 10% of the total land area of England was woodland, while the equivalent figure for Oxfordshire is 9% (23,203 ha), 1% less than the national average. The National Forest Inventory typically includes coppice, wooded gardens and wet woodland (carr), as well as plantation and semi-natural woodland, both coniferous and broadleaved. Approximately 73% of the county’s woodland is broadleaved, or predominately broadleaved. That broad classification covers a range of tree species assemblages shaped by underlying geology, hydrology, soil type and the influence of past and present management practices.

Thames Valley Environmental Records Centre (TVERC) recently completed an inventory that identified 8,919 ha of ancient woodland in the county, a figure which includes ancient wood pasture, ancient woodland, ancient semi-natural woodland, plantations on ancient woodland sites (PAWS) and recent woodland (areas that became wooded after 1600) (Benstead-Hume, 2012). Ancient semi-natural woodland has had continuous cover since 1600 AD. PAWS have also kept their tree cover, but native trees have largely been
replaced by felling and replanting (often with conifers but also beech *Fagus sylvatica* in the Chilterns). Restoration of PAWS with conifers to mixed deciduous woodland is an important procedure for the overall improvement of woodland biodiversity. Wet woodland is rare in the county, whereas wood-pasture and parklands are widespread, reflecting a long tradition of land ownership by estates. Orchards are also common, showing just how important they once were to rural communities.

Many local woodlands have rich historical and cultural links, not least the woodlands of the Royal hunting Forest of Wychwood, mentioned in the Domesday Book of 1086 but with evidence of human settlement in the area dating from at least 3000 BC. Parklands and wood-pasture are well distributed across Oxfordshire, reflecting a long tradition of land owning by estates in the county (Parks and Gardens, 2016) as are traditional orchards, reflecting their importance to rural communities. Many of our historic woodland sites incorporate trees from more ancient landscapes, for example, the ancient oaks of the medieval royal park of Woodstock Palace, including a 1000+ year specimen, are embedded in the eighteenth-century Blenheim Park (Rackham, 1990). Blenheim Palace and Park is designated a World Heritage Site, and is home to more than 800 veteran trees.

### Oxfordshire’s Woodland and Trees Headlines

- Willow tits *Poecile montanus*, which like scrub and wet woodland, are the most rapidly declining woodland bird species locally
- Oxfordshire lost 80% of its orchards (by area) between 1911 and 2011, but coverage remained relatively stable from 2011 to 2016.
- Nightingale *Luscinia megarhynchos* have all but disappeared from Oxfordshire woodlands since 1995 with only 4 birds reported in 2016 and no confirmed breeding pairs (Uren, 2016).
- Many of Oxfordshire’s woodlands are small – 38% are less than 10 ha in size, indicating a scattered and fragmented resource.
- Blenheim Palace in Woodstock hosts one of the greatest collection of ancient oak trees in Europe, including one that is 1,000 years old.
- Wytham Wood, owned by University of Oxford, is one of the most well researched woodlands in the world.
- Approximately 73% of Oxfordshire’s woodland is broadleaved, or predominately broadleaved.
- Trees remove 400 tonnes of pollutants from the county’s air per year, equivalent to avoiding £6.5 million in associated healthcare costs (Sylva, 2016).

### The State of Woodland Nature

Oxfordshire has a relatively high proportion of small woodlands, indicating a scattered and fragmented resource. Data from the Forestry Commission (2013), shows that 38% of the county’s woodlands are less than 10 ha in size. Comparison with previous national forest surveys indicates that between 1980 and 2013 there has been a 6033-ha increase in recorded woodland of more than 2 ha in size in the county. As of June 2015, Forestry Commission (FC) data indicated that only 53% of the wooded area in Oxfordshire is managed to the United Kingdom Forestry Standard (UKFS), the reference standard for sustainable forest management. Benefits of sustainable woodland management include greater biodiversity, the removal of carbon and air pollutants from the atmosphere, enhanced recreational values and business opportunities. There are some rare and declining species dependent upon older stands of woodland that may be impacted by an un-sustainable increase in management activity, such as hazel dormice *Muscardinus avellanarius* and Natterer’s bat *Myotis nattereri* (Frey-Ehrenbold, 2013).

Woodlands represent one of the richest wildlife resources in Britain, and approximately a quarter of priority species under the UK BAP are associated with woodland habitats (Atkinson, 2011). Many animals of
woodlands rely on the surrounding landscape for foraging, including foxes (foraging in farmland and gardens), deer (farmland and gardens) and bats (a range of foraging sites dependent on species). Woodlands are particularly important habitats for bats, and at least 12 of the 17 species of bat currently known to be breeding in the UK have been recorded in Oxfordshire. Whereas detailed, county-wide knowledge of woodland mammals is scarce many years of research have taken place on the mammal populations at Wytham Woods (Buesching, 2010).

Ancient semi-natural woodland (ASNW) is generally the most valuable for biodiversity. These sites often contain plants rarely found elsewhere. Over 40 species of terrestrial snails and slugs can also be encountered in this habitat (Gregory, 2000), of which 6 species are confined to prime habitat where these woodlands lie over lime-rich soil and contain plenty of dead wood and waterlogged areas; these are: *Acicula fusca*, *Vertigo substriata* (wet areas), *Ena montana*, *Limax cinereoniger*, *Malacolimax tenellus* and *Perforatella subrufescens*. Many woodlands planted on un-improved grassland have preserved within them vestiges of high quality grassland, untouched by the arable intensification that has affected semi-natural grasslands in the wider countryside (Peterken, 1981).

Apart from trees in woodland, individual trees are a vital component of our countryside, villages, towns and City. Data from the Woodland Trust (Brown, 2009) states that tree cover outside woodlands has more than doubled in Oxfordshire since 1948, with most of this being attributable to the transformation of hedgerows into linear woodland and the expansion into farmland of suburban gardens.

**Lowland Beech and Yew Woodland**

The Chilterns is a stronghold for calcareous beech and yew woodland in Oxfordshire; classified (JNCC) as *Asperulo-Fagetum* beech forests. The Chilterns Beechwood SAC represents a very extensive tract of this habitat. The canopy can include a mixture of beech *Fagus sylvatica*, ash *Fraxinus excelsior*, sycamore *Acer pseudoplatanus*, yew *Taxus baccata* and whitebeam *Sorbus perrigentiformis* with an under-storey of shrubs and herbs that varies with the soil pH and management regime. Some of the rarer plants associated with this woodland in Oxfordshire are the uncommon and decreasing hard-fern *Blechnum spicant*, white helleborine *Cephalanthera damasonium*, bird’s-nest orchid *Neottia nidus-avis* and the Critically Endangered ghost orchid *Epipogium aphyllum* (OxRPR 2016). The standing and fallen dead and decaying wood within these woodlands is important for many invertebrates, including rare flies and beetles. Chilterns beechwoods in the Woodcote area are home to an important population of *Malacolimax tenellus*, also known as the lemon or slender slug, an ancient woodland indicator species.
Hartslock Wood SAC is designated for its yew *Taxus baccata* woods and the priority habitat type "orchid rich sites" that it hosts. The steeply sloping chalk grassland are sheltered by the woodlands, mostly consist of short-turf NVC type CG2 *Festuca ovina−Avenula pratensis* grassland and taller CG3 *Bromus erectus* grassland, and support one of only three UK populations of monkey orchid *Orchis simia*. This nationally rare Red Data Book species had suffered severe long-term declines and was thought to be extinct before its re-discovery at Hartslock SSSI reserve in 1960. The careful management regime implemented at this site by BBOWT has enabled the population to slowly stabilize and start to increase.

Recent surveys from Aston Rowant SAC show an incredible diversity of invertebrates in this area of beech woodland and old chalk scrub (Webb, 2013-14). Two years of interception trapping revealed over 700 species of flies present, with at least a third of these being dependent on dead wood or fungi (saproxylic). This work gave a Site Quality Index (SQI) of 392, placing it amongst the nationally significant sites for saproxylic communities. Wytham and Brasenose Wood have also been listed in this way at different times, as a result of survey effort. There have been recent sightings of the rare and elusive hazel dormouse *Muscardinus avellanarius* at Aston Rowant National Nature Reserve (part of the SAC). This species was thought to be declining in 1998 although then, as now, there was insufficient data to be able to discern clear population trends.

Other mammal species typically found in this and other woodland habitats are badger *Meles meles*, fox *Vulpes vulpes* and a range of deer species. Reliable data on deer numbers are not available but populations of our resident deer the fallow *Dama dama* and roe *Capreolus capreolus*, and introduced muntjac *Muntiacus reevesi* and smaller numbers of sika *Cervus nippon*, and red deer *Cervus elaphus* are believed to be on the increase across the county (Deer Initiative data, 2016). Forestry Commission (FC) England and Natural England are supporting deer management by working with the Deer Initiative in five priority areas, where deer have been shown to have the highest impact on designated sites, such as SSSI’s. Two of these priority sites are in Oxfordshire, around the Wychwood and Bernwood Forest areas (Sylva, pers. Comm.). Roe deer are native to Britain but were largely eradicated by the mid-18th century through over-hunting and did not return to Oxfordshire until the mid-1970s (Buesching, 2010) (see page 41 for Deer Initiative Distribution Maps).

**Badger, Meles meles © Ben Andrew/rspb-images.com**
Lowland Mixed Deciduous Woodland

This broad category of woodland occurs on a range of soil types, from the very acidic to base-rich and includes most semi-natural woodland in the county. Many ancient woods in this habitat type have a history of management as coppice with standards, though many may now have been converted, or developed naturally, into high forest or have been left as minimum intervention (either by design or default) since the deterioration of the market for coppice produce. Lowland mixed deciduous woodland is important for a range of plant, bird and butterfly species.

Several woodland bird species in Oxfordshire have been in long-term decline and on the Red List for Birds for some time (BoCC4, 2015) include lesser spotted woodpecker *Ficedula hypoleuca*, willow tit *Poecile montanus*, marsh tit *Poecile palustris* and hawfinch *Coccothraustes coccothraustes*. The most rapidly declining woodland bird species is the willow tit *Poecile montanus*. Banbury Ornithological Society (BOS) surveys showed 24 pairs of willow tits in 108 sq. km woodland area in 1982; by 2008 this number had fallen to just 5 pairs in 82 sq. km. (ed. Easterbrook, 2013). Nightingales *Luscinia megarhynchos* breed in dense scrub, including coppice woodland of 8-10 years re-growth (Holt et al., 2009), large overgrown hedgerows and naturally regenerating scrub around gravel pits. BTO surveys of nightingales *Luscinia megarhynchos* in Oxfordshire in 1976 and 1980 recorded totals of 55 and 79 singing males respectively (Davis, 1982). Since then a major and rapid decline has led to their near extinction in the county. From 1999, when only 17 singing males were recorded in our woodlands, the decline has continued to such an extent that in 2016 only 4 sightings were reported to the Oxfordshire Ornithological Society (OOS), of which only one may have been a potential breeding bird, the others probably being birds on passage (Uren, 2016).
The chart below may reflect the lack of habitat for woodland birds in Oxfordshire compared to the rest of the South-East region, or there may be other underlying issues related to woodland management.

Graph shows a factor of the abundance of species from the woodland bird indicator assemblage excluding pied flycatcher, a species which is not found in the county. Charlotte Kinnear, RSPB

![Graph showing woodland bird abundance](image)

The regular opening of the canopy that occurs with coppice management benefits a range of flowering plants of the forest floor, such as bluebells *Hyacinthoides non-scripta*; widespread in Oxfordshire woodlands but a species under threat globally. The UK population represents up to 50% of the world population. Studies from Wytham Woods (Kirby, 2010), which contains areas of ancient broadleaved deciduous woodland, secondary woodland and plantations, indicate an overall decline in species richness of plants of the forest floor. Plants of the forest floor include woodland generalists such as bramble *Rubus fruticosus* and bracken *Pteridium aquilinum* as well as those species restricted to, or more abundant in woodland, such as primrose *Primula vulgaris*, wood false-brome *Brachypodium sylvaticum*, dog’s mercury *Mercurialis perennis* and the nationally scarce and declining copse-bindweed *Fallopia dumetorum* (fewer than 50 plants exist at 1 site in the county (Oxfordshire Flora Group & TVERC, 2016)). There can be considerable variation between sites, with some showing increased richness and increasing species. Both specialist and non-specialist woodland flora have shown declines though, with a shift to assemblages of more shade tolerant species, possibly because of a decrease in woodland management. In addition, there is
evidence of effects of increased nitrogen deposition on vegetation from intensive agricultural activity surrounding the wood.

There is cause for concern for Oxfordshire’s woodland specialist butterflies. A recent national report by Butterfly Conservation (Fox, 2015) shows moderate but significant decreases in overall abundance of woodland butterflies both in the long-term (since 1990) and over the past 10 years. Here, the picture is variable; we have recently lost the wood white Leptidea sinapis butterfly (declining in 1998 and last recorded in 2008). In contrast, the silver washed fritillary Argynnis paphia (recorded as declining in 1998), purple emperor Apatura iris and brown argus Aricia agestris have expanded in range, if not abundance (Upper Thames Butterfly Conservation, 2016). The black hairstreak butterfly Satyrium pruni, found only in hedgerows and thickets of blackthorn in woodlands on the heavy clay soils between Oxford and Peterborough, has suffered a dramatic decline nationally (losing 43% of its population since the 1970’s) but the Buckinghamshire and Oxfordshire colonies seem stable.

Wet woodland

Wet woodland is particularly rare in Oxfordshire and occurs on poorly drained or seasonally wet soils, usually with alder Alnus glutinosa, birch Betula sp. and willow Salix sp. as the predominant species. Europe’s rarest tree, our native black poplar Populus nigra var. betulifolia, is a tree of wet woodland and forested floodplain. Thought to be declining over the long-term in Oxfordshire, more information is needed about this species which requires DNA-testing to confirm its identity. Wet woodland can be found in the floodplain and at spring lines on valley sides and provide important habitats for animals and plants of both woodlands and wetlands. The current interest in, and support for, river restoration and natural flood management delivery may well result in an increase in wet woodland in the county, as trees are planted along rivers and wetlands to help retain soil, provide shade and enhance water infiltration.

Wet woodlands can be sites of important fen habitat, supporting a rich invertebrate fauna that is quite different from that of open fen, and Oxfordshire has a few important examples of such sites. This habitat is especially important for biodiversity where its presence has a long history, since invertebrate faunas should be well established and very rich in species. In the 1990s Keith Porter of English Nature (now Natural England) undertook invertebrate surveys of fen marginal wet woodland on Cothill Fen SAC; these showed the site to be extremely important for fungus gnats (including BAP species) and other deadwood breeding invertebrates that specialise in waterlogged or fungally colonised dead wood. It is unlikely that this kind of invertebrate survey will be repeated in the foreseeable future, because of a lack of resources to pay for the difficult identifications in many insect groups (Webb, 2016) (Porter, 1991 and 2011).

Wood Pasture and Parkland, Including Veteran Trees

These habitats are the product of historic land management systems and are frequently of national historic, landscape and ecological importance. It includes areas derived from medieval forests, wooded commons, parklands created from the 19th century onwards, unmanaged wood-pastures, and relic parkland that has been converted to farming or forestry, but where veteran trees still survive. It typically consists of widely
spaced, large trees (often pollards, where the removal of lower branches facilitates grazing animals), interspersed with grazed grassland, heathland and/or woodland wildflowers. During the last two centuries, there has been a decline in the amount of surviving, intact wood-pasture at a national level (Rackham, 1986). Locally, there is no data for comparison, but the county does have a wealth of sites of particular importance for veteran trees and wood pasture (English Nature, 2005), including Blenheim Great Park, Cornbury Park, Watlington Park, Nettlebed Commons and woods, Shotover House and Hill, Horspath Common and Ditchley Park. The English Nature report of 2005 concluded that the frequent parklands and long history of wood-pasture management in the [Thames & Chilterns] region highlights its national and international importance as an area containing habitats and species associated with veteran trees. However, this same report showed that some 65% of surveyed sites were considered vulnerable unless future management was targeted to support the continued presence and enhanced longevity of these veterans.

The county’s important pasture woodlands and veteran trees provide habitat for scarce fungi that depend on dead and decaying wood, such as the royal bolete Boletus regius. Fungi are crucial for the functioning of ecosystems including nutrient re-cycling, and the health of woodlands depends on the healthy mycorrhizal fungal community in the soil to assist growth. There are no non-mycorrhizal trees. Fungal fruiting bodies are also very important for specific invertebrates like fungus gnats Mycetophiloidea, and fungally infected deadwood is an important food for many deadwood invertebrates (Chandler, 2010). Blenheim Great Park and Cornbury Park (Alexander, 2015), been listed at different times as having important saproxylic communities. Wood-pasture and parkland is also prime habitat for bats, with species such as the noctule Nyctalus noctula roosting in the cavities of aging trees and foraging over the pastures.

Traditional Orchards

Traditional orchards are defined as groups of fruit and nut trees planted at low densities in permanent grassland and managed using low-intensity methods without pesticides and fertilisers, and with grazing animals or hay-cutting rather than regular mowing. The minimum size is defined as five trees with crown edges less than 20m apart, but there are relict orchards where trees have been lost that are of potential interest for their genetic and biodiversity value. Oxfordshire had 1570 ha of traditional orchard mapped in 1911 (PTES, 2016), this figure had reduced to just 260 ha today (TVERC, 2017). This is a long-term loss of over 80%, and of the traditional orchards that remain in the county today over 50% are in poor condition.

The veteran trees and old grassland in traditional orchards provide habitats for a wide range of birds, bats and other small mammals as well as fungi and invertebrates that rely on old and decaying wood. The noble chafer Gnorimus nobilis is one of our rarest beetles, a Priority species almost entirely restricted to traditional orchards and recorded as extinct in the county in 1998 but subsequently recorded at several sites. The extremely rare Red Data listed orchard tooth fungus Sarcodontia crocea is dependent on very old apple trees, found at only 20 sites in England, including in Oxfordshire.
Traditional orchards were one of the Priority habitats under HLS (High Level Stewardship) options in Oxfordshire. From 2006 to 2014 payments were made to landowners to manage these orchards for landscape, historic and wildlife objectives; and new trees of local varieties were planted in 5.75 ha of the county.

**Causes of Change**

A range of threats ranging from neglect, climate change, pests and diseases are all affecting Oxfordshire’s trees and woodlands. Sustainable woodland management is crucial to maintain biodiversity, productivity and ecosystems functions (Defra, 2012). Pryor, Curtis, Peterken (Pryor, 2002) suggest that restoring PAWS to native woodland offers an opportunity to conserve and enhance remnants of ancient woodland communities and create restored native woodland on ancient sites (RNWAS). The decline in willow tit *Poecile montanus*, a species that prefers damp woodland with scrub and rotting wood, may be linked to the reduction in traditional woodland management, such as lack of coppice management, and increased deer browsing, both of which reduce the shrub layer in woodlands (ed. Easterbrook, 2013). These factors, and climate change impacts, are implicated in the decline of nightingales *Luscinia megarhynchos* in the county (Wilson, 2002), although their wintering habitat in West Africa is also under threat. Their return to the county will require the creation of significant areas of suitable habitat.

Climate change has both negative and positive effects on woodland plants and animals: the mature beech woodlands of the Chiltern’s are expected to suffer from the drier warmer summers that climate change models predict, but some woodland specialist species are responding positively to increases in average temperatures (Ray, 2010). In a Nutshell, the emerging forestry strategy for Oxfordshire (Sylva Foundation, 2016) notes that amongst a range of climate related impacts the expected trend towards fewer days without frost could impact on the ability of trees to break winter dormancy. Research on Wytham badger populations show that increases in badger numbers can be explained by beneficial effects of climate change, rather than changes in protection (Buesching, 2010) and the silver-washed fritillary butterfly *Argynnis paphia* has responded to higher temperatures with an earlier and longer flight period, resulting in major increases in distribution and population size (Asher *et al*, 2016).

Woodlands have an important role to play in the carbon economy, for example, 1 ha of newly planted woodland will sequester on average 4.5 tonnes of CO₂ per year (Sylva Foundation, 2016), and larger and older trees have been shown to accumulate carbon more rapidly than younger, smaller ones (Stephenson, 2014). All mycorrhizal fungi are threatened by increasing nitrogen deposition via Nitrous oxides, fertilizer drift or enriched water run-off from arable fields, which reduces the occurrence of mycorrhizal fruiting bodies and species diversity (Lilleskov *et al* 2011).

Woodland pests and diseases that the Forestry Commission’s Tree Health Team currently actively survey for are Chalara dieback of Ash *Hymenoscyphus fraxineus*, oriental chestnut gall wasp *Dryocosmus kuriphilus*, oak processionary moth *Thaumetopoea processionea* and Plane tree wilt *Ceratocystis platani*. Of these the only one confirmed to have been found in Oxfordshire so far is Chalara, which is already widespread throughout the rest of the UK (FC, *pers comm* 2017). Research at Wytham Woods and other sites indicates that increasing pressure from excessive deer browsing contributes to changes in the composition of both woody and ground flora layers.

*Edible dormouse, Glis Glis © Hilary Phillips*
(Kirby, 2001), resulting in changes in populations of small mammals, invertebrates and birds (Buesching, 2010). The grey squirrel *Sciurus carolinensis* damages woodland trees, stripping bark from the main stem and branches, with vigorously growing and dominant trees generally being most affected (Mayle, 2007). Grey squirrel is now common throughout our woodlands, parklands and rural gardens. Introduced by the Victorians it wiped out our native red squirrel *Sciurus vulgaris* by transmitting a fatal disease (the parapox virus). Another potentially damaging non-native woodland species is the edible dormouse *Glis glis*, which has been spreading throughout the Chilterns since its introduction in 1902 and was recently found in the Wallingford area.

**Case Studies**

*In a Nutshell – Making the Case for Sustainable Forestry in Oxfordshire*

Woodlands and trees are quintessential components of Oxfordshire’s landscape. They support the local economy, sustain habitats and species, improve water quality, reduce flooding, lock up carbon, provide inspirational places to learn, attract visitors, and are essential for our health and well-being.

Although often imperceptible, unprecedented threats ranging from neglect, climate change, pests and diseases are now affecting Oxfordshire’s trees and woodlands. An effective response is needed to protect, improve and expand this vital natural resource.

Many organisations and groups have an interest in looking after Oxfordshire’s woodland and trees and supporting the forest-based economy. During the summer of 2015 the Oxfordshire Local Economic Partnership (OxLEP) asked environmental organisations from across Oxfordshire to complete project proposals to feed into the Strategic Environmental and Economic Investment Plan (SEEIP) for the county. At least five organisations submitted forestry proposals, however it quickly became clear that working together was the best way to progress and an accord was formed. The ethos of the accord was to establish a consensus between organisations with an interest in Oxfordshire’s trees and woodlands by fostering ‘joined up’ thinking and enabling efficient and effective partnership working across all sectors.

Key to progressing the accord will be the formation of an evidence-based action plan that brings together NGOs, Government, business and local communities. Robust data will be key to the development of an effective action plan. Information will enable the continued assessment of: woodland condition; the state of the forestry sector; and where the range of public benefits can be realised and improved.

In 2016 a strategy was drafted with the involvement of over 12 organisations. The strategy aimed to make the case for investing in sustainable forestry in Oxfordshire for social, environmental and economic reasons. The strategy identified that by bringing 80% of woodlands into management and supporting forest-based businesses, it is estimated that **£37 million** could be added to the county’s economy each year. Well-coordinated action will ensure that woodland ecosystem services e.g. recreation, reducing pollution, flood alleviation and carbon storage, with an estimated value of at least **£42 million per year**, are protected and enhanced. It is in everybody’s interest to see a thriving forestry sector as jobs will be created and
environmentally friendly products produced. Ultimately healthy woodlands and forests play a vital role in our county and planet’s life support system.


**For more case studies demonstrating what’s being done to conserve and enhance our woodlands see:**

1. Daeda’s Wood – A Millennium Community Wood (© Hilary Phillips)

2. Grimsbury Woodland Nature Reserve (© Mike Pollard)

3. Stoke Wood Near Bicester (© Hilary Phillips)

4. The Wychwood Project (© Wychwood Project)

5. Leafield Community Woodland (© Wychwood Project)

6. Where Have All the Dormice Gone? The First Year of a County-wide Dormouse Project (© Pete Newbold)
Farmland

Overview

Oxfordshire is primarily a rural, agricultural county. The county has 192,754 ha under farmland, equating to 74% of Oxfordshire’s land cover (NFU, 2014). By farmed area, 56% is under cereals farming, with the next biggest proportion being livestock grazing (approximately 30%). In 2014 63% of the farmed area was under agri-environment schemes. Farmland characteristics alter with the landscape; drystone walls define the arable land of the Cotswolds; large fields of mixed arable and pasture typify the Midvale Ridge; and hedged livestock farms dominate the Upper Thames Clay Vales (Natural England, 2014).

Over recent years there has been a restructuring of farm size in the county. There has been an 11% reduction in the number of small farms (20 ha to 50 ha) and a 5% increase in the number of holdings greater than 100 ha in size over the same period (Defra, 2015). This could be due to increasing land values making it difficult for new entrants to the sector to purchase land, resulting in a switch to contract farming. Dairy farming has declined by more than two thirds since 1995, and although this has been offset to a degree by an increase in beef and sheep farms the overall number of livestock has declined. This, in turn, has led to a reduction in intensively managed rye grass rotations and an increase in permanent pasture.

Farmland once contained a range of features arising from both its land use and management history. Increasing intensification and specialisation has resulted in the loss of many of these features, leading to a less diverse landscape. Despite that farmland in the county is home to at least 11 types of Priority Habitat, with lowland semi-natural grassland among the most threatened of these. Managed sensitively, farmland can support a wide range of plants, butterflies and moths, invertebrates, birds, small mammals, amphibian
and reptile species. Even less species-rich, agriculturally improved grasslands can be managed in a way that supports wildlife. Indeed, managing farmland sensitively helps to combat habitat fragmentation, provides vital links between protected sites and creates a more resilient landscape.

With such a large proportion of Oxfordshire’s biodiversity dependent upon farmland it is essential that ways are found to effectively integrate modern agricultural practices and wildlife conservation. Several local organisations are using innovative tools and case studies to show how farms can address issues including sustainable management and conservation, for example, Cotswolds Seeds at Honeydale Farm and Agricology. We are also home to two major centres of research on farming, wildlife and conservation: WildCru, part of Oxford University’s Department of Zoology, has collaborated with farmers in the Upper Thames area for more than 25 years seeking farmers’ opinions and gathering data with the aim of achieving practical solutions to conservation problems and FAI Farms, also part of Oxford University, set up to develop farming systems that benefit the environment, animal welfare and human health. FAI is also home to a project that help adults with autism and learning disabilities to improve their well-being and increase their independence, as well as one to introduce children to food, farming and the environment.

Oxfordshire has been home to the Oxford Farming Conference (OFC) for 80 years. OFC is a charity that invests in agricultural education and knowledge-sharing. Since 2009 the Oxford Real Farming Conference has also been held at around the same time as the OFC, with the aim of exploring new agricultural models for those interested in meeting the global food system challenges in innovative, environmentally sustainable ways.

**Farmland Headlines**

- Between the 1980s and 2000s, there was a 27% reduction in hedgerow length within a 1,200 km² study area centred on Banbury BOS, 2016).
- Turtle dove numbers have decreased by 93% since 1994 – the largest decline of any farmland bird.
- Research suggests that up to 50% of recorded ponds have disappeared from farmland in the upper Thames region over the last century.
- 47 species of conservation concern use hedgerows as their main habitat.
- Oxfordshire’s farmland is home to 11 types of priority habitat. Between 2006 and 2014, more than 4,200 ha of priority habitat were managed in the county under agri-environment schemes.
- Between 2005 and 2015, farmers managed 1,600 ha in Oxfordshire under agri-environment scheme options designed to help support declining birds, such as providing winter food, attracting insects and creating nesting places.
- Wildcru has more than 25 years of collaborative working with farmers in the Upper Thames region looking at practical solutions to conservation problems.
- Over 4,207 ha of Priority Habitat were managed under agri-environment agreements in Oxfordshire between 2006 and 2014.
- Almost 55km of hedgerow were restored and over 21,000 Ha of margins / buffer strips planted between 2006 and 2014 under agri-environment agreements.
- Banbury Ornithological Society (BOS) conducts what is probably the longest running survey of winter farmland birds anywhere in the country.

**The State of Farmland Nature**

The biodiversity value of many features of the farmland landscape depends on good stewardship, which can be voluntary, supported by organisations such as the Countryside Land and Business Association (CLA) and Campaign for the Farmed Environment (CFE), or paid for by agri-environment schemes. During the 2014/15 crop year, over 268,000 ha were managed voluntarily in England under CFE, with measures including grass
buffer strips next to watercourses, pollen and nectar mixtures for bees and efforts to reduce erosion and better protect soil. In Oxfordshire between 2006-2014, approximately 4,207 ha was under some sort of Environmental Stewardship scheme (now called Countryside Stewardship). By area, lowland meadows and pastures was the main habitat type to benefit from these schemes locally (1,400 ha), closely followed by floodplain and grazing marsh (1,320 ha). Policy level initiatives designed to support large-scale conservation efforts also exist in the county, such as Catchment Sensitive Farming. A joint venture between the Environment Agency and Natural England it delivers practical solutions and targeted support to enable farmers and land managers to take action to protect water bodies and the wider environment. Much of the Cotswolds and areas of the Upper Thames river valleys are covered by this scheme.

Some of Oxfordshire’s farmers are guardians to some of our rarest habitats and species, including meadow clary *Salvia pratensis* and the natterjack toad *Bufo calamita*. They work in partnership with the RSPB and other organisations to enhance our landscape for declining and threatened birds and look for innovative ways to manage farmland while benefitting people and nature. In 2005, the RSPB Upper Thames Wader Project was launched to undertake more systematic surveys of breeding lapwing *Vanellus vanellus*, curlew *Numenius arquata*, redshank *Tringa totanus* and snipe *Gallinago gallinago* and provide habitat restoration and management advice to farmers and land managers. Since 2006, the project has worked with farmers to restore over 990ha of wetland grassland and provided management advice to achieve suitable quality habitat for breeding waders. Despite this work the downwards trend for breeding waders on farmland has continued, with curlew numbers in the project area declining by 51%, lapwing by 21%, snipe by 88% and redshank by 50%.

**Arable field margins**

The variety of habitats and connectivity provided by arable field margins makes them key areas for conservation in farmed landscapes (Smith, 2015). They buffer hedgerows, ponds and ditches from farming operations. They also provide refuges for small mammals and important habitat for birds and invertebrates, including pollinators. Pollinator numbers and ranges have decreased at national and local levels since the 1950’s, with some species now lost or incredibly rare (Feber, 2015). Pollinating insects include honey bee, solitary bees, bumblebees, hoverflies and other flies, butterflies, moths and beetles.

Field margins are important breeding areas for several butterfly species, including in the Upper Thames area (Berkshire, Buckinghamshire, Oxfordshire) the small skipper *Thymelicus sylvestris* and Essex skipper *Thymelicus lineola*. Both species have declined by approximately 14% over the last twenty years. This
reflects the habitat indicators for butterfly populations at farmland sites in England, that show significant decreases in overall abundance both in the long-term (since 1990) and over the past 10 years.

Arable plants are considered the fastest-declining group of plants in the UK. A quarter of these species are threatened including in Oxfordshire spreading hedge parsley *Torilis arvensis* and broad leaved cudweed *Filago pyramidata*. Where cultivated margins can naturally regenerate without the use of herbicides they may promote growth of these and other rare and declining arable plants, such as rough poppy *Papaver hybridum*, fine-leaved fumitory *Fumaria parviflora*, few-flowered fumitory *Fumaria vaillantii*, broad-leaved spurge *Euphorbia platyphylla* and the glorious annual of chalky soils pheasant’s-eye *Adonis annua*. Corn cleavers *Galium tricornutum*, an annual of arable fields, is Critically Endangered and a UK Priority Species which prior to its recent re-introduction in Wytham Woods ‘triangle’ and at College Lake BBOWT reserve, had last been recorded in Oxfordshire in the early 1970s.

**Hedgerows and Scrub**

Many of our hedgerows are ancient and have associated banks and ditches of great archaeological importance. They are the most important wildlife habitat over our farmland and can support an amazing diversity of plants and animal. They are especially important for farmland birds, butterflies, moths, bats and dormice. Hedgerow trees form networks of mature specimens across the landscape between woodland patches. They may facilitate the dispersal of populations of a range of species across the landscape, and their decline has impacts for species such as invertebrates including moths (Feber, 2013), birds and bats (Frey-Ehrenbold, 2013).

At least 47 species of conservation concern use hedgerows as their main habitat, and associated tussocky grass margins and patches of scrub provide food and shelter for many more species (Feber and Macdonald 2013). Scrub on farmland can comprise scattered shrubs, young trees or dense thicket and is valuable for many bird and invertebrate species. It can buffer other valuable habitats from farming activities and, like trees, help retain soil, enhance infiltration and reduce run-off by ditches and rivers.

Neglect or poor management practices has resulted in the historic loss of hedgerows from the countryside, with many of the remaining hedges left in poor condition. The loss of hedgerows, which has been identified as a factor in the decline of many farmland plant and animal species, was quantified by Banbury Ornithological Society’s ‘Domesday Survey’. This recorded a 27% reduction in hedgerow length between the 1980s and 2000s, within the 1200km² study area centred on Banbury (ed. Easterbrook, 2013).

**Cropped Areas**

If managed sympathetically cropped areas can also provide valuable habitat for arable plants, birds and mammals. Conservation headlands, which have reduced inputs from insecticides, herbicides and fertilisers, benefit farmland bird species that have suffered the most extensive declines, such as grey partridge *Perdix perdix*, corn bunting *Emberiza calandra* and turtle dove *Streptopelia turtur*, with the last showing the
greatest decrease of any species, 93% since 1994 (BTO, 2016). Turtle doves have suffered a 93% UK population decline since 1994, and research shows that the number of chicks they are producing has halved since the 1970s (Operation turtle dove, 2016). Otmoor represents the only reliable site in Oxfordshire where turtle doves still breed. The thick, scrubby hedgerows, easy access to water and the availability of small arable weed seeds along the edge of field margins provides ideal habitat, bolstered by the special turtle dove cover crops in the Otmoor Basin.

Banbury Ornithological Society (BOS) conducts what is probably the longest running survey of winter farmland birds anywhere in the country. This is the "Winter Random Square Survey" which started in 1975 and is continuing to this day. It measures the abundance and distribution of around 40 common species. This survey has shown that several resident farmland birds, including yellowhammer and linnet, declined greatly in the 70s and 80s, before stabilising somewhat in the late 90s and 2000s. For a few, the declines are continuing, notably corn bunting Emberiza calandra and tree sparrow Passer montanus (ed. Easterbrook, 2013).

Brown hare Lepus europaeus is just one of the mammals associated with farmland that has suffered declines in numbers. There is no county level data to compare but there has been an 80% national decline in the last 100 years (Aebischer, 2011). Hares benefit from a ‘mosaic’ of arable and grassland fields, and other habitats such as woodland connected by hedgerows.

Small farmland mustelids, such as the weasel Mustela nivalis and stoat Mustela ermine are lacking county data due to difficulties in robustly assessing population size. Both considered declining species in 1998, opportunistic anecdotal evidence suggests that both species are still widespread throughout the county. The harvest mouse Micromys minutus, arguably the most iconic farmland mammal, is also currently lacking data to determine population status and trends but recent surveys by the Oxfordshire Mammal Group should provide a better picture of their status for future reports.
Ponds and ditches

Farmland often includes a range of non-farmed features, such as ponds and ditches, which have significant benefits for wildlife. Good water quality in these features attracts amphibians, reptiles, birds, dragonflies and other important invertebrates. Seasonally flooded and permanent ditches provide habitats for a range of rare plants and invertebrates, if they have good water quality, as well as acting as wildlife corridors. Feber and Macdonald (2016) found that the flowering plants along wet ditches provide important foraging for bumblebees, especially in late spring. The true fox-sedge Carex vulpina was regarded as rare and declining in 1998, limited to just a few sites along the River Ray. In 2004/2005 it was discovered at eight new sites along the Ray, and since then has been the subject of careful management by BBOWT and others which has stabilised the population in the area. Research by Feber and Macdonald (2013) suggested that up to 50% of recorded ponds had disappeared from farmland in the Upper Thames region area over the last century.

Causes of Change

Over the centuries the response of farmers, land-owners and land-managers to commercial, social and technological challenges has shaped the countryside we see today. For many centuries the rate of change was relatively steady, and the natural world had time to adapt to new conditions as they emerged. However, post-war farming practices have become increasingly and more rapidly intensified (Robinson, 2002) causing a dramatic reduction in landscape diversity and species declines. Many of these declines were the result of land management changes and the intensification of farming since the 1950s and 60s, in particular, during the late 1970s and early 1980s - the period of the most rapid decline in farmland bird populations (Defra, 2015). Changing management methods include decreases in mixed farming, moving from spring to autumn sowing of arable crops, switching from hay to silage production, increased pesticide and fertiliser use, and the removal of non-cropped features such as hedgerows. A 2014 Parliamentary Office of Science and Technology (POST) note recognised that agricultural pollutants contribute 50-60% of nitrates, 20-30% of phosphates and 75% of sediment in England’s waterways (H.M. Gov., 2014a). They are also a source of faecal and other bacteria and pesticides.

The move from spring to autumn sowing of arable crops, and agri-chemical use to improve yields, have been demonstrated to have had adverse impacts on skylark Alauda arvensis and pollinators such as bees, although species such as woodpigeon Columba palumbus have benefitted (Larkman, 2015). Larkman et al (2015) suggest that weedy overwinter stubbles historically provided seeds at a density that benefitted small bird species, and the increase in sources of larger seeds at high density, provided primarily by gamebird feed hoppers and game cover plots, may have favoured the larger species, for example woodpigeon. The reduction in arable weeds has forced species such as turtle dove Streptopelia turtur into feeding on other more readily available plants such as cereal grains – a change associated in this species with a reduction in nesting attempts (Operation turtle dove, 2016).

There does not appear to be one single, overriding cause of decline in pollinating insects (Vanbergen, 2014) but changing farming practices resulting in the loss of natural habitats, the use of some pesticides (including
neonicotinoids (Godfray H.C.J., 2014)), climate change, pests and disease are all thought to contribute. The decline of many farmland butterfly species is thought to be linked to a general deterioration in the quality of habitats rather than to the wholesale loss of habitat (Fox, 2015). The decline of the brown hare *Lepus europaeus* has been linked to the reduction of agricultural diversity through intensification of farmland management. On livestock farms problems arise from a lack of cover combined with high mortality of leverets through predation and grass-cutting machinery (G&WCT, 2002). A slight recovery in their numbers has been noted since the introduction of set-aside and agri-environment schemes that have restored some habitat diversity to farmland. (Aebischer, 2011).

Agriculture is vulnerable to extreme weather events so climate change will impact heavily on farmland nature. Changes in the frequency of intense rainfall events, particularly following periods of dry weather, could contribute to increased soil loss and related nutrient runoff from agricultural land. This may affect local water quality as well as harming biodiversity and ecosystems (Defra, 2012).

Farming has both positive and negative impacts on the natural environment and while its negative impact has been decreasing it still imposes a net cost on the environment and there are further improvements to be made (WWF, 2008). Action is needed to protect finite resources such as soil, and to adapt to climate change.

The Campaign for the Farmed Environment, Farming Futures (Farming Futures, 2016), Agricology, the Linking Environment and Farming (LEAF) programme and local organisations, such as Cotswold’s Seeds, use tools and case studies to show how farms can address issues including sustainable irrigation, soil management, biodiversity conservation, and climate change adaptation.

**Case Studies**

**Honeydale Farm**

Three years ago, Cotswold Seeds acquired the 107 acre Honeydale Farm in Oxfordshire, with a plan to develop it as a Centre for Farm Diversity, trialling new ways of making smaller farms sustainable by growing diverse crops and having more livestock on the farm, reducing the need for fertilisers and pesticides and adding value to commodity foods like oats, wheat and milk.

At the heart of Honeydale is an eight-year crop rotation which begins with a 4 year deep rooting herbal ley, boosting soil fertility and ultimately driving the profitability of the farm.
The mixture of plants contained in the ley brings multiple benefits. Red clover, for instance, has a deep root structure and can fix nitrogen into the soil. Chicory provides an even deeper root, mining the soil for minerals and improving its structure and health. Mixes containing sainfoin, birdsfoot trefoil and chicory are natural anthelmintics and have the added benefit of being pollen and nectar rich for wild pollinators.

After four years, the ley will be ploughed and followed by turnip and rape. Wheat is then planted and undersown with yellow trefoil and white clover as an intercrop, which acts as a soil improver, to be grazed with sheep after the wheat has been harvested. Oats are then sown, followed by a wild birdseed mix, followed by a final cereal crop under sown to grass again.

In keeping with the plans for a Centre for Farm Diversity, a natural flood management scheme, wildflower area and ten acre heritage orchard have been created to provide wildlife habitats. Several beehives have been established for honey production. Experiments are being conducted to provide winter feed for birds during the hungry gap.

‘As farmers we are custodians of the land and we can’t keep taking from it without putting something back,’ says Cotswold Seeds MD and farmer Ian Wilkinson.

For more information see: https://www.cotswoldseeds.com/updates/ian-wilkinson-introduces-honeydale-farm

For more case studies demonstrating what’s being done to conserve and enhance our woodlands see:

1. Improving the lot for farmland birds (© Mike Kettlewell)

2. Bothy Vineyard (© Sian Liwicki)

3. Oxford Meadows and Farmoor Land Management (© Judy Webb)

4. Some Aspects of Nature Conservation on a Corallian Estate (© Hilary Phillips)
Settlements

Overview

Despite being a largely rural county more than 66% of Oxfordshire’s population live in urban settings (H.M. Govt, 2016). Urban green spaces such as domestic gardens, playing fields, allotments, parks, woodlands churchyards and cemeteries, not only benefit people but provide important habitats for wildlife. Urban green spaces in Oxfordshire range from the centuries old sites, such as Oxford Meadows, to the newly created within development areas such as north west Bicester. Many of Oxfordshire’s historic parklands, which are managed to varying degrees for their wildlife resource, are in rural parts of the county. Oxford City however is unusual in having both meadows and old college parkland in an urban setting.

Churchyards and cemeteries cover approximately 198 ha of the county, and the Diocese of Oxford is one of many organisations that actively encourages churches to promote wildlife in churchyards. Allotments, of which there are 251 ha in the county, are an increasingly important resource for nature, providing a refuge for many of the plants and animals that struggle to survive on intensively managed farmland. Urban green spaces can act as stepping stones for plants and animals, linking to rural areas and larger ecosystems. This connectivity through the landscape is vital for ensuring the resilience and sustainability of sites and the populations they support, particularly in light of climate change (Brown, 2016).

Neglected brownfield sites are another important urban wildlife resource with, for example, areas of scrub providing shelter for species such as the declining song thrush Turdus philomelos and the sparrowhawk Accipiter nisus, while areas of long grasses and tall herbs provide habitat for small mammals and
invertebrates (including crucial pollinator species). Elements of the built environment, such as domestic housing, churches, factories and office blocks, can provide crucial nesting and roosting sites for species such as house sparrow *Passer domesticus*, swift *Apus apus* and species of bat *Chiroptera sp*. Oxfordshire has two important swift-focused projects: The Oxford Swift Research Project and Cherwell Swifts Project, established in 2008.

It is increasingly acknowledged that access to the natural environment promotes good physical and mental health, encourages people to take exercise and sustains their participation in physical activity (Bird, 2004 and 2007). Indeed, these benefits increase with an increase in species richness. The first ‘Green Gym’, conceived by Dr William Bird of the Sonning Common Medical centre, was set up in Oxfordshire by TCV (The Conservation Volunteers) in 1998. These ‘gyms’ provide conservation volunteering opportunities with a focus on the physical health and general well-being of those taking part, and there are now many more established in both urban and rural settings around the county. A similar but more recent innovation is Oxfordshire’s ‘Logs for Labour’ scheme that encourages woodland management by volunteers in exchange for firewood (see Woodland and Trees, case studies). The Centre for Sustainable Healthcare (CSH), based in Oxfordshire, runs a green space and health programme ‘NHS Forest’ that works with healthcare organisations to open up their green spaces to local communities and promote better use of the natural environment by staff and patients. They recently opened the ‘Marston Green Health Route’ which enables local G.P.s to prescribe exercise to their patients (see case studies).

**Settlements Headlines**

- Between 1990 and 2007, there was an 11% increase in developed land cover in Oxfordshire.
- Numbers of swifts, a bird dependant on accessible nest-sites in urban areas, declined by 47% in the UK between 1994 and 2014.
- Between 1995 and 2014, urban butterfly abundance fell by 69% compared to a 45% decline in rural areas.
- Urban hedgehog populations have increased by a third, but rural populations have more than halved.
- Urban and rural gardens hold 86% of all ponds and nearly a quarter of the total number of trees outside woodland.
- In Oxford city, nature reserves like Iffley meadows have internationally important populations of threatened plant species, such as snake’s-head fritillary.
- 1,000 species of beetle – nearly a quarter of all the known beetle species in Britain – have been recorded at Shotover country park.
- The otter is making a comeback in urban areas, and is regularly spotted in Oxford city.

**The State of Nature in Settlements**

The 2016 National State of Nature report identified that over the long term, 47% of urban species declined and 53% increased. Over the short term, 49% of species declined and 51% increased.
Few species can be considered urban specialists, but two that are, the house sparrow *Passer domesticus* and swift *Apus apus*, have suffered dramatic declines in both the long and short term. At a national level, since the 1970s, numbers of house sparrows *Passer domesticus* plummeted by more than two-thirds (Peach, 2015), and the swift *Apus apus* population has declined dramatically in Oxfordshire, as it has elsewhere in the country (BTO, 2016). Oxford has a long standing cultural and scientific association with swifts – the colony at the Oxford University Museum of Natural History has been the subject of the Oxford Swift Research Project, started by David and Elizabeth Lack in 1947. This is one of the longest running studies of any species of bird, and has contributed greatly to our knowledge of the species. A recent study using butterflies as indicators of urban habitat (Dennis et al, 2017) has shown greater declines in urban (69% fall in abundance) than rural (45% decline) populations of butterflies; whereas hedgehogs *Erinaceus europaeus* have declined at a greater rate in the wider countryside.

![BBS index for SE England 1994-2015](image1)

*Breeding bird survey data trends, 1994-2015. BTO.*

**Parks and Nature Reserves**

The UK Priority Habitat ‘Wood Pasture and Parkland’ is usually associated with large country estates but there are exceptions to this in Oxfordshire, such as Shotover Country Park (CP) near the Oxford Eastern bypass. Shotover CP has a mixture of Priority Habitats and has been well studied by experts from Shotover Wildlife group. Around 1,000 species of beetle, nearly a quarter of all the known beetle species in Britain, have been recorded there over the last hundred years. Through the survey work of Shotover Wildlife's entomologists on Shotover Hill and in Brasenose Wood, more than 700 species have been recorded since 1999, of which over 500 are new discoveries for the Shotover area. This concentrated focus of specialist recording activity has resulted in the site now being widely recognized as a nationally important site for beetles.

Including Shotover CP, Oxford city has 2,000 hectares of parks, sports fields and open spaces. Included in this figure is 400 ha of nature reserves, some of which are home to nationally and internationally important populations of rare species. The Lye Valley, a SSSI in Headington, contains an internationally rare habitat: tufa-forming (calcareous) valley-head alkaline spring-fen, which is now the rarest natural habitat in the whole of
England. This fen supports 22 plant species that are rare in Oxfordshire, of which 14 are on the Vascular Plant Red List for England. It is also home to thriving populations of reptiles and amphibians as well as 10 species of rare and 27 species of nationally scarce invertebrates. The Critically Endangered creeping marshwort *Apium repens* has two of its three UK populations in Oxford.

There are many other examples of both old and new parks within and close-by settlements in Oxfordshire that benefit wildlife as well as local communities. For example, Spiceball Country Park in Banbury, laid out 25 years ago and now the focus of restoration and enhancement work by BBOWT, and the planned new country park north of Banbury (see case study). Together these two parks will contribute to the broader Green Infrastructure (GI) for Banbury, helping to enhance connectivity of wildlife sites in the Cherwell valley as well as providing recreation and education opportunities for local communities. Another case study in this report looks at how GI and planning for wildlife are being brought together in Bicester.

**Gardens**

Typically, one quarter of any city area (and half its green space) is private gardens, making clear the significance of the county’s gardens as a resource for wildlife. It has been estimated that the nations’ gardens hold 86% of all ponds, and just under a quarter of the total number of trees outside woodland (University of Sheffield, 2009). This makes them a haven for amphibians, aquatic invertebrates and plants as well as for birds, bats and other tree-dependent species. During research involving radio-tracking red fox *Vulpes vulpes* in the area around Wytham (Buesching, 2010), David Macdonald found that gardens provided the richest foraging habitat for this species.

**Wildlife Corridors**

Like a number of other species, the European hedgehog *Erinaceus europaeus* is increasingly reliant on urban and suburban gardens, but like many other species it needs safe wildlife corridors so it can cover its 10 – 20 ha average home range (PTES, 2016). Since 2000 urban populations of hedgehogs have increased by up to a third while in the same period rural populations of hedgehogs declined by at least a half. Nationally we appear to have lost around 30% of the hedgehog population since 2002 and therefore it seems likely that there are now fewer than a million hedgehogs left in the UK.

In contrast, vascular plants rarely disperse along wildlife corridors, as many of them have seed that needs moving around by animals like grazers. As a result many plant populations in Oxfordshire’s settlements are now ‘locked in’ to isolated sites, making them vulnerable to extinction. Plants with windblown seed can fare...
better but get distributed randomly and may not land in habitats suitable for them to thrive. Some species whose seeds are distributed in bird droppings, such as hawthorn, bramble, spindle, buckthorn and oak might benefit if perching sites for birds were made available along green corridors, to encourage this process (Webb, 2016).

**Built Environment**

Brownfield sites and elements of the built environment can provide important shelter and food for wildlife. Urban specialists, such as the house sparrow and swift, which depend on accessible cavities in buildings for nesting sites, have declined dramatically. Nationally, numbers of house sparrows have plummeted by more than two-thirds since the 1970s, and swift numbers have halved. Swifts spend most of their life on the wing, but the swift colony at the Oxford University Museum of Natural History has offered an ideal opportunity for long-term research and has been the subject of the Oxford Swift Research Project since 1947.

**Causes of Change**

Over both the long and short-term the increasing need for housing has resulted in a decrease in the average size of gardens; and modern trends for decking, paving and other impermeable surfaces means the overall green cover of garden holdings is also declining (Head). Small gardens are much less likely to contain hedges, tall shrubs and trees, which will have consequences for both the wildlife and ecosystems services provided by these features. Increased fragmentation of habitat patches by infrastructure such as roads and railways, and increased fencing of gardens, prevents small mammals such as hedgehogs from commuting across the areas needed to provide sufficient resources for them to thrive.

Water courses suffer impacts from the increase in area of impermeable surfaces in and around settlements (Astaraie-Imani, 2012), with storm drains emitting high volumes of water to natural watercourses. This causes watercourse erosion, bank collapses and flash-flooding downstream. If wetlands are adjacent to the eroded water course (as in the Lye and Boundary brooks which run past/through Lye Valley fens) the lowering of the water table dries out fen and damages wetland communities.

The decline of creeping marshwort *Apium repens* in Port Meadow is closely linked to altered drainage regimes in the vicinity, and changes in the flooding regime of the meadows caused by climate change. Additional impacts come from land management changes higher up the catchment and poor water quality. A programme of works designed to bolster the population has been in place for several years, but the last two translocation events failed to establish new populations. One translocation failure is thought to have been due to insufficiently heavy grazing, and the other was probably a result of transplanted seedlings being killed by prolonged flooding on the Port Meadow site. The thriving ‘reserve’ population in North Hinksey Meadow may come under threat from either hydrological change to a drier regime or a lack of grazing when the Oxford Flood Alleviation scheme goes through the adjacent meadow (Webb, 2016), although it is also possible that the scheme may be able to create more favourable conditions for this plant.

Surface water pollution can come from cars (including heavy metals (Defra, 2008)) but may also be from sewage if there are mis-connections or leakages. This can result in either sewage running directly to water
courses or leaking from pipes underground, causing high nitrate levels in groundwater. This can negatively impact important low nutrient spring-fed wetlands. The Rivermead nature park (Oxford, Iffley) is a spring-fed pond which used to be one of the best and most diverse ponds for invertebrates locally, and an important toad population. The recent availability of low cost, reliable water testing kits enabled this to be tested for the first time in 2016, when it was found to be enriched with a high nitrate load. Despite this it still supports three amphibian species, but the invertebrate assemblage is greatly reduced from that recorded in 1991. It is thought that the nitrate enrichment at this site is most likely a result of leakage from the sewerage system crossing the site (Webb, 2016).

Recent mapping work by the Campaign to Protect Rural England (CPRE) clearly shows light pollution across nearly all of Oxfordshire. Greater light levels severely affect breeding birds, night-flying insects and foraging bats (Stone, 2013). Additional stresses for wildlife in settlements include noise pollution, human disturbance, predation by domestic pets (in particular, cats who are major predators of wildlife (Woods, 2003)) and poor pest control. Intensive maintenance of buildings, gardens and parks also negatively affects species that rely on unkempt cracks, crevices, long grass and deadwood for nesting, breeding and foraging. The urban heat island effect – where a built-up area is warmer than a rural area – is caused by artificial land surfaces, combined with concentrated energy use. It impacts on wildlife and people – heat-related stress accounting for 1,100 premature deaths per year in the UK.

Changes to the way buildings and green spaces are maintained has impacts on a range of species that have in the past relied on long grass and piles of deadwood, and made use of cracks and crevices in buildings. For example, repairs and renovations to buildings resulting in the loss of nest sites for swifts Apus apus, compounded by other factors (including fewer insects, unpredictable weather conditions and habitat changes in their African wintering quarters), has led to a dramatic decrease in swift numbers over the last twenty years. Swifts are site-faithful, returning annually to their chosen nest site. Physically adapted for a life spent almost completely on the wing, swifts can only

North and South Oxfordshire Dark Skies Map, CPRE 2016: these new maps provide a new baseline. (They are not directly comparable to previous CPRE light pollution maps due to advances in technology and a much more sensitive satellite being used.). The maps are at a pixel resolution of 400 x 400 metres, so the most detailed maps ever of Britain’s night skies. They were created using data captured throughout September 2015. Going forward, CPRE will be looking to create comparable maps approximately every five years. Map data © LUC 2016
construct nests from light-weight materials they catch in-flight and ‘glue’ together using saliva, so accessible, deep crevices are crucial to their survival.

The trend for over-managing urban parks and gardens leaves few wild areas available for nesting, breeding and foraging species. Lack of pest control (deer and squirrels), invasive species and inappropriate mowing regimes can all be issues when it comes to managing our green spaces for wildlife. However, some more enlightened authorities, as with more enlightened gardeners, have been adopting more wildlife-friendly management regimes which allow for wild corners and more diverse habitats to be maintained.

Case Studies

**Horspath Parish Council Wildlife Conservation Area**

Horspath Local Wildlife Site is established in the disused railway cutting accessible from Butts Road, Horspath. Originally created by digging out and deepening a pre-existing valley in the early 1860s, the 450 metres long tunnel was constructed by a large travelling labour force over a period of about 3 years. In 1969 Oxfordshire County Council bought the 5-acre site and the tunnel which was subsequently purchased in 1982 by Horspath Parish Council. In 2000 the Parish Council decided to convert the cutting into a local nature reserve for the village as a Millennium community project, and to secure the tunnel for use as a bat hibernaculum.

The first phase of this project included the creation of paths, three clay dams to separate a variety of wetland habitats — a frog breeding pond, a reed bed and silt trap, and a seasonal bog - and a log pile footbridge. The footbridge created a secure habitat for amphibians as well as providing good pedestrian access across the wetlands. In 2002 grants totalling £25,000 were spent on the major engineering work to convert the 450 metres long railway tunnel into a bat hibernaculum, which is now a safe and secure for both bats and volunteers to visit. Subsequently more external bat boxes, tit nesting boxes, frog protection cages and underground frog refuges have been installed.

The site was designated an “Oxfordshire Jubilee Wildlife Space” in 2003, and in the same year was selected by the judges of the Best Kept Village Competition as the “Best Nature Conservation Area in Oxfordshire”. Since then local volunteers have devised a sustainable annual maintenance programme to further enhance the wildlife habitats on the site. With improved paths to all parts of the site, there is no reason now for visitors to disturb the more sensitive wildlife habitats, and the wildlife is now better protected.

This site’s national importance is for providing a vast underground temperature and humidity controlled environment for the hibernation of at least 4 species of bats - Daubenton’s *Myotis daubentonii*, natterer’s *Myotis nattereri*, barbastelle *Barbastella barbastellus*, and brown long eared *Plecotus auritus*. Special bricks with holes to accommodate bats have been set into the wall at different heights, and many thick wooden boards have been fixed attached with enough room for bats to crawl behind them. This offers roosting space sufficient to accommodate well in excess of 1,000 bats if necessary.
The bats start using the tunnel in late autumn as their natural food supply of moths and flies reduces with the first frosts. Temperatures are measured at 600 places inside the tunnel using passive infra-red thermometry on the three occasions when the bats are monitored between November to March. Airflow is measured and controlled through the tunnel, and a 40 metres long lake is maintained inside the tunnel at the Horspath end to raise the relative humidity to about 90%: high humidity is critical for hibernating bats.

The engineering modifications to the tunnel involved inserting robust vertical box section steel reinforcements within double layer concrete block walls at each end of the tunnel and installing lockable steel grill access doors. An external ladder is needed to enter the tunnel at the Horspath end, and a steel platform for instrumentation is installed just inside this high-level entrance, with a secure steel ladder fixed inside to descend from this onto a secure board walk alongside the lake. The 3 metres higher elevation of the Littleworth end over the Horspath end ensures that any cold air sinks down towards this sump, while any warm air tends to move along just under the ceiling in the tunnel, thereby producing a great spectrum of temperature zones suitable for the different species of hibernating bats. This range is maintained in both warm and cold winters.

This unique and pioneering wildlife conservation project is very successful and is special to Horspath.

For more information see http://www.horspath.org.uk/common/hwlca.htm
For more case studies demonstrating what’s being done to conserve and enhance our settlements see:

1. Marston Green Health Route (© nhsforest.org)

2. Tools for Planning and Evaluating Green Infrastructure – Bicester and Beyond (© Andrew Stowe)

3. New Country Park for Banbury (© Cherwell District Council)

4. Cherwell Swifts Project (© Roger Wyatt)

5. Chipping Norton Bumblebee Project (© Hilary Phillips)

6. Aston’s Eyot

7. St Mary and St John Church, East Oxford
Improving Nature in Oxfordshire

More, bigger, better, joined

There are many individuals, organisations and partnerships working in Oxfordshire to protect and enhance our special places for nature. We need to harness this momentum, capitalise on these successes and find more ways to rebuild biodiversity – especially for those species and habitats under greatest threat. Our ambition should be to achieve a clear net gain in nature.

To achieve real change, we need to invest in our natural assets and become more dynamic and ambitious in what we seek to achieve. The 2010 Making Space for Nature (Lawton et al. 2010) report emphasises the need to enhance the resilience and coherence of our ecological network within the landscape and take into account wider environmental pressures. This can be summarised in four words: MORE, BIGGER, BETTER and JOINED.

There are five key approaches which encompass these four words and also take account of the land around the ecological network. We need to:

1. Improve the quality of current sites by better habitat management.
2. Increase the size of current sites with high quality habitat.
3. Enhance connections between, or join-up, sites either through wildlife corridors, or the creation of ‘stepping stones’.
4. Create new sites where wildlife can thrive
5. Reduce the pressures on wildlife by improving the wider environment, including through buffering wildlife sites.

Taking a Strategic Approach

In Oxfordshire, there are several strategic approaches that can deliver coherent landscape scale improvements for nature and also benefit people, including:

- **Oxfordshire’s Conservation Target Areas (CTAS)** – these are concentrations of Priority Habitats and Priority Species that include surrounding land which could buffer and link these areas, as well as provide opportunities to create new areas of high quality and Priority Habitat should funding become available.
- **BBOWT’s Living Landscapes and RSPB’s Futurescapes initiatives** – these are both prime examples of landscape-scale projects run by conservation organisations that aim to link up habitats for the benefit of wildlife and people across a wider area.
- **River Catchment Partnerships** – these aim to restore the ecological quality of rivers and reconnect them to their floodplains. Combined with enhanced land management in catchments, particularly along river corridors, they can benefit biodiversity and water quality, as well as regulating flows in times of flood and drought.
- **Areas of Outstanding Natural Beauty (AONBs)** – the Cotswolds, Chilterns and North Wessex Downs provide a framework for wider landscape and habitat improvement within their boundaries.

In developing this report Wild Oxfordshire invited contributors to a workshop and asked them to suggest key actions to improve nature in Oxfordshire. More than 40 individuals representing 30 organisations attended.
The key actions they proposed and the contributions they and other organisations made to this report, reflect deep concerns in the county for the state of our natural environment.

In summary, the key actions include:

1. Urgently create larger and more resilient areas of high quality, connected habitats.
2. Help farmers to find financially viable ways of managing land to provide greater benefits to nature.
3. Improve practical advice and support for communities and landowners.
4. Ensure better strategic planning for blue and green infrastructure across the county that benefits nature and people.
5. Put sustainable development that invests in nature at the heart of local decision-making.
6. Increase access to green space and volunteering opportunities to keep people in touch with the health and well-being benefits of nature.
7. Develop more collaborations within our strong and diverse environment sector.
8. Continue to improve the methodology for monitoring the state of nature across Oxfordshire.

These proposed actions are not just aimed at the conservation sector; to improve nature in Oxfordshire action is needed across all sectors wherever there are opportunities. For example, planners and developers should ensure new construction projects achieve a net gain by creating accessible natural green spaces, protecting and enhancing existing habitats, and enabling wildlife to flourish within the built environment. Farmers and land managers should be encouraged to deliver functioning landscapes that are alive with
wildlife while still feeding our communities. Oxfordshire is well-placed, with its range of long-term applied research facilities and organisations, to set new standards for a truly joined-up, integrated approach to protecting and enhancing our natural resources, ensuring they are still there to provide for future generations.

The case studies in this report demonstrate ways in which people have made, or plan to make, a difference in the county. They are intended as inspiration and guidance for local communities and decision-makers who want to take action for nature in their local area. Some of the case studies are more strategic in their level of implementation, requiring cooperation across different sectors in order to deliver them.

**More**

To offset past losses and deliver real gains in the future, it is imperative that we capitalise on all opportunities for creating new sites for nature. New natural habitats can be created within housing and commercial developments, alongside major infrastructure or flood-defence projects, and through changes in farming and land management practices. Restored quarries and flooded gravel pits provide significant opportunities for enhancing wildlife and Oxfordshire already has several outstanding examples of best practise. New wildlife habitats can be created by farmers, nature conservation bodies and other land managers.

Support for such conservation outcomes currently comes from grant-making bodies and funds, such as Defra, the Heritage Lottery Fund and the Landfill Communities Fund. In future, payments for ecosystem services (PES) schemes could support the creation of new habitats that provide specific public benefits, including natural flood management and carbon storage.

**Bigger**

Bigger sites are preferable to small ones because on average they contain more species with larger populations than small sites. They also have proportionately less edge and potentially have greater topographic, geological and hydrological diversity. Large sites present opportunities to restore and promote more natural geological, ecological and hydrological processes.

Strategic partnerships are needed to lead major habitat restoration and creation projects. Ambitious strategies are currently being put in place across the county, including the Strategic Environmental and Economic Investment Plan, led by OxLEP, and In a Nutshell, a woodland strategy for Oxfordshire, proposed by Sylva Foundation. We need to challenge ourselves to do more on a wider scale and have bigger ambitions for what can be achieved for wildlife in Oxfordshire.

**Better**

Lack of appropriate management, habitat fragmentation and human activities have all impacted upon the quality of Oxfordshire’s natural habitats. It is vital that our existing sites for nature are managed effectively to ensure they are in the best possible condition, enabling them to support thriving populations of Priority Species. For example, increasing the proportion of our SSSIs in favourable condition will be an important measure of success.

There are some outstanding examples of good practice in habitat management from across Oxfordshire that could be followed elsewhere; these are exemplified in case studies throughout this report, which range in scale from multi- hectare wetland creation to enhancements for small, local green spaces. These studies, and
the people and organisations responsible for them, are invaluable sources of knowledge and skills that can be used to inform better future delivery.

**Joined**

Small patches of habitat, no matter how well they are managed, are inevitably more vulnerable to external impacts than large sites. They also provide fewer habitat niches for plants and animals. Nature’s chances of survival is improved by joining existing habitat patches to create larger, more resilient sites. There are many ways this can be achieved, for example, by establishing wildlife-friendly field margins alongside sympathetically managed hedgerows, or by creating new woodlands linking existing patches of precious ancient woodland.

However it is achieved, joining-up patches of habitat to create wildlife corridors or ‘stepping stones’, through which species can move around, is vitally important for increasing the resilience of both species and ecosystems to environmental pressures, such as climate change and pollution.
Challenges and Successes

Overview

Whilst the overall picture is one of continued pressure on Oxfordshire’s flora and fauna there are success stories that show how, with the right interventions, declines in our natural habitats and the diversity of species can be reversed. Great examples include the otter and red kite – both great rarities thirty years ago which are now widespread across the county thanks to huge conservation efforts. There have also been localised gains such as water vole recovery across tributaries of the River Thames and the return of breeding bitterns at Otmoor Nature Reserve.

Society is becoming increasingly aware of the benefits nature brings, including providing the resources for life, underpinning the services that regulate these resources, and enhancing our quality of life. It is imperative that we continue to show people from all walks of life the benefits nature can bring in order to push the preservation of our natural environment up the political agenda. And that to realise these benefits we need to be more effective in how we conserve nature across the county, to prevent any further losses and regain some of the biodiversity that has been lost already.

Clear Trends in Oxfordshire Highlighted by this Review

- Species-rich semi-natural grasslands suffered huge losses in the mid-20th century.
- Water quality and river habitat have been severely impacted by historic modifications to watercourses and pressures from human activity.
- The value of our special places for nature has reduced due to shortfalls in management across a range of habitats (with some notable exceptions).
- Accessible green spaces and habitats have decreased due to increases in the extent of urban areas and housing density.
- Farmland biodiversity, including birds and plants, has suffered major declines.
- Woodland biodiversity, including birds and butterflies, has suffered major declines.
- The amount of woodland increased in the latter part of the 20th century.
- Some wetland habitats and species, such as otter and snipe, have begun to recover when properly protected and managed, though many are still vulnerable.

The Challenges Facing Our Wildlife

Notable amongst the many new challenges faced by Oxfordshire’s natural environment are the pressures of a fast-developing economy, increasing housing and the upgrading and creation of infrastructure. All of these are acting against the backdrop of long-term changes in farming policy and practices and, possibly more dramatically, changes in our global climate that will have international, national and local repercussions. These pressures act to further fragment and degrade our already damaged natural habitats, resulting in increasingly isolated species whose populations are more vulnerable to the negative effects of climate change and impacts from incoming non-native pests and diseases (Defra, 2015).

To enhance the management of our landscapes and alert us to potential problems and demonstrate where interventions have made a difference, we need to improve monitoring at a local level. The review process for this report has highlighted gaps in county-wide data that prevent comparisons to be made over time. This is...
something that must be tackled urgently by the conservation and recording community in conjunction with local authorities and government agencies.

This report has demonstrated some clear trends in the extent and quality of Oxfordshire’s habitats and wildlife. But it is less clear what changes the county’s soil resource and air quality have undergone, and the impacts of invasive non-native pests and diseases. The effects of climate change on weather patterns and land-use decisions, and the impact these have on local wildlife, are still in the early stages of assessment. These are important points for focusing future work.

**Delivering Net Gains for Nature**

We must plan to deliver net positive outcomes for biodiversity when developing and actioning strategies that effect our natural environment. This will be achieved through the exchange of knowledge and skills across all sectors. We also need to ensure that, in these times of economic uncertainty, spending on the environment is lifted up the political agenda in order to prevent further damaging losses that cannot be reversed and may send ripples, not just through ecosystems, but through society as a whole.

Actions to support these principles must be taken at many levels, and by many different people and organisations. Together with a continued focus on large-scale improvements in the county’s water and air environments, this will give us the best chance to ensure that future generations will continue to benefit from Oxfordshire’s nature as we do.
Case Studies

Lowland Semi-Natural Grassland and Heathland

1. Grassland Enhancement at Barton Fields, Abingdon

Barton Fields Nature Reserve is an area of grassland and marsh situated next to the Thames, owned by the Vale District Council and managed by Abingdon Naturalists Society’s ‘Green Team’. The site is part of the Radley Gravel Pits LWS and has not been in agricultural use for many decades, consequently the soil is low in nitrates and phosphates. Parts of the field are subject to flooding from the river.

In 2008 Lottery funding enabled the creation of a wildflower meadow in the flood-prone area by introducing appropriate native plants. That autumn half a hectare was harrowed and seeded with yellow rattle *Rhinanthus minor*, and the following year 21 perennial herb species were sown or planted as plugs. The meadow is now mown in March and August with the hay being removed from the area. Changes in plant abundance over a five-year period were monitored using 47 quadrats. About sixty herb and seventeen grass species have been recorded in the area and of these 22 herbs have increased significantly while seven have declined.

The Green Team also undertakes weekly butterfly counts under the United Kingdom Butterfly Monitoring Scheme (UKBMS). The walked transect traverses both enhanced and un-enhanced sections. Butterfly numbers were about three times higher in the enhanced compared to the unenhanced sections, following the creation of the wildflower meadow.

For more information see [http://www.abnats.org.uk/bf_home.html](http://www.abnats.org.uk/bf_home.html)

2. Earth Trust: Sinodun Hills Grassland Restoration Project

This project has taken an existing site of high conservation value – the Wittenham Clumps – and extended semi-natural habitats outwards from it into the surrounding working landscape. The project has focussed on the creation of 187ha of lowland neutral grassland on former arable land and restoration of a further 20ha of existing grassland.

Grassland restoration work began in 2004 when, as part of a Countryside Stewardship Agreement, green hay from an existing wildflower meadow was spread on Round Hill. This work was carried out for five years with the area receiving the green hay being grazed, lightly cultivated using spring tines...
and then the hay spread. Subsequent grazing ensured the competitive grasses were kept in check as the seedlings established and also helped to trample the seed into the soil. The main grassland restoration and creation works then took place in the autumn of 2009. Restoration works on the existing grasslands involved topping of the sward followed by disking in two directions to create sufficient bare earth. Power harrowing then created a finer seedbed onto which the wildflower seed was then sown. Finally, the area was Cambridge rolled to ensure good contact between seed and earth.

Similarly, on the former arable areas, a spring wheat crop was grown with no fertiliser inputs. The aim being to draw nutrients out of the soil prior to the grassland creation works. Once the crop was harvested the seed bed was prepared and the regrowth of weeds controlled by two sprays of glyphosate. The results of the grassland monitoring (completed by Gregory, S. in 2009, 2010 & 2011) demonstrate that most of the sown species have become well established and have shown large increases in their percentage occurrence within quadrats. The semi-improved grasslands of Clifton Meadow, Church Meadow, Round Hill and Castle Hill have been slowest to respond to grassland diversification. These old, established grasslands are several decades old and past applications of herbicides and/or fertilisers have resulted in a grass dominated sward that proves resistant to wildflower establishment. Also, because these grasslands contain extant areas of high conservation interest, only small patches have been put down to grassland restoration, while the entire grassland, whatever the vegetation, is included within the monitoring programme.

In contrast the former arable fields were essentially a blank canvas free of coarse grasses and perennial weeds, and supporting few, if any, species of conservation importance. Free of competition from other plants, a sward mainly dominated by desirable wildflowers has rapidly become established across the former arable fields.

For more information see http://www.earthtrust.org.uk/About-us.aspx

3. The Shotover Wildlife Acidic Grassland Project

Since 2000, Shotover Wildlife has embarked upon a number of initiatives to address the decline of acidic-soil habitats within this SSSI. In 2007 funding was awarded from the local authority (Section 106) and Trust for Oxfordshire's Environment (TOE) for a Grassland Habitat Project. This enabled the creation of a hectare of new acidic grassland in the SSSI over the following three years.

Some particularly notable invertebrates have arrived to take advantage of the rare opportunity. The Adonis ladybird *Adonia variegata*, never before recorded on Shotover, has been found on the Project area and the handsome green tiger beetle *Cicindela campestris* which for many years was thought lost from Shotover, is now resident on the new habitat. The rare saproxylic beetle *Colydium elongatum* was found on one of the standing dead trees and the bare soil is already home to some of the largest and densest aggregations of solitary bees and wasps in Oxfordshire.

Moreover, the Project has demonstrated that bryophytes can remain the dominant cover for nearly a decade at least, giving way only very gradually to acidic grasses. Bryophytes play a key role in stabilising the soil surface, retaining soil moisture and providing a vegetative foundation for the invertebrate food chain. This exceptionally slow succession is therefore a strong indication that the Project will contribute to a rich acidic grassland ecology for many years to come. A variety of locally scarce acidophile mosses and liverworts...
have colonised the area since the soil was exposed. Restoration and monitoring of Shotover’s heath and acidic grasslands continues to the present day.

For more information see [http://www.shotover-wildlife.org.uk/](http://www.shotover-wildlife.org.uk/)

### 4. Breeding Waders in the Upper Thames River Valleys

The Upper Thames and its tributaries are an important area for breeding waders on lowland farmland. However, periodic surveys in the 1980s and 1990s showed numbers were declining. In 2005, the Upper Thames Wader Project was launched to undertake more systematic surveys of breeding lapwing, curlew, redshank and snipe and to provide advice to farmers and land managers on habitat restoration and management.

Sites identified in 2005 were resurveyed in 2010 and again in 2015; providing important information on wader numbers over a 10-year period. It shows that, excluding the RSPB’s Otmoor reserve, curlew numbers had declined by 51%, lapwing by 21%, snipe by 88% and redshank by 50%. When data for the Otmoor reserve is included results are more positive, with increases recorded for lapwings (66%), redshanks (70%) and snipe (100%). In 2015, 120 pairs of lapwings, 84 pairs of redshanks and 22 displaying male snipe were recorded on the reserve.

Clearly, the trend in the numbers of waders on farmland is not positive. Nevertheless, in 2015, 50 pairs of lapwings, two pairs of redshanks, 1 displaying male snipe and 41 pairs of curlews were recorded in farm surveys which, taken together with numbers for the Otmoor reserve, shows that the Upper Thames continues to hold an important lowland population of these species.

Since 2006, the project has worked with farmers to restore over 990ha of wetland grassland and provided management advice to achieve suitable quality habitat for breeding waders. Going forward, it will liaise with Natural England to support farmers’ entry into the new Countryside Stewardship scheme focussing where possible on a landscape-scale, working with adjoining landowners to create areas of continuous restored habitat.

There are particular concerns about curlew numbers in the UK with a 46% decline in the breeding population between 1994 and 2010. RSPB have been awarded Landfill Communities Fund (LCF) funding by Oxfordshire funder TOE2 (Trust for Oxfordshire’s Environment) to start a pilot project, undertaking additional surveys for curlews in the Upper Thames in 2016. This will help to improve understanding of the importance of specific in-field habitat characteristics of curlew nesting and feeding sites and to this knowledge will be used to better inform land managers about management for this species.
5. Suck Seed and Sow

‘Suck Seed and Sow’ is a Wychwood Project initiative to bring more colour and beauty to roadside verges and community green spaces in Crawley, Chipping Norton, Chadlington, Taynton and Worsham, funded by The Trust for Oxfordshire’s Environment (TOE2) Ltd, Grundon Waste Management Ltd. and Cotswolds Conservation Board Sustainable Development Fund.

Road verges are hugely important for the diversity of flowering plants that they support, which range from the appealing and widespread Blue Meadow Cranesbill to the nationally rare Downy Woundwort.

Flower rich road side verges are not just beautiful, they are also a valuable habitat for birds and small mammals. Verges act as essential wildlife corridors along which species can move and spread, linking habitats and allowing wildlife to re-colonise landscapes fragmented by modern agriculture.
Verges also act as an important refuge and food source for many beneficial key pollination insects, such as the honeybee. The U.K. National Ecosystem Assessment estimated the production value of insect pollination (in 2007 GB£) to be at £430 million or about 8% of the total market value of crop production (Smith, 2011).

Over the years, a number of road verges in the Wychwood area have been identified as having ecological interest for their range of plant species characteristic of limestone grassland, or for one or more specific plant species. These verges have been marked with Nature Reserve posts, given specific management prescriptions and are periodically surveyed. This project will seek to enhance the flora diversity of nine Road Verge Nature Reserves and green spaces.

During the summer of 2016 Wychwood Project volunteers gathered seed both by hand and using a specially adapted vacuum from several ‘donor’ sites. ‘Receptor’ sites were prepared by scarification, leaving up to 60% of bare soil, creating the best conditions for seed germination and growth.

Wychwood Flora Group have gathered information on previous surveys of the sites and undertaken monitoring so that we can judge if our interventions result in better flora diversity in the future.

For more information see [http://www.wychwoodproject.org/cms/content/our-work](http://www.wychwoodproject.org/cms/content/our-work)

6. Heathland and Acid Grassland Restoration at Nettlebed and District Commons

The Nettlebed and District Commons (NDC) are a 227-ha (560 acres) fragmented expanse of green open space, ranging from the villages of Nettlebed in the north to Rotherfield Peppard in the south (see map at end of paper). There are eight commons in total (from north to south, roughly); Nettlebed Common, Lower Common Wood, Oxlands Bottom, Highmoor Common Wood, Highmoor Common, Witheridge Hill Common, Kingwood Common and Peppard Common.

Nettlebed Common includes Priest’s Hill geological Site of Special Scientific Interest (SSSI), whilst six of the eight commons are designated Local Wildlife Sites. The majority of the commons are owned by the Nettlebed Estate, whilst Witheridge Hill Common is separately owned by two individuals.

Each common would have been used as a resource by the local community, and as such the landscape of each common varied. Generally, traditional management practices carried out on the commons such as grazing and tree felling for fuel would have created more open landscapes than exist today. The cessation of the majority of these traditional management practices has meant that scrub and trees have replaced areas that were once open.

The underlying geology of the NDC is chalk with an overlying clay cap often with seams of sand or gravel. The soils are predominantly acidic, although there are occasional patches of plants indicative of calcareous soils (Peppard and Kingwood commons). The commons support a variety of habitats, including ancient beech woodland, secondary woodland, acid grassland, heathland, woodland ponds and veteran trees. Notable
species to be found on the commons include the hazel dormouse *Muscardinus avellanarius*, great crested newt *Triturus cristatis*, noble chafer *Gnorimus nobilis*, white admiral *Limenitis camilla*, heather (ling) *Calluna vulgaris* and bell heather *Erica cinera*.

Heathland is very rare in Oxfordshire, and the NDC includes three of the best heather populations in the county (Nettlebed, Kingwood and Peppard commons). Peppard Common is the last remaining site in Oxfordshire for Dwarf Gorse *Ulex minor*. The potential for heathland expansion on Nettlebed and Peppard commons is small, due to the unsuitability of the directly adjacent areas. However, Kingwood Common provides a location with enormous potential to expand existing heathland areas. Nettlebed common supports a small area of damp heath, the only known location of such a habitat in the county and historically has been Oxfordshire’s best site for amphibians and reptiles (D’Ayala R.L., 2016).

Between 1995 and 2005, the NDC was under a Countryside Stewardship agreement (CSA) with Defra. This arrangement was made as a partnership between the Nettlebed and District Commons Conservators (NDCC) and the Berks, Bucks & Oxon Wildlife Trust (BBOWT). BBOWT, the Sonning Common Green Gym (SCGG) and other local volunteers carried out various management tasks on the commons including tree felling, heather and gorse cutting, bracken cutting and treating, path clearing, and scraping to encourage new heather plants to grow. This work allowed the creation of open glades and rides on Kingwood Common, and the enhancement of the heathland areas on Peppard and Nettlebed commons. However, the end of the CSA meant that a lot of the management work on the commons has ceased. The SCGG have been continuing management work and have kept the existing heathland areas and rides in good condition. However, due to limited time and resources they cannot sustainably expand the heathland areas on Kingwood Common.

For more information on the site visit [http://www.chilternsaonb.org/about-chilterns/chilterns-commons-project/commons.html#id_373](http://www.chilternsaonb.org/about-chilterns/chilterns-commons-project/commons.html#id_373)

### 7. Fen Violet and the Oxfordshire Flora Group

Plant species conservation in the county is well exemplified by the extensive collaboration on fen violet *Viola persicifolia* organized by the Oxfordshire Flora Group. In the 1960s this small pale-blue flower was only known in the UK from two East Anglian fens, where it had reappeared following scrub removal after long absences. Experiments were conducted on its seed longevity and the depth of disturbance ideal for its continued presence. A visit to Czechoslovakia revealed that fen violet flourishes in hay meadows on big river systems; this habitat is present in Oxfordshire at Otmoor where the plant was re-found in 1996.

A steering group, made up of representatives from Natural England, Plantlife and Otmoor Reserve wardens, was established to manage fen violet conservation. Long term annual monitoring was carried out by Oxford University to examine the distribution of hybrids and to assess any danger of losing the species by introgression. The monitoring showed a mobile population as well as some long-lived plants, and seed production throughout the summer including from flowers that never open. Seed was sent to the Millennium Seed Bank who carried out germination trials. These trials produced surplus plants which then became available for introduction.
The RSPB made an adjacent area available on their new Otmoor reserve, and an experimental translocation was carried out. Soil chemistry and anoxia studies were made to compare the UK and Irish sites where the plant grows in seasonal turloughs, grazed by cattle.

Four years later some of the Otmoor transplants have spread by seeding and the study has demonstrated the appropriate soil conditions and flooding regime, with quick spring drawdown, which the plant requires. Natural England has now asked the steering group to draft a five-year plan proposing further research to include the use of a webcam to study pollinators, as well as more introductions, perhaps at the Earth Trust’s River of Life Project on the Thames.

For more information see http://anthriscus.co.uk/ofg/violapersicifolia.html

8. Aston Upthorpe Downs and Other Conservation Work: Butterfly Conservation’s Upper Thames Branch (UTB)

The branch have been collecting butterfly and moth data since 1982 and the last atlas of our butterflies distribution and abundance (Atlas of Butterflies in Berkshire, Buckinghamshire & Oxfordshire, 2016) alone was produced from over 700,00 records. Records are collected of all life stages and the annual New Year’s Day Brown Hairstreak egg hunt at Otmoor (RSPB) has featured on television and repeatedly on the radio. These thousands of records, of butterflies and of moths, allow targeted conservation effort towards both the most threatened species and also in habitats that are both important and perhaps losing parts of their essential habitat resources.

Volunteers on the egg hunt at Otmoor to help maintain such habitats the UTB work at various sites, often to control scrub and protect areas of flower rich grassland. At most, UTB volunteers join in with work organised by groups like BBOWT and MOD, but at Aston Upthorpe on the Downs, we have had our own programme of winter work parties for decades. This site has lost the Duke of Burgundy but key populations of Grizzled and Dingy Skipper, Green Hairstreak and other less common butterflies and moths have been retained through the creation of warm, sheltered, interconnecting ‘glades’ in the over-dominant scrub. We also help with work in woodland settings, where without occasional clearance the woodland becomes too shady and loses first its abundant ground flora and then, consequently, its butterflies and moths (which fed on that lost flora). Creating a glade in scrub at Aston Upthorpe Much of the conservation work we undertake seems to be directed to recovering grassland from over-shading by scrub and secondary woodland, but we also plant food plants for scarce butterflies and moths into sites where they are in short supply for various reasons. For instance, the Elm tree has been seriously depleted in numbers as a result of Dutch Elm disease; so we plant new resistant forms where we are invited to do so, to help the White-letter Hairstreak butterfly and various moths (e.g. Dusky lemon Sallow). Planting Wych Elm at a MOD site in Oxon. We are currently exploring avenues to allow us access to other sites where we can help to restore and maintain high quality habitats in a landscape that has increasingly large areas of neat, tidy and generally uniform land. Our aim is to conserve...
habitats with mosaics of diversity which invertebrates need if they are to thrive. By working to keep those habitats, butterflies and moths will be safeguarded within them.

For more information see [http://upperthames-butterflies.org.uk/sites.html](http://upperthames-butterflies.org.uk/sites.html)

Rivers and Wetlands

1. RSPB Otmoor: Nature Reserve Reedbed

This 394-hectare nature reserve comprises extensive floodplain grazing marsh and reedbed – all created on former pump-drained arable land in the Otmoor Basin.

In 1997, the RSPB acquired the first arable field and initially planned to build two reservoirs to store surplus winter rainfall on the reserve, allowing the surplus water to be released in the spring to supplement the floodplain grazing marsh ensuring the levels are suitable for breeding waders. However, rather than create open water reservoirs, the decision was made to establish reedbeds, a priority habitat, within the reservoirs.

A network of islands, ditches and open water were created with support from an EU Life grant and the Environment Agency. For the next 7 years 150,000 reed plugs were grown in poly tunnels on the reserve and planted by hundreds of RSPB volunteers from the local community.

Twenty years later, following this establishment phase and ongoing management to create additional channels, the reedbed has now become a haven for wildlife. Over 50 pairs of reed warblers, a pair of bitterns and a pair of marsh harriers have all bred successfully within the reedbed. The reedbed will become even more important in future years, and may attract some of the expected colonist species from mainland Europe - including purple heron, great white egret and little bittern.

For more information see [https://www.rspb.org.uk/reserves-and-events/find-a-reserve/reserves-a-z/reserves-by-name/o/otmoor/](https://www.rspb.org.uk/reserves-and-events/find-a-reserve/reserves-a-z/reserves-by-name/o/otmoor/)

2. Earth Trust River of Life Project: Restoring Floodplain Connectivity and Function

The River of Life is a wetland creation and river restoration project, developed over three years, in partnership with the Environment Agency. In 2010, the Earth Trust purchased new land which added 2.5km of River Thames frontage and expanded the total landholding to 500ha. The River of Life project aimed to:
Create high quality floodplain habitats to meet national biodiversity targets, including 15 ponds, a fen, two reed beds and 25ha of herb-rich grasslands.

To excavate 5 large backwaters connected to the Thames, to deliver valuable fish breeding habitats and provide vital refuges during flood events.

To reduce flood risk through the removal of 38,000m³ of spoil from the floodplain, thereby enhancing Oxfordshire’s floodplain capacity.

To provide regulating services, including the interception of run-off from agricultural land and act as a buffer to the local catchment – processing and storing silt and processing sediment-bound phosphates and nitrates, ultimately reducing run-off rates and on agriculturally active fields converting excess nutrients into an agriculturally valuable crop.

Vital hydrological, soil and LIDAR data were collated to provide a two-year evidence-base to determine the feature and habitat locations. Excavation works were undertaken between October and December 2013, whilst the soft landscaping such as reed planting, wet woodland planting and grassland restoration took place 2014-2016.

New wetland habitats link directly to an existing Site of Special Scientific Interest (SSSI), Little Wittenham Wood, and is interconnected with the wider 500ha site via hedgerows, field margins, the Thames and grasslands thereby ensuring the permeability of this landscape to new colonising species.

Species surveys in 2014, identified 12 species of fish utilising the backwaters, with population densities into 6 figures - thereby realizing a key Water Framework Directives objective for this catchment area. Butterflies and Odonata species number exceeded 12 and 9, within the first 12 months, respectively. Seven amphibian and reptile species have been surveyed on the project site and 37 macrophyte plant species were observed within the features in 2015. These monitoring efforts are on-going into 2016 and have expanded to include bird, water quality, bat species, botanical surveys across the restored grassland and freshwater invertebrate surveys. In June 2014 River of Life was the joint winner of the Best Practice Award for Practical Nature Conservation at the Chartered Institute of Ecology and Environmental Management (CIEEM) Awards.

For more information see http://www.earthtrust.org.uk/Our-work/waterandwetlands/RiverofLife.aspx
3. Gill Mill Quarry Extension, Smiths Bletchington

Mineral sites offer some of the best opportunities to re-build biodiversity on a large scale. A major new extension to Gill Mill Quarry near Witney will create 120 hectares of priority habitats including one of the largest reedbeds in southern England. Water vole, otter and bittern are among the many species that will benefit from these new wetland habitats. Extensive new public access will be provided and a number of eco-lodges will be built to benefit the local economy and provide revenue for sustainable management of the resulting nature reserve.

The scheme also reflects the need to conserve existing habitats of biodiversity and cultural value, and make a landscape-scale contribution to the wider Windrush Valley strategy and helping flood management downstream of Witney. The RSPB is providing habitat design and management expertise to Smiths that will help ensure the quarry restoration provides the best conditions for reedbed wildlife to flourish. In recognition of this exciting vision for Gill Mill, Smiths Bletchington was the national winner of the “Planned” category at the 2015 Mineral Products Association (MPA) Biodiversity Awards.

For more information see http://www.mineralproducts.org/documents/Case_Study_1_Gill_Mill.pdf
4. Water Vole Recovery Project

In 1998, the Berks, Bucks & Oxon Wildlife Trust began a pioneering project to reverse the decline of the water vole, which had suffered a 95% reduction of its range since 1900. The Water Vole Recovery Project works in partnership with the Environment Agency, the Canal & River Trust and Thames Water. Water voles are monitored with the help of a dedicated team of around 50 volunteer surveyors. The project works with landowners to ensure habitat is enhanced and managed favourably for water voles and to establish mink control in order to protect voles from their biggest threat, the introduced American mink. The project currently co-ordinates 68 mink rafts on Oxfordshire’s waterways. It focuses efforts in Local Key Areas, sites designated because water voles are known to be present or within dispersal distance. During the period 2008 to 2016, against the backdrop of a national decline, the total water vole Local Key Areas in Oxfordshire increased more than three-fold from 137 to 433km². Key Areas are also linking up, creating more connected populations, which will help to safeguard the future of water voles in Oxfordshire.

For more information see [http://www.bbowt.org.uk/what-we-do/protecting-wildlife/water-vole-recovery-project-0](http://www.bbowt.org.uk/what-we-do/protecting-wildlife/water-vole-recovery-project-0)

5. Nettlebed Pond Restoration/Creation

Most of Oxfordshire is covered by neutral or calcareous rocks and soils and acidic habitats are naturally uncommon. The clay cap habitats in the Chilterns are one area where acidic (rainwater fed) ponds can be found, with perhaps the best and most extensive area of ponds being found in the abandoned quarry ponds on Nettlebed Common. No proper census has been carried out of the number of ponds on the site but to date well over 100 water bodies (small to large) have been identified. Many of the small or relatively small ponds are shady as they are located in areas of heavily wooded, unmanaged common. There are a small number of larger open sunny ponds.

Management work began on the Nettlebed Common Ponds in the late 1980s when it was realised just how special the site was – not only because of the number of ponds but also because of the variety of plants and
animals they support. Several of the species found at Nettlebed are rare or uncommon in the rest of the county. In recent times (2014 to 2016) more targeted management has been carried out in one part of the clay-pits to open up a whole suite of ponds that had formerly been dominated by willow scrub and shaded by woodland and scrub. This work has been undertaken by the Nettlebed and District Commons Conservators and headed-up by conservation consultant Rod d’Ayala.

Old ponds have been restored and improved and new (bare clay substrate) ponds created. This newly opened landscape is a partial recreation of the original open landscape when the site was an active quarry. Careful management has included the creation of numerous small dams that serve to increase the volume of water and length of time it’s held in the disused pits. Some larger scale work has also been carried out, re-excavating existing ponds and creating new ones.

The restoration has resulted in a dramatic increase in the abundance of specialist acid plants such as water purslane *Lythrum portula*, bulbous rush *Juncus bulbosus* and sharp-fruited rush *Juncus acutiflorus*—species that are rare elsewhere in the county. Another of the key species groups for these wet habitats are bryophytes— including pond species such as lesser cow-horn bog moss *Sphagnum auriculatum* and epiphytic species (e.g. tree fringewort *Ptilidium pulcherrimum*) some known in the county only from Nettlebed. It is important to leave areas of wet shady woodland as well as to re-create the open habitats of the past.

Nettlebed Common is one of the most important sites for amphibians in the county, supporting all five native species (common frog, common toad, smooth, palmate and great crested newt). Problems of over-shading with the existing larger and more open ponds has led to a decline in amphibians even on this site, but it is hoped the re-creation of a more extensive area of open sunny ponds will result in their increase again.

The sheer number, variety of type (including acidic) and size of ponds on the site alone makes it notable at a county level. The variety of size is matched by the variety of type, from permanent to seasonal, sunny to shady, and it’s this range that supports the variety of species present. The work has been grant funded by a range of organisations, including the Chilterns Conservation Board, TOE2 and the Patsy Wood Trust, with much of the on-going management work undertaken by a team of local volunteers.

For more information see [http://www.nettlebed-commons.org/ccbproject.html](http://www.nettlebed-commons.org/ccbproject.html)

6. Lye Valley Project

The Lye Valley was once a rural site, but is now within the bounds of Oxford City, with urban development encroaching closely on two sides. Within the valleys of the Lye and Boundary brooks a special geological situation (permeable limestone of the Corallian Ridge overlying impermeable Oxford Clay) gives rise to a spring line which has, over thousands of years, formed calcareous (limy) alkaline fen habitats with a range of rare plant and invertebrate species. These were studied by the earliest botanists and entomologists from Oxford University from as long ago as the 1600s, when the site was known as Hogley.
Bog. A depth of peat and tufa (lime) deposits formed from the calcium-rich spring water and over a metre of this remains, despite historic peat cutting. Although there are problems of catchment development (reducing spring flow) and brook bank erosion due to flash flooding, 22 plant species from the county Rare Plants Register are still present at the site. This short alkaline fen vegetation type is now the rarest habitat in England due to losses elsewhere. In the Lye Valley the area of quality short fen is still small at around 1.5ha, and loss of a large section occurred due to succession to scrub since grazing ceased about 100 years ago; however two valuable areas of short fen survived and are designated SSSI.

Better management of the two short fen areas has improved habitat condition vastly over the last 6 years. Grant funding achieved by Natural England and BBOWT (Wild Oxford Project) has enabled a great deal more scrub reduction and more extensive annual cutting and raking of fen vegetation using an army of volunteers, which include the local Friends of Lye Valley group. This cutting and raking simulates grazing activity. However, the north fen and south fen SSSI sections are still separated by 600m of scrub and secondary woodland on old peat. Isolated plant and invertebrate populations in the two SSSI sections will have a better chance of survival into the future with current plans to remediate ‘stepping stone’ sections of what was old Hogley bog back to a much greater area of high quality fen vegetation; re-joining the best surviving habitat areas.

Pressure to develop nearby is high and catchment protection is needed. Whilst Oxford City Council own part of the project area, most of the rest is in multiple private ownership. Further grant funding and hopefully management agreements with as many of the private owners as possible will also be needed.

For more information see http://www.friendsoflyevalley.org.uk/

7. Enslow Marsh LWS

Enslow Marsh contains one of the largest sedge beds in Oxfordshire, along with areas of wet woodland and scattered scrub. The presence of this sedge bed, as well as Enslow Marsh’s proximity to a number of other wetland habitats along the River Cherwell corridor, makes it a priority for conservation.

The site has typical marshland species including common meadow-rue, marsh-bedstraw, skullcap, water horsetail, wild angelica, yellow iris and great willowherb with previous records for hemlock water-dropwort, marsh marigold, common valerian and purple loosestrife. Historically the site has been shown to be important for breeding birds, with records for both sedge warbler and reed bunting breeding on site. The site has previously been used by otters and water voles have been recorded on the banks of the Canal bordering Enslow Marsh, though it is not currently a key area for water vole activity.

Lack of management over many years has created a wet sedge dominated site, with scattered wildflowers. The Local Wildlife Sites project has established an agreed a set of conservation objectives and a site work plan to control scrub encroachment and enhance the structural diversity within the sedgebed, encouraging more wildflowers to flourish.

For more information see http://www.ocv.org.uk/sites.php?id=189
8. BBOWT: Cothill Fen Project

This project, funded by SITA UK, started in April 2010 and covers four BBOWT nature reserves within the Cothill Fen SAC: Dry Sandford Pit, Lashford Lane Fen, Parsonage Moor and Gozzards Ford Fen. The project’s aim was to make sure the fen areas of the reserves stay in favourable condition for the vast array of interesting wildlife they support. More specific goals were to:

- Make practical habitat improvements on site e.g. new ponds for open water at Parsonage Moor and removing encroaching trees and diverting ditches at Lashford Lane.
- Enhance on-site grazing infrastructure to allow improved grazing regimes e.g. Install new fencelines at Dry Sandford Pit to allow the fen to be grazed for the first time and expanding the fen grazing area at Lashford Lane as well as creating handling pens so that livestock can be on sites longer due to having the facilities to do remedial and routine husbandry.
- Purchase new livestock particularly suited to the fen habitats to allow for longer periods of grazing.
- Raise public awareness of the rare fen habitat and its wildlife
- Recruit volunteers to help with surveying water levels and species, stock watching and practical tasks.

Over 1 kilometre of fencing was installed during January 2011 at Dry Sandford Pit to facilitate sensitive grazing of the fen and the provision of lay back. Being a reserve heavily used by local walkers and dog walkers, the public perception of fencing and grazing needed careful management. Plans were communicated on site and in local newsletters outlining the reasons for these changes and this was clearly a great help. Most people were pleased and excited at the prospect of having cattle and the wildlife benefits that would bring.

Dexter cattle have been used at Lashford Lane and Dry Sandford Pit where this half sized breed is invaluable on the wet ground, eating tough vegetation and keeping pools open for the rare Southern Damselfly to breed. At Parsonage Moor Carneddau Welsh Mountain Ponies will replace the New Forest Ponies. This breed is much smaller with small hooves and are very hardy, making them ideal for the wet, swampy ground on this reserve. The summer grazing here will back up the huge amount of reed and fen cutting that has been achieved to get the management regime back on track.

During October 2011 fifty encroaching trees were removed from the edge of the fen at Lashford Lane. The trees were felled and then extracted using the horse power of Hermes, the 16-year-old Ardennes horse of Horse Force Logging. Hermes was more adaptable than machinery and caused much less damage on the wet, delicate ground.

With more light in the fen, seeds stored in the soil will be able to emerge providing a greater diversity of specialist and rare fen flowers. The project has also encouraged over twenty volunteers to get involved in these reserves whether it be surveying, stockwatching or being part of the monthly practical work party.

For more information see: http://www.bbowt.org.uk/news/2012/11/08/cothill-fen-project-wins-opt-award
9. Evenlode Catchment Natural Flood Management

The River Evenlode, a headwater tributary in the Thames Basin, is a flashy clay catchment with several small rural towns and villages prone to flooding. The Evenlode Catchment Partnership is working with the Environment Agency (EA) and local communities to develop, coordinate and deliver a project that integrates Water Framework Directive (WFD) objectives with a Natural Flood Management (NFM) demonstration scheme. These natural solutions to manage flood waters often require land management changes to slow and store run-off, which can have multiple benefits for water quality and habitat creation. They will also drive improvements in agricultural land management.

The project has multiple objectives:

- Plan and deliver Natural Flood Management (NFM) and WFD interventions at a lowland catchment scale
- Communicating NFM and WFD objectives to local communities, stakeholders and wider audiences;
- Work with landowners to enable sustainable delivery of NFM and WFD land management changes;
- Demonstrate the contribution that NFM may make to reducing flood peaks and sedimentation;
- To understand the natural capital costs and benefits (catchment resilience potential) of NFM actions in a lowland catchment, including its contribution to reducing flood risk to rural communities, improving water quality and habitat creation.

And outcomes:

- Potential reduction of fluvial flood peaks and surface water flooding issues improved Reduction in levels of diffuse agricultural pollution and sediment loading in rivers: Improve river water quality and habitat, contributing to a WFD status improvement.
- Deliver NFM interventions integrated into best farming practices and increased utilisation of agricultural payment (NE/FC) schemes – delivered in partnership with Thames Water’s Upper Evenlode rural diffuse phosphate reduction project:
- Land management changes will provide habitat creation opportunities,
- Improve reputation and relationships with Partners and community:
- Increased evidence base in the delivery and benefits of NFM in lowland catchments as a tool for reducing flood risk to communities. NFM learning shared across catchments in Thames Area and Nationally.

The project has 5 years of funding from the Regional Flood and Coastal Committee (RFCC) Local Levy, the EA WFD Grant in Aid, and partnership funding from a range of sources including Parish Councils, Thames Water Rivers and Wetlands Community Days, Landowner, ToE2, Fisheries Improvement fund, Cotswold River Trust.
Partners in the project include: Wild Oxfordshire, Wychwood Project, Cotswolds Rivers Trust, West Oxfordshire District Council, Natural England, Milton-under- Wychwood Parish Council, Centre for Ecology and Hydrology, Thames Water, the Bruern Estate.

For more information see: http://www.wildoxfordshire.org.uk/biodiversity/river-catchments/evenlode-catchment/

Woodlands and Trees

1. Daeda's Wood – A Millennium Community Wood

Once a nine-acre field of waving corn, Daeda's Wood is now a spread of 3,500 maturing trees; a stretch of path for the less able-bodied to stroll more easily down to the boundary river Swere; a couple of seats; open areas which are a tangle of wild flowers in due season. Daeda’s Wood was the very first in the Woods-on-Your-Doorstep Millennium project sponsored by the Woodland Trust, with financial backing from the Millennium Commission and supporters such as the Cherwell District Council ... and not least the parishioners of Deddington. In order to qualify we had to raise £9000 in a very few weeks.

Deddingtonians - well over 100 of them - turned out with their spades at the tree-planting in near blizzard conditions in November 1996. A few months later, in rather friendlier conditions, we were out there again sowing seeds for the wild flower areas.

The wood’s contorted northern boundary is formed by the River Swere. This dictated the riverine nature of the new wood, and thus the trees planted: ash, five species of willow, oak, alder, grey and black poplar, aspen, downy birch, osier, hawthorn, blackthorn and guelder rose. Some of the oak seedlings originated from the ancient oaks in Windsor Great Park. As the river Swere runs along one boundary of the wood BBOWT built an otter holt.

Because this is a developing new habitat, the variety of wild flowers will increase and change as the wood matures. There is already a wide variety of birds attracted to the area. In winter sizeable flocks of visiting fieldfare settle on the surrounding fields or noisily in the mature trees, and tree sparrows and groups of long-tailed tits are often seen. Usually there's a kestrel on the hunt, possibly a great spotted woodpecker. As the trees have matured, there are increasing summer populations of warbler - whitethroat, willow warbler, chiffchaff, blackcap, garden warbler.

For more information see http://www.deddington.org.uk/community/daedaswood
2. Grimsbury Woodland Nature Reserve

Grimsbury Woodland was established by the Forestry Commission in Banbury back in the early 1960s, in conjunction with construction of the new Grimsbury reservoir. The woodland is on land owned by Thames Water, just to the north east of the reservoir. It is a 3.5 hectare site of Scots pine and alder with other trees and scrub. Banbury Ornithological Society (BOS) took on a formal management licence to manage the woodland on behalf of Thames Water in 1992, and is now working to enhance the conservation value of the maturing woodland, including enrichment of the shrub and creation of feeding and nesting habitat for willow tits.

The woodland sits alongside the proposed new country park, immediately north of Banbury and is a good example of how infrastructure projects (in this case a new reservoir) can be designed in a way that also makes space for nature. A mixture of birds has been recorded from the site, including wintering Siskin and Lesser Redpolls and warblers in the summer.

For more information see [http://www.banburyornithologica lsociety.org.uk/index.php/reserves](http://www.banburyornithologica lsociety.org.uk/index.php/reserves)

3. Stoke Wood Near Bicester

Stoke Wood is a 35-ha wood situated in relatively flat open farmed landscape and is unconnected to other woods. In the 1950s half of the wood was planted with conifers and the main conifer species present is European larch, with smaller proportions of Corsican and Scots pine. The long-term management of broadleaf species including hazel, ash, field maple and oak through coppicing ceased in the 1950s, leading to the development of large broadleaf trees now observed in the wood. The wood is especially important for its woodland flora and during spring there is an impressive ground cover of woodland flowers such as bluebell, wood anemone, early purple orchid and primrose.

The wood has historic importance as a very large old woodbank surrounds most of the perimeter of the wood, and there are also other internal earth banks of ancient origin which researchers believe may be connected with a burial chamber. An area of the wood was damaged in 1954, when an American B47 bomber plane crashed into the wood killing its crew.

The long-term plan for this wood is to gradually restore the Planted Ancient Woodland Sites (PAWS) area, securing the ancient woodland components of this wood. Natural regeneration of native broadleaves will improve the structural diversity and species composition of the woods. The emphasis is on a gradual restoration, with only a small proportion of conifers removed in any operation limiting impact on ground
flora, temperatures and invasion of course vegetation. The broadleaf component of the wood will be allowed to develop naturally, as there is already good structural and species diversity present. Chalara is an acknowledged threat and the decline of ash will be monitored to ensure that restructuring occurs and suitable alternative species such as hawthorn, hazel and sycamore fill gaps.

This wood provides significant access to locals in an area with few similar opportunities, but the majority of visitors arrive by car due to the nearest village Stoke Lyne being several miles away. ‘Logs for Labour’ volunteers meet in the wood to help manage the hazel coppice and receive firewood in return.

For more information see https://www.woodlandtrust.org.uk/visiting-woods/wood/?woodId=4577&woodName=stoke-wood

4. The Wychwood Project

The Wychwood Project is a community based initiative that uses the focus of the Royal Hunting Forest of Wychwood to encourage local people to understand, conserve and restore its rich mosaic of landscapes and wildlife habitats. The area covers 120 square miles and 41 parishes, mostly in West Oxfordshire.

Through a wide range of activities, and by partnering with other organisations and working closely with local communities, the project delivers advice, training, events, education and on-the-ground conservation projects. It aims to promote and support woodland management, increased levels of woodland planting in appropriate locations and to encourage and assist all who live and work in the area to understand the importance of and become involved with conservation.

To date the Wychwood Project has helped support the creation of 10 community woodlands (including Leafield Wood - see below), that provide space for pleasure, learning, wildlife, health and help bring communities together.

In 2009 the charity acquired 9 ha of agricultural land on the outskirts of Witney and over 4 years, with help from many community groups and local people, planted around 10,000 native trees and shrubs to create another community woodland with wide open glades as a prominent feature. A stream with pools runs though the centre adding another habitat type to the woodland. A small car parking area along with an access friendly ‘welcome’ trail is open to all, 364 days of the year to encourage visitors. Regular volunteer work parties, to maintain and care for the trees, are held at Foxburrow Wood. Community Woods

As well as Foxburrow Wood, the Wychwood Project also manages Grimes Meadow in Witney, Wigwell Nature Reserve in Charlbury and Woodstock Water Meadows in Woodstock.

For more information see www.wychwoodproject.org

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4 A volunteer scheme in which logs can be taken as ‘payment’ for woodland management http://www.oxonwoodfuel.org.uklogs-for-labour/
5. Leafield Community Woodland

Leafield Community Woodland grew from a much simpler project aiming to involve local children in growing and planting trees around the village to mark the millennium. Rural Action funded seed collection and planting courses with John Brannan of Oxford Tree Seeds. In 1998 oak, ash, hawthorn, crab apple and wild service seeds were gathered.

Local forester, John Brannan, was engaged to teach the school children about raising trees from seed. He led 4 sessions; an introduction at school, collecting seeds, sowing them in pots and later, planting the young seedlings at the Community Woodland. Hilltop Garden Centre provided the materials and 140 adults and children were involved in sowing 1000 local tree seeds. As the children’s enthusiasm spread, the whole community became involved in a more ambitious plan to buy land and plant a woodland.

In 2000, over 900 new trees and shrubs were planted by volunteers on a 1.28-acre site, purchased from Oxfordshire County Council. A glade was left open for school and village events. The first of these was a grand opening ceremony on 6th October, with an exhibition of the children’s tree project work at Leafield School. The children completed their seed sowing project with John Brannan, by planting their 100 seedling trees at the Community Woodland. Leafield School children also provided leaf designs for the noticeboard and paintings, used on fund raising cards.

In 2001 a work party prepared the hazel trees for coppicing. The young trees were cut down to about 4 inches, so that they would sprout with lots of shoots from the base. These shoots grow into long stems which can be cut for beanpoles, use in hedge laying etc. A fence was built to protect the young shoots from damage by deer or rabbits. This was constructed with stakes and woven wands in the style used by hedge layers, to show what can be done with the products of a mature hazel coppice. And in 2006 the first coppicing of the woodland took place.

Since 2008 regular work parties have maintained and developed the wood. The aims of Leafield Community for this woodland are:

- To establish and maintain a healthy and sustainable woodland in Leafield for use by the whole community.
- To establish habitats for wildlife and allow visitors a pleasant time in the Community Woodland, with an opportunity to learn.
- To encourage and facilitate the planting of trees within Leafield parish.

For more information see: http://www.leafieldwoodlands.co.uk/index.htm
6. Where Have All the Dormice Gone? The First Year of a County-wide Dormouse Project

Until the start of the millennium, very little was known about our common or hazel dormouse *Muscicapa avellanarius*, but it was assumed that dormice lived solely in hazel coppices and occupied a very restricted range in the south of England. Today slightly more is known about these creatures. Dormice live in a wide range of habitats, including coastal scrub, conifer plantations, motorway verges and mixed broadleaved woodland. Their diet is also more catholic than previously understood; they consume a range of foodstuffs throughout the year, from the classic hazelnut, to cherries, buds, haws, flowers, pollen, insects and who knows what else.

Even with our increased knowledge of this species and on-going research pushing the boundaries yet further, the dormouse remains at risk from threats including climate change, habitat loss, habitat fragmentation and disturbance. Within Oxfordshire there are very few records of dormice, either from a lack of survey effort or from a worryingly low population – and as yet we don’t know which.

The charity group the Trust for Oxfordshire’s Environment (TOE2), has provided a generous donation to Oxfordshire Mammal Group to undertake the Oxfordshire Dormouse Project, with the money coming from Grundon Waste Management through the Landfill Communities Fund. BSG ecology and Natural England have also assisted the project by providing dormouse tubes and boxes. Members of Oxfordshire Mammal Group (OxMG) with the appropriate Protected Species licences have led surveys in 16 woods since January 2015, supported by 754 volunteer hours from other members of OxMG.

Nut hunt training days were run in the autumn and winter by Peter Newbold and Amanda Lloyd as part of the Dormouse Project, and two public talks were presented by Peter Newbold for the Oxfordshire Dormouse Project. A landowner liaison event was undertaken at the conference centre in Ditchley Park Estates. which helped raise landowner awareness of the dormouse project, whilst enabling input into future management plans for the relevant estates. In addition the dormouse project presented at the Oxford Real Farming Conference where it detailed methods farmers can implement to improve dormouse habitat (e.g. hedgerow connectivity) on farms.

Through the project dormouse presence was confirmed at three sites where no records had previously been recorded, or had not been recorded for over ten years. These were Aston Rowant National Nature Reserve (Natural England), Withymead Nature Reserve (Anne Carpmael Charitable Trust) and Warren Bank Nature Reserve (BBOWT reserve). Dormice are assumed to be likely absent in the remaining sites, although surveys will continue in the future to provide more certainty.

For more information please see: [http://www.oxonmammals.org/](http://www.oxonmammals.org/)
Farmland

1. Improving the lot for farmland birds

Over Norton farm is a small 400-acre mixed family farm on Cotswold brash in West Oxfordshire, which has been in higher-level stewardship schemes for 16 years to try and improve the on-farm environment and species yield. These schemes include birdseed plots, winter stubbles, plant rich margins, new hedges, ponds with reedbeds and arable reversion to traditional Cotswold meadows.

With time, there has been measurable improvement in plant and insect species and in some cases dramatic increases of old favourites such as cowslips and blue butterflies. Bird numbers improved slowly but the introduction of winter feeding and then year-round millet fed from hanging feeders has been dramatic for winter numbers and birds remaining to breed. The winter supplementary bird feeding was at the inspired instigation and support of the Wychwood Bird Aid project and has continued for over 12 years. Natural England now fund much of the winter feeding.

![A generous arable field margin full of cornfield annuals © Mike Kettlewell](image)

The most dramatic effect has been on the winter numbers of farmland specialist birds such as chaffinches, yellowhammers, linnets, reed bunting, goldfinches and tree sparrows as well as skylarks and bramblings. Mixed flocks of birds moving around the fields and hedges can number many hundreds particularly with the influx of continental migrants. Impressions are useful but not evidence of success, so a formal study by professional bird surveyors was commissioned, which confirmed that farmland bird numbers had increased.
through the winter months, as opposed to the decline more usually seen on stewardship farms without supplementary feeding.

Small farmland birds carry few fat reserves and rapidly die of starvation when food is unavailable. The larger species, such as pigeons and corvids, carry more fat reserves and their diets are amply provided by modern farms. The small birds need about 5gms of food daily to survive and small oil rich seeds are best, while being least attractive to larger birds. The recipe for successful supplementary feed seems to be important much as it is to optimize crop yields. Feeding wheat, or other whole grains, from game-bird hoppers or in dense patches is inadequate because the small birds are out competed by pheasants, pigeons and corvids plus squirrels, rats and deer (BTO research papers).

Tailings from the combine are a good source of suitable seed, where available. The farm uses 85% crushed corn (Wheat and Barley rolled for the cattle) with the addition of 15% Rapeseed, Millet and Linseed, scattered thinly over a wide area around birdseed plots and tracks near hedges. By scattering thinly and cracking the corn the feed is less appealing and available to large birds but is easily found by the small ones. About 15Kg of feed is scattered daily on each of two blocks of land a mile apart and continued from mid-December to April/May for a total of about 120 days. A John Deere Gator is used to speed up the feeding but a quad bike with a pellet spreader is probably a better tool.

For more information see: http://www.wychwoodproject.org/cms/content/bird-aid

2. Bothy Vineyard

Bothy Vineyard is Oxfordshire’s oldest vineyard and winery, established on 11 acres of land with deep and poor, sandy soils. The free draining soils are perfect both for vines as well as heathy species-rich wildlife that is endemic and particular to this habitat. Spectacular but prickly viper’s bugloss Echium vulgare, orchids, lizards and slow worm Anguis fragilis, solitary bees and unusual wasps as well as a thriving population of glow worm Lampyris noctiluca survive amongst agriculture. Recently the European polecat Mustela putorius has returned to the area.

In the Bothy Vineyard sustainable agriculture is central to the business, and wildlife protection is no exception. Whilst not organic, at Bothy fungicides are sprayed only when required and under optimal conditions. Wide grassy driveways between vines, sown with grass and clover (which provides nutrition for bees and soil) were established when the vineyard was placed under new management in 2002. The weeds (such as cranesbills and forget-me-nots) directly under the vines are cleared with herbicides, but only after they’ve had time to flourish and set seed.

In the hedges many English elms Ulmus minor var. vulgaris have died so a programme of re-planting is underway utilising local species such as field maple, small leafed lime and yew with honeysuckle, and other native species in support. In the west of the vineyard there is an established coppice which provides good habitat for birds and houses a number of bee hives. To the north there are small woodland areas planted for both ornament and wildlife. Some of the dead trees are cut up for fire wood, whilst others are left in gradually decomposing piles to encourage beetle populations.
Large areas which are less favourable for vines have been put aside for wildflowers, with over 50 species sown to date. The interface between low grass corridors with taller dry flowers in late summer is perfect for glow worms mating. Birds are fed through the year, except in the run up to harvest in October. Numerous bird and bat boxes have been gradually installed on farm buildings.

For more information see http://www.bothyvineyard.co.uk/

3. Oxford Meadows and Farmoor Land Management

The Oxford Meadows and Farmoor Conservation Target Area includes the Oxford Meadows Special Area of Conservation (SAC). The SAC covers six Sites of Special Scientific Interest (SSSI) to the north-west of Oxford. Five of the SSSIs are traditionally managed hay meadows and the sixth, Port Meadow, is a traditionally grazed meadow which is also important for its historical and archaeological interest.

Through a Conservation Target Area (CTA) initiative, BBOWT, local owners and Natural England worked together to achieve benefits for biodiversity across the five hay meadows. The hay meadows are amongst the best remaining examples of neutral grassland in lowland England and have been managed by haymaking with aftermath grazing for well over 1000 years. The sites support species-rich (MG4) grassland and it is essential that management is continued to maintain the botanical diversity.

A number of different constraints made it difficult to achieve appropriate land management on these SSSIs. Together the meadows cover over 100 hectares (over 250 acres), but each meadow is in different ownership and some of the meadows are quite small and difficult to access. Each year the individual landowners struggled to find someone willing to cut the hay and then aftermath graze. The meadows used to be covered by different types of agri-environment schemes. The management prescriptions of the different schemes presented a barrier to combined management agreements in the past.

Through the CTA process, all the sites were brought into the Higher Level Stewardship (HLS) scheme with the same start date. Numerous capital works were completed to ensure that the site could be managed and through partnership working, one land manager was identified to manage the five sites as one management unit. This management has continued for the past six years and is proving very successful. The five SSSIs are now managed favourably through an annual hay cut followed by aftermath grazing.

4. Some Aspects of Nature Conservation on a Corallian Estate

Parts of a private estate on the Corallian and Kimmeridge Clay have been managed primarily for wildlife over the last twenty or so years, thanks to a sympathetic owner. The estate is run on a commercial basis with a variety of arable crops and hay on both the Corallian and Kimmeridge Clay. The hay fields also play an important part in the annual sheep grazing regime.
Small clumps of trees and shrubs, especially gorse *Ulex europaeus* and broom *Sarothamnus scoparius*, as well as individual trees, particularly oak *Quercus robur* have been planted. Old hedges with their important dead wood fauna have been left untouched, while some additional hedges have been planted.

Where appropriate in the arable fields bare areas have been left which have been successful in encouraging lapwing *Vanellus vanellus* to breed. Wide regularly mown borders around many of the fields have led to the now rare grey partridge *Perdix perdix* breeding. Amongst the conservation activities on the estate are the following examples:

- At the junction of the Corallian and Kimmeridge Clay a pond was excavated some fifteen years ago with first rate water quality from a catchment that is untreated with any chemicals. Seventeen species of dragon and damselflies have so far been recorded but not all of them breed in the pond. There is a strong colony of the ruddy darter *Sympetrum sanguineum* a Notable species. To date nineteen species of water bugs have been identified including the water stick insect *Ranatra linearis*, and thirty-two species of water and marsh beetles of which four are Notable B.
- Four years ago the UK BAP priority species leaf hopper *Macrosteles cyane* was found on broad-leaved pondweed *Potamogeton natans*. This semi-aquatic leaf hopper is only known from three other ponds in Britain.
- On the Corallian sands two strips each of about half a hectare are ploughed annually, one in the autumn the other in spring. Each strip has its distinctive flora with poppies *Papaver* spps. and haresfoot clover *Trifolium arvense* being dominant on the autumn plough. The spring plough is dominated by goosefoots and oraches *Chenopodium* spps. and *Atriplex* spps. which support the tortoise beetles *Cassida nebulosa* RDB 1 and *Cassida nobilis* Notable B.
- In one field plants of the kidney vetch *Anthyllis vulneraria* were introduced and within three years small blue butterflies *Cupido minimus* appeared and have now formed a strong colony.
- Eight fields on the Corallian sands are managed by sheep grazing from late summer until late winter. No fertilizer or other chemicals have been applied for some twenty years. The sands vary from a few acidic areas with sheep’s sorrel *Rumex acetosella* though neutral, to calcareous. The sands are Breckland in type and support many typical species such as small-flowered catchfly *Silene anglica* and hoary cinquefoil *Potentilla argentea*. These fields have proved rich in insects where especial attention has been paid to the true bugs *Hemiptera* and beetles *Coleoptera*.
Settlements

1. Marston Green Health Route

The Centre for Sustainable Healthcare manages the national NHS Forest programme, which seeks to create green spaces and plant trees on NHS sites. This can involve anything from a single tree outside a GP surgery, to major woodland creation schemes at large hospital sites.

A key initiative within the NHS Forest is the promotion of local “Green Health Routes” in communities, which build on the NHS Forest’s engagement of the NHS organisation and which provide a sustainable local option for people to improve their health and wellbeing both physically and mentally.

Thanks to a series of National Lottery awards, and the generosity of several other donors, The Centre for Sustainable Healthcare has facilitated the establishment of a Green Health Route in Marston, a suburb of Oxford, to encourage local people to get outside and use and enjoy their greenspace. The route also enables local GPs to prescribe exercise to their patients. Medical research from around the world, collated by the University of Exeter, demonstrates that a ‘Green Prescription’ can deliver physiological and psychological benefits for patients. The evidence also shows that doctors are ready and willing to give Green Prescriptions, and that an effective partnership with other providers is required, which has been enabled through delivering this project.

CSH’s approach is asset-based, linking up healthcare sites with other local assets, both green space and community focused. The end result is a health route fully rooted in the community, as accessible from a local school, park or community centre as it is from a GP surgery or clinic.

Marston, which is just outside the city centre, has many green spaces, parks, cycle paths and walks. The route highlights local greenspace and is easy to follow thanks to waymarker signs on lamp-posts and leaflets featuring the Route map being available at local hubs. Flashcards featuring some of the flora and fauna that can be seen along the route have been published, and help people identify and engage with the urban nature along the paths.

CSH is working in Marston, and also broadening our reach to other areas of Oxfordshire, to support health workers on the issue of social prescriptions, promoting high quality and consistent natural wellbeing options and working with GPs and other practitioners to embed this provision as a core part of modern health care.

For more information see: http://nhsforest.org/marston-green-health-route
2. Tools for Planning and Evaluating Green Infrastructure – Bicester and Beyond

Bicester is set to double in size over the next 20 years, which creates both challenges and opportunities for wildlife. Cherwell District Council and Bioregional are working with the Environmental Change Institute (ECI) at the University of Oxford on a NERC-funded project to develop a simple, practical and affordable approach for planning networks of green infrastructure (GI) in and around Bicester, based on existing freely available tools. The council wants to know which areas need to be protected or buffered from development, which existing areas could be enhanced, and how to identify opportunities for adding new high quality GI as part of developments. With budgets under pressure, they also need tools to evaluate the (multiple/many) benefits of these investments.

A wide range of stakeholders are involved as project partners, including BBOWT, Wild Oxfordshire, the RSPB, the County Council and Town Council, TVERC, the Environment Agency and A2Dominion (the developers of NW Bicester Eco-town). The aim is to create multifunctional green infrastructure that delivers a range of ecosystem services as well as providing connected networks for wildlife and people, linking existing GI with the new GI and the wider countryside.

An initial workshop identified priority ecosystem services, including flood protection and health and wellbeing. Maps of the existing supply of ecosystem services are being developed, and these will be compared with the demand for GI, such as the distance from housing to the nearest green space, to ensure that benefits are delivered in the areas where they are most needed.

ECI are working with wildlife stakeholders to identify priority species and their habitat requirements. Forest Research are providing expertise on connectivity mapping, using their BEETLE toolkit which calculates least-cost paths based on the permeability of different land use types for each species.

A range of other tools are being tested including spreadsheet-based valuation tools, citizen science (TreeZilla), ecosystem service mapping tools (EcoServ-GIS) and participatory approaches that allow the views and values of local stakeholders to be taken into account in the planning process. This is being done in partnership with the Ecosystems Knowledge Network and their Tool Assessor service. The ultimate aim is not only to build a GI plan for Bicester but also to develop a toolkit and guidance that can be used by other local authorities.

For further information contact: Dr Pam Berry pam.berry@eci.ox.ac.uk or Alison Smith Alison.smith@ouce.ox.ac.uk

3. New Country Park for Banbury

It has been the long-term ambition of Cherwell District Council to establish a new County Park beside the River Cherwell, immediately upriver of Banbury. Land has been secured by the council for this purpose and work is underway to design the layout, including access provision and habitats. This has involved consultation and input from many local stakeholders.

The country park includes rare habitats such as reedbed and floodplain grazing marsh, and offers potential for considerable enhancement for nature, as well as being readily accessible to local people. The project will

- Provide recreation and education opportunities for, and contribute to the health and wellbeing of, present and future generations of people who live and work in Banbury as well as visitors to the town
- Enhance the landscape character and wildlife value of the Cherwell Valley through protection and enhancement of important habitats and associated species
- Contribute to the broader green infrastructure provision for Banbury as a result of its location within the Cherwell Valley and its proximity/connectivity with Grimsbury Reservoir (in Thames Water ownership) and Spiceball Park (in Banbury Town Council ownership).
- Provide improved access through the development of a permissive path system, linking with the canal towpath and existing rights of way

Our towns benefit greatly from the provision of this type of accessible natural green space, and this is a good example of how long-term planning can deliver these benefits (including health and well-being) for local people.

4. Cherwell Swifts Project

Data from the British Trust for Ornithology (BTO) show that swift numbers in the UK declined by 47% between 1994 and 2014. Swifts are now on the amber list of Birds of Conservation Concern. One reason why numbers have declined so much and so quickly is loss of nest sites caused by building improvements and alterations.

The aims of the Cherwell Swifts Project are to protect traditional swifts’ nest sites, encourage the provision of additional nest places in existing buildings and new developments, and to increase awareness of the decline in swift numbers and what people can do about it.

Swifts were identified as a Local Character Species in the Cherwell Biodiversity Action Plan 2005-2010 and as a result Chris Mason, a member of the Kirtlington Wildlife and Conservation Society (KWACS) initiated the project in 2008 with the support of the Council. Since then over 300 buildings where swifts nest in the District have been identified. Annual records of nest sites are submitted to TVERC and the Centre sends them in computerised map form to the Council’s planners.

One result has been that the Council has made the inclusion of Swift bricks and boxes a condition of several new developments. It has also asked owners of buildings with nesting swifts to be swift-friendly when undertaking building work requiring planning permission. The Council has also incorporated swift bricks in many of its own building projects in Banbury and Bicester.

Project volunteers have put up nest boxes for interested home owners. There are now many records of swifts nesting in boxes including from Adderbury, Islip, Bodicote and Kirtlington. In a

5http://www.cherwell.gov.uk/media/pdf/a/7/Che...pdf

Swift, Apus apus © Roger Wyatt
few cases home owners have been inspired to incorporate nest places within home extensions and these too have had success. In 2016 the project recorded its first successes in attracting swifts into nest boxes installed behind louvres in church towers.

In 2014 a swift tower was put up at the Banbury Ornithological Society’s wetland reserve in Bicester using funding provided by TOE2. The tower has a box with 20 nest places on a galvanised steel pole. So far swifts have not used the boxes but they have been noted close by and the project is hopeful that in due course they will be used.

Many walks, talks, displays and other events have been organised to publicise the plight of swifts and encourage people to get involved.

For more information about the project see [www.cherwell.gov.uk/naturalenvironment](http://www.cherwell.gov.uk/naturalenvironment) and follow the link to the swifts’ conservation project.

### 5. Chipping Norton Bumblebee Project

The continuing decline in bumblebee species and populations is well documented. There are 25 species of bumblebees in the UK and some, such as the great yellow bumblebee *Bombus distinguendus*, survive only in small numbers.

In Oxfordshire up to 8 species may be regularly seen over the summer months including white tailed *Bombus lucorum*, common carder *Bombus pascuorum* and red tailed *Bombus lapidarius* bumblebees.

Many bumblebees are attracted to urban habitats including gardens and other green spaces.

Last autumn a bumblebee project was initiated in Chipping Norton and Butterfly Conservation helped out with advice, talks and training.

A local group identified several potential sites including Chipping Norton School, the cemetery, a garden centre and the recently opened health centre.

The aim was to ‘improve’ these areas by establishing wildflower grasslands and ‘bee-friendly’ herbaceous borders.

A range of plants, such as *Pulmonaria* and hyssop, were chosen for the health centre. These were planted in a bed at the front of the building - to be seen and enjoyed by people attending the clinic.

Chipping Norton Green Gym undertook all the preparation and planting.

Hopefully, the addition of an interpretative board and the offer of leaflets should encourage people to incorporate some of these plants into their own gardens.

Initially, funding was sought from local businesses but without much success. Fortunately, TOE2 and Save our Magnificent Meadows project were able to supplement a donation from the health centre.
Overall, the project has successfully raised the profile of bumblebees in Chipping Norton.

It was encouraging to involve key sectors such as education and health, and gain support from the Town Council for creating suitable habitats on their land.

Raising funds was more of a challenge than anticipated, but it was positive to work with partners such as Green Gym and the Wychwood Project.

Potentially this is a project that could be replicated in other towns and villages throughout the county.

For more information see http://www.chippygreengym.org/work-sites/health-centre/

6. Aston’s Eyot

Aston’s Eyot is a 30 acre (12ha.) ‘island’ bordered by the Thames, Cherwell New Cut and Shire Lake Ditch, approached from Meadow Lane via the Kidneys across a footbridge, or off Iffley Road down Jackdaw Lane past the scrapyard. The land, owned by Christ Church College, was until the mid-19th century a low-lying riverside water meadow, used as a mixture of pasture and market garden. From late Victorian times until the 1940s it was used as a rubbish tip. Over the past 60 years it has developed into a mosaic of habitats: some woodland (both plantation & self-generated) but most is open or scrubland.

During rebuilding of one of the college boathouses on Christ Church Meadow in the late 1980s, a pontoon bridge was placed across the Cherwell. This allowed local people an informal link with walks through the Meadow; despite this the area maintains a welcome degree of isolation from the city’s bustle.

Friends of Aston’s Eyot formed in 2010 with a view to securing the Eyot’s future and avoiding both unsympathetic management and deterioration of the environment due to lack of any management at all. A wildlife- and community-friendly outline management plan was proposed and generally endorsed, and Christ Church College approached for permission to carry out management work on site.

Many people now enjoy Aston’s Eyot and the Kidneys Nature Park for a quiet stroll, dog walking, running, bird-watching, harvesting wild fruit, picnicking by the river etc., spotting a deer if they’re lucky. However, some of Aston’s Eyot is overgrown, paths have been being lost and there are often issues with rough sleepers. Practical action is needed on an ongoing basis to enhance the area and keep the mix of open areas, scrub and woods that has wide local appeal.

This is an excellent site for common woodland and wood-edge species of the sort not found in over-tidied urban parks and gardens. Breeding birds include sparrowhawk, stock dove, green woodpecker, blackcap, garden warbler, whitethroat and long-tailed tit, while kites, buzzards and kingfishers are regularly seen. In winter redwings and fieldfares join local thrushes on the berries, while siskins and goldfinches feed on the alder seeds, with occasional redpolls, and water rails lurk in the ditch. Roe deer, muntjac and foxes are frequent visitors, and in some years large numbers of frogs and toads breed in the ditches. Butterflies are numerous, and the now rare brown hairstreak has recently been found.

For more information see http://friendsofastonseyot.org.uk/
7. St Mary and St John Church, East Oxford

In the latter part of the twentieth century the churchyard, which had been established a hundred years earlier, gradually became massively overgrown with self-sown trees and impenetrable thickets of bramble and ivy. It had become a place for drug taking and prostitution. In 2000, under the leadership of a Community Policeman, a team of soldiers from the locally-based Pioneer Regiment, spent a week cutting back the jungle, revealing many dislodged and damaged memorials. With support from the East Oxford Single Regeneration Budget, paths were resurfaced, lights installed, and a boundary wall lowered. The churchyard was closed for burials and Oxford City Council took over the maintenance, but with the proviso that they did not have the resources to maintain it in its wilderness state. After consultation with the local community (through questionnaires and an interactive display), a partnership was established whereby a voluntary Churchyard Group, responsible to the PCC, manage most of the site as a wildlife conservation area, while the Council are responsible for cutting the short grass areas, tree safety, emptying litter bins, and providing some support to the voluntary group over issues such as removal of green waste.

For the Queen's Golden Jubilee in 2002 the Lord Lieutenant of Oxfordshire tasked ONCF to help set up ten new local groups that would look after a wildlife site in their community (Wild Oxfordshire was formerly known as ONCF: Oxfordshire Nature Conservation Forum). The churchyard of St Mary and St John’s church was one of the selected sites, which served to give the restoration project a real boost. A wildflower garden of Thanksgiving and Remembrance was planted out, crossed by a pathway and stepping stones in grey-blue slate. Fusion Arts commissioned two artists, in cooperation with local people, to design a 'rest-space' in front of the church: they created a cobbled mini-labyrinth which has become the centre-piece of a community garden welcoming people to the church and churchyard. Interpretation boards, describing the wildlife and the links between the memorials and local history, have been placed near the through path, allowing many people to take a moment to reflect a little on both past and present.

Two successive 5-year management plans have guided the maintenance of a variety of habitats and the development of specific projects (such as a wildflower Garden of Thanksgiving and Remembrance, and an area planted out so as to encourage butterflies and moths), while at the same time keeping sight lines throughout and providing access to family graves. Trying to keep control over the invasive plants (brambles, nettles, docks etc.) is a huge task. We have weekly volunteer working sessions (Saturday afternoons, plus Wednesday evenings in the summer) and are always on the look-out for people willing to help. We have benefited from corporate volunteering when staff teams have spent a day with us.

Appendices

Appendix 1: Oxfordshire’s Areas of Outstanding Natural Beauty

Oxfordshire has parts of three Areas of Outstanding Natural Beauty (AONB) totalling some 25% of the county. AONBs are nationally and statutorily protected landscapes designated to conserve and enhance their natural beauty. The International Union for Conservation of Nature (IUCN) designates AONBs as Category V Protected Landscapes: ‘a protected area where the interaction of people and nature over time has produced an area of distinct character with significant ecological, biological, cultural and scenic value’.

Section 85 of the Countryside and Rights of Way (CROW) Act 2000 places a statutory duty on all relevant authorities to have regard to the purpose of conserving and enhancing natural beauty when discharging any function in relation to, or affecting land within an AONB.

AONBs have statutory management plans reviewed every 5 years. Normally the responsibility for the management plan is with the local authorities but is discharged through the AONB Partnership. The exceptions are the management plans for the Cotswolds and Chilterns AONBs, which are the responsibility of their respective Conservation Boards. The two Conservation Boards are established by parliament with the dual purposes of conserving and enhancing the natural beauty of the AONB and to increase the understanding and enjoyment of the special qualities of the AONB. The Boards also have the duty to seek to foster the economic and social well-being of people living in the AONB.

The Cotswolds Area of Outstanding Natural Beauty

The Cotswolds Area of Outstanding Natural Beauty is the largest AONB and third largest protected landscape in England covering 2038km². The AONB sits on the most prominent part of the band of Jurassic limestone that runs from the Dorset coast to Yorkshire and stretches from Bath in the south, north to Edge Hill in Warwickshire and eastwards to Stonesfield and Long Hanborough in Oxfordshire.

The Cotswold landscape has long been perceived as a rural idyll with many features evoking strong images, particularly the west facing escarpment cut through by steep incised river valleys, expansive high wolds and the network of dry stone walls. The built environment is also evocative ranging from picturesque towns and villages to individual houses, churches, mansions and historic designed landscapes.

Underlying geology and past land management practices have resulted in the Cotswolds supporting a range of habitats and their dependent flora and fauna. Of particular importance are unimproved Jurassic limestone grassland, ancient woodland (particularly Lowland Beech/Yew woodland) and lowland mixed deciduous woodland, wood pasture and parkland, limestone streams and rivers and the often-forgotten habitat of open farmland important for a suite of farmland birds and arable plants.

The Cotswolds is a stronghold for species such as Cotswold pennycress, pasqueflower and specialist farmland birds such as the corn bunting and grey partridge, Duke of Burgundy butterfly and following successful reintroduction in the Gloucestershire Cotswolds, the large blue butterfly.

The Oxfordshire Cotswolds

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The Cotswolds AONB in Oxfordshire covers an area of some 248km² (9.5% of the county and 12% of the AONB) in the north and west of the County. Of particular note in the Oxfordshire Cotswolds are areas of open High Wold, the Evenlode and Windrush Valleys and the Wychwood Forest the largest continuous area of ancient broadleaved forest in Oxfordshire.

Areas of unimproved limestone grassland are found across the Oxfordshire Cotswolds including Stonesfield Common and the Wigwell Nature Reserve, one of 21 sites nationally for meadow clary. Much of the wildflower rich floodplain meadow has been lost to agricultural improvement to pasture or conversion to arable but there are good opportunities for restoration and recreation.

The river valleys are also important for areas of fen and open water features such as ditches and ponds and for willow pollards.

Like the rest of the Cotswolds, the Oxfordshire Cotswolds has retained a good population of farmland birds and much effort to retain them and increase numbers has taken place through agri-environment agreements.

Further information about the AONB and the work of the Board and partners can be found at http://www.cotswoldsaonb.org.uk/

The Chilterns Area of Outstanding Natural Beauty

The Chilterns Area of Outstanding Natural Beauty stretches from the River Thames at Goring, Oxfordshire to Hitchin in Hertfordshire: an area of 833 km² of exceptional and nationally protected landscape. The area’s landscape has an underlying chalk geology, with a steep north-west facing chalk escarpment, rolling foothills and a heavily wooded south–east facing dip slope.

Unlike other chalk areas, the plateau tops are overlain by superficial deposits of clay with flints, producing heavy, acid soils. Historically these areas have had little agricultural value and have largely remained as rough common or heathland, or as woodland. The chalk downland has been grazed by sheep or converted to arable cultivation. The landscape today is an intricate mosaic of woodland, wooded copses, enclosed pasture and arable land, chalk grassland, wooded and open heath, chalk rivers and dry valleys, and scattered farms and villages.

The Oxfordshire Chilterns

233 km² of the Chilterns AONB (8.9% of the county and 28% of the AONB) lies within Oxfordshire - entirely within the South Oxfordshire district council area.

Of note in this part of the Chilterns are the ancient woodlands, chalk downland and scrub communities (including juniper scrub). Three sites along the chalk escarpment are designated SACs for their calcareous grassland and scrubland, juniper scrub, beech forest and yew woodland habitat. The Oxfordshire Chilterns is particularly rich in ancient woodland and associated archaeology and flora and fauna.

A string of calcareous grassland SSSI are found along the Chilterns’ chalk escarpment, particularly to the north-east of the AONB, including Aston Rowant National Nature Reserve which is bisected by the M40. In addition, there are numerous Local Wildlife Sites, notably including a large block of common land in the Nettlebed area. This now largely wooded area has important ponds and remnants of former heathland.

The light, friable soils of the Chilterns’ chalk escarpment provide ideal conditions for a wide range of arable flora, including many rare and declining species. Despite dramatic declines over the last 50 years, the area is still important for this group of plants. The South Stoke/Ipsden area is also of note for its farmland birds.
At a national level the Chilterns is considered to have high potential for restoration and recreation of wood pasture and parkland habitat. There is a good concentration of such sites in the Oxfordshire Chilterns, albeit many are now only remnants of former habitat.

Further information about the AONB and the work of the Board and partners can be found at www.chilternsaonb.org

The North Wessex Downs Area of Outstanding Natural Beauty

The North Wessex Downs is a tranquil yet stunning landscape of rolling chalk downlands, forests, woods and dales. Beech woodland crowns the tops of many of the downs, which provide panoramic views for miles around. Thinly populated, the downs project a feeling of remoteness and timelessness. In the vast skies skylarks, lapwings and majestic birds of prey can be seen.

From the base of the steep escarpment between Ashbury and Didcot, the North Wessex Downs AONB extends south beyond the Ridgeway. It includes slopes running south into Berkshire and the area around Wittenham Clumps in Oxfordshire.

The special qualities concerning biodiversity are defined in the North Wessex Downs AONB Management Plan 2014-2019 as:

- A nationally significant area of chalk grassland including rare flora such as field fleawort *Tephroseris integrifolia* ssp. *integrifolia* and bastard toadflax *Thesium humifusum*; invertebrate species such as the wart-biter cricket *Decticus verrucivorus* and important butterfly populations
- Agricultural areas provide habitats for rare and colourful arable weeds, such as dense flowered-fumitory *Fumaria densiflora*, slender tare *Vicia parviflora* and shepherd’s needle *Scandix pectinatus*. Many other scarce plant species survive in less intensively managed field margins. Arable land provides feeding and breeding habitat for several rare and declining farmland birds including skylark *Alauda arvensis* and stone-curlew *Burhinus oedicnemus*
- Broadleaved Woodland and Wood Pasture, including a significant concentration of ancient woodlands provide roosting and/or feeding sites for bats species. Long-rotation hazel coppice provides important habitat for mammals such as the hazel dormouse *Muscardinus avellanarius*; concentrations of native bluebell *Hyacinthoides non-scripta* in calcareous woods; and several nationally scarce moss species
- Rare chalk streams and rivers with a high diversity of aquatic plants, and invertebrate species including those that are nationally scarce, such as the white-clawed crayfish *Austropotamobius pallipes*. These rivers support nationally and locally scarce bird species; nationally declining mammals such as the water vole *Arvicola amphibius* and otter *Lutra lutra*; and healthy fish populations including brown trout *Salmo trutta*, grayling *Thymallus thymallus*, perch *Perca fluviatilis*, chub *Squalius cephalus* and dace *Leuciscus leuciscus*
- A rich mosaic of associated wetland habitats creating distinctive valley landscapes including fens, floodplains, water meadows, carr and wet woodland.

The North Wessex Downs in Oxfordshire

The NWD AONB in Oxfordshire covers an area of 186.5km² in the south of the county (7.2% of the county area) in both the Vale of White Horse and South Oxfordshire Districts. Amongst the habitats represented in the county are:

- Extensive areas of chalk grassland at White Horse Hill, Hackpen Hill and around Blewbury.
- Several smaller sites, most of which are County Wildlife Sites. There are some areas of restored grassland.
- Relatively few woodland plantations and shelter belts of trees. The main sites are near Uffington, within the SSSI.
- Good veteran trees at Ashdown Park in the far south-west of the county including an SSSI for the lichen flora on sarsen stones.
- The arable land supports a good flora and the area is important for farmland birds such as corn bunting, lapwing, yellowhammer and stone curlew.

Besides areas of significant chalk grassland, the AONB is rich in archaeological features.

Further information about the AONB can be found at [http://www.northwessexdowns.org.uk/](http://www.northwessexdowns.org.uk/)
Appendix 2. Oxfordshire’s Rare Plants Register

The Oxfordshire Flora Group (OFG) has also been working with John Killick and the Thames Valley Environmental Records Centre (TVERC) on a County Rare Plants Register. This is a national project of the Botanical Society of the British Isles to establish how many species are locally or nationally threatened, and where they are. We found that of some 1700 native and long established plants which were present between 1968 and 1998 50 have not been found since 2000, and 288 are either nationally listed (146) or occur in 10 of fewer localities in the county (142). Thirty-two species are listed under Section 41 of the 2006 Natural Environment and Rural Communities (NERC) Act as requiring monitoring and enhancing (Table 1.) The 146 nationally listed species include two which are European Protected, two which are Critically Endangered in England, 25 which are Endangered, 56 which are Vulnerable a and 55 Near Threatened in England. Additionally, seven are rare or scarce or Near Threatened in Great Britain (see www.oxfordshirefloragroup for more detail).

Table 1. Conservation Status of the 32 Section 41 plant species present in Oxfordshire.

Species listed in red: urgent action required to save these species in the county.

<table>
<thead>
<tr>
<th>Latin name</th>
<th>English name</th>
<th>No. of Oxon sites 2000-15</th>
<th>Approx. No. of plants if known</th>
<th>Conservation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blysmus compressus</td>
<td>Flat-sedge</td>
<td>1</td>
<td>c. 1000</td>
<td>Urgent need</td>
</tr>
<tr>
<td>Fallopia dumetorum</td>
<td>Copse-bindweed</td>
<td>1</td>
<td>50</td>
<td>Urgent need</td>
</tr>
<tr>
<td>Galeopsis angustifolia</td>
<td>Red Hemp-nettle</td>
<td>4</td>
<td>46</td>
<td>Urgent need</td>
</tr>
<tr>
<td>Gentianella anglica</td>
<td>Early Gentian</td>
<td>4</td>
<td>100s</td>
<td>Urgent need</td>
</tr>
<tr>
<td>Ophrys insectifera</td>
<td>Fly Orchid</td>
<td>2</td>
<td></td>
<td>Urgent need</td>
</tr>
<tr>
<td>Platanthera bifolia</td>
<td>Lesser Butterfly-orchid</td>
<td>3</td>
<td></td>
<td>Urgent need</td>
</tr>
<tr>
<td>Valerianella rimosae</td>
<td>Broad-fruited Cornsalad</td>
<td>1</td>
<td></td>
<td>Urgent need</td>
</tr>
<tr>
<td>Adonis annua</td>
<td>Pheasant’s-eye</td>
<td>1</td>
<td>&lt;160</td>
<td></td>
</tr>
<tr>
<td>Filago pyramidata</td>
<td>Broad-leaved Cudweed</td>
<td>2</td>
<td></td>
<td>OFG</td>
</tr>
<tr>
<td>Lythrum hyssopifolium</td>
<td>Grass-poly</td>
<td>1</td>
<td>c.1000</td>
<td>OFG</td>
</tr>
<tr>
<td>Microthlaspi perfoliatum</td>
<td>Perfoliate Penny-cress</td>
<td>4</td>
<td></td>
<td>OFG</td>
</tr>
<tr>
<td>Pulsatilla vulgaris</td>
<td>Pasqueflower</td>
<td>1</td>
<td></td>
<td>OFG</td>
</tr>
<tr>
<td>Sium latifolium</td>
<td>Greater Water-parsnip</td>
<td>2</td>
<td></td>
<td>OFG</td>
</tr>
<tr>
<td>Scleranthus annuus</td>
<td>Annual Knavel</td>
<td>2</td>
<td></td>
<td>OFG &amp; others</td>
</tr>
<tr>
<td>Cynoglossum germanicum</td>
<td>Green Hound’s-tongue</td>
<td>3</td>
<td>100s</td>
<td>OFG +NE</td>
</tr>
<tr>
<td>Apium repens</td>
<td>Creeping Marshwort</td>
<td>1</td>
<td>100s</td>
<td>OFG +NE</td>
</tr>
<tr>
<td>Carex vulpina</td>
<td>True Fox-sedge</td>
<td>6</td>
<td>&lt;100</td>
<td>OFG +NE</td>
</tr>
<tr>
<td>Species</td>
<td>Common Name</td>
<td>Abundance</td>
<td>Habitat Code</td>
<td></td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------------------</td>
<td>-----------</td>
<td>--------------</td>
<td></td>
</tr>
<tr>
<td>Viola persicifolia</td>
<td>Fen Violet</td>
<td>1</td>
<td>&gt;500</td>
<td></td>
</tr>
<tr>
<td>Astragalus danicus</td>
<td>Purple Milk-vetch</td>
<td>1</td>
<td>few</td>
<td></td>
</tr>
<tr>
<td>Muscari neglectum</td>
<td>Grape-hyacinth</td>
<td>4</td>
<td>others</td>
<td></td>
</tr>
<tr>
<td>Neotinea ustulata</td>
<td>Burnt Orchid</td>
<td>1</td>
<td>others</td>
<td></td>
</tr>
<tr>
<td>Orchis anthropophorum</td>
<td>Man Orchid</td>
<td>1</td>
<td>others</td>
<td></td>
</tr>
<tr>
<td>Orchis simia</td>
<td>Monkey Orchid</td>
<td>1</td>
<td>others</td>
<td></td>
</tr>
<tr>
<td>Cephalanthera damasonium</td>
<td>White Helleborine</td>
<td>27</td>
<td>?incr</td>
<td></td>
</tr>
<tr>
<td>Clinopodium acinos</td>
<td>Basil Thyme</td>
<td>16</td>
<td>1000s</td>
<td></td>
</tr>
<tr>
<td>Galium pumilum</td>
<td>Slender Bedstraw</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypopitys monotropa</td>
<td>Yellow Bird’s-nest</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iberis amara</td>
<td>Wild Candytuft</td>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Juniperus communis</td>
<td>Juniper</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oenanthe fistulosa</td>
<td>Tubular Water-dropwort</td>
<td>&gt;30</td>
<td>1000s</td>
<td></td>
</tr>
<tr>
<td>Ranunculus arvensis</td>
<td>Corn Buttercup</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scandix pecten-veneris</td>
<td>Shepherd’s-needle</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stellaria palustris</td>
<td>Marsh Stitchwort</td>
<td>10</td>
<td>&gt;100s</td>
<td></td>
</tr>
<tr>
<td>Torilis arvensis</td>
<td>Spreading Hedge-parsley</td>
<td>2</td>
<td>50-00</td>
<td></td>
</tr>
<tr>
<td>Anagallis foemina</td>
<td>Blue Pimpernel</td>
<td>5</td>
<td>50-100</td>
<td></td>
</tr>
</tbody>
</table>
Appendix 3: Land Cover Changes in Oxfordshire

Introduction

TVERC used four sources of data to assess changes in land cover:

1. Corine satellite data (Cole et al. 2015a, 2015b), accessed from the Centre for Ecology and Hydrology’s Environmental Information Portal. This is available as vector data from 2006 and 2012. This allows direct comparison of land cover changes over this time period.

2. Land cover data (Fuller et al. 1993), accessed from the Centre for Ecology and Hydrology’s Environmental Information Portal. This is available as raster data from three different surveys in 1990, 2000 and 2007. These data are not collected or classified in exactly the same way each time so drawing conclusions on changes in habitats over time is difficult. However, broad land cover class data is available.


4. Data from TVERC’s habitat mapping for Oxfordshire, currently being prepared. These data are not yet complete, so these data are an early estimate of broad habitat types.

Direct comparison of land cover changes between these data sets is not possible as they were all collected in different ways, use different land cover class types and were collected for different end uses. However, broad changes can be detected when viewing the data as a whole.

Below is a summary of each of these data sets, with an analysis of land cover change where possible. There follows a summary section which outlines broad changes in the land cover of Oxfordshire across the 26-year period that the data covers.

Results

Corine satellite data

Satellite images served as the basis for image interpretation, supported by aerial imagery from Google Earth to aid the interpretation process for all areas greater than 5 ha. The data is
available as vector (e.g. shapefile) data, which allows easy comparison of land cover between the two data sets.

Comparison of the two data sets (Table 1) shows that there was a decline in the area of arable land and pasture, with corresponding increases in industrial commercial and transport units, mine dump and construction sites, and urban fabric. There were no apparent changes in the other land cover types. Put more simply (Table 2) there has been a loss of agricultural land uses and a concomitant increase in artificial surfaces.

Table 1: Land cover changes in Oxfordshire between 2006 and 2012. Data extracted from Corine land cover data (Cole et al., 2015a, 2015b; see text for further details)

<table>
<thead>
<tr>
<th>Habitat</th>
<th>2006</th>
<th>2012</th>
<th>Difference (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arable land</td>
<td>149,656</td>
<td>149,505</td>
<td>-151</td>
</tr>
<tr>
<td>Artificial, non-agricultural vegetated areas</td>
<td>5,911</td>
<td>5,911</td>
<td>0</td>
</tr>
<tr>
<td>Forests</td>
<td>10,915</td>
<td>10,915</td>
<td>0</td>
</tr>
<tr>
<td>Heterogeneous agricultural areas</td>
<td>305</td>
<td>305</td>
<td>0</td>
</tr>
<tr>
<td>Industrial, commercial and transport units</td>
<td>4,542</td>
<td>4,551</td>
<td>9</td>
</tr>
<tr>
<td>Pastures</td>
<td>70,679</td>
<td>70,568</td>
<td>-111</td>
</tr>
<tr>
<td>Urban fabric</td>
<td>15,634</td>
<td>15,707</td>
<td>73</td>
</tr>
<tr>
<td>Total</td>
<td>260,595</td>
<td>260,595</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Broad land cover changes between 2006 and 2012. Data extracted from Corine land cover data (Cole et al., 2015a, 2015b; see text for further details)

<table>
<thead>
<tr>
<th>Habitat type</th>
<th>2006</th>
<th>2012</th>
<th>Difference (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artificial surfaces</td>
<td>28,089</td>
<td>28,351</td>
<td>262</td>
</tr>
<tr>
<td>Agricultural areas</td>
<td>220,671</td>
<td>220,410</td>
<td>-262</td>
</tr>
<tr>
<td>Forest and semi natural areas</td>
<td>11,175</td>
<td>11,175</td>
<td>0</td>
</tr>
<tr>
<td>Wetlands</td>
<td>170</td>
<td>170</td>
<td>0</td>
</tr>
<tr>
<td>Water bodies</td>
<td>489</td>
<td>489</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>260,595</td>
<td>260,595</td>
<td></td>
</tr>
</tbody>
</table>
National Land Cover Map

This is a data set providing a classification of land cover types into a maximum of 25 classes produced from Landsat 5 Thematic Mapper satellite data (Fuller et al., 1993). These data are available as raster data, and based on 1 km grid squares. To derive the land cover data, each square is classified based on the land cover type that best represents that square. As a result much of the fine scale resolution of the data is lost, where squares are classified as one land cover type, but in fact contain more than one land cover type. As such the accuracy of these data is fairly low, but does offer a broad estimate of the relative proportions of the different land cover types. Data is available from 1990, 2000 and 2007. However, the 2007 data set includes data obtained mainly from Landsat, IRS and SPOT sensors, unlike the 1990 and 2000 datasets, which are just from Landsat sensors. As such direct comparisons between these data are difficult.

However, some board changes are detectable.

Comparison of these three datasets (Table 3) shows that the 2007 data mapped land cover types differently from the preceding two datasets. There were large increases in the mapped area of inland water, grassland and developed land and large decreases in agricultural land. However, the classification of grassland is different between the 2007 dataset and the early datasets.

Table 3: Differences in land cover as mapped in the National Land Cover Map data

<table>
<thead>
<tr>
<th>Habitat</th>
<th>1990</th>
<th>2000</th>
<th>2007</th>
<th>difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>inland water</td>
<td>499</td>
<td>499</td>
<td>998</td>
<td>499</td>
</tr>
<tr>
<td>grassland</td>
<td>41,816</td>
<td>41,816</td>
<td>60,179</td>
<td>18363</td>
</tr>
<tr>
<td>woodland</td>
<td>9,281</td>
<td>9,281</td>
<td>9,182</td>
<td>-99</td>
</tr>
<tr>
<td>agricultural</td>
<td>197,804</td>
<td>197,804</td>
<td>178,443</td>
<td>-19361</td>
</tr>
<tr>
<td>developed land</td>
<td>10,379</td>
<td>10,379</td>
<td>11,477</td>
<td>1098</td>
</tr>
<tr>
<td>Total</td>
<td>259,779</td>
<td>259,779</td>
<td>260,279</td>
<td></td>
</tr>
</tbody>
</table>

If the difference between grassland area recorded in 2000 and 2007 is added to the agricultural area, the subsequent difference in agricultural area is -998 ha. The sum of the woodland difference and the agricultural difference is equal to the increase in developed land area. The difference in the area of inland water recorded between 2000 and 2007 is not so easily explained. In summary, these data show that there has been an increase in developed land and a concomitant decrease in the area of woodland and agricultural land.

Habitat mapping data

The Steel and Vardy (1991) data and the TVERC data (Table 4) were both derived from interpretation of aerial photographs, with some site based surveys also carried out. As such these two datasets are broadly comparable as the methods used to collect the data are similar. The habitat categories for the two surveys do differ, but for the purposes of comparing the data, the
Steel and Vardy (1991) data has been re-categorised to match the categories used by TVERC so that it is possible to make some broad comparisons between the two datasets.

TVERC’s habitat mapping of Oxfordshire was not complete at the time of producing this report. There remained approximately 8,000 polygons left to map, the large majority of which is woodland habitat. Therefore, the TVERC data does not represent a complete inventory. In addition, TVERC are not mapping urban areas explicitly, and any urban habitat mapped is as a result of OS master Map Natural Feature polygons actually being urban habitats (e.g. urban green spaces). Therefore, the area of urban habitat is a vast underestimate. It should be noted that TVERC data uses the Integrated Habitat System (IHS) of classification.

The main difference between the two datasets is the total area, which is greater in the 1991 data than in the 2016 data. This is because the TVERC habitat mapping does not map all of the urban areas. As such the TVERC dataset underestimates the total area of land cover in Oxfordshire.

Agricultural land is also classified differently, with arable classified separately in 1991.

There does appear to have been a decrease in the area of woodland between 1991 and 2016, with 15,942 ha in 1991 and 12,306 in 2016. There also appears to have been an increase in the area of quarries (and associated rock and spoil habitats), with 575 ha mapped in 1991 and 1,230 ha mapped in 2016.

Table 4: Habitat types as recorded by Steel and Vardy (1991) and TVERC (2016)

<table>
<thead>
<tr>
<th>Broad habitat</th>
<th>Steel and Vardy 1991 data</th>
<th>TVERC 2016 data</th>
<th>Difference (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>122,009</td>
<td>128,635</td>
<td>6,626</td>
</tr>
<tr>
<td>Bracken</td>
<td>not known</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Fen, marsh and swamp</td>
<td>436</td>
<td>221</td>
<td>-215</td>
</tr>
<tr>
<td>Grassland</td>
<td>66,313</td>
<td>81,835</td>
<td>15,522</td>
</tr>
<tr>
<td>Heathland</td>
<td>3</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Linear features</td>
<td>not known</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>6,672</td>
<td>2,614</td>
<td>-4,058</td>
</tr>
<tr>
<td>Rock, quarries and spoil</td>
<td>576</td>
<td>1,230</td>
<td>654</td>
</tr>
<tr>
<td>Running water*</td>
<td>1,349</td>
<td>515</td>
<td>426</td>
</tr>
<tr>
<td>Standing water*</td>
<td></td>
<td>1,260</td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>47,742</td>
<td>604</td>
<td></td>
</tr>
<tr>
<td>Woodland</td>
<td>15,844</td>
<td>12,306</td>
<td>-3,538</td>
</tr>
<tr>
<td>Total</td>
<td>260,944</td>
<td>229,234</td>
<td></td>
</tr>
</tbody>
</table>

*The Steel and Vardy (1991) data does not separate water into standing and running.

Summary

When taken as a whole, there are some broad trends that can be identified from these data. There has been a decline in arable and pasture land cover types between 2006 and 2012. There has also been a decline in woodland cover identified both between 1991 and 2016 and 2000 and 2007. However, this should be set against the Forestry Commission’s National
Forest Inventory data (Ditchburn et al. 2016) that estimates total woodland cover for Oxfordshire at approximately 23,000 hectares and shows an increase in woodland cover over time. There has been an increase in urban land cover, identified between 2000 and 2007 and 2006 and 2012. In general, it would seem that urban development has been at the expense of arable and grassland habitats.

The magnitude of these changes is difficult to assess and the different datasets provide different values, and differences in classification make it hard to be certain. However, both the National Land Cover Map data and the Corine land cover data suggest that these changes have been gradual over the last two decades or so.

**Data quality and coverage**

Data quality varies for each of the datasets used in these analyses. Satellite derived data is reasonably coarse in its resolution, and for some methods of processing these data, compromises are made regarding the classification of land to achieve a higher level classification. The advantage of satellite data is that it is relatively quick to produce and is good for broad and large scale classifications of land use. One of the major problems with the data used for this study is that each dataset used different classification schemes for land cover types. This makes it hard to compare data, except at the very broad descriptions of land cover type. The aerial photography interpretation data is more detailed and fine scale, as it is able to classify land cover at the field level. It is also possible to differentiate better between different types of land cover (e.g. unimproved vs semi-improved grassland) which is not possible using satellite data. Therefore, the confidence in the data is much higher. However, as a result of the detailed method, this approach is much more time consuming and therefore expensive. TVERC are currently engaged in work to compare satellite derived data with our own aerial photography interpretation data to see if we can take advantage of the more rapid data collection carried out by satellites and similar remote sensing data.

To accurately assess land cover change over time, the following types of data are required:

- Standardise land cover classification system. TVERC uses the Integrated Habitat System (IHS), which allows both broad and detailed information to be recorded both for habitats and land use.
- A standard method for collecting land cover data, that is repeatable
- A rapid yet robust system that incorporates the best of remote sensing, interpretation methods and ground survey methods for collecting the data.

Data should also be collected over reasonable time scales (e.g. every 5 years) to allow sufficient time for major changes to take place, but at time scales that allow land managers and conservationists to respond to the detected change.
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