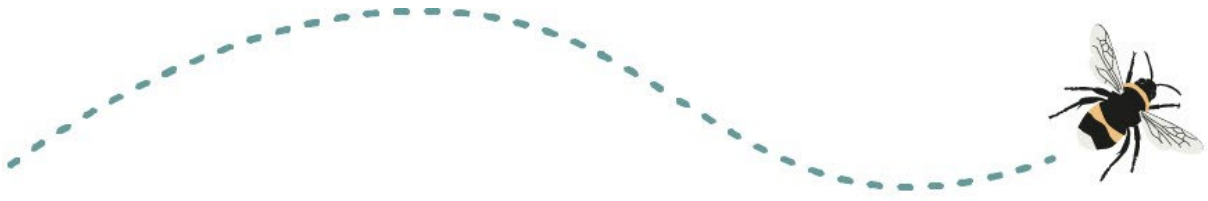
Staffordshire Moorlands District Plan for Nature

September 2023

This report has been written by Staffordshire Wildlife Trust and Staffordshire Moorlands District Council



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1. Background

1.1. Introduction

The UK is one of the most nature-depleted countries in the world. The most recent comprehensive scientific study into the health of the natural environment in Great Britain, the State of Nature report[1] (2019), revealed that of the 8,431 wild species assessed, 15% are threatened with extinction and 41% have declined in population since the 1970s.

Why does nature loss matter?

We need functioning natural systems in order to live. Ecosystems provide a range of services for humans, such as fertile soil, clean air and water. Healthy ecosystems help to regulate the climate and ensure our food security, through pollination and soil health for example. Ecosystem services also contribute vast amounts to the economy - one third of our food is pollination dependent.

Nature brings joy into our lives and makes us feel good. The pandemic brought this into sharp focus, and highlighted inequalities in access to greenspace. There is a mounting body of scientific evidence to say that spending time in the natural world improves mental and physical health outcomes. A large-scale research project led by the University of Exeter in 2019[2], found that people who spend at least 120 minutes in nature a week are significantly more likely to report good health and higher psychological wellbeing than those who don't visit nature at all during an average week.

Nature and the environment is really important to local people too. The Climate Change Attitude Survey, commissioned by Staffordshire Moorlands District Council and published in 2021, canvassed the views of 500 residents across the district. The research revealed that 93 per cent of those surveyed were 'very concerned' or a 'little concerned' about the loss of animals, plants, habitats and biodiversity in relation to climate change. 87 per cent were 'very concerned' or a 'little concerned' about species extinction.

This picture is reflected nationally too. In the weekly YouGov issues tracker, the environment is consistently rated as one of the most important issues facing the country.

Nature and Climate Change

Climate change and the nature crisis are inextricably linked. Nature can play a major role in helping us to tackle and adapt to the climate crisis. Healthy ecosystems on land and at sea can absorb vast quantities of CO_2 from the atmosphere and lock it away as carbon, but conversely, damaged ecosystems, such as degraded peatlands, can become carbon emitters. It is estimated that restoring our natural systems here in the UK could provide 37% of the CO_2 mitigation needed by 2030 to meet the Paris Agreement.

All habitats play a role – not just trees!

The value of tree-planting as a method of tackling climate change is well-known. But all natural habitats - not just woodlands - can play an important role in absorbing and storing carbon in vegetation and soils, including peatlands, wetlands and species-rich grasslands. For example, grasslands consisting of lots of different species of plants can capture up to five times more carbon than a closely mown amenity grassland. This is why management of our grassland areas and road verges can play an important part in both improving biodiversity and tackling climate change.

The UK's peatlands soils store around 3.2 billion tonnes of carbon, but are heavily degraded and release the equivalent of 23 million tonnes of CO2 every year.

Nature-based solutions

The restoration and creation of natural habitat therefore must play a vital role in the council's response to tackling climate change - through both offsetting opportunities and also providing 'nature-based solutions'. Nature-based solutions involve working with nature to address societal challenges, providing benefits for both human wellbeing and biodiversity.

Examples of nature-based solutions are:

- Wetland restoration and re-naturalising watercourses can help to protect communities downstream from flooding
- Increased vegetation such as trees in populated areas will have an urban cooling effect, reducing temperature during heatwaves
- Some types of hedges and trees act as natural filters, trapping particle pollution and contributing to better air quality
- Increasing people's access to high quality greenspace can improve physical and mental health outcomes
- Restoring peatlands and restoring or creating other natural habitats will increase carbon sequestration and storage, helping to combat climate change

Purpose of the Plan for Nature

The Plan for Nature is intended to guide the actions that need to be taken by Staffordshire Moorlands District Council to halt and reverse the decline of the natural world across the authority area by 2050.

It draws together data on the current state of nature within the Staffordshire Moorlands and offers recommendations on how and where conservation efforts should be prioritised.

It contains targets and a timescale for different actions and interventions to ensure the authority can track and measure its progress on an annual basis.

Key stakeholders have been involved in the development of the plan, and will also be vital in facilitating its delivery.

Appendix A sets out the relevant policy and legislative objectives and requirements for both urban and rural settings. This includes the strengthened biodiversity duty for public authorities in England under the Environment Act 2021 is a requirement to:

- Consider what you can do to conserve and enhance biodiversity.
- Agree policies and specific objectives based on your consideration.
- Act to deliver your policies and achieve your objectives.

The Plan for Nature will provide a framework to deliver these duties.

1.2. Staffordshire:

Staffordshire Biodiversity Action Plan 3rd Edition

Although last updated in 2012, the plan has been adopted by all local authorities in Staffordshire and gives a broad overview of the county along with targets and objectives for habitats and species. It particularly highlights scarce local species for conservation that are not recognised on national lists, such as hybrid bilberry, ground nesting bees and wasps, and the pink waxcap fungi. This information is still relevant to inform local species projects and actions. For example it is referenced in Policy "NE1 Biodiversity and Geological Resources" in the adopted Staffordshire Moorlands Local Plan. The plan can be viewed at http://www.sbap.org.uk

1.3. Staffordshire Moorlands:

Staffordshire Moorlands Local Plan September 2020

The current local plan has a number of policies relating to biodiversity and green infrastructure. While the plan predates the requirement for 10% mandatory biodiversity net gain, the current policies support BNG and enable a net gain to be required and secured

These are set out in Appendix A.

Staffordshire Moorlands Green Infrastructure Strategy 2018

The strategy sets out key Green Infrastructure (GI) assets across the District, priorities and proposals and maps out key GI corridors across the district and in key settlements. Each of the strategic corridors / areas provides a steer as to the habitat protection, restoration or green infrastructure enhancement and creation actions that should be considered and contributed to through land management or financial contribution - as part of any development proposal.

The proposed priorities and actions for the strategic network will be used to:

- Form part of the evidence base for Local Plan policies including Strategic Development Site policies.
- Inform the Local Plan Infrastructure Delivery Plan.
- Assist with development management decisions.
- Inform design and contributions required from new developments.
- Guide use of any CIL monies and other developer contributions.
- Help identify potential sites for any biodiversity off-setting and opportunities to conserve and enhance the setting of heritage assets.
- Identify and inform any future partnership projects.
- Identify and plan specific projects through grant funding opportunities or neighbourhood plan proposals.
- Support broader ecological networks, for example through the Local Nature Partnership and Duty to Cooperate with the strategies of neighbouring authorities.
- Create significant corridors and larger scale features outside the boundary of the strategy.
- Support and encourage community engagement and participation around GI assets.

A Delivery Plan is under development to set out a delivery framework. A draft Schedule of Green Infrastructure projects has been collated, which will form the basis for costed projects.

Churnet Valley Masterplan

The plan includes specific actions within each of the 8 separate character areas identified within the Masterplan and specific opportunity sites, including biodiversity aims. Note that the adopted Masterplan SPD is referenced in the adopted 2020 Staffordshire Moorlands Local Plan, and has its own Policy SS11 'Churnet Valley Strategy'.

Staffordshire Moorlands District Council Infrastructure Delivery Plan February 2018

This delivery plan sets out actions for a variety of identified infrastructure needs across the Staffordshire Moorlands relevant to the delivery of the Staffordshire

Moorlands Local Plan, many of which overlap with opportunities for nature recovery and people's access to wildlife.

Transport infrastructure includes several new roads and improvements to parking, cycling, footpath and canal facilities. Flood Risk and Drainage infrastructure includes work to reduce surface water flooding and runoff in particular settlements such as Biddulph, Endon and Leek, and also using natural flood management in vulnerable river catchments. Plans for Green Infrastructure, Public Space and Open Space provision include new play spaces, investment in existing parks and features for young people, while Sports, Leisure and Recreation Infrastructure includes several new sports pitches.

All of these projects could present opportunities for nature recovery; delivering multi-functional benefits and environmental net gain.

Nature Recovery Network Mapping Report 2020

This study is part of the evidence base for the local plan, as well as helping to guide the location and priorities for future biodiversity projects.

Using existing habitat data and connectivity modelling, the mapping outlines Habitat Connectivity Opportunity (HCO) areas that illustrate the type of habitats best created or enhanced in every part of the district, along with the relevant issues and opportunities that guide actions. Strategic Areas maps show where work should be prioritised strategically to best link existing habitats.

Staffordshire Moorlands Climate Change Action Plan July 2021

The strategy recognises the co-benefits of addressing the Climate and Nature emergency, such as improving physical health and mental wellbeing, achieving economic growth and alleviating poverty. The plan includes actions to:

- Increase tree cover, and improve wildlife habitats and biodiversity.
- Protect and enhance the existing green infrastructure resource within the district's towns and villages.
- Encourage action to conserve and improve biodiversity in the district by developing a Biodiversity Strategy.
- Encourage tree planting and create a framework for the planting of new trees by developing a Tree Strategy.
- Reduce the risk of flooding in the district by supporting delivery of the Staffordshire Local Flood Risk Management Strategy.

Deliver tree planting schemes including the Community Orchards scheme.

Work in partnership with communities, including the most vulnerable, to protect and improve the environment.

Developer Contributions Supplementary Planning Document – Due to be adopted October 2023

The Supplementary Planning Document, due to be adopted in October 2023, sets out the Council's approach to the use of Section 106 agreements used to secure developer contributions from new developments. This highlights the delivery of 10% biodiversity net gain, arising from the Environment Act, through off-site measures funded by financial contributions, or potentially via Section 106 agreements.

2. The vision and targets

In 2050 the Staffordshire Moorlands will be a district where nature has recovered to sustainable levels. Formerly declining habitats and species have been restored; both town and countryside are resilient to climate change, and everyone can access and engage with nature on their doorsteps.

3. A third of all land in the Staffordshire Moorlands will be protected and managed for nature, making a beautiful, healthy and resilient environment for all who live and work in the district.
4. In line with recommendations in the Making Space for Nature report 2010 (the 'Lawton principles') there will be more sites designated for wildlife, and sites will be larger, more connected and in better condition.
5. Our most important habitats and wildlife corridors will form a robust network where wildlife can migrate, live and breed. Woodlands, hedges and verges, rivers, species-rich meadows, peatlands and moorland will be flourishing across the Moorlands, with traditional orchards making a come-back in urban green spaces.
6. Landowners in the parish will be aware of, and able to access, a range of funding and advice to manage their land to benefit wildlife and tackle climate change.
7. Iconic species that indicate the health of our environment, such as the curlew, otter and peregrine are plentiful. Our rarest specialists like the dormouse, lesser butterfly orchid and native crayfish are recovering and expanding from their strongholds. Species that were formerly extinct such as beavers and red squirrels are again present in the district.
8. The Churnet Valley is a thriving example of re-wilding and tourism. Sustainable farming, forestry and rivers enable residents and visitors to enjoy an abundance of wildlife in a beautiful landscape.
9. Everyone who lives in the settlements of the Staffordshire Moorlands will have access to enough natural greenspace near to their home, and be able to get involved, or simply enjoy time spent, in a green and healthy environment. All publicly-owned greenspaces and buildings will be more wildlife-friendly. Many new developments will meet Building with Nature standards, delivering best practice for wildlife, water and wellbeing.
10. Nature-based solutions will be tackling the effects of climate change by reducing flooding, conserving soils, cooling urban areas and filtering air and water pollutants. Healthy habitats will be removing and storing carbon in trees, plants and soils.

Fulfilling the Vision

In order to fulfil our vision for biodiversity in the Staffordshire Moorlands, the following targets have been developed to underpin the council's Plan for Nature.

Target 1

By 2030, we will ensure that 30% of all land in the Staffordshire Moorlands will be protected and looked after so that wildlife can thrive there - focusing particularly on priority habitats and wildlife corridors as identified in the Nature Recovery Network mapping. Caring for our land in this way will provide many benefits for local people too – such as helping to reduce flooding, buffering us from extreme temperatures and making us more resilient to the impacts of climate change.

Target 2

By the end of 2023, we will investigate the opportunities to reintroduce or boost populations of two wild species in the Staffordshire Moorlands that have been identified as being a priority for local conservation efforts. During 2024, we will produce a plan to secure funding to resource the species recovery work.

Target 3

By the end of 2023, we will set a measurable target to restore the rivers, streams and wetlands in the Staffordshire Moorlands that have been identified as being most in need of re-naturalisation, utilising the expertise of the Environment Agency, who monitor the ecological health and pollution levels in our watercourses, and other stakeholders.

From 2025, we will work with partner agencies to create publicly accessible reports on the ecological health of watercourses in the Staffordshire Moorlands, which will help to inform future conservation efforts.

Target 4

By the end of 2024, we will launch a citizen science project to involve local people in supporting wild species that are at risk in the Staffordshire Moorlands. The project will focus on supporting volunteers to collect data on species which have been identified as a priority by Staffordshire Ecological Record because population data is currently lacking/limited.

Target 5

By the end of 2024, we will set a measurable target to make our Local Wildlife Sites better for wildlife. Local Wildlife Sites are places that have been identified as some of the best wild habitats across the Staffordshire Moorlands. Work to improve them could include, for example, restoring wetland areas, increasing wildflower diversity on grassland areas and making woodlands better for birds and butterflies.

Target 6

Target TBC - focusing specifically for the Churnet Valley, following on from / supporting the Churnet Valley Masterplan.

Target 7

By the end of 2025, all residents of recognised settlements in the district will have adequate access to natural greenspace in line with the Natural England Green Infrastructure Standards

https://designatedsites.naturalengland.org.uk/GreenInfrastructure/Home.aspx

3. Baseline Methodology

Staffordshire Moorlands Ecological Data Review

3.1. Assessment of Current Biodiversity within the District

There is currently 5,780 Ha of land within Staffordshire Moorlands (excluding Peak Park) that is covered by one of the following statutory or non-statutory designations.

3.1.1. Statutory Designated Sites

International Designations

There are no internationally designated sites within Staffordshire Moorlands.

National Designations

Sites of Special Scientific Interest (SSSI)

There are a total of 16 sites designated as SSSIs within Staffordshire Moorlands that collectively cover 750.81 Ha of land. This habitat protected by this designation comprise; upland and lowland acid grassland, lowland neutral grassland, upland calcareous grassland, lowland fen, marsh and swamp, upland and lowland dwarf shrub heath, upland and lowland broadleaved woodlands, and earth heritage features.

Two of the SSSIs are only partially located within Staffordshire Moorlands, namely Hulme Quarry SSSI and Stanton Pastures & Cuckoocliff Valley SSSI which have approximately 30% and 11% of the designated land within the district.

Caldon Low SSSI, Caldon Railway Cutting SSSI and Hulme Quarry SSSI are all designated for their geological earth feature interest, although they are also of interest for their biological characteristics this is not the reason for their designation. The other 13 SSSIs have all been designated for their biological interest.

Appendix B lists the sites in Table 1 and provides details on each at the end of the appendix.

National Nature Reserves (NNRs)

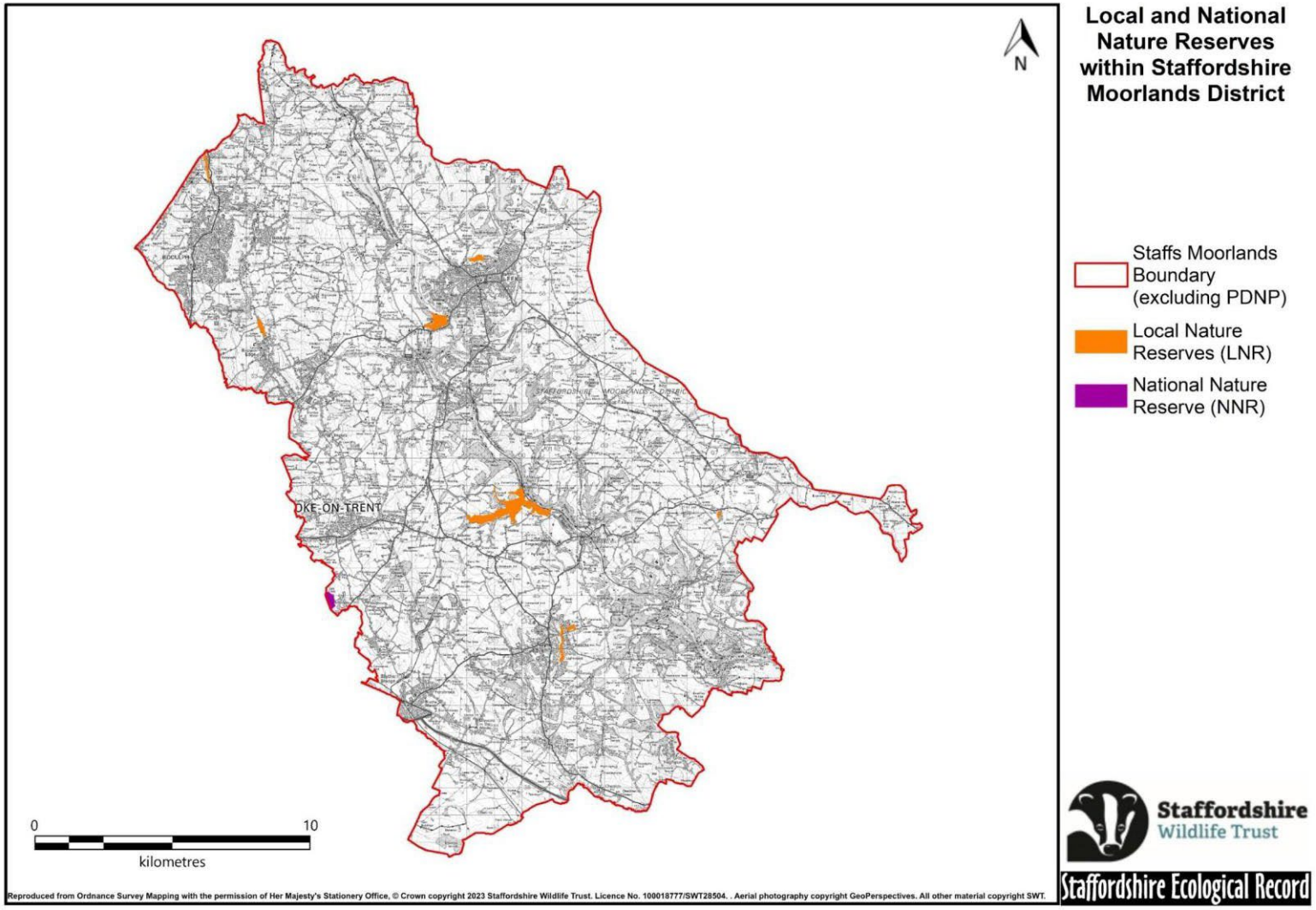
Hulme Quarry NNR is the only National Nature Reserve within the district, although 70% of the site falls outside of the district it is contiguous with the section that is within Staffordshire Moorlands. The whole site is also designated as a SSSI. See Figure 1 for a map of the sites.

Local Designations - Local Nature Reserves (LNRs)

There are 8 LNRs within Staffordshire Moorlands covering a total of 145 Ha. These sites comprise old railway lines, large areas of unimproved and semi-improved grassland, watercourses, broadleaved woodland and heathland.

See Figure 1 for a map of the sites.

Figure 1


Local and National Nature Reserves within Staffordshire Moorlands District
N
Staffs Moorlands Boundary (excluding PDNP)
Local Nature Reserves (LNR)
National Nature Reserve (NNR)
0
10
kilometres
Staffordshire Wildlife Trust
Staffordshire Ecological Record
Reproduced from Ordnance Survey Mapping with the permission of Her Majesty's Stationery Office, © Crown copyright 2023 Staffordshire Wildlife Trust. Licence No. 100018777/SWT28504. . Aerial photography copyright GeoPerspectives. All other material copyright SWT.

Staffordshire Moorlands NNR and LNR

3.1. Non-Statutory Designated Sites

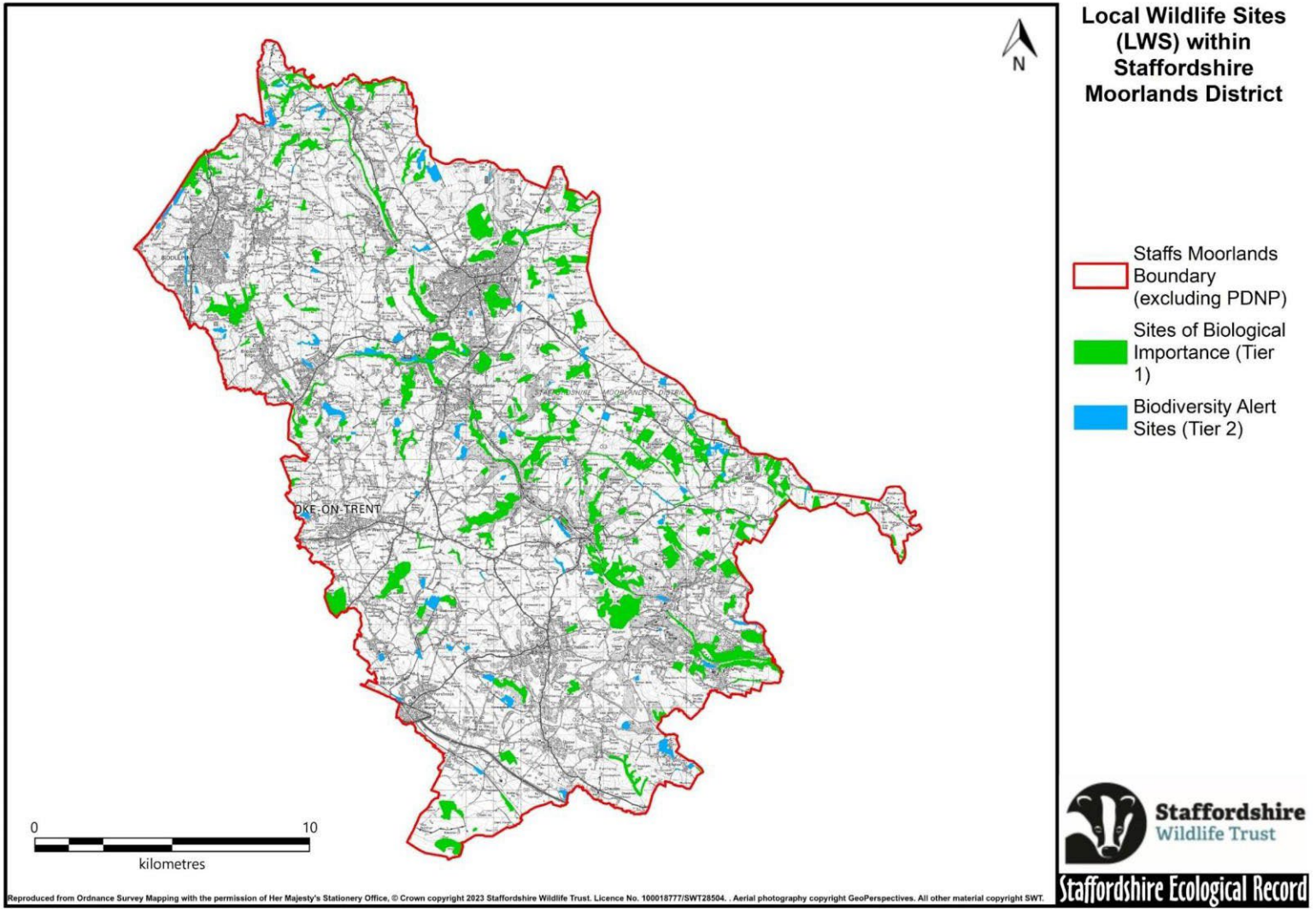
Local Wildlife Sites (LWS)

There are a total of 357 Local Wildlife Sites within Staffordshire Moorlands that cover a total of 2,897 Ha. Within Staffordshire there are two tiers of LWS designation, Sites of Biological Interest (SBIs) are sites of substantive nature conservation value and are considered to be of county importance, while Biodiversity Alert Sites (BAS) have less value but may have the potential to be of substantive value and are therefore considered to be of local value.

There are significantly more SBIs than BAS within Staffordshire Moorlands with 272 sites covering 2,520 Ha, compared with 85 sites covering 377 Ha. This will by no means be an absolute list of the sites meeting LWS designation criteria within the district, it is a current list of designated sites and new sites will likely be added over time. There will be undesignated sites already known to meet the necessary criteria and many other sites where there is no existing survey data. The primary limitations to designating more LWS are landowners permission to access their land and the resourcing of experienced people able to undertake the necessary survey work and for the designation committee to consider and process the designation on a site by site basis.

See Figure 2 for a map of the sites.

Figure 2 Staffordshire Moorlands Local Wildlife Sites

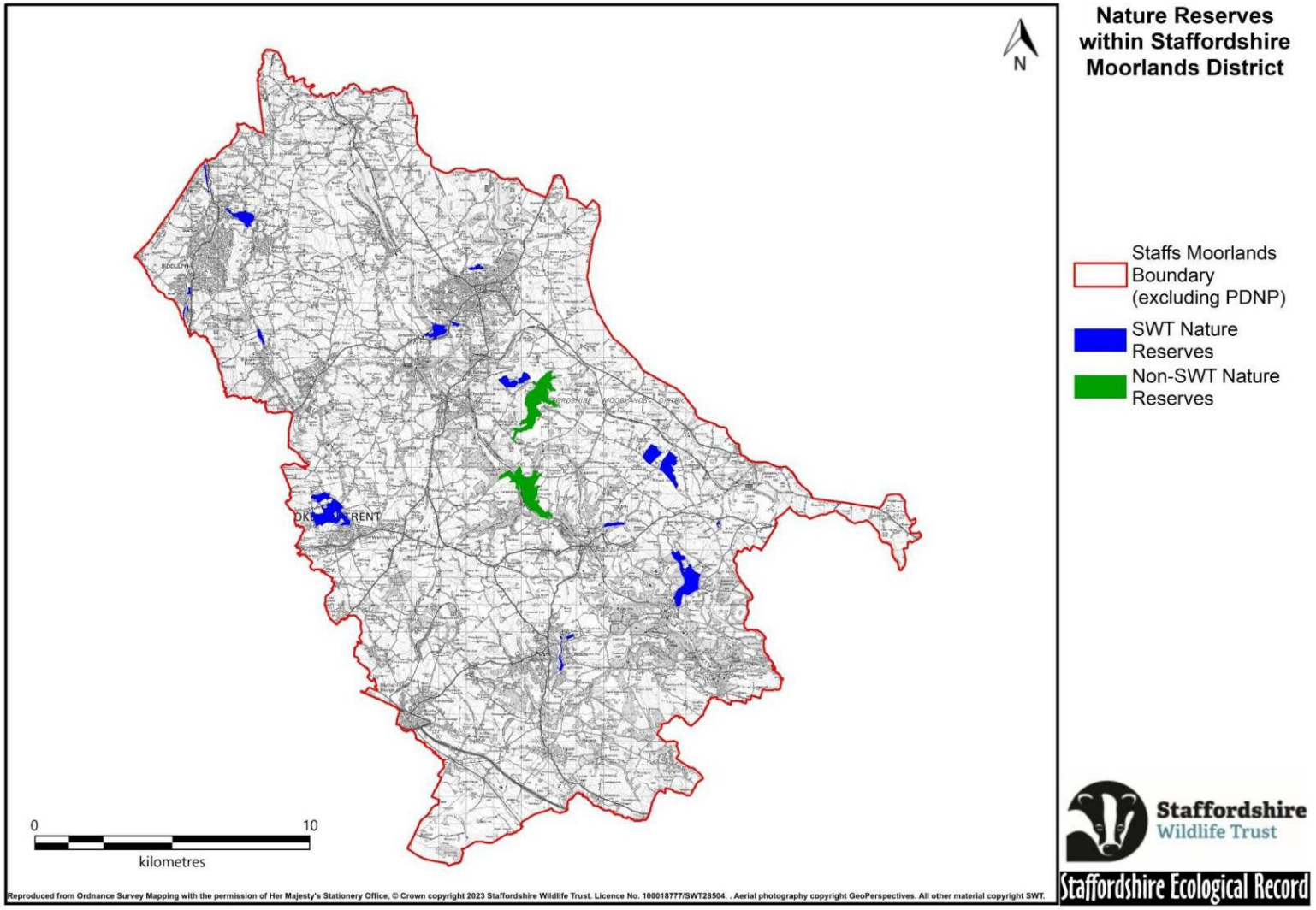


Non-statutory Nature Reserves

There are 16 non-statutory nature reserves within Staffordshire Moorlands covering 562.8 Ha, with 385.28 Ha of these nature reserves also have a statutory designation as a SSSI or LNR. Cotton Dell and Ipstones Edge are both only partially designated as SSSIs.

See Figure 3 for a map of the sites.

Figure 3 Staffordshire Moorlands Non-Statutory Nature Reserves



Ancient Woodland Inventory (AWI)

The Ancient Woodland Inventory in Staffordshire is in the process of reviewing the woodlands within the county to determine how long each site is believed to have been consciously wooded for. There are currently three different definitions of woodland that are;

Semi-Natural Ancient Woodland

Broadleaf woodland comprising mainly native tree and shrub species which are believed to have been in existence for over 400 years.

Replanted Ancient Woodland Site

Sites which are believed to have been continuously wooded for over 400 years and currently have a canopy cover of more than 50% non-native conifer tree species.

Long Established Woodland (Unconfirmed)

Long established woodlands have been present since at least 1893. While not ancient, these woodlands are still very important.

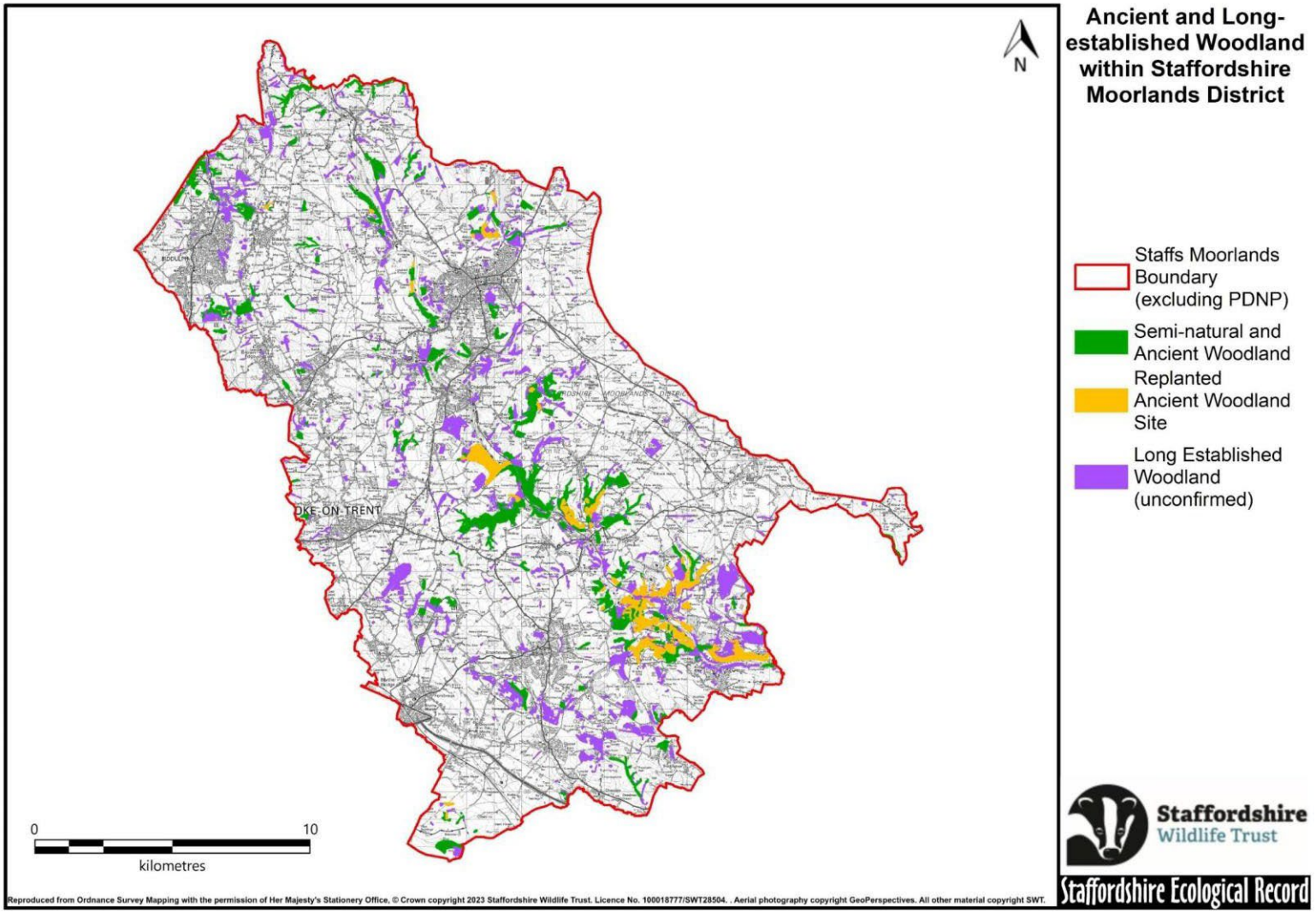
There are 1,509 Ha of recognised ancient woodland within Staffordshire, 1,070 Ha is semi-natural ancient woodland, with 439 Ha of replanted ancient woodland sites.

The long established woodlands have been identified by comparing current and historical maps to identify sites that appear to have been continuously wooded. Work is now being undertaken to ground truth these sites looking at their structure and the flora present to determine whether they have been continuously wooded.

There is significantly more woodland in Staffordshire Moorlands, than has been mapped as part of the Ancient Woodland Inventory, however for the purposes of this report, sites where woodlands are not believed have been continuously wooded since before 1893 have not been included.

See Figure 4 for a map of the sites.

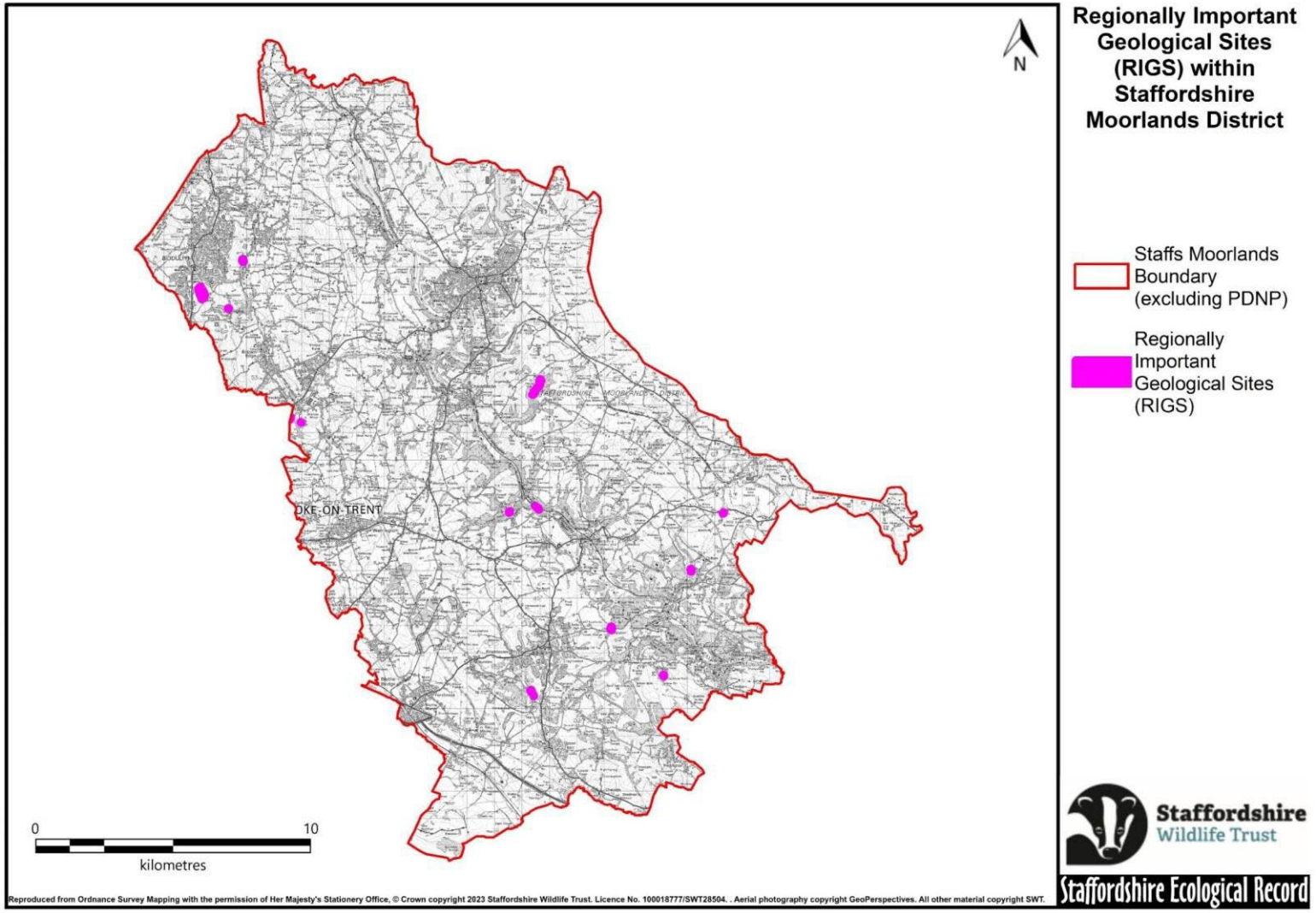
Figure 4 Staffordshire Moorlands Ancient and Long-established Woodlands



Regionally Important Geographic Sites

There are 13 RIGS located within Staffordshire Moorlands covering approximately 9.4 Ha. These are non-statutory sites selected to protect the important places for geology, geomorphology and soils. These complement the network of legally protected Sites of Special Scientific Interest, and are selected for their scientific, educational, historical and aesthetic features.

Figure 5 Regionally Important Geological Sites (RIGS)



3.2. Protected Species

The species records here have been obtained from Staffordshire Ecological Record, the biological records centre for Staffordshire. Based on the records available, it may appear that some species that would have been expected to be present within the district have not been recorded in the last few years. With the prolific use of iRecord; a website for sharing wildlife records; there is often a lag time between species being recorded, these records being submitted to iRecord and verification of the records before they are added to the Staffordshire Ecological Record database the following year.

European Protected Species

There are 57 species recorded within Staffordshire Moorlands afforded European protection under Habitats Directive and Birds Directive. Of these 39 have UK protection under the Wildlife and Countryside Act (as amended), 14 are Species of Principle Importance under the Natural Environment and Rural Communities Act 2006 and 8 are Staffordshire Biodiversity Action Plan (SBAP) species.

Staffordshire Moorlands Species with UK Protection

There are 47 species recorded within Staffordshire Moorlands afforded UK protection under the Wildlife and Countryside Act (as amended), 15 are Species of Principal Importance under the Natural Environment and Rural Communities Act 2006 and 4 are Staffordshire Biodiversity Action Plan (SBAP) species.

3.3. Identification of Undesignated Sites that Could Benefit from Designatory Protection.

3.3.1. Introduction

It is reasonable to assume that the vast majority of sites within SMDC that would meet the selection criteria for a statutory designation have already been identified and receive the benefit of such a designation.

When considering land that does not qualify for statutory designation, we can reasonably assume that there are still areas within SMDC that would benefit from non-statutory designation. There may be certain areas that are thought to have potential for meeting the LWS selection criteria, but it is likely that a significant percentage of the undesignated sites with potential for designation are unknown.

While potential areas may be identified from aerial photography or other desktop assessments, the sites inevitably need ground truthing at the appro priate time of year to determine the species composition and other characteristics of the habitats present. The ambition to identify sites that would benefit from

designation is largely constrained by the availability of knowledgeable surveyors to undertake the site visits, permission from the landowner to undertake such surveys and the time of the designation committee to review any potential designations.

Working with limited resources it is important for efforts to be focussed in the areas that are considered to have the greatest chance of success, and to that end strategic area mapping has been employed to focus the potential surveyor effort. This can be used individually, or overlaid with other specific mapping of SMDC to further narrow down potential areas for investigation.

3.3.2. Mapping Methodology

The mapping has been undertaken by assessing the proportion of broad habitat types e.g. woodland, grassland, heathland, etc. within an area to determine whether they are 'strategic', 'semi-strategic' or 'non-strategic' for the creation or restoration of further habitats based on the proportion of habitats already present in the area.

Using composite Phase 1 habitat data, the proportion of specific higher quality habitats (e.g. heathlands or species-rich grassland) that overlap individual Ordnance Survey 1km grid squares was calculated in a GIS package. Each square was subsequently classified into one of three hierarchical area bands defined below, based on the area of habitat overlapping the 1km square.

The strategic habitat areas can be viewed as a hierarchy when it comes to the creation of a particular type of habitat:

- **Strategic areas** - Key areas to focus habitat creation or restoration. There is some high quality semi-natural habitat but additional high quality semi-natural habitat would improve the function of the network.
- **Semi- strategic areas** – The secondary preference with regard to habitat creation. These areas already have a relatively large area of high quality semi-natural habitat but more would still be of benefit.
- **Non-strategic areas** - There is very little or no high quality semi-natural habitat and it would be difficult to create enough high quality semi-natural habitat for it to be functional. (This is not to say that semi-natural habitats should not be created in this area but that it is lower in the overall hierarchy).

Once the strategic areas had been identified, further criteria were applied.

- Only Strategic and Semi-strategic areas were included (i.e. any 100 metre squares that have >5% 'semi-natural' habitat within them)
- A 200m buffer was added to the strategic areas, which was then reduced by
- -100m to connect nearby areas (similar to NE network analysis mapping), arriving at a 'smoothed' 100m dataset buffer.

- Designated nature conservation sites were removed from the dataset resulting in buffered boundaries to designated areas e.g. SSSI, LWS, LNR.
- Any areas smaller than 1ha were removed to clean the dataset (remove slivers and erroneous polygons arising from processing).
- Prioritisation was applied to areas based on their proximity to existing designated nature conservation sites e.g. SSSI, LWS, LNR):
- High Priority (adjacent)
- Medium Priority (<500m)
- Low Priority (>500m)
- Areas of low and very low distinctiveness were removed from the habitat distinctiveness mapping (essentially any potentially 'less diverse habitats', built-up land etc.) as these would not be considered of high survey importance (mainly gardens, buildings, arable land etc)
- Disaggregate the dataset and remove any new areas that had been reduced to <1ha again for a final data clean (remove slivers and potential erroneous 'floater' polygons).

Following the above process identifies the areas of medium and higher habitat distinctiveness within zones of higher strategic significance, prioritised by proximity to existing designated nature conservation sites.

See figures 6 and 7 for maps.

Caveat: This dataset does not equate to any form of designation over the identified land in question, nor does it illustrate any landowner survey or designation permissions. The map shows a modelled dataset designed to help prioritise where to direct future LWS surveys. No conclusions can be drawn regarding the number, size or status of any sites which may result from any survey undertaken.

Figure 6 Habitat distinctiveness

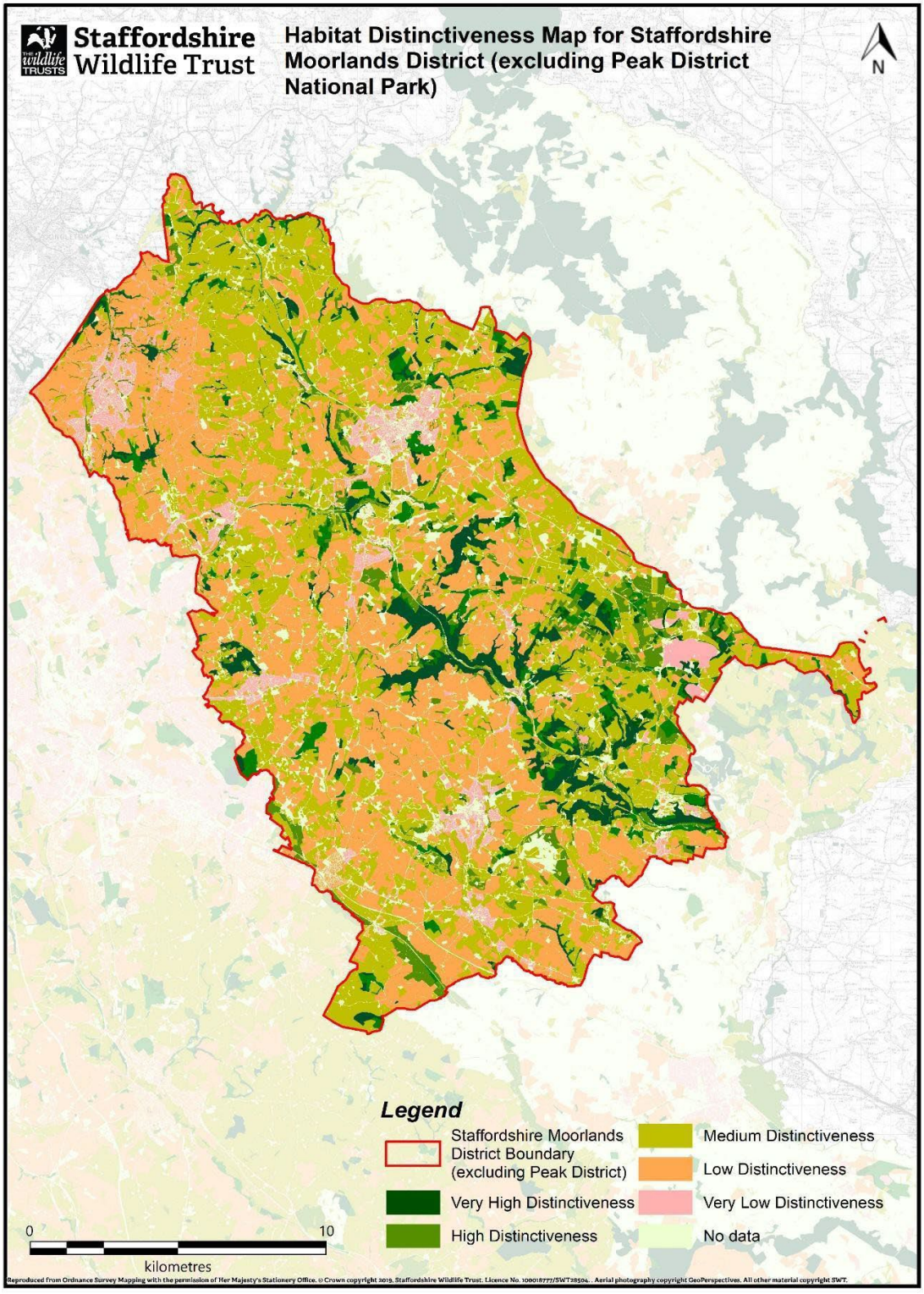
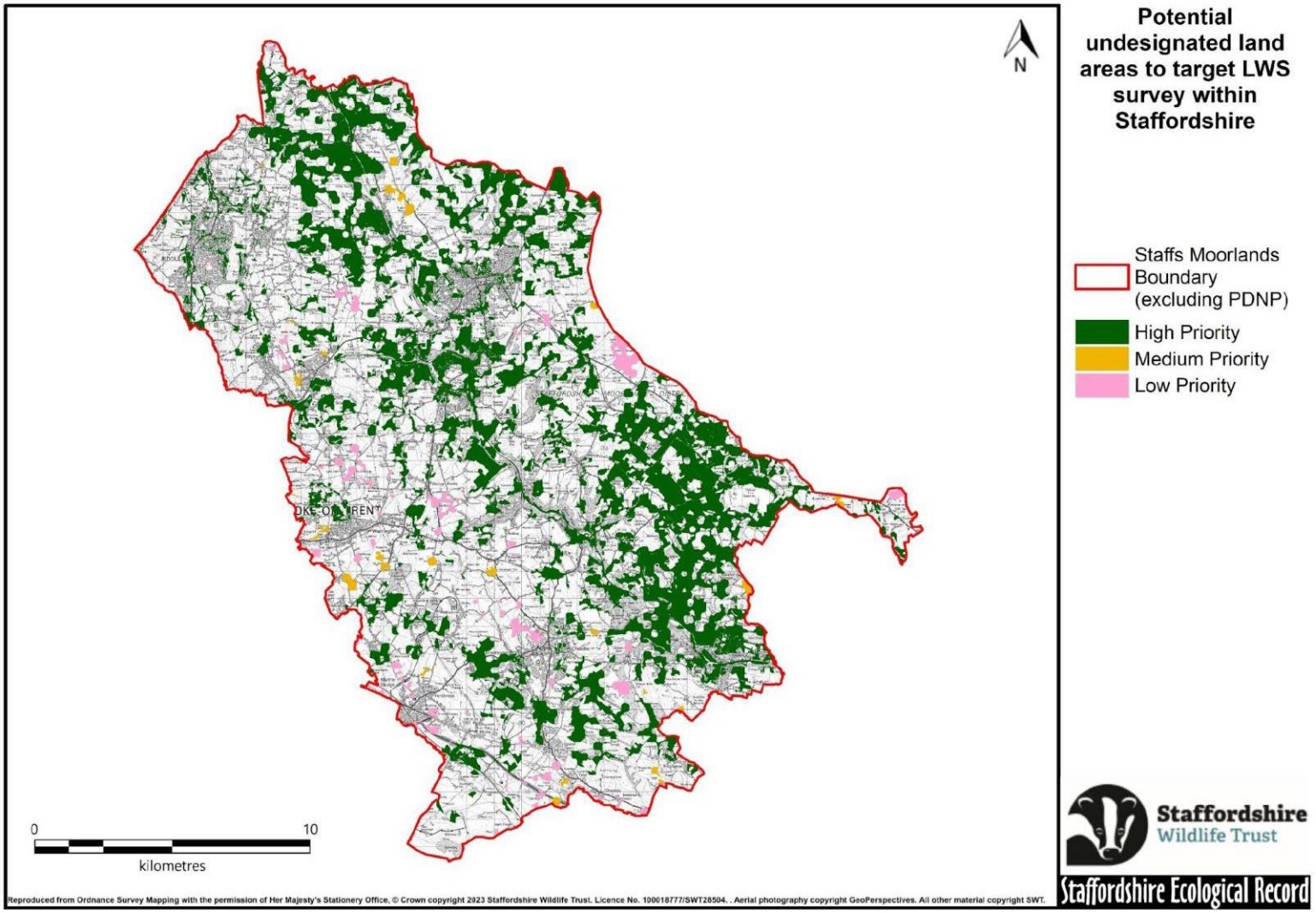


Figure 7 Potential upgrade of undesignated land



3.4. Public Greenspaces with Potential for Habitat Improvement in Staffordshire Moorlands

3.4.1. Introduction

Green infrastructure is the term used to describe the network of natural and semi-natural places and corridors within an area. While this includes habitats such as woodlands, hedges, lakes and ponds, it also includes parks and gardens, allotments, playing fields and footpaths. These areas are not only considered for their biodiversity potential but also for the benefits that they can provide for the physical and mental wellbeing of people, alongside ecosystem services. These are benefits freely achieved by natural processes in properly functioning ecosystems, such as helping reduce local temperatures, alleviate flood risk and help with climate change adaptation.

The Staffordshire Moorlands Nature Recovery Network report, completed in 2021, carried out a strategic assessment of the District's biodiversity and habitat networks, to form part of an evidence base in order to ensure biodiversity is an integral part of policy development. Through the strategic creation and enhancement of habitats, their connectivity within the landscape can be improved to help address the negative impact of habitat loss and fragmentation.

This involved combining existing data with additional Phase 1 habitats survey data, mapping to analyse habitat connectivity within the district and Local Nature Recovery (LNR) mapping. MapInfo, a GIS software package was used to digitise the habitat survey data and network maps, while another software package called Condatis was used to analyse the potential movements species would make through existing landscape connections.

With the coming of mandatory Biodiversity Net Gain these maps can be used to both inform the metric and target the location and application of future ecological enhancements contributing to a functional nature recovery network.

3.4.2. Methodology

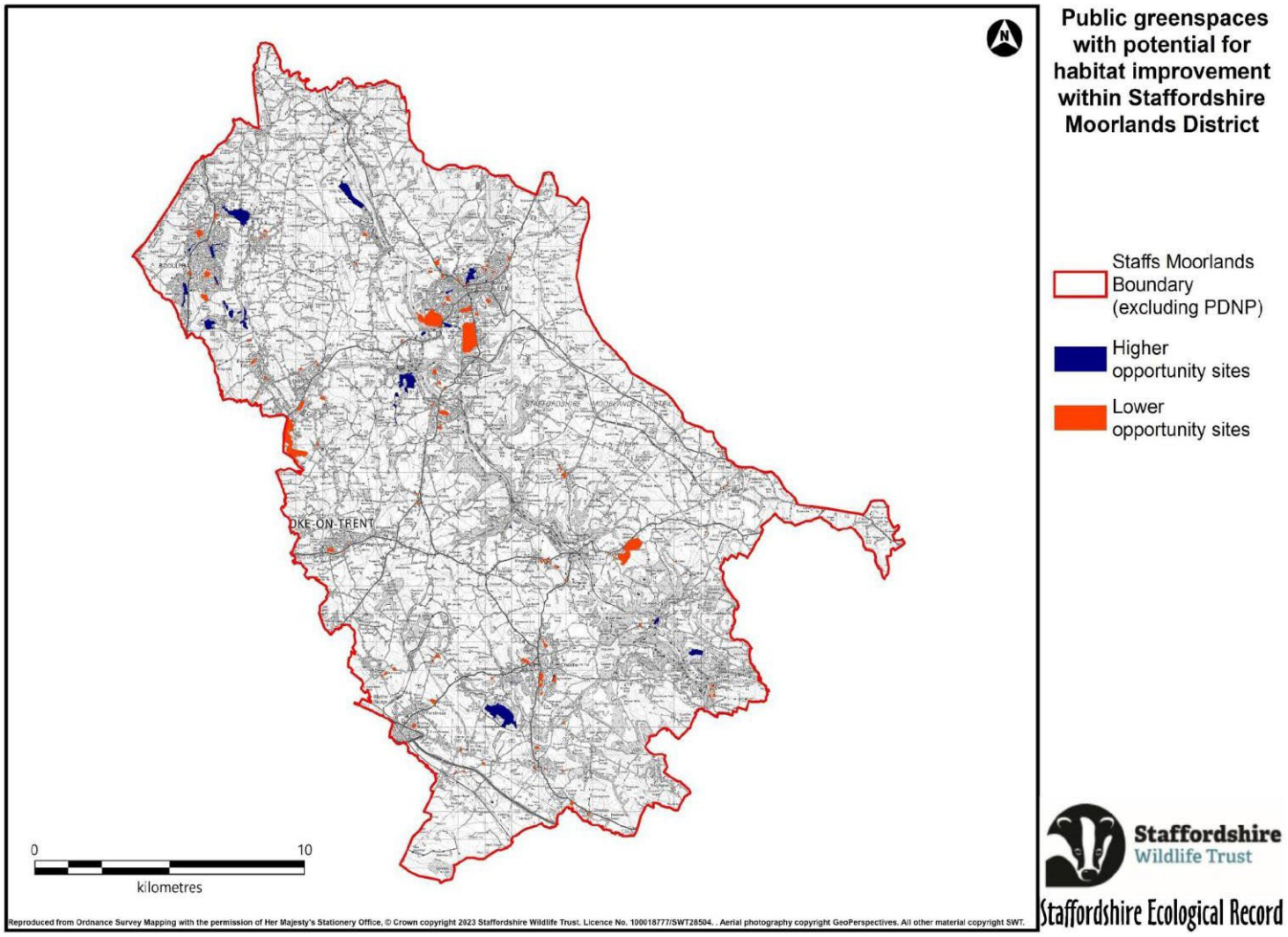
Selection Criteria

Any areas where the high and lower priority sites overlapped with an existing designated (SSSI, SBI, BAS, LNR, Ancient Woodland sites) were removed from the dataset.

Areas smaller than 0.05ha were removed to clean the dataset of any slivers and erroneous polygons.

The resulting mapping created two layers with opportunity prioritised based on their location and current land use.

Caveat - There may be a number of other sites which could potentially be restored or improved for their biodiversity but condition assessments would need to be carried out to determine the current status of these sites.



.Figure 8 Public green spaces with improvement potential

4. The Built Environment

4.1. Policies for Biodiversity

4.1.1. Introduction

Our urban areas are in most need of greening; not only to help wildlife recover, but to make a healthy environment for us to live, work and travel. Adding micro green features across many sites gradually adds up to support nature networks, to manage flooding and drought, reduce urban heat, noise and air pollution, and create more beautiful places. This links in to wider aims for regeneration, wellbeing and climate change resilience.

Currently, various policies relating to biodiversity and green infrastructure are in place nationally and locally. The Staffordshire Moorlands Local Plan adopted in September 2020, and associated evidence base/ guidance such as the Green Infrastructure Strategy, all require the protection and enhancement of important ecology assets: designated sites, irreplaceable and priority habitats, protected and priority species, corridors and stepping stones, and landscape features such as rivers, trees, drystone walls and hedgerows according to the mitigation hierarchy derived from the National Planning Policy Framework (NPPF); also schemes in other locations should where possible seek to deliver a net gain in biodiversity proportionate to the scale of the scheme. Water management, landscape, access, amenity and climate change policies also interact with and support biodiversity provision. A summary of policies is provided in Appendix A.

These policies are used when assessing planning applications to ensure that all requirements for habitat and species protection and mitigation are met. Both planners and ecologists work to secure appropriate enhancement features for wildlife and the landscape, depending on the species present or nearby, the location and the constraints or needs ofthe site.

However, the majority of proposals do not trigger the need for ecology input or action. Yet, all development could, and should, play a role in nature's recovery. Therefore, guidance on standard requirements for supporting biodiversity in the built environment could serve to ensure that all proposals add small-scale features, irrespective of their scale, or the availability of bespoke advice.

3.1.2 Scope and Purpose

Biodiversity Net Gain (BNG) is achieved when habitats and species are in a better state than before intervention - whether this be an impact from development, or a nature conservation action. Where an impact causes a loss of

biodiversity, a net enhancement should only be claimed once the mitigation hierarchy has been followed as far as possible (avoidance, mitigation, compensation). The current local plan policy used to guide decision making on BNG is Policy NE 1 Biodiversity and Geological Resources, Section 5. This applies to all schemes, of any size, whether a negative impact is caused or not. The policy states:

The biodiversity and geological resources of the District and neighbouring areas will be conserved and enhanced by positive management and strict control of development (and having regard to relevant ecological evidence) by:

> ***5.*** *Expecting all development where possible seeks to deliver a net gain in biodiversity proportionate to the size and scale of the development. In circumstances where adverse impacts are demonstrated to be unavoidable, developers will be required to ensure that impacts are appropriately mitigated, with suitable compensation measures towards loss of habitat used only as a last resort where there is no alternative. Where any mitigation and compensation measures are required, they should be appropriately scheduled and managed according to the nature, size and scale of the development so as to minimise impacts that may disturb protected or important habitats and species.*

In the absence of specific local guidance on how net gain is measured and the percentage of gain that is expected, a pragmatic approach is currently taken. Decisions are made on a case-by-case with regard to when a BNG metric assessment is requested, and how small-scale proposals can contribute to net gain in a proportionateway.

Where a proposal will be likely to provide a clear gain in habitat value (due to a low baseline and/or overall increase in green areas and habitat quality), in the view of the ecological advisor, a metric is not requested. General advice is given on maximising habitat and species enhancement appropriate to the location, using the Nature Recovery Network mapping and site-specific details. However note that starting from November 2023 it is anticipated that most forms of planning application in England (with different commencement dates for different categories of development) will be required to demonstrate a BNG of at least 10% under the S.98 Environment Act 2021.

Where the net impacts are unclear, or likely to be negative, a metric assessment may be requested. A suitable gain is secured via amendments to the design, additional mitigation or compensation; sometimes off-site. Usually a gain of 1% or over is considered sufficient, and most sites achieve more than this. For major applications, those in a recognised GI corridor or adjacent to a designated site, 10% net gain is usually requested in order to support nature recovery and GI aspirations.

On small sites such as householder applications, changes of use and in urban areas where there is limited ecological impact and opportunity, standard advice is given with regards to wildlife-friendly landscaping and drainage options that will make a small enhancement to the site. This typically includes features like wildflower areas, native hedging, fruit tree planting, reinforced grass parking spaces and bird/ bat boxes.

The above mentioned S.98 duty under the Environment Act for Biodiversity Net Gain will mean that developments of a certain size and type will have to provide as standard a biodiversity assessment via the latest approved metric from Natural England, and show a 10% gain in habitat value. This will cover the majority of proposals impacting wildlife; however, smaller proposals including householder applications are likely to fall outside of this mandatory requirement.

A metric calculator does not deal with individual species, but species conservation is still part of BNG, although less easily quantified. Species protection and mitigation is addressed under existing legislation and policies. Many smaller sites, especially in rural areas, on brownfield land and with older buildings have wildlife value, and good opportunities for restoring nature. They often support protected and priority species, such as bats, hedgehogs and house sparrow, as well as more common but declining species like swifts. Ecological reports, where these are needed, typically advise on required mitigation, and also recommend enhancement measures to boost existing or attract new species. However, many small proposals will not need an ecological survey, and there are simple options that could be applied to enhance nature in even the most built up environments.

Surface water drainage information is not typically required up-front for many smaller applications, and will usually be dealt with via condition and with standard engineered solutions such as soakaways or underground storage, or connecting to combined sewers (which can exacerbate sewage releases during storm events). For larger schemes developers are expected to demonstrate adherence to the drainage hierarchy – refer to Policy SD 5 Flood Risk in the Staffordshire Moorlands Local Plan. There are many ways water can be an asset within the landscape, adding wildlife and sensory benefits through small-scale water features like rain gardens, small ponds and planted swales.

A policy on biodiversity in the built environment would give more detailed and specific guidance on including suitable wildlife and water features within any site. Thus 'filling the gaps' outside of statutory requirements, and helping to deliver broader aspirations for environmental gain. The recently published Natural England Green Infrastructure Standards could also be adopted, within an SPD or within the next local plan.
https://designatedsites.naturalengland.org.uk/GreenInfrastructure/Home.aspx

3.1.3 Use and Testing

The detailed guidance set out in Sections 3.1.5 and 3.1.6 formalises the typical advice given to deliver biodiversity and green infrastructure. It is intended for use on any type of development, to specify enhancements outside of mandatory BNG and species requirements. It would be especially applicable on sites where there is limited space or ecology impact, where an ecological survey isn't required, or where an ecologist would not typically comment.

We envisage this specific guidance could be used to inform built design and landscaping requirements. It could be secured through the landscaping scheme, boundary details and building design and any ecology plans provided at application stage, or via conditions.

Prior to finalising and adopting the guidance, we suggest that consultation is made with planning officers and other stakeholders to finesse the details and ensure ease of use and positive implementation. The guidance could be tested by applying it to a variety of existing planning applications and presenting the relevant recommendations as case studies.

3.1.4 Existing Policies

National and local policies already cover key ecological requirements, but also support the conservation of biodiversity in all forms and at all scales. Biodiversity gain in urban areas can help deliver wider design standards too, such as creating beautiful spaces with a sense of place, that are climate resilient and give access to nature.

Specific guidance on wildlife in the built environment is supported by existing policy and would help deliver multiple green infrastructure benefits. The Counc il will need to decide how to adopt such guidance, whether to refer to it within the Plan for Nature, or to adopt a more formal SPD.

National Planning Policy Framework (NPPF)

Existing policies for considering nature in determining planning applications appear in the several paragraphs which are summarised in Appendix A.

Other policies that specify biodiversity policy for the built environment would also help deliver the following NPPF broad policy chapters and paragraph references :

8. Promoting healthy and safe communities

Such as - high quality public space, encouraging use of public areas, supporting healthy lifestyles, provision of safe and accessible green infrastructure, layouts that encourage walking and cycling.

12. Achieving well-designed places

Such as - beautiful and sustainable buildings and places, visually attractive, good architecture, layout and appropriate and effective landscaping, establishing or maintain a strong sense of place

13. Protecting Green Belt land

14. Meeting the challenge of climate change, flooding and coastal change

Such as- proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, water supply, biodiversity and landscapes, the risk of overheating, avoiding increased vulnerability and ensuring the future resilience of communities and infrastructure including through the planning of green infrastructure.

15. Conserving and enhancing the natural environment

Staffordshire Moorlands Local Plan adopted September 2020

The Local Plan builds on the National Planning Policy Framework to ensure we value and enhance the local character, heritage and landscape of Staffordshire Moorlands.

The Local Plan has several spatial objectives which consider biodiversity.

Small-scale biodiversity gains can also help deliver many of the spatial objectives in the Local Plan, through retaining and enhancing local distinctiveness, the creation of healthy environments, and provision of green infrastructure including gardens, green corridors, and street trees.

The relevant spatial objectives are –

SO2. To create a District where development minimises its impact on the environment, helps to mitigate and adapt to the adverse effects of climate change and makes efficient use of resources.

SO4. To provide new housing that is affordable, desirable, well-designed and meets the needs of residents of the Moorlands.

SO5. To ensure the long term vitality and viability of the three market towns of Leek, Biddulph and Cheadle.

SO7. To support and enhance the tourism, cultural, recreation and leisure opportunities for the District's residents and visitors.

SO6. To maintain and promote sustainable regenerated rural areas and communities with access to employment opportunities, housing and services for all.

SO8. To promote local distinctiveness by means of good design and the conservation, protection and enhancement of historic, environmental and cultural assets throughout the District.

SO9. To protect and improve the character and distinctiveness of the countryside and its landscape, biodiversity and geological resources.

SO10. To deliver sustainable, inclusive, healthy and safe communities.

Staffordshire Moorlands Local Plan Green Infrastructure (GI) Strategy May 2018

Achieving urban greening and biodiversity enhancement in every development would contribute to these aims by helping to fund green infrastructure, support wildlife and travel corridors, enhance the setting of new and existing development, and support ecosystem services such as water management and pollinators.

Specific green infrastructure needs are identified in the main settlements, and this guidance could support these and other opportunities identified in delivery plans.

The strategy sets out a number of aims.

The aims of the GI Strategy are to:

1. Provide a wide variety of parks, wild areas and open spaces to meet the needs of both nature and people.

2. Create, improve and protect green travel links that enable people to access a range of jobs, services, facilities and recreation opportunities using sustainable transport options.

3. Create, improve and protect biodiversity and the ecological networks that provide the opportunity for species to move within the landscape.

4. Improve flood and water management including by contributing to maintaining waterways and managing surface water flow.

5. Protect and enhance the distinctive character of the District's towns and villages together with their landscape settings.

6. Protect and enhance historic landscape character and heritage assets.

7. Protect and enhance the ecosystem services our green infrastructure provides such as soil conservation, water management, air quality and crop pollination to ensure a healthy and resilient natural environment.

8. Promote the sustainable economic growth of the District.

9. Provide a clear framework for funding biodiversity enhancements appropriate to the size, scale and nature of a development.

10. Facilitate partnership working and improve access to resources through relevant funding regimes enabling green infrastructure to be funded on a similar basis to other local infrastructure

3.1.5 Species Features

A number of key species are found in the built environment that are priorities for conservation. These include legally protected species, Species of Principal Importance under the NERC Act 2006, and other rare and notable species that are listed in the Staffordshire Biodiversity Action Plan or are declining, such as red and amber listed Birds of Conservation Concern.

Considering integral nest boxes along with freestanding , bespoke wildlife towers can provide homes for several species of bats, birds and insects

Bats

The most commonly found in buildings and structures are pipistrelle species, which roost in small crevices, and Brown Long-eared bats which need an indoor void like a roof space to hang in. However, there are 14 bat species that use buildings and they all have varying needs. The best way to help bats when renovating or building a new structure is to include integrated bat roosting features that are part of the building rather than attached. These can be bat boxes, bat tiles, or spaces designed into the roof or walls that bats can access.

More details can be found at https://www.bats.org.uk/our-work/buildings-planning-and-development/accommodating-bats-in-buildings

Birds

Protected and priority birds that nest on or in built structures include House Sparrow, Starling, and Barn Owl. Certain tall and large-roofed buildings can support Peregrine Falcons, and some ground nesting birds such as Black Redstart and Oystercatcher can use brown/green roofs. Swifts, House Martins and Swallows are declining, and are a welcome sight returning every spring- and can be encouraged with the right nesting spots.

Boxes for Tree Sparrow, birds of prey and woodpeckers can be appropriate for sites with larger greenspaces or those near to the countryside. A range of boxes and bird bricks are suitable for more common birds such as Robins, Wrens and Blue Tits.

Song Thrush, Bullfinch and Dunnock are further priority birds found in gardens and parks, which can be encouraged with good landscaping such as hedging, shrubs and green walls.

Mammals

Badgers and Hedgehogs are often found in urban areas, and the main issue for these creatures is access through boundaries, so that they can use gardens and landscaping. 'Hedgehog highways' are commonplace in most new developments now, providing access holes at the base of fences and walls, or using open

fences, railings or hedges. Hedgehog boxes can also be provided, as well as creating log or brash piles from any trees and shrubs that have to be cleared from a site.

Amphibians and reptiles

Great Crested Newts, Common Toad, Grass Snake and Slow Worm are most commonly found in more urban sites, especially where there are ponds and habitat corridors such as old railway lines, or brownfield sites.

Traditional roads with curbs, drains and gully pots trap migrating amphibians. Good sustainable drainage schemes can be more wildlife friendly as they avoid structures in favour of water running directly from hard surfaces into swales, ponds and rain gardens. Amphibian friendly road and drainage design can be adopted on any site where there are ponds nearby, so that frogs, toads and newts can roam freely.

Log piles, dead hedges, compost piles and hibernacula give shelter, hibernation and breeding places for these species. They can all be created from vegetation and inert materials from site clearance.

Mini ponds can be incorporated into landscaping, as a small container either raised or sunk into the ground with access for wildlife. They can also be part of rain gardens designed as part of Sustainable Drainage Systems (SuDS), which divert clean roof water into temporary ponds and planted wetlands.

https://www.wildlifetrusts.org/actions/how-create-mini-pond

Invertebrates

Encouraging groups like bees, butterflies and moths helps support pollination as well as feeding bat and birds. Bee bricks and bug houses can be built in to structures, and sandy 'bee banks' added to landscaping schemes

Pollinator planting can incorporate native and ornamental plants to provide nectar sources throughout the year.

3.1.6 Urban Habitat Features

Diverse Amenity Grassland/ Spring Meadows

Even if cut short, lawn areas can be very diverse and the old lawns of cemeteries and historic buildings are a testament to this. New short flowery lawns can be created with a specific seed mix, or plugs planted into turf. Low growing flowers such as daisies, cowslip and self-heal will flower even with regular cutting, but if some areas can be left longer or not cut until late spring following the 'No Mow May' principle, a short 'meadow' can provide great value while maintaining a formal and usable grassed landscape. Small bulbs such as snowdrop, crocus, bluebell and wild daffodils can enhance diversity further, particularly under trees.

Pollinator Planting

Planting for insects can be achieved in formal and semi-naturalistic settings within landscape schemes. Ornamental options include spring/ summer bulbs, herbs, and many garden varieties with single flowers (rather than double), flowering trees and shrubs and climbers such as honeysuckle, roses and ivy. Wildflower areas, either annual seed mixes (which have to be sown every year) or perennial meadow areas that are cut annually to re-grow, can be used in areas that are not cut short, and look best adjacent natural features or boundaries like hedgerows.

Native Hedgerows

These are a Habitat of Principal Importance and also critical habitat corridors linking other habitats. As well as shelter and nest sites for numerous species, they are important bat flight paths and foraging grounds. Within developments they provide shade, wind shelter and visual screening, as well as absorbing rainwater and storing carbon.

The ideal new hedgerow should incorporate a bank and ditch, standard trees and spare dead wood and brash from any site clearance to form a more varied and robust feature. Locally characteristic species suitable for the site should be used, avoiding non-native or non-local species. Elm, Honeysuckle, Dog Rose, Dogwood, and Crab Apple are all valuable to include as they are more scarcely found in new hedges.

Drystone Walls

Part of the landscape of the Moorlands especially in rural areas, these stone walls have heritage value as well as cavities that shelter small mammals, amphibians, reptiles, invertebrates, ferns and lichens. Drystone features could be used on a boundary, on level changes within a site, or as landscape features and even outdoor seating. In more formal areas or where structural performance is needed, stone gabions could perform in a similar way.

Small Native and Fruiting Trees

Trees with blossom and berries help feed wildlife, and look attractive through the seasons. Ideally trees should be visible from shared spaces and streets, but can be standards or included in new or existing hedges where space allows. Suitable smaller native tree species would include Rowan, Crab Apple, Field Maple, Wild Cherry, Hazel, Dogwood and Hawthorn. Domestic fruit trees of any type but especially older and local varieties are great for people and wildlife. They also add rural character and distinctiveness, particularly as many former small farmyard orchards have disappeared.

Rain Gardens

These are small scale sustainable drainage features, planted with wetland tolerant garden or native plants and designed to fill temporarily with rainwater from roofs or driveways. This slows down water allowing it to infiltrate rather than add to flooding or to combined sewers. It also helps combat drought in summer, and makes water a visible asset in the landscape. Rain gardens can be designed into individual front gardens, communal areas or as roadside swales. Roof water can also be used to feed more formal raised ponds or water features that are more ornamental and retain water as a visual feature for residents to interact with.

Green Walls

These can be most simply achieved by growing climbers up sturdy walls or fences – either freestanding boundary structures or the side of buildings. As well as visual screening, they are a space-saving way to provide a large area of green surface. They can provide bird nesting habitat, flowers for nectar and scent, at the same time dampen noise, trap air pollution and help absorb rainwater.

Self-gripping climbers such as ivy are suitable as long as the wall surface is appropriate; otherwise a permanent metal wire or mesh structure should be used to support climbers.

Where there are extensive hard surfaces, heat and water may be limiting factors in summer and so provision may be needed to divert a proportion of roof water to the base of the green wall via a perforated pipe or other appropriate irrigation feature.

Green walls could be required where development will impact sensitive receptors, such as recognised biodiversity features, green belt, flood zones and residential properties.

Green Roofs

Green and brown roofs can be created on flat or slightly sloping (less than 30 degree) roofs, and can be fairly thin and lightweight (extensive) to grow drought tolerant plants and mosses, or use thicker substrate to support a short meadow habitat. Their benefits are multiple, providing habitat for birds and insects, slowing water run-off, urban cooling, and providing some visual amenity. They require a building to be designed structurally to hold the roof, and are most useful in heavily built up urban areas, where there is little ground-level space for green features.

They can also play a valuable role where there is regular surface water flooding or where development encroaches into flood zone 2 or 3. As the green roof holds water above the ground, this can help slow water before it reaches flood-prone land.

Green roofs can be accounted for in Biodiversity Net Gain metrics, and so may be used to achieve a gain where there is limited space on-site. However, some cities such as Sheffield have adopted specific guidance and action plans to increase green roof coverage and require new buildings meeting certain criteria to include a green roof. Green roofs are typically more expensive to install than a traditional roof, due to structural needs, additional materials, and specialist design and build skills - although this would depend on the type of building originally proposed. On the plus side, they provide cooling and roof protection benefits, meaning costs of maintenance and building operation could be lower long-term.

In the largely rural Staffordshire Moorlands, green roofs would not be economical in most locations, versus habitats at ground level. However the cost/benefit balance could be positive where particular problems need to be tackled, such as urban heat, air pollution, surface water drainage and lack of natural green space.

3.1.7 Critical Urban Greening Areas

The more specialist Green Infrastructure (GI) features such as green roofs, walls, urban Sustainable Drainage Systems (SuDS) and urban/street trees can involve greater engineering considerations for building structures and underground excavations e.g. utilities. Therefore, they tend to be justified only where there is a clear need for mitigation on-site, in a constrained area. This could be due to known issues that need to be resolved such as drainage, mitigation for biodiversity loss, or areas where general environmental regeneration is an aspiration.

Further work to interrogate the existing evidence base could identify critical areas where urban greening measures would be required. This could be developed as a project to build on and deliver existing objectives within the Green Infrastructure Strategy and Green Infrastructure Delivery Plan. Various datasets could be overlaid to find the areas within settlements most in need of intervention:

- Accessible natural green space standards audit (showing areas in deficit not meeting standards).
- Tree canopy cover (areas with lower than 20% cover).
- Habitat distinctiveness maps (areas of low/no distinctiveness).
- Urban temperature heat maps.
- Noise maps.
- Air pollution hotspots.
- Flood zones and surface water flooding.

This might be combined with other data on deprivation, regeneration needs and landscape quality to tie in with wider aspirations.

3.1.8 Biodiversity in the Built Environment Policy

Below is generic advice to be applied to all developments where mandatory Biodiversity Net Gain (BNG) is not applicable and in addition to any required species mitigation.

Please note, where mandatory BNG is required, the habitat and species measures will be covered by necessary ecological reports and bespoke ecology advice, so generic guidance isn't needed.

For development where Biodiversity Net Gain is not applicable.

All new homes and extensions:

- 1 bat tile, 1 bug brick
- 1 bird nesting feature from list A – see below
- Small mammal access point in boundary treatment
- At least 1 landscaping feature from list E, appropriate to the site

Per 5 houses/ 0.5 ha area (in addition to the above for all new homes and extensions):

- 1 bat loft in a roof space, or a wildlife tower
- 2 bird nesting features from list B, 1 bird nesting feature from list C where habitat is adequate
- Rain garden feature fed by roof water (if not already included in SuDs design)
- 1 other landscaping features from list E
- Tree planting to achieve 20% tree canopy cover at maturity. Consider including a community orchard or small group of fruit trees (at least 3), where appropriate.

New structures that are within 15m of, or otherwise affect, sensitive receptors:

- Designated wildlife sites
- Strategic habitat corridors (as identified in the GI strategy)
- Semi-natural and linear habitats such as rivers, woodlands, railway lines, green lanes
- Shared public spaces and footpaths
- Existing residential dwellings impacted negatively by visual, noise/other pollution
- Flood zone 2 or 3, or areas prone to surface water flooding
- Green belt
- Green infrastructure improvement projects
- Critical areas in need of urban greening
- Planting of a native hedgerow or green wall at least 2 metres in height, either on or screening the structure.

Green roof to elevations adjacent to the receptor if appropriate, to reduce impacts in certain cases.

New buildings or structures within identified critical urban greening areas:

- Green roof to at least 50% of roof area
- Green walls on 30% of vertical walls
- Urban/ Street trees – density as per existing urban/ street tree policies and best practice, aiming to achieve 20% canopy cover at maturity.

List A- Priority urban birds

House Sparrow, Starling, Swifts, House Martins, Swallows.

List B- Common garden birds

Robin, Wren, Blue Tit/ Great Tit. Nuthatch, Tree Creeper.

List C – Specialist bird species

Tree Sparrow, Pied Flycatcher, Barn Owl, other owls, Kestrel, woodpecker species.

List D- Other species features

Hedgehog box, Log pile, brash pile, dead hedge, compost pile, hibernaculum, bug hotel, bee bank.

List E Habitat Features

Diverse amenity grassland

Staffordshire Moorlands District Council Owned Properties

Publicly owned buildings present a good opportunity to showcase best practice and to make small environmental gains when practical.

An audit of all buildings would be an ideal start: surveying the current wildlife and features present, to build a baseline of constraints and opportunities. Ideally sites could then be assessed using the Building with Nature standards, which set out 12 points covering wildlife, water and wellbeing An assessment highlights how a site meets the requirements and where there are opportunities to improve. This could inform a long-term plan for elements to be retrofitted as part of planned renovations, or via new funding.

Some opportunities could include: green roofs or walls, rain gardens, bird, bat and bug boxes, community orchards, wildlife friendly planting and greening of hard surfaces especially shared spaces.

The council could consider adopting Building with Nature standards for any new development on public land.

5. Site Suitability

5.1 Restoring Roadside Verges and Public Greenspaces for Nature

This report highlights some examples of habitat restoration/creation that can be undertaken in urban areas to improve them for nature, along with providing a range of environmental benefits.

The suggestions include:

- Creation of species rich grassland, focussing on roadside verges
- Hedgerow creation
- Tree planting
- Issues around suitability and location of the changes are addressed, along with management suggestions and how these would impact biodiversity and nature based solutions.

5.1.1 Suitability of sites

The primary functions of most roadside verges relate to road safety and maintenance and service provision. The 0.8-1.2m from the kerb is designed to enable emergency stopping, road maintenance and access to services. This is especially the case for major roads such as motorways, dual carriageways and trunk roads, which are normally managed by Highways England, and verges surrounding junctions where visibility needs to be considered. However, in Staffordshire there are over 6,000km of minor roads, and around 2.5million m^2 of grass verges, indicating a huge potential for biodiversity and increasing the connectivity of greenspace across the county. By using local nature recovery strategies, road networks that increase connectivity of green spaces can be targeted.

For recreational areas any changes in management need to ensure the primary function of the space is still possible. For example, creating a large area of species rich grassland in the centre of a football pitch would not be recommended. However, creating flower rich buffers around the perimeter of the site, or a small area away from the main area of recreation could be beneficial.

Initially focussing restoration on areas adjacent to species rich-grassland has the benefit of creating larger areas that are more cost-effective to manage, as well as being more resilient to environmental pressures such as climate change.

Factors that need to be considered when deciding if a verge or greenspace is suitable:

Health and safety- both for drivers using the road and individuals who will be undertaking management.

Accessibility- will it be possible to access the site with the necessary equipment to undertake suggested management changes

Community support- Need to engage with the community to educate as to why the selected site will look different. Often species rich grasslands can take a few years to develop.

What is the primary function of the site- Is there enough space for both human use and to enhance biodiversity and nature?

Is there space - This is particularly relevant for urban tree planting, need to ensure there is enough space both for the tree to grow but also for the space to be used in an urban context

6.3.1 4.1.2 Managing roadside verges/areas of amenity grassland as species rich grassland

The following steps can be taken:

Step 1 Surveys of proposed sites

Before changes in management are implemented, surveys need to be undertaken in order to locate appropriate sites and to understand what is currently there. These can be done through a combination of desk based research, drive-by surveys to reduce cost and identify potential sites and full botanical surveys if possible. The following factors need to be determined:

- Does the verge have an existing wildlife designation or known value.
- Does the verge have any historic designations or features.
- What is currently growing there- plant identification survey.
- Are there invasive plant species present that need to be controlled.
- Are there any protected species that need to be considered when implementing management changes.
- Other wildlife surveys, such as identifying pollinator species present.

Step 2 Management

General principles

Regular management is essential**:** An annual or cyclical programme is ideal. Rolling management programmes are cost effective and minimise operational impacts.

Timing is key: Wild flowers need to complete their full lifecycle e.g. grow, flower and set seed. Cutting too early and frequently eliminates many species.

Ideal management

Two cuts per year, one in May and then again in August/September (Figure 9)

If only one cut is possible- once between August and September

When mowing, leave parallel strips of vegetation at different times, this delivers best long-term survival for grassland wildflowers (see figure 10). For all cutting events remove the cuttings from the area

Management option		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
One cut									full cut				
Two cuts	Summer and autumn cutting								partial cut		full cut		
	Late winter and autumn cutting		full cut							full cut			
	Dry verges (short vegetation)	regular cuts								regular cuts			
	Species-rich verges with mown edge		1m strip							full cut			

Figure 9 Time table of when cutting should take place for the different management options to help promote species diversity (Credit from Plantlife Managing Grassland Verges)

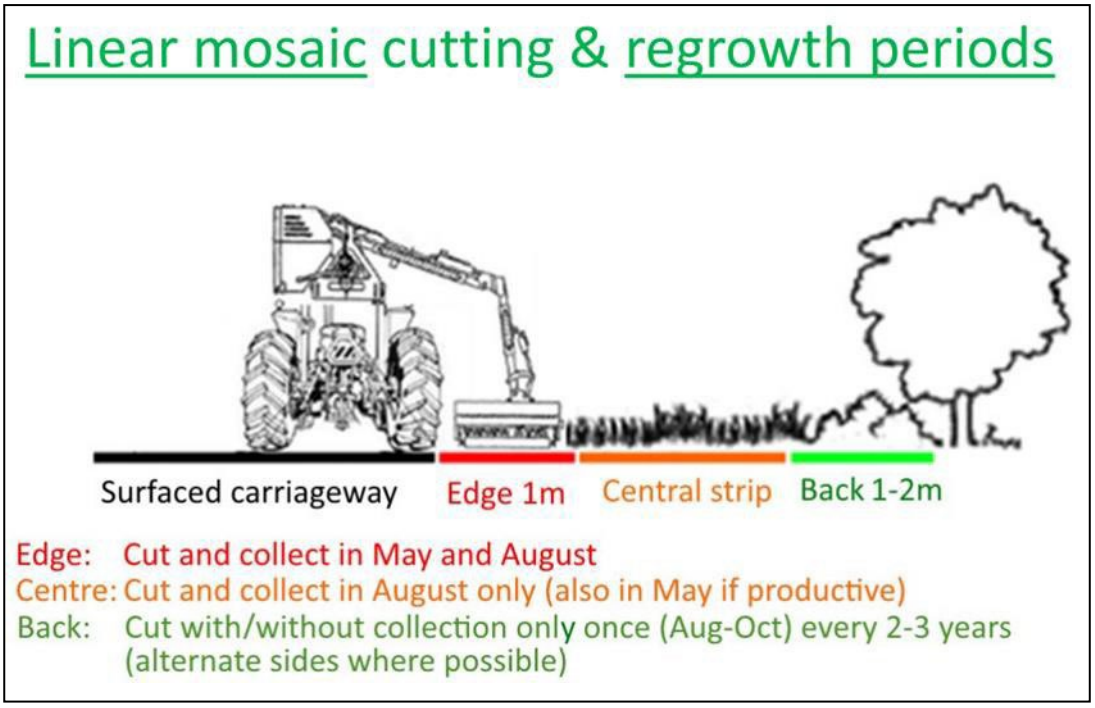


Figure 10 Cutting cycle of a roadside verge to maximise biodiversity benefits. Taken from Lincolnshire Wildlife Trust

Management Specifications for maximising species diversity

Approach 1: Enhancing amenity grassland verges

Some amenity verges/greenspaces have little biodiversity value but they can offer significant potential. Some may already have a good diversity of flowers. Steps:

- Cut and collect twice a year (May and August/September).
- Plug plants can be used to introduce greater diversity and kick-start colonisation and spread.
- Whilst plug roots establish, care must be taken to avoid excessive competition or shading e.g. by removing tussocks.
- Plant out at a rate of 6-10 plugs/m^2, and planting in autumn is recommended.

Approach 2: Restoring open grassland verges

- In areas where there has been no management its first important to reduce soil fertility in order for fine grasses and wild flowers to thrive.
- Targeting areas which have low densities of positive indicator species can result in re-emergence of dormant or latent wildflowers.
- Species diversity can be restored by opening the sward and introducing the management techniques mentioned in the previous section.
- Variety is key, with an increase in vegetation height as you travel further away from the road (e.g. Figure 10 and 11).
- On wider verges, this can be achieved by the standard safety cut, keeping vegetation short nearest to the tarmac, with reduced cutting for the central areas and a longer three to five year cutting cycle for the back to stop scrub and woodland encroachment.
- The final section can be maintained as hedgerow (if there is space, Figure 11).
- Incorporating scrub is important as it provides structural diversity and can be part of grasslands if managed under rotation.
- In large areas of grassland, about 5% scrub can be advantageous.
- When cut it should be cut as close to the ground as possible- hand tools will be more appropriate for smaller areas, and tractor mounted flails for dense scrub.
- Scrub clearance should take place between February and September to avoid disturbing nesting birds.
- Creating areas of scrapes/bare ground is important for a range of wildlife.

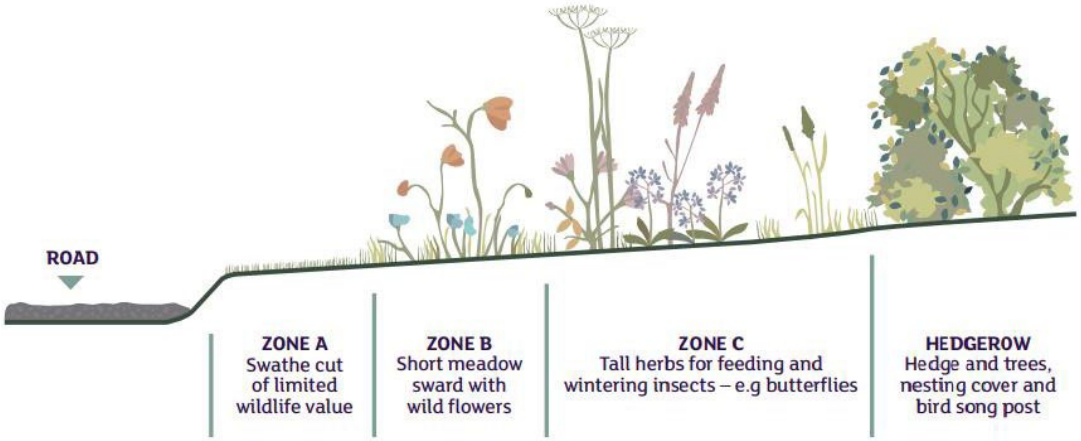


Figure 11 Ideal management zones across the width of a roadside verge (Credit Plantlife Managing Grassland Verges)

Approach 3: Maintaining existing species-rich grassland

- Maintenance of species rich grassland is often less expensive than open aesthetic grassland or amenity grassland as they require fewer cuts.
- Management prescriptions should be detailed in specification works for the area and identified and mapped on GIS systems to allow for future monitoring.
- They are maintained on an annual cycle, using cut-and-collect operations wherever possible.

Equipment

The type of equipment required will depend on the size and location of the site. For example, for a small strip of flat verge a generic ride on mower and hand collection of cuttings may be feasible. Slightly larger sites at more awkward horizontal angles, like banks, may require a tractor mounted flail. These can also cope with tussocky and dense grass swards or light scrub which is mown once or twice a year. The reach of the flail is limited by the length of the side arm. The standard 1-2 metre swathe cut immediately next to the road edge is one width of the flail head. The issue with both of the equipment listed above is they do not collect the cuttings at the same time as they cut. There are cut-and-collect machines which most likely would result in cost savings and make managing green spaces and verges easier for biodiversity. Appendix C includes some examples of equipment.

5.1.3 Hedgerow and Tree Management

Hedgerows

- If creating new hedgerow, it should be planted between November-March as trees aren't losing leaves or producing new buds, so can be transported without being damaged.
- Avoid planting in very cold or windy weather and don't plant in waterlogged or frozen soil.
- Select the species mix, approximately 70% should be hazel, hawthorn and blackthorn. For a good quality hedge there needs to be at least 5 species.
- Plant five plants per metre for a thick hedge, at 40cm intervals.
- In the first spring the shrubs should be cut to around 60cm above the ground to encourage them to thicken.
- Hedges should not be cut every year, as flower buds often form on second-year growth. Trimming on a three-year rotation is best, targeting different sections each year. If a cut has to be done every 2 years reduce intensity to allow incremental growth
- If cutting on a 3 year rotation, you may only need to cut 1/3 of your hedges every year
- Cut in late winter where possible. If cutting can only take place in autumn reduce the intensity of the cut. The larger the hedgerow, the greater biodiversity and carbon benefits
- Traditionally hedge rejuvenation has been achieved through hedge laying, where stems are partially severed at the base and woven into a dense woody linear feature to help promote hedge thickness. This used to occur within the first 10 year of growth and subsequently every 40-50 years. Now it tends to happen more frequently, but it is recommended that it is no more than 5% of its total length at a time
- The traditional method is fairly time consuming and costly. Newer methods have been created which result in similar benefits to wildlife, such as an increase in berry yield and thickening of the lower parts of the hedge. For example, conservation hedging involves stems being cut at the base and layered over, with remaining stems being layered along the line of the hedge rather than to one side. Fewer branches are removed in this method (see Staley et al 2015 for details on the method and results) and it costs about half the amount of traditional hedge-laying.
- For a good guide to hedge management see https://hedgerowsurvey.ptes.org/hedge-management-options and Figure 4.
- Hedges can be maintained in a variety of sites, including wide road verges. They provide multiple benefits for biodiversity and can act as wildlife corridors between isolated sites of good quality habitat.
- In areas of greenspace often used for recreation, such as parks, they can be planted and maintained on the perimeter so as not to get in the way of recreational activities.

Equipment

- Can use a flail trimmer. However, this must be managed with care as has the potential to damage the hedge. This is the most cost-effective method.
- If a hedge has grown too thick a tractor mounted shaping saw can also be used for specific areas.

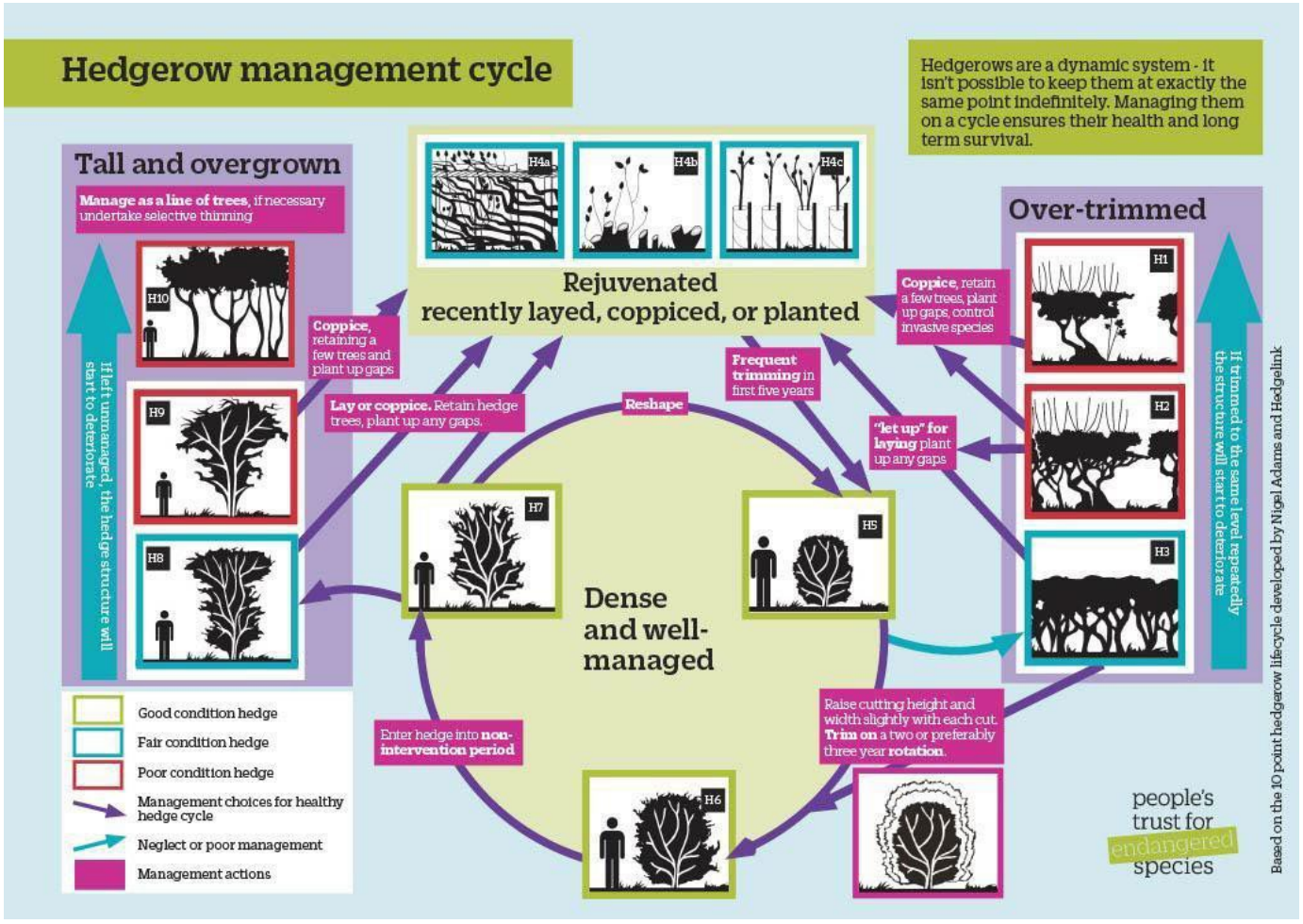


Figure 12 Suggested management cycle of hedgerows. Taken from People's Trust for Endangered Species (https://hedgerowsurvey.ptes.org/hedge-management-cycle)

Trees

- Before new trees can be planted the soil type and its permeability and compaction mustbe understood.
- The tree species selection needs to consider:
  - Tree suitability for your soil type/growth requirements
  - Ecosystem services you want to be delivered (Table 1)

    - Climate change resilience- potentially need to consider a mixture of species, including some that are more drought resistant than others
- If planting species to tackle a specific problem, for example air quality, trees need to be planted within city centres, close to where the pollution is occurring, otherwise they provide minimal benefit.
- Biodiversity always needs to be considered, with no more than 5-10% of an urban forest being made of the same species or family.
- For a useful source on trees and air pollution in cities, see Barwise and Kumar 2020.
- For an example of a major urban tree planting scheme see the San Francisco tree planting strategy (https://default.sfplanning.org/plans-and-programs/planning-for-the-city/urban-forest-plan/Urban_Forest_Plan_Final-092314WEB.pdf).
- Areas where trees could be targeted in the landscape include:
    - Along linear transport routes and waterways
    - Parks, nature reserves and informal green spaces
    - Along streets
    - Domestic gardens
    - Urban greenspaces such as housing estates, school and hospital grounds
    - Urban woodlands

With all the suggested changes monitoring should take place to understand the impacts changes in management are having on ecosystems services and biodiversity.

Table 1 Ecosystem Services

The ecosystem services urban trees can provide, the specific tree characteristics that maximise these benefits with some species suggestions and how to best manage urban trees for these benefits. In all cases native species should be used and the local environment assessed to ensure the right tree is planted in the right place. For example, understanding the soil type, the amount of space available and practicality of management.

Ecosystem Service	Tree characteristics	Species suggestions	Management Suggestions
Air Quality	Rugged and hairy surfaced leaves Large canopy Evergreen	Silver Birch Yew Elder (Wang et al 2019) European Beech	Need to be planted near to city centres/where pollution is highest in order to have an impact. Busy traffic

			corridors or commuter routes.
Temperature Regulation	Dense canopy cover Simple leaf shape with low thickness	Tilia cordata (lime tree) (Rahman et al 2017) Acer campestre (Field Maple) (Rahman et al 2019)	Trees growing over asphalt have biggest impact on surface temperature compared to when growing over grass. If planted near buildings can reduce electricity consumption. Parks of at least 3ha are cooler than the surrounding urban areas.
Carbon Sequestration	Fast growing Long living Large leaves Low maintenance Native	Oak Horse chestnut Scots Pine Silver Birch	Need to be low maintenance otherwise emissions associated with management can outweigh sequestration rates. If trees are being planted in an area where they are likely to be short lived, then choose those that reach maturity faster. Plant replacement trees when trees are lost and use timber in infrastructure to ensure carbon is 'locked'.
Flood mitigation	Large leaf surface area Mature canopy	Large and medium broadleaf evergreens Large conifers Hedgerows consisting of hawthorn, blackthorn and hazel	Need to consider space requirements, if planting on a pavement or roadside verge large trees may not be suitable.

5.1.4 Environmental benefits of all suggested management options

Biodiversity

- Mowing twice per year with removal of hay increases the number of flower species and total number of inflorescences along with invertebrate abundance and flower visits (Noordjik et al 2009).
- Rotational cutting is beneficial for species, especially pollinators, as immediately after a cut, forage is reduced to almost nothing. By cutting areas at different times this ensure there is forage available throughout the flowering season.
- Urban meadows support a wider range of plant and invertebrate species compared to mown grassland (Norton et al 2019).
- Urban corridors between areas of good quality green space have been found to significantly increase species biodiversity in urban areas due to them assisting with the dispersal of animals and plants (Beninde et al 2015).
- Reducing mowing frequency in urban greenspaces other than verges has the same effect, with plant species richness and diversity increasing (Chollet et al 2018).
- Hedgerows are highly valued for their ability to provide food and shelter for a wide range of species and provide corridors between habitats. However, in urban environments when places adjacent to a hard surface their biodiversity was reduced. When managing urban hedges, the surfaces immediately adjacent needs to be considered (Gosling et al 2016).
- Hedgerows have been found to be effective secondary habitats for Species of Conservation Concern, and can act as dispersal corridors between isolated habitat fragments (Wehling and Diekmann 2009).
- Urban parks that contain a variety of habitat types generally have higher species richness and biodiversity (Cornelis and Hermy 2003). If managed appropriately, urban woodlands can have a vegetation structure that is comparable to woodlands in more rural contexts and allow for the maintenance of numerous species (Croci et al 2008).
- Habitat connectivity between rural woodlands can help increase species diversity within urban woodlands (Niemela et al 2002).

Carbon sequestration and storage

- There is little research on the carbon sequestration abilities of species rich grasslands on roadside verges. However, species rich hay meadows seeded with *Trifolium* species have been found to remove up to 11.62 tonnes of CO_2e/ha/yr (DeDeyn 2011).
- Species rich grasslands are able to store more carbon than species poor monocultures (one study stating 178% more) due to natural plant species succession and the importance of a variety of functional traits, with some

species releasing nitrogen and others taking this and fixing it in the soil (Yang et al 2019).

- A reduction in mowing will also result in fewer emissions associated with the grassland management.
- Although taking up to 20 years for major carbon benefits to be seen, trees are able to remove and store significant amounts of carbon. On average, 1ha of mixed broadleaf woodland can remove up to 10 tonnes of CO_2 per year when averaged over the first 30 years post planting (Woodland Carbon Code).
- Hedgerows and trees in general store carbon both in the aboveground woody biomass and below ground in the soil. In the top 50cm of soil beneath hedgerows there was 31% more carbon compared to the adjacent intensively managed grass fields, with old hedgerows storing almost double that amount (Biffi et al 2022).
- Carbon removal in soils beneath hedgerows was found to be 5.43 tonnes of CO_2 /ha/yr, with rates higher in larger hedgerows (wider and taller)

Flood mitigation

- Vegetation, especially trees, contribute to reduced flood risk and soil erosion by absorbing run-off, reducing flow rates and intercepting rainfall.
- Planting trees and hedges along appropriate verges will contribute to storm water management.

Air quality

- Hedgerows have been found to control and reduce concentrations of traffic pollutants and can affect the air quality at street level, acting as a remedy to pedestrians and resident's exposure to pollutants (Gromke et al 2016).
- Trees and shrubs remove gaseous air pollution mainly by uptake via the leaf stomata. They also intercept airborne particles, with some of these being absorbed into the tree or retained on the plant surface.
- A study in Strasbourg, France, found that publicly managed urban trees removed around 7% of the particulate matter emissions in the city (Wissal et al 2016).

Other benefits

Economic

- Reduced maintenance costs associated with mowing e.g. Hartlepool Council in the North East of England has saved £35,000 per year since 2014 mowing 10km of road verges by switching from regular grass cutting every 3 weeks to informal annual planting (National Environmental research Council 2017 Greening the Grey report).
- White City Estate in London has a small area (around 300m^2) managed as an urban meadow, which cost less than £500 to create and less than £100

per year to maintain, where before with regular mowing it was costing double this.

- Dorset County Council's annual budget for highway verge management dropped from nearly £1m to £650K in five years under a cut and collect, low fertility approach (Greenfield 2020).
- There will also be a reduction in costs associated with herbicide treatments.

Changes to regimes will however incur initial variations to finance based on different equipment, collection of arisings or cuttings, staff training and monitoring.

Tree planting will have high initial costs and maintenance for the first few years. However, savings that are harder to quantify include those associated with the presence of trees, such as urban cooling, flood mitigation and human health benefits**.**

Cultural

- Local residents generally rate plots higher for aesthetic preference that have high plant richness and medium height vegetation compared to short low diversity vegetation that represents mown-amenity grassland.
- There are numerous health benefits to having easy access to nature, such as lower stress levels (Wells et al 2003), reduced rates of anxiety and depression (Park et al 2010), and a general improvement to well-being.
- Two studies used neurophysiological measures to assess brain state. Near-infrared spectroscopy (NIRS) of adults revealed a more relaxed brain state, and fewer feelings of anger or hostility when looking at forest views. MRI scans of adult city dwellers living close to a forest displayed an amygdala structure associated with better capacity to cope with stress (Wolf et al 2020)
- It is important that changes are communicated well and do not look abandoned as this can have negative social impacts.

Table 2 Management Options

Management option	Effect on ecosystem services and biodiversity	Comments
Mowing – reduced frequencies	Enhanced biodiversity Increased pollinator numbers Enhanced aesthetics from increased floristic diversity Potential for reduced aesthetics if taller vegetation gathers litter or appears untidy	Verges that are cut twice per year show the highest biodiversity for plants and invertebrates.
Mowing – altered timings for	Enhanced biodiversity Increased pollinator	Cuts in early and late summer (i.e. May/June and

verges currently receiving two cuts per year	numbers Enhanced aesthetics from increased floristic diversity	August) show enhanced plant and invertebrate biodiversity. Maintenance costs likely to remain static if the proposed timings of cut do not require extra vehicles.
Mowing – mosaic cutting	Enhanced invertebrate biodiversity Increased pollinator numbers Potential for reduced aesthetics if vegetation strips lead to uneven appearance	Plant diversity would not be affected but the continued presence of flowers in the different strips would increase availability of nectar sources and benefit insect diversity and abundance. A staggered cutting regime will likely increase maintenance costs since sites would need to be visited twice as often.
Mowing – partial cutting	Enhanced biodiversity Increased pollinator numbers Enhanced aesthetics from increased floristic diversity and enhanced signs of care	Frequent mowing of first metre nearest road would maintain sight lines. Less frequent mowing of area further back would enhance plant diversity and insect diversity. Reduced maintenance costs due to reduced cutting area, and magnitude of savings will increase with verge width.
Removal of vegetation cuttings from grass verges	Enhanced biodiversity Potential compost source for brownfield sites	Removal of cuttings will enhance roadside verge biodiversity of plants and animals. Upfront and maintenance costs expected to increase due to the need for collection and disposal. This may be offset to some extent by composting cuttings although use may be limited due to contamination.
Decreased herbicide use	Reduced possibility of contamination of nearby ecosystems	Glyphosate should not be used if heavy rain forecast due to increased mobility leading to contamination of aquatic ecosystems.

		Decreased herbicide use will lead to some savings although maintenance costs may increase if extra labour required to control vegetation at points where mowers cannot reach.
Wildflower seed mix	Enhanced biodiversity Enhanced aesthetics	Presence of wildflower species can support insect biodiversity. Upfront costs would involve purchase of seed mix and site preparation. Maintenance costs may decrease if savings from reduced mowing completely offset reseeding costs.
Establishment of Yellow Rattle (Rhinanthus minor)	Enhanced biodiversity Enhanced aesthetics arising from floristic changes	High density sowing required (at least 1000 seeds per m^2) for successful establishment (Ameloot et al., 2006). As well as enhancing biodiversity, reduced biomass production may lead to reduced mowing frequencies and reduced maintenance costs.
Tree planting	Carbon sequestration Pollution interception Local climate regulation Noise interception Stormwater management Improved aesthetic quality Enhanced biodiversity	An urban tree planting program would involve large upfront and some increased maintenance costs but potentially contribute to savings in other areas due to provision of a wide range of ecosystem services. Urban trees have been demonstrated to contribute to support for local biodiversity, enhanced carbon sequestration, enhanced local air quality and removal of PM, particularly if planting is targeted in high traffic pollution areas such as roundabouts; mitigation against urban heat island effect, enhanced stormwater management through

		interception of rainfall and water uptake by roots, noise interception when planted in dense strips; and aesthetic improvements and enhanced psychological well-being. The magnitude of benefits varies between species and there are trade-offs between different services.

Management recommendations to enable 75% of SSSIs in Staffordshire Moorlands to be in favourable condition by 2030.

There are 23 SSSIs that are at least partially located within SMDC. Of those that are not entirely within the SMDC boundary (excluding Peak Park);

- Leek Moors SSSI has a small amount located within Cheshire and Derbyshire.
- Hamps and Manifold Valleys SSSI a small amount is located within Derbyshire.
- The Dove Valley and Biggin Dale SSSI has approximately half located within SMDC.
- Hulme Quarry SSSI approximately a third is located within SMDC and two thirds are located within Stoke-on-Trent City Council.
- Stanton Pastures & Cuckoocliff Valley SSSI is largely located within East Staffordshire District Council, with a small amount in the SMDC boundary.

Details of the SSSI sites have been included in Appendix B, Table 1 and management recommendations have been provided for each site to bring them into favourable condition.

5.1.5 Benefits to improved biodiversity Conclusions

There are a range of environmental and non-environmental benefits to restoring greenspaces for nature. In order to maximise these benefits, steps need to be taken to ensure the right habitats are restored in the right place, and their continued management and process is monitored. By creating good quality habitat along corridors, such as roads and canal sides, sites can be linked together, increasing connectivity and helping species disperse across the currently fragmented landscape. Managing our urban greenspaces more for nature will improve community wellbeing, whilst at the same time being more economical than with traditional amenity grassland management.

Sites can be used both for recreation and nature, and have the potential to make a huge impact on ecosystem regulation and biodiversity, but also for our own wellbeing.

5.2 Local Authority Site Carbon Audit

Nature based solutions are actions that protect, sustainably manage and restore natural or modified ecosystems, providing human well-being and biodiversity benefits. For example, restoring a floodplain and reducing flood risk to neighbouring houses. An offshoot of nature based solutions are natural climate solutions. These are conservation, restoration and improved land management actions that increase climate storage or avoid greenhouse gas emissions in landscapes across the globe. We are currently facing not only a biodiversity crisis, but also a climate crisis, with countries around the world agreeing to net zero targets. This means we must remove as much CO_2 and other greenhouse gases (GHGs) as we emit into the atmosphere, with natural climate solutions at the forefront of this ambitious but essential goal.

Often the contribution urban greenspaces can make towards climate mitigation and conservation are overlooked. However, there are 1.77 million hectares of urban area in Great Britain, of this 556,000 hectares are classed as natural land cover (31%, ONS) and 23% of this has a specific function, such as public gardens and parks. This is a significant area which, if managed effectively, could make major contributions towards climate and flood mitigation, biodiversity and human wellbeing. For example, Forest Research estimate that urban woodland makes up around 7.5% of total woodland in Great Britain and removed an estimated 1,366,000 tonnes of CO_2 in 2017 (ONS). In 2017 the avoided health costs attributed to urban green spaces amounted to around £162 million due to their part in removing air pollutants. These figures highlight the impact our urban green spaces have on our environment and our lives. However, many of these green spaces are managed purely for one purpose, e.g. recreation. If, where possible, these areas were managed for both human use and the environment, the benefits they could provide could be significantly increased.

5.2.1 The Carbon Cycle

Carbon is cycled between the atmosphere, land and ocean due to processes of photosynthesis, respiration, decomposition and combustion. Ecosystems can capture this carbon, in the form of carbon dioxide (CO_2) and store it in their vegetation and soils. Carbon stocks held in ecosystems fluctuate naturally as habitats progress through successional changes or degrade. When carbon inputs are greater than emissions, then the ecosystem is a sink. However, if emissions are greater than inputs then it can become a net source of carbon. Generally, undisturbed habitats have reached an equilibrium, where they sequester as much carbon as they emit. However, through changed management or disturbance, habitats are capable of no longer being in equilibrium and can instead become a carbon sink or source.(Figure 13).

5.2.3 Ecosystems and Carbon

Different ecosystems and habitats are capable of capturing and storing carbon at different rates. For example, young woodland is very efficient at removing carbon from the atmosphere due to the increased demand from photosynthesis to allow for growth during the early stages of development. Just as healthy ecosystems are capable of sequestering significant amounts of CO_2 , unhealthy habitats are capable of emitting. The most famous example being degraded peatlands. Peat is plant material which is partially decomposed and has accumulated over thousands of years in waterlogged conditions due to incredibly slow degradation. Peat stores the carbon plants have absorbed from the atmosphere, meaning they are acting as significant carbon stores. This also means if a peatland ecosystem is damaged, often through drainage, it is capable of emitting this stored carbon through the increased rate of decomposition of the plant material by the bacteria found in the soil. This results in the production of CO_2 along with other, often more damaging GHG emissions such as methane and N_2O.

Correctly managing and maintaining our existing habitats whilst also restoring those which are damaged will be vital in achieving net zero and halting the climate crisis. However, there are of course trade-offs between management for carbon capture and biodiversity, which must always be considered when making management decisions.

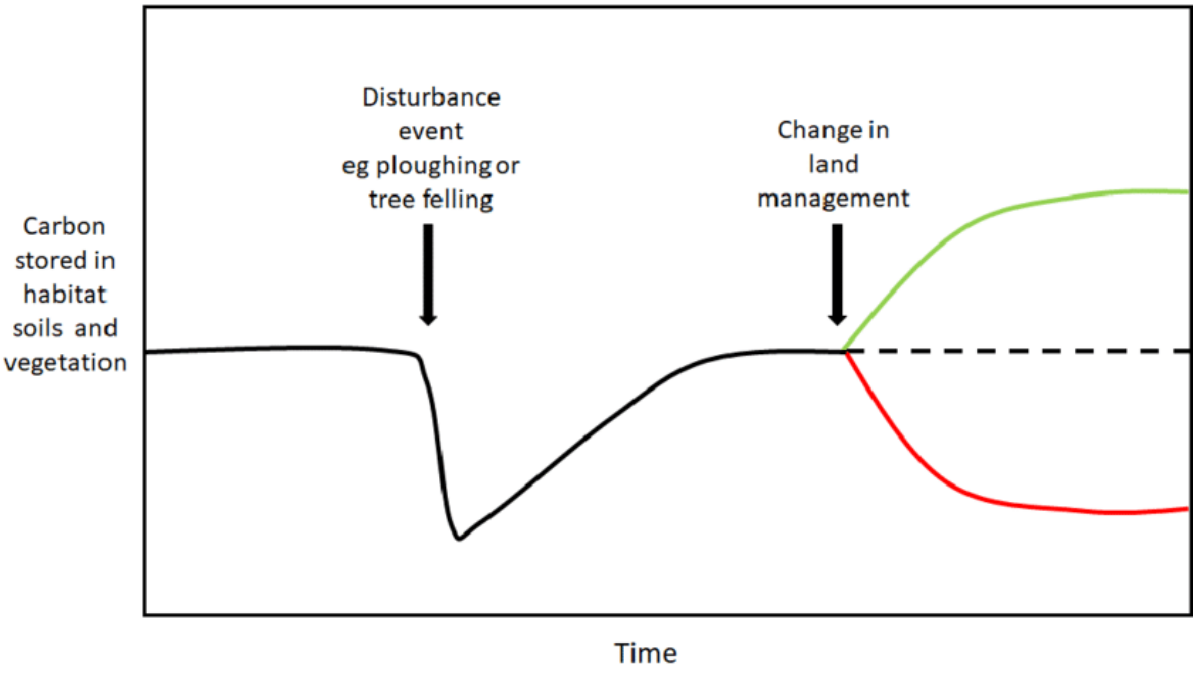


Figure 13 Conceptual model of habitat carbon stock equilibrium and land use change. Taken from the 2021 Natural England report (Gregg et al 2021)

4.2.3 Reasons for this Report

The aim of this section of the report is to determine the current carbon storage and sequestration of 17 SMDC managed sites and 9 SWT managed sites (still in SMDC ownership). This will highlight where changes in management may be able to influence these figures in the future. Three sites and how changes in management may influence their carbon sequestration and storage estimates have been examined in detail, with general suggestions for the remaining 26 sites.

Maps and estimates on carbon sequestration and storage for all sites have been created and are later in this section. These maps and figures will provide baseline estimates which can then be referred to in future to determine how habitat management is influencing the carbon sequestration and storage of different sites. This report focuses on carbon capture and does not address issues around biodiversity and other potential nature based solutions. These would also need to be incorporated into any management decisions going forward.

5.2.7 Carbon Sequestration Methodology

The habitat data for this report was taken either from existing habitat surveys, or if these were not available a combination of the Living England Habitat Map (accessed through MAGIC), aerial images and ground surveys. Habitats are then assigned into broad categories depending on their age, management and composition. This allowed for a literature search for studies on carbon sequestration and storage which examine these broad habitat groups, selecting studies which matched the conditions on the sites as closely as possible. Most figures are taken from the recent Natural England report on carbon sequestration by habitat (Gregg et al 2021) or the Woodland Carbon Code for woodland figures. Many factors influence the carbon sequestration of habitats, including age, health and management style. When determining the sequestration figure to use these factors are taken into consideration as much as was possible with the information available.

When deciding on what figures to use from the literature the source material of where the numbers have originated is consulted. When multiple figures and studies are available, decisions on which figure to assign are driven by which study has the most similar environmental parameters to the site where numbers are being assigned. For example, location, management style and where appropriate age of habitat. For soil storage estimates figures used are for soil depths of up to 15cm unless stated otherwise.

Figures used are reported as tonnes of CO_2 or CO_2 e (CO_2 equivalent) per hectare per year. CO_2 e includes data from other greenhouse gases (GHG) not just CO_2 , such as methane and nitrous oxide. Methane and nitrous oxide have higher warming potentials than CO_2 . This means, over a 100-year period 1 tonne of

methane is equivalent to 27 tonnes of CO_2 and 1 tonne of nitrous oxide is equivalent to approximately 300 tonnes of CO_2. When a figure is negative this indicates the habitat is removing carbon, when positive it indicates carbon is being emitted. Sequestration relates to the amount of carbon dioxide being removed from the atmosphere per year, taking into account emissions due to processes such as soil respiration. For carbon storage figures are reported as tonnes of carbon per year. Carbon storage relates to the amount of carbon present in the soil and aboveground vegetation of a habitat. Healthier habitats are able to store more carbon per hectare than those that are degraded, and therefore will be able to sequester more CO2 per year for longer time periods.

To determine the total sequestration and storage of a habitat the assigned figure is multiplied by the total area of the habitat in hectares. This gives the total amount of CO_2 removed or emitted from the atmosphere per year for that habitat. For storage, it indicates how much carbon is stored in that habitat per year. Maps were created using Arc Pro software to visually display the differences in carbon storage and sequestration by habitat.

Results

5.2.5 SMDC Managed Sites

Across the 17 SMDC managed sites, a total of 59 tonnes of CO_2 ($tC0_2$) or CO_2 equivalent (tCO_2e)are sequestered per year, and 5,480 tonnes of carbon stored (Figure 4.2).

The site which is removing the most CO_2 overall per year is The Waste (16 tCO2e/yr), with St Chads removing the least (0.032 tCO2e/yr). When size is taken into account, The Waste is still removing the most per hectare (5 tCO2e/ha/yr) but Church Road is removing the least per hectare (0.02 tCO2/ha/yr).

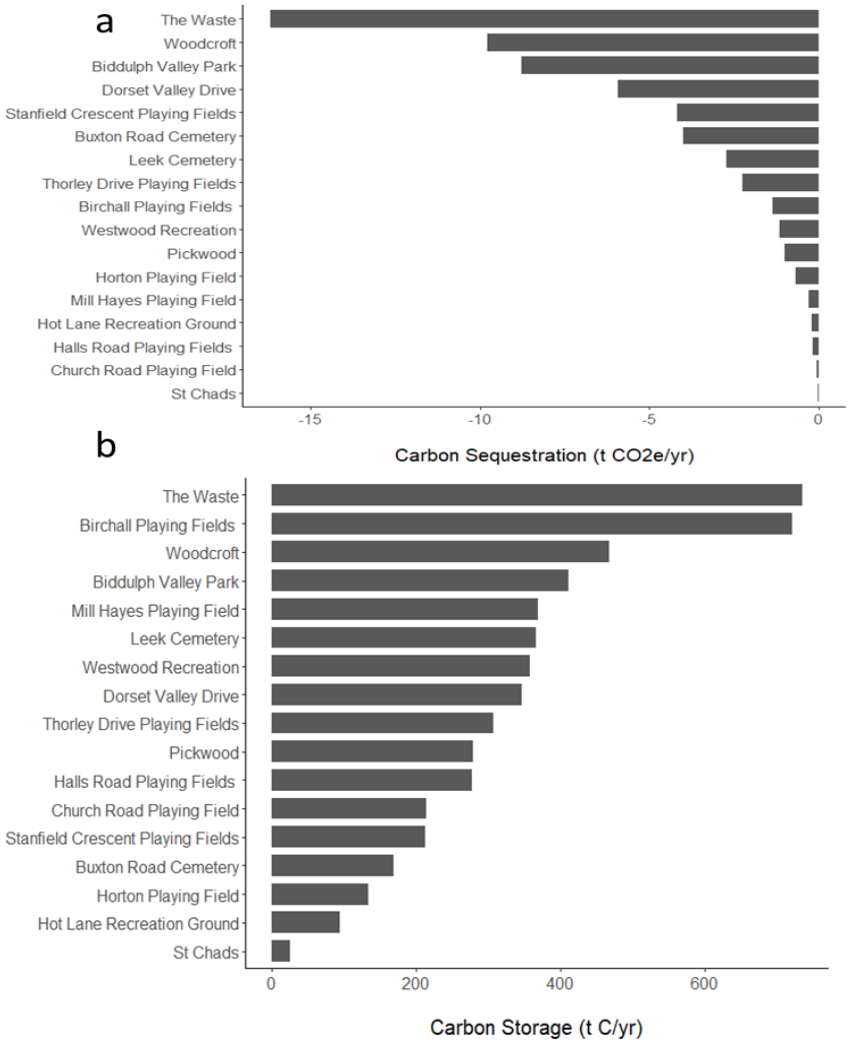


Figure 14 Carbon sequestration and storage

Figure 14 shows all 17 sites managed by SMDC included in this report ranked by (a) the most carbon removed and (b) the most carbon stored across all habitats. In figure A, a negative number indicates a site is removing CO_2 from the atmosphere

The Waste has the highest amount of carbon removal due to it containing a significant area of woodland (2.72ha, Figure 15). The habitat type removing the most CO_2 across all sites is woodland, at -56 tonnes of CO_2 e per year (Table 3).

The only other habitat which has been defined as sequestering carbon is natural grassland, which includes hay meadows, a habitat which has been found to continue to remove carbon for a significant period of time due to the mowing regime associated with its management (Yang et al 2019). Natural grasslands found across the SMDC managed sites are removing nearly 3 tonnes of CO_2 e per year (Table 3).

Amenity grasslands have been given sequestration figures of 0 due to limited research on urban grassland management and carbon sequestration. Some studies suggest regularly mown grasslands do have a net removal of carbon from the atmosphere (Hayden 2020). However, this often is not enough to compensate the emissions associated with their management, e.g. fuel use of mowers and disposal of grass clippings (Hayden 2020).

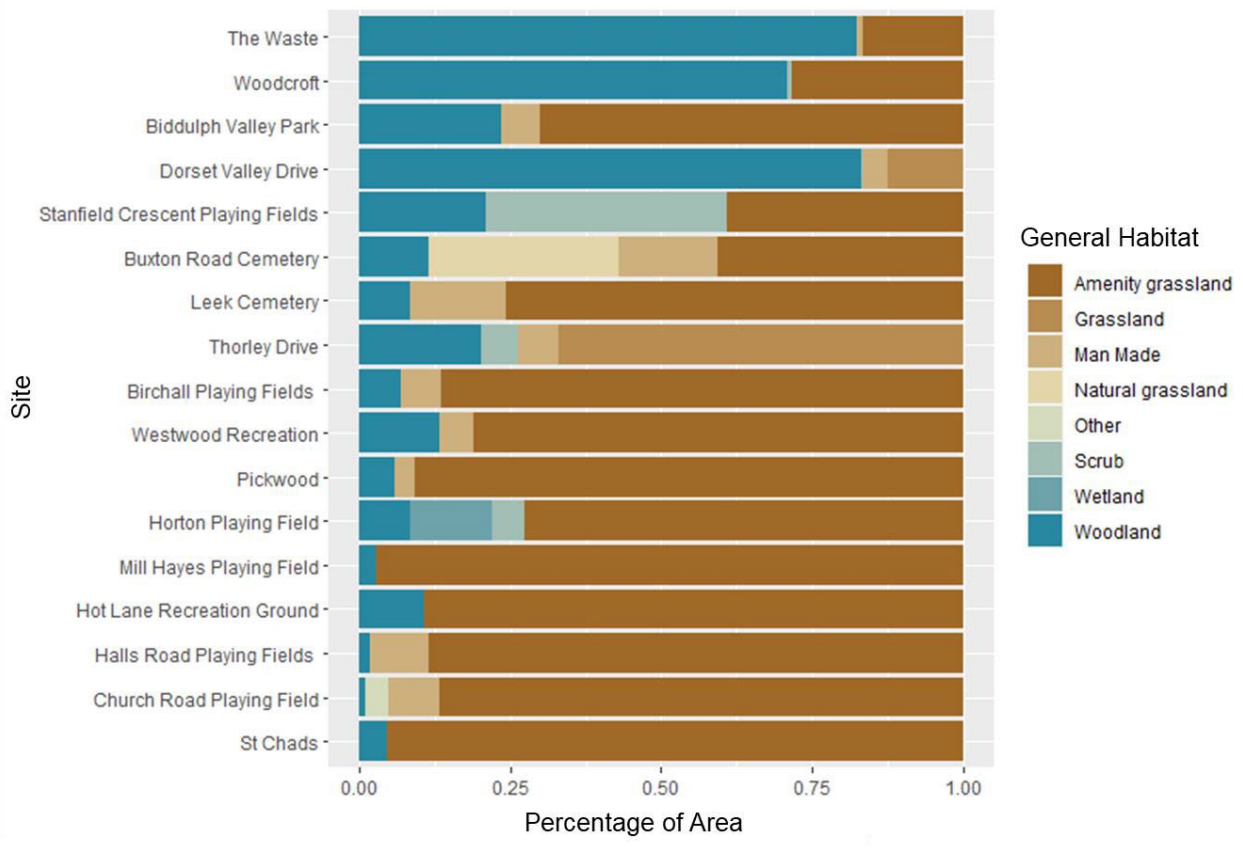


Figure 15 Each SMDC managed site and the proportion of the total area each of the general habitats account for.

Woodlands also store the most carbon across sites (2,345 tonnes, Table 4.1), and although they do not remove significant levels of carbon from the atmosphere the amenity grasslands are storing nearly 3,000 tonnes of carbon across the 18 sites.

Amenity grassland is grassland which is highly managed for public use, such as in parks and recreation grounds, manmade includes buildings, paths and roads, natural is grassland that is less intensely managed, such as hay meadows or acid grasslands, other is allotments, scrub includes tall ruderal herbs and bramble and very young trees, wetlands includes areas dominated by purple moor grass and woodland encompasses all woodland ages and compositions.

Broad Habitat	Carbon Sequestration (tCO2e/yr)	Carbon Storage (tC/yr)	Total Area (ha)
Amenity grassland	0	2966.392	49
Manmade	0	0	4
Natural grassland	3	50	1
Other (allotments)	0	9	0.2
Scrub	0	90	1
Wetland	0	21	0.2
Woodland	56	2346	12

Table 3 Total carbon sequestration and storage for the broad habitat types found across all 17 SMDC managed sites.

4.2.6 SWT Managed Sites

Across the 9 sites which are now managed by SWT a total of 646 tonnes of CO_2/yr is being removed, with 39,377 tonnes/yr being stored. This is significantly more than the 17 SMDC managed sites (59 tonnes sequestered, 648 stored).

The site removing the most CO_2 e is the Biddulph Valley Way (343 tCOe/yr, Figure 4.3). This is most likely due to the large amounts of relatively young woodland present throughout the site. Woodland across the sites is removing the most CO_2e (623 tCOe2/yr, Table 4).

The site removing the least amount of CO_2e is Marshes Common (0). This is due to this site containing no habitats thought to have reached carbon equilibrium. However, there were signs of young heather growth at the site, meaning it is likely carbon removal is occurring. This is because heather in the building phase (around 15 years old) has been found to sequester significant amounts of CO_2e, but before and after this point carbon removal is minimal. In order to remain conservative and due to the difficulties in assessing heather age, all heather is assumed to be net neutral.

Although Marshes Hill Common is removing the least amount of carbon from the atmosphere, it is storing more than Hoften's Cross Meadow. This is due to heathland habitats storing significant amounts of carbon both in the soil and the aboveground woody biomass, even compared to species rich grasslands.

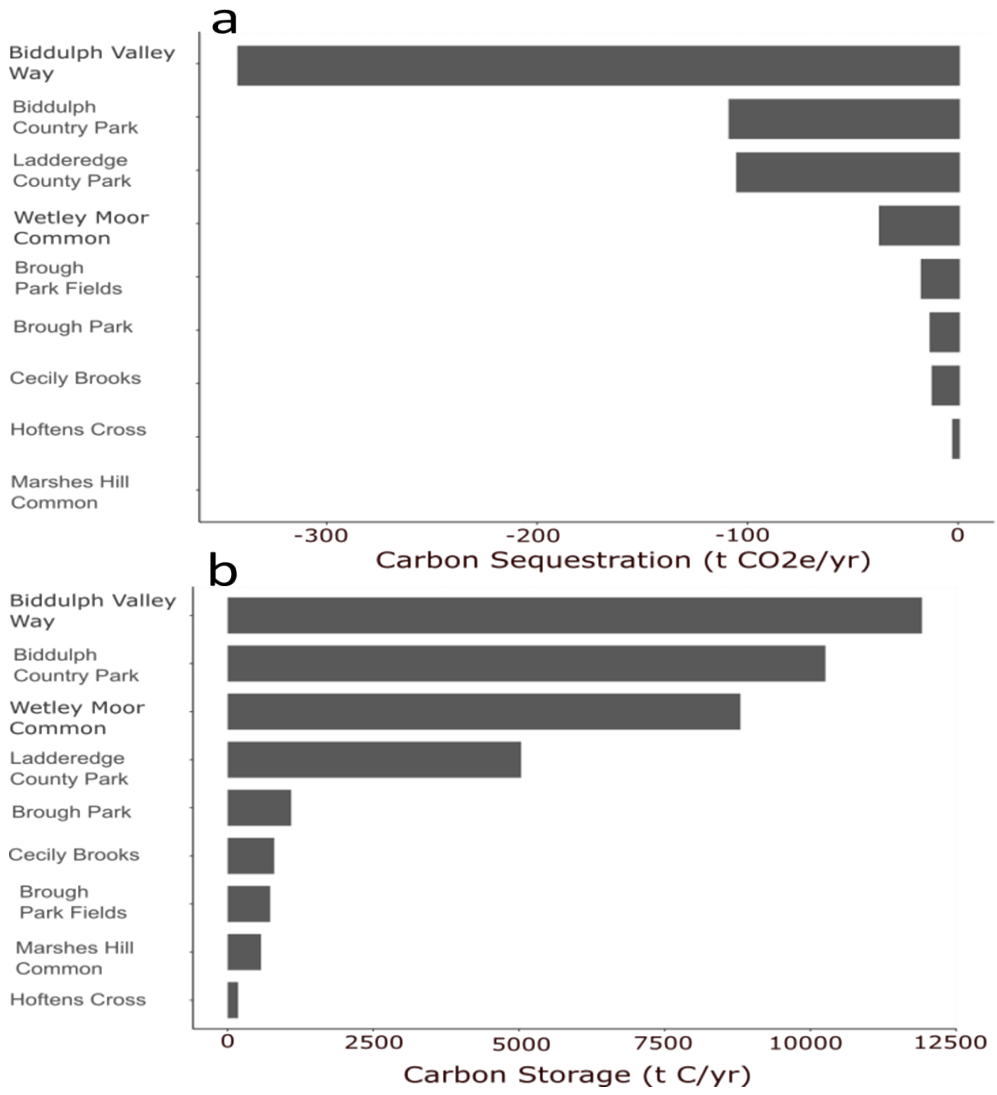


Figure 16 All 9 sites managed by SWT included in this report ranked by (a) the most carbon removed and (b) the most carbon stored across all habitats.

Wetley Moor Common is the only site estimated to have habitats that are both removing and emitting CO_2 e due to areas of degraded fen/marsh/swamp throughout the site (Figure 17). They are classed as degraded due to the dominance of *Molina* and only small amounts of *Sphagnum* present.

Much of Wetley Moor Common is in a degraded state, and at the most recent SSSI assessment was classed as unfavourable and declining. That being said, it is still storing a significant amount of carbon (nearly 9,000 tonnes), with this figure able to improve if habitat restoration were to take place.

Even with most of the heathland on the included sites being in poor condition, heathland habitats are still storing more than both amenity and natural grassland habitats (Table 2).

Amenity grassland is grassland which is highly managed for public use, such as in parks and recreation grounds, manmade includes buildings, paths and roads, natural is grassland that is less intensely managed, such as hay meadows or acid grasslands, scrub includes tall ruderal herbs and bramble and very young trees, wetlands include fens/marshes/swamps and woodland encompasses all woodland ages. A negative sequestration figure indicates a habitat is removing CO2e. A positive figure means it is emitting

Broad Habitat	Area (ha)	Carbon Sequestration (tCO_2 e/ha)	Carbon Storage (tC/yr)
Amenity grassland	12.275	0	737
Heathland	64.412	0	5996
Man Made	12.014	0	0
Natural grassland	53.654	-26	3550
Pond/Lake	1.569	0	0
Scrub	4.579	-0.564	343
Wetland	1.819	+1.402	153
Woodland	100.563	-623	28,597

Table 4 Total carbon sequestration and storage for the broad habitat type found across all 9 SWT managed sites.

As with the SMDC sites, those containing the highest proportion of woodland are removing the most CO_2 e (Figure 4.3). However, Brough Park Fields and Hoften's

Cross Meadow contain relatively high proportions of woodland but are not major CO_2 removers. This is due to the woodland present on these sites being predominately hedgerow or very young. Trees don't begin to sequester significant amounts until around 30 years, and hedgerows have similar sequestration rates as young woodland (Robertson et al 2012).

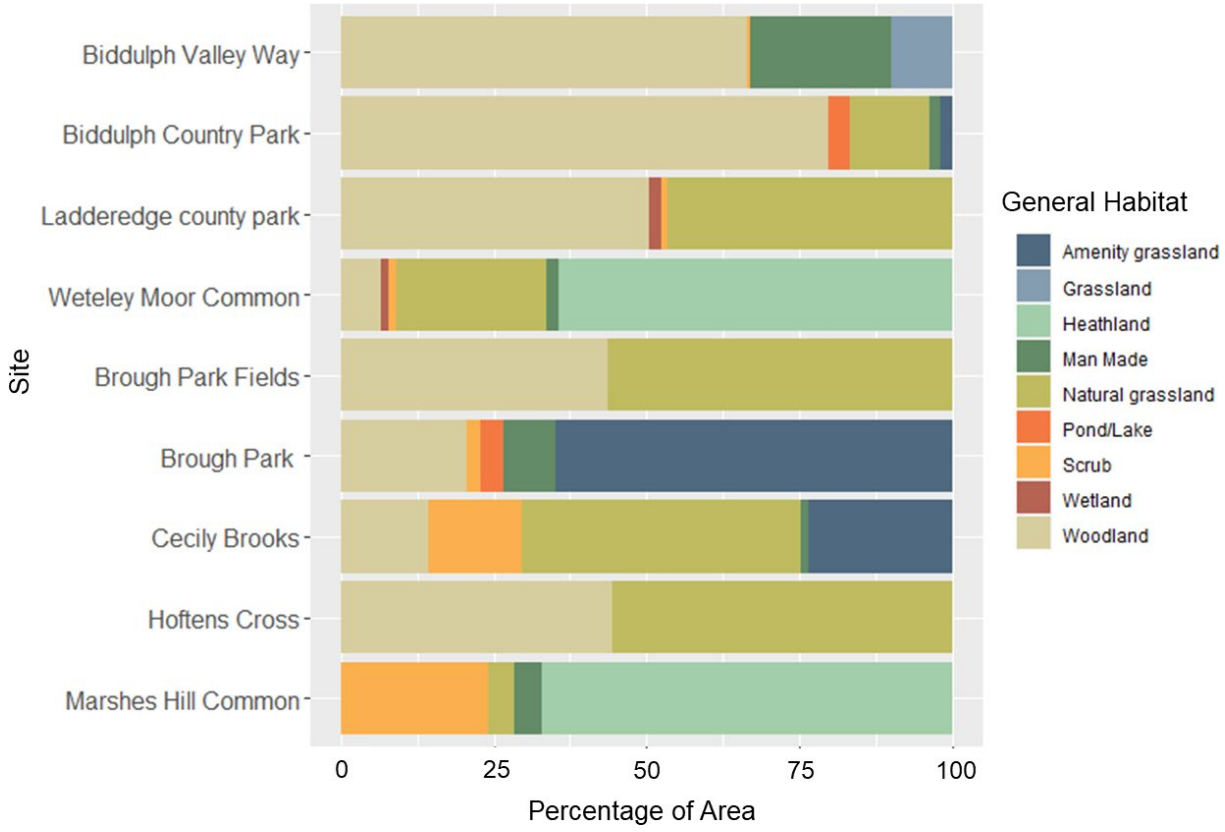


Figure 17 Each SWT managed site and the proportion of the total area each of the general habitats account for.

Discussion

In general areas managed for conservation have the highest carbon sequestration and storage estimates. However, recreation sites and those with other purposes, such as cemeteries, are able to contribute to CO_2 removal.

For example, Buxton Road Cemetery is removing around 4 tonnes of CO_2 e per year. For perspective, the average UK car emits approximately 1.7 tonnes of CO_2 per year.

Other urban green spaces which may not be associated with their climate regulation include playing fields.

For example, Stanfield Crescent Playing Fields is also sequestering around 4 tonnes of CO_2 e per year. This is due to the woodland border surrounding the

amenity grassland, and this figure is likely to increase in the next 10 -20 years due to the growth of some recently planted trees.

The figures given for the cemeteries in this report are also likely to be less than in reality. This is because many cemeteries are managed with less intense mowing regimes and have higher vegetation species diversity than recreational parks. However, due to limited research on cemetery management and carbon sequestration they were treated the same and assumed to be at net neutral.

There are many ways in which management can be adapted to help increase carbon storage and sequestration, whilst still allowing sites to maintain their main purpose. A few sites have been chosen as examples to demonstrate potential carbon gains, with overall management suggestions for all sites given in Table 5.

The following SMDC managed sites have been selected as they sequester some of the smallest amounts of CO_2 out of the reviewed sites and are representative of how many of the SMDC sites are currently managed.

4.2.7 Church Road Playing Fields

Currently Church Road Playing Fields in Biddulph is predominately amenity grassland with a small amount of hedgerow and young trees around some of its perimeter (Table 3, Figure 18)

As Church Road is an area for recreation, such as playing football and other sports, having the entire site consist of woodland or species rich grassland would be impractical. However, the site is relatively large at nearly 4 hectares, with only around 2 hectares set aside as a designated football pitch. This leaves a remaining 2 hectares that can be set aside for nature and general recreational use. An example of how a change in management can influence the carbon sequestration and storage of the site is stated in Table 3.

Current habitats and their carbon sequestration and storage estimates along with how these estimates may change with the proposed changes in management outlined in text for Church Road Playing Fields. Numbers in brackets indicate the difference between current and potential.						
Habitat	**Current Area (ha)**	**Current Total Sequestration (tCO2e/yr)**	**Current Total Storage (tC/yr)**	**Potential Area (ha)**	**Potential Total Sequestration (tCO2e/yr)**	**Potential Total Storage (tC/yr)**
Allotment	0.14964	0	8.604	0.150 (0)	0	8.604
Amenity Grassland	3.3164	0	198.984	2.369 (-0.975)	0	142.14 (-56.844)
Hedgerow	0.041677	-0.696	6.022	0.192 (+0.1507)	-0.216 (+1.464)	27.744 (+22.722)
Man Made	0.200342	0	0	0.200 (0)	0	0
Play Park	0.116454	0	0	0.117 (0)	0	0
Hay Meadow	-	-	-	0.797	-2.924	54.776
Total	3.825	-0.696	213.611	3.825	-3.140 (+2.44)	233.264 (+19.653)

Table 5 Church Road carbon sequestration potential

The proposed changes in management of Church Road Playing fields includes increasing the amount of hedgerow along the perimeter of the site and converting some of the amenity grassland around the edges into urban meadows (Figure 18). These changes would result in a potential increase in carbon sequestration of 2.44 tonnes of CO_2 e per year, from the estimated 0.696 under current management to 3.140. Carbon storage would also increase, from 213 to 233 tonnes. These figures are calculated using conservative estimates for hay meadow carbon sequestration. One study found meadows that were seeded with *Trifolium* species were sequestering up to 11.62 tonnes of CO_2 e per hectare per year. If this figure is used then the new estimate would be 9.473 tonnes of CO_2 e per year, an increase of 8.778 tonnes. This is the equivalent amount of CO_2 released annually by 5 average UK cars.

These estimates also don't take into account the reduction in emissions that would likely occur through a reduction in the area and frequency of mowing. Amenity grassland can be mown as regularly as once every four weeks. This uses significant amounts of fuel, for example, using a lawn mower for one hour can have the same global warming impact as driving a car for just over 1.6km, with ride on mowers having an even higher impact. (Science News).

Figure 18 Church Road habitats sequestration

Figure 18 shows Church Road Playing Fields habitats and their carbon sequestration and storage figures. A shows the habitats that are currently present within the site, with B indicating the potential habitats if managed differently, along with the changes in carbon sequestration associated with these. C and D show the same information for carbon storage.

5.2.6 Halls Road Playing Fields

Halls Road Playing Fields is located in the centre of Biddulph and is similar to Church Road in that it is predominantly amenity grassland with a children's play park, car park and the presence of woodland around some of the perimeter. It is a relatively large site (around 5 hectares), with tennis courts and a few designated football pitches spread throughout (Figure 19).

Although more of the area is for recreation compared with Church Road Playing Field, it still has potential for gains in carbon sequestration and storage. By managing 0.82 hectares of the site as an urban meadow, and increasing the amount of low density woodland to 0.15 hectares, the site may be able to sequester a total of 4.31 tonnes of CO_2e per year (Table 6), an increase of 4.132 tonnes compared to what is currently estimated. These changes also increase the amount of carbon stored, from 277 tonnes to nearly 300 tonnes.

Current habitats and their carbon sequestration and storage estimates along with how these estimates may change with the proposed changes in management outlined in text for Halls Road Playing Field. Numbers in brackets indicate the difference between current and potential.

Habitat	Current Area (ha)	Current Total Sequestration (tCO_2e/yr)	Current Total Storage (tC/yr)	Potential Area (ha)	Potential Total Sequestration (tCO_2/yr)	Potential Total Storage (tC/yr)
Amenity Grassland	4.505	0	270.294	3.623 (-0.881)	0	217.381
Car Park	0.136	0	0	0.136	0	0
Playpark	0.357	0	0	0.357	0	0
Scrub	0.089	-0.179	6.703	0 (-0.089)	0	0
Hay Meadow	0	-	-	0.817 (+0.817)	-2.999 (+2.999)	56.170
Low Density Woodland <30yrs	0	-	-	0.154 (+0.154)	-1.313 (+1.313)	26.070
Total		**-0.179**	**276.998**		**-4.311 (+4.132)**	**299.620 (+22.132)**

Table 6 Halls Road Playing Field habitats sequestration

Figure 19 Halls Road habitat sequestration maps

Figure 19 shows Halls Road Playing Fields habitats and their carbon sequestration and storage figures. A shows the habitats that are currently present within the site, with B indicating the potential habitats if managed differently, along with the changes in carbon sequestration associated with these. C and D show the same information for carbon storage.

4.2.9 Overall Changes in Management for Urban Green Spaces

Both of the sites above illustrate how urban areas can be managed in such a way to increase carbon sequestration and storage, but not impact the role of the site for recreation. Suggested changes to increase carbon sequestration and storage include:

- Creation of Urban Meadows
- Creation of Hedgerows
- Tree Planting

There are other habitats that can be incorporated into sites that may provide greater biodiversity benefits than those associated with carbon, for example pond creation. However, there is currently limited data on ponds and carbon sequestration so these have not been suggested in the context of this report.

Urban Meadows

One of the main changes in management that is beneficial for amenity grassland is the creation of urban meadows.

- Meadows are popular with the general public, with research indicating people prefer designed meadows to standard mown amenity grass.
- Urban meadows are less labour intensive than mown grass, but do require preparation and maintenance at specific times of the year.
- They are planted with seed mixes that are not only beneficial to wildlife, but also aesthetically pleasing.
- It often involves establishing new areas of meadow and can comprise perennial grasses and flower rich species which flower each year, with sequential flowering during one season achieved by cutting after the first flowering.
- Annual meadows are also possible, with flower species which flower once but can persist by self-seeding. However, there is a slight risk with these that re-seeding annually may be needed if self-seeding is unsuccessful.
- Peripheral areas of parks are ideal locations

General Maintenance

- Initial removal of existing amenity mown grass and weeds from the sites is needed
- Cultivation of the soil followed by raking, treading and removal of large stones
- Mixing of seed with sand before hand-seeding, with seeds distributed evenly across the site

- With perennial meadows, mowing occurs once or twice a year. Cuttings need to be removed, with shorter plant species generating a small volume of cuttings
- With annual meadows, cutting once at the end of the flowering season. For best visual results annuals should be re-sown into a clean seed bed each year, but this is more expensive so not feasible on a large scale

There are many local councils that manage urban meadows and have created useful management guides, for example Newcastle.

(https://www.newcastle.gov.uk/sites/default/files/201901/wildlife_creating_managing_urban_meadows_0.pdf)

There are many environmental benefits to managing sections of urban green spaces less intensively. These include an increase in biodiversity, especially of invertebrate species, increased carbon sequestration and storage, erosion control, and an increase in water storage and therefore less runoff. However, there are also potential economic benefits. One study in Canada found that by reducing mowing frequency of urban parks from 15 cuts per year to 10 cuts per year there was a cost reduction of 36% (Watson et al 2019) . In the UK, Dorset County Council's annual budget for highway verge management dropped from nearly £1m to £650K in five years under a cut and collect, low fertility approach (Greenfield 2020).

Creation of Hedgerows

Hedgerows and hedges in general are crucial in supporting a wide diversity of animal species through providing shelter, nest sites, food resources and corridors for movement. They also provide wider ecological benefits, such as carbon sequestration and storage, cooling and temperature regulation and help reduce water runoff and soil erosion. As with the urban meadows, hedgerows are best placed on the periphery of sites to ensure they don't interfere with recreation. There are a wide range of tree species that can be used in hedge creation, all with different requirements. Most hedges will require an open and sunny site, and consideration needs to be made on whether they are evergreen or deciduous, and on their height and spread. There is not currently enough data on the different carbon sequestration and storage characteristics of evergreen and deciduous hedges.

Hedges will require general maintenance to prevent them becoming too large and developing into trees. In general, annual cutting is required. For more information on hedge management see https://www.rhs.org.uk/plants/types/hedges/with-environmental-benefits.

Tree Planting

Trees can provide a wide range of ecological benefits and are likely to be an essential part of our urban landscape in the future to help adapt to the rising temperatures caused by climate change. Although they are capable of removing

significant amounts of CO_2 and other greenhouse gases, this does take quite a long time, with trees reaching sequestration peaks around 30 years old. Single trees in urban parks will also sequester less than those in healthy woodlands due to the lack of understory vegetation and that they are generally at a lower density. Tree planting and maintenance can also be quite expensive. For these reasons tree planting should be targeted in areas to maximise connectivity with already existing woodland or where the soil is appropriate for tree planting. For more information on urban trees, see:

https://cdn.forestresearch.gov.uk/2022/02/7111_fc_urban_tree_manual_v15.pdf

The above changes in management may be applicable to all or some of the urban, SMDC managed sites covered in the report. For some general recommendations for each site see Table 7.

SMDC maintained sites and a list of proposed management suggestions to help improve carbon sequestration and storage. Habitat opportunity maps have been used where appropriate to help guide suggestions

Name	Type	Management suggestions	Comments	Site address
Brough Park	Formal Park	Tree planting Urban Meadow Creation	Adjacent to large sections of existing woodland.	2 Brough Cl. Leek ST13 8XT
The Waste	Open space	-	Already contains large areas of woodland, with only a small section of amenity grassland which would be impractical to convert.	7 Princess Avenue, Leek, ST13 6QA
Westwood Rec	Recreation ground	Maintain existing hedgerows Urban Meadow Creation	Already has a good border of hedgerows. Small section near the end of park which could be managed as a meadow.	88 Westwood Rd. Leek ST13 8DL
Pickwood Rec	Recreation ground	Urban Meadow Tree Planting	Potential to increase the size of the adjoining woodland by planting trees. However, is quite a small site so may not be possible.	Milltown Way Leek ST13 5SZ

Woodcroft	Open space	Reduce mowing	Site contains large areas of woodland already, perhaps not suitable for meadow creation.	Campbell Av Leek ST13 5RR
Birchall Playing Fields	Sports pitches	Maintain existing hedgerows Flower margins	As the site contains multiple sports pitches creation of a full meadow would be difficult. Flower margins around the car park and some of the periphery may be possible and still provide some carbon benefits.	Cheadle Rd Leek ST13 5RE
Leek cemetery	Cemetery	Maintain existing hedgerows	There is little change that can be done within this site.	5 Condlyffe Rd Leek ST13 5PP
Buxton Road Cemetery	Cemetery	Creation of hedgerow/line of trees	Along the path network.	Central Dr Buxton SK17 9RT
St Chads	Closed Churchyard	Maintain existing hedgerows	There is little change that can be done within this site.	Leek Rd Longsdon ST99QF
Biddulph Valley Park	Park	Urban Meadow Creation Tree planting Scrub/tree growth along watercourse	Along the southern edge of the site tree planting would increase the size of the adjacent woodland. Area is large enough to hold an urban meadow and amenity grassland.	Thames Drive Biddulph ST87HL
Halls Road Playing Fields	Sports pitches and recreation	Urban Meadow Creation Tree/hedge creation	See text	30 Halls Road Biddulph ST8 6DB
Church Road Playing Field	Sports pitches and recreation	Urban Meadow Creation Tree/hedge creation	See text	Church Road Biddulph ST8 6NA

The Paddock	Open space (redundant play area)	Urban Meadow	There are a few sections of amenity grassland adjacent to the road which could be managed as a meadow.	Charnwood Cl Leek ST13 8HX
Mill Hayes Playing Field	Sports pitches	Tree Planting Urban Meadow	Tree planting adjacent to existing woodland to increase area. Meadow creation along the edges or in the open greenspace where playing fields aren't located.	Tunstall Road Knypersley ST8 7PX
Hot Lane Recreation Ground	Sports pitch and recreation	Tree Planting Urban Meadow	Tree planting of small area on the north of site to increase adjacent woodland size. Small sections of amenity grassland which isn't in playing field use which could be managed as meadow.	Hot Lane Biddulph Moor ST8 7HP
Stanfield Crescent Playing Fields	Sports pitch	Maintain newly planted trees Grass verge	Near the edge of the existing woodland there is currently significant scrub. Could cut this back and grow a wildflower border.	Tean Rd Cheadle ST10 1LW
Thorley Drive Playing Fields	Sports pitches	Scrub control/tree planting	A small area to the north of the site is currently unmanaged scrub. This could be cleared and planted.	Thorley Dr Cheadle ST10 1SA

Horton Playing Field	Open space (redundant sports pitch)	Acid Grassland Improvement	Soil type on site appears to be acid grassland. Potential to allow site to regenerate, or use green hay. There is also a marshy grassland border with purple moor grass that needs to be maintained.	Rudyard Leek ST13 8RU

Table 7 Management Suggestions

4.2.10 Staffordshire Wildlife Trust Managed Sites

The newly SWT managed sites are, in general, removing and storing significantly more carbon than with the currently SMDC managed sites. This is due to these areas being managed more with wildlife in mind than for human recreation. That being said, some of these sites could become better carbon sinks with some management changes. For example, Wetley Moor Common.

Wetley Moor Common is a SSSI, but was designated as degraded in the most recent review. It is predominately lowland Heathland containing a mixture of heather, purple moor grass and gorse (Figure 20). There are sections of wetter marsh. However, these are dominated by purple moor grass, indicating their deteriorating condition. Purple moor grass is a herbaceous plant classed as a graminoid. Graminoid species have higher rates of respiration compared to woody-shrub like species, such as heather, due to their faster metabolism. Higher rates of respiration are also associated with rapid decomposition of leaf litter, leading to lower concentrations of carbon in the soil (Quin et al 2015). Studies have found that grass dominated heathlands sequester significantly less CO_2 and store less carbon overall than those dominated by shrub-like species (Eldridge et al 2011, Quin et al 2014, Quin et al 2015).

By restoring the *Molina* dominated areas of Wetley Moor Common so they have a higher ratio of *Calluna* to *Molinia,* overall carbon sequestration and storage can be increased. Quin et al. 2015 found that heather dominated heathlands sequestered up to 12.66 tCO2e/ha/yr when in the building phase, compared to *Molinia* dominated sites removing 5.9 tCO_2e/ha/yr.

In this report all heathlands, regardless of condition, have been assumed to be at equilibrium, not removing or emitting CO_2, due to their long term consistent management. However, if *Calluna* species were able to re-establish, this would result in carbon gains due to changes in the ecosystem, and plants existing in the building phase, where most CO_2 sequestration occurs. As restoration would take time and most likely there would be a high concentration of *Molinia* while the heather establishes itself, the lower figure of 5.9tCO_2e/ha/yr has been used for the potential carbon gains.

There are areas of improved grassland throughout Wetley Moor Common. There may be limited potential for restoring these back to heathland. However, for the purposes of this report and demonstrating potential carbon gains with changes in management they have been included Figure 20). The higher carbon sequestration rate for heathland recovery has been used for these areas.

If all these suggested changes were to occur, the site could potentially sequester around 330 tonnes of CO_2 e per year, an increase of 500 tonnes (Table 8). Storage is also estimated to increase by 1030 tonnes to nearly 9,830 tonnes of carbon. Not only would these improvements majorly increase carbon sequestration and storage, but would also bring huge benefits to biodiversity and likely improve visitor satisfaction to the site.

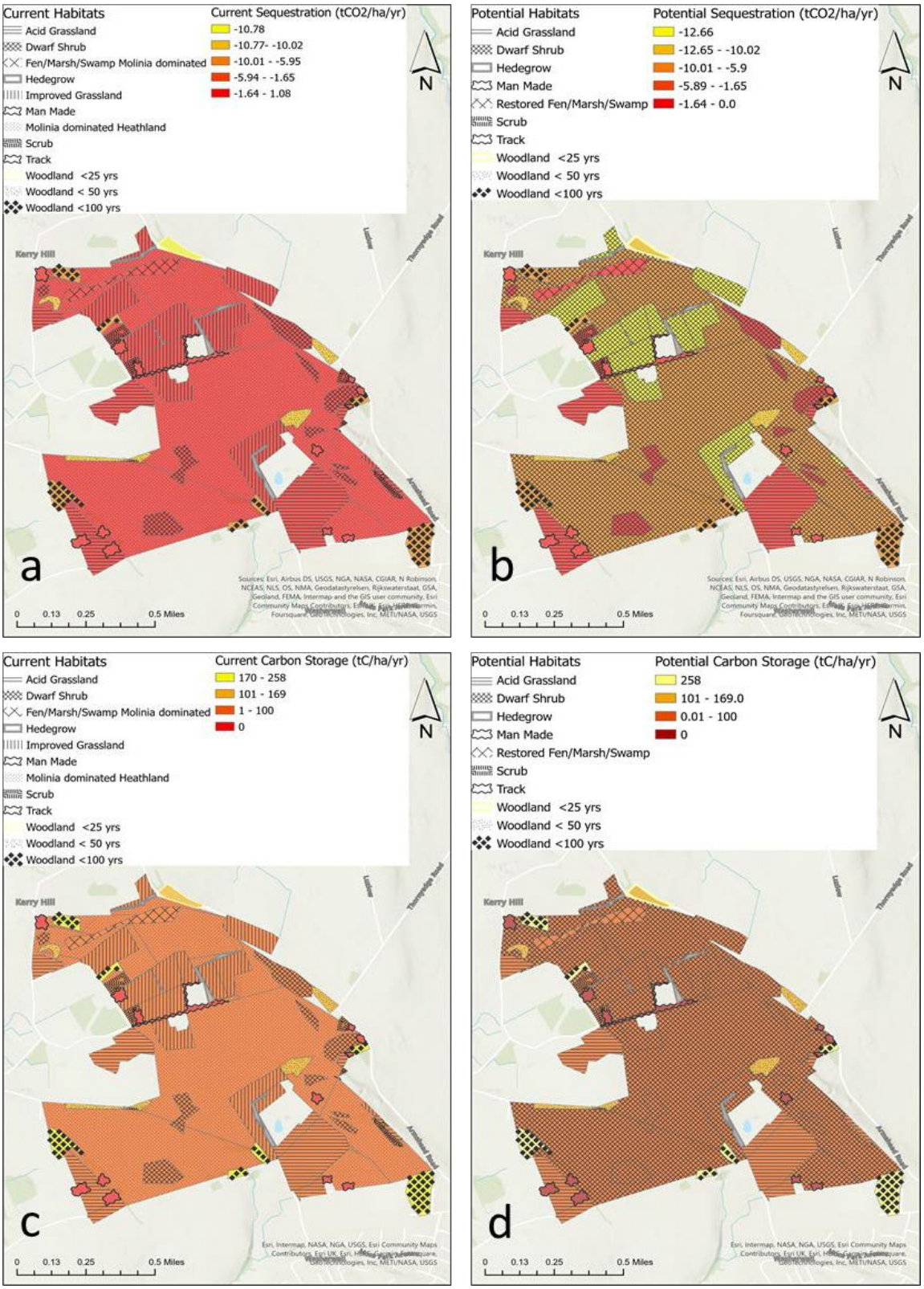


Figure 20 Wetley Moor Common Habitats

Figure 20 shows Wetley Moor Common and the a: current habitats and their carbon sequestration estimates and b: potential habitats and carbon sequestration estimates if the changes in management highlighted in text were

delivered. c: current habitats and their carbon storage estimates, and d: potential habitats and their carbon storage estimates if the changes in management highlighted in text were delivered.

Current habitats and their carbon sequestration and storage estimates along with how these estimates may change with the proposed changes in management outlined in text for Wetley Moor Common. Numbers in brackets indicate the difference between current and potential.

Habitat	Current Area (ha)	Current Sequestration Total (tCO_2/yr)	Current Storage Total (tC/yr)	Potential Habitat	Potential Area (ha)	Potential Sequestration Total (tCO_2 e/yr)	Potential Storage (tC/yr)
Acid Grassland	9.617	0	836.653	Acid Grassland	9.617 (0)	0	836.653
Dwarf Shrub	4.483	0	448.312	Dwarf Shrub	4.483 (0)	0	448.313
Fen/Marsh/Swamp Molinia dominated	1.298	1.402	122.051	Fen/Marsh/Swamp Restored	1.298 (0)	-0.260 (+1.662)	129.841 (+7.79)
Hedgerow	0.974	-1.607	140.706	Hedgerow	0.974	-1.607	140.706
Improved Grassland	13.306	0	798.364	Dwarf Shrub	13.306	-168.455 (+168.455)	1330.607 (+532.243)
Man Made	1.249	0	0	Man Made	1.250	0	0
Molinia dominated Heathland	55.598	0	5115.008	Improved Dwarf Shrub	55.598	-330.711 (+330.711)	5605.273 (+50910.265)
Scrub	1.089	0	81.672	Scrub	0.634	0	81.672

Track	0.528	0	0	Track	0.528	0	0
Mixed Broadleaf Woodland <25 years	0.493	-5.319	83.379	Mixed Broadleaf Woodland <25 years	0.493	-5.318	83.378
Mixed Broadleaf Woodland < 50 yrs	1.459	-14.619	376.407	Mixed Broadleaf Woodland < 50 years	1.459	-14.619	376.407
Mixed Broadleaf Woodland <100 yrs	3.085	-18.355	795.908	Mixed Broadleaf Woodland <100 years	3.085	-18.355	795.908
Total		-38.497	8798.460			-539.325 (+500.828)	9828.759 (+1030.299)

Table 8 Wetley Moor Carbon sequestration

Although many areas of the SWT managed sites are currently in good condition for nature, there are some changes or improvements that can be undertaken that would benefit both carbon sequestration and storage, and biodiversity (Table 9). For example, in Ladderedge Country Park one section of woodland could be left to naturally regenerate and spread into the neighbouring field, increase connectivity and area of the woodland on the site. One area of Ladderedge County Park (Barnfields) is currently maintained as a meadow. However, due to high levels of dog fouling this is struggling to maintain species diversity. Replanting this area as woodland would be more beneficial for carbon gains.

SWT maintained sites and a list of proposed management suggestions to help improve carbon sequestration and storage. Habitat opportunity maps have been used where appropriate to help guide suggestions			
Name	**Management suggestions**	**Comments**	**Address**
Biddulph Grange Country Park	Maintain areas of grazed grassland and limit mowing of amenity grassland, potentially restore to species rich meadow	There isn't much need to maintain any of the site as amenity grassland.	Grange Rd Biddulph ST8 7TZ
Biddulph Valley Way	Plant woodland on areas of neutral grassland adjacent to the valley way path.	Much of the route falls within woodland opportunities areas.	Smokies Way Biddulph ST8 6TZ
Brough Park Fields	Tree planting on the field adjacent to the existing woodlands on either site of the site, linking these together. On the top western fields restore to species rich meadows.	Falls within woodland and grassland opportunity areas.	Fowlchurch Rd Leek ST13 6BW
Cecilly Brook	Reduce mowing on the amenity grassland strips spread throughout the site. Maintain the newly created meadows and ensure scrub does not dominate.		Oakamoor Rd, Cheadle, ST10
Hales Hall Pool	Less regular mowing of the neutral grassland located on the perimeter of the pool. Maintain the existing hedgerows on the site.		Oakamoor Rd Cheadle ST10 4QR
Hoften's Cross Meadow	Lay hedgerows around the boundary with neighbouring land along fence line.	The site is already fairly well managed for nature and indirectly carbon. Scrub control will be needed.	Cauldon Low ST10 3EU

Laddered ge Country Park	Allow natural regeneration/spread of the bottom wood into the adjacent field. Ensure grazed fields are low intensity. Sow seeds in fields where floristic diversity is currently low.	Area falls within both woodland opportunity and grassland.	108 Newcastle Rd. Leek ST13 7AA
Laddered ge Country Park (Barnfiel ds)	Due to the meadow having low floristic diversity as a result of visitor use, tree planting on this site is recommended.	Falls within a woodland opportunity area.	108 Newcastle Rd. Leek ST13 7AA
Marshes Hill Common	Reduce the amount of scrub/gorse on the site and restore some of the acid grassland areas to dwarf shrub.		Brown Edge ST6 8TY
Wetley Moor Common	See text.		301 Armshead Rd. Werrington ST9 0NB

Table 9 SWT managed sites suggestions

5.2.7 Conclusions

Across all 26 sites, 707 tonnes of CO_2e is removed and 4,458 tonnes of carbon is stored per year. Per hectare, this is -2.22 tCO2e/yr and 141.02 tC/yr. The carbon sequestration figure is the equivalent of the average annual carbon footprint of 87 UK households (8.1 tonnes per household). However, this figure could be increased through implementing various fairly simple management changes. Although the more 'wild' sites examined in this report are removing significantly more carbon than those used for recreation, this doesn't mean these sites don't have potential for major carbon gains.

As mentioned above, by implementing a few simple changes in management across only two sites a further 6 tonnes of CO_2 can be removed per year. This is the equivalent of removing nearly 4 cars off the road for a year. If this were expanded to all SMDC managed sites, the gains in carbon removal could be incredibly high. These figures also don't include how changes can influence the carbon used during management, such as through mowing. A reduction in mowing frequency will significantly reduce carbon usage.

Not only are there environmental benefits to many of the suggested changes, but also economic. For example, since 2014 Hartlepool Council in the North East of England has saved £35,000 per year on mowing 10km of road verges by

switching from regular grass cutting every 3 weeks to informal annual planting (National Environmental research Council 2017 Greening the Grey report). White City Estate in London has a small area (around 300m^2) managed as an urban meadow, which cost less than £500 to create and less than £100 per year to maintain, where before with regular mowing it was costing double this. Economic gains that are harder to measure include flood mitigation, as soils in species rich grasslands and under trees have less erosion and are able to hold higher levels of moisture. There are numerous health benefits to having easy access to nature, such as lower stress levels (Wells et al 2003) reduced rates of anxiety and depression (Park et al 2010) and just a general improvement to well-being.

Urban parks and greenspaces may often only be small in size individually, but when grouped together have the potential to make a huge impact not only for the climate, but for nature and our own wellbeing as well.

6. Staffordshire Moorlands Conservation Projects

6.1. Explore and Identify Opportunities

Engage with communities in protecting the natural world, such as promoting wildlife-friendly gardening and improving local greenspaces for wildlife.

6.2.1 Wildlife Gardening

Local communities can play a crucial role in supporting the recovery of nature by helping to manage more land favourably for nature. Action can be taken on an individual basis, in gardens and allotments for example, or collectively, on greenspaces within a community, such as land owned by the local council or a housing provider.

It is estimated that the total area of gardens in the UK is about 433,000 hectares – around a fifth of the size of Wales – so if every individual made some small positive changes for the environment in their garden it would add up to a large collective impact. Added to this, Staffordshire Moorlands' residents enjoy good access to an abundance of publicly owned greenspaces, which, with nature-friendly management, can all contribute to the creation of a Nature Recovery Network.

Wildlife gardening is a simple and inclusive activity that residents can take part in to support the natural world. There are many different actions that people can take within their gardens to help sustain local wildlife populations, many of which can be undertaken within smaller plots and even on balconies – a large garden is not a necessity.

Here are a few examples of actions people can take to support wildlife in their garden:

Plant Wildlife-friendly Species

Wildlife-friendly plants (which are often native to the UK) provide food and habitat for local wildlife. A variety of wildlife will benefit from native planting schemes, such as bees, butterflies, and other pollinators, garden birds and mammals. It is important to aim to include plants which have a variety of flowering times to support wildlife throughout the year.

Create Shelter

Provide shelter for wildlife by creating and installing features such as log and stone piles, bird boxes and insect hotels. These structures offer nesting sites and refuge for birds, invertebrates and amphibians. These creatures in turn will offer a food supply to mammals and birds. Additionally, simply leaving parts of the garden undisturbed, with areas of long grass and vegetation such as brambles and nettles offer food sources and shelter for a variety of wild species.

Provide Water

Install a bird bath, pond, or small water feature to provide a water source for wildlife. Fresh water is vital for birds, insects, and other animals. Ensure that the water is kept clean and accessible, especially ponds, which need a sloping edge or shallow areas to allow creatures to safely drink and bathe.

Feed the Birds

Set up bird feeders and provide suitable bird food to attract a variety of bird species. Different species have different feeding preferences, so offer a range of foods such as seeds, nuts, suet, or mealworms. Regularly clean and refill the feeders to prevent the spread of diseases.

Avoid Using Peat-based Compost

Wild peatlands store vast amounts of carbon - locking in an estimated 3.2 billion tonnes in the UK alone. When peat is harvested for use in compost we're destroying one of our greatest weapons against climate change, as well as a precious wildlife habitat. A ban on the sale of peat-based composts for gardeners will come into force in 2024, and there are now plenty of peat-free alternative to choose from when purchasing a compost. However, gardeners should also take care when buying plants as many are still grown in compost containing peat. Plants grown in peat-free compost are becoming more widely available from some of the larger retailers – check the labels to make sure.

Ditch the Chemicals

Avoid the use of pesticides such as slug pellets and insect sprays and weedkillers as they can harm wildlife. If you need to control pests in the garden, encourage natural pest controllers such as ladybirds, which feed on aphids, and frogs, which feed on slugs. You can also use natural pest control methods such as creating physical barriers, companion planting and biological controls.

Compost and Mulch

Make your own compost with materials from the garden that would otherwise go in the green waste bin. Compost needs to comprise of a 50 -50 mixture of green

leafy material and brown woody material. A huge range of insects live inside the compost heap, helping the decomposition process, and gardeners have also recorded everything from toads to Slow worms taking up residence in them.

Carry Out Garden Maintenance at the Right Time

Many invertebrates overwinter in shrubs and trees, and birds nest in trees and hedges from February to August. Make sure you will not be disturbing any wildlife before trimming and pruning.

Create Mini Habitats

If you have a suitable spot, set aside a portion of the garden as a mini wildflower meadow, bog garden or woodland area. This can be determined by what the conditions are in your garden. A shady spot will lend itself well to woodlands or wildflowers, while a damp area will make a good bog garden.

Lock Away the Lawnmower

Letting the lawn grow will give a boost to pollinators, who will benefit from the additional nectar sources available from any wildflowers that emerge. Initiatives such as Plantlife's No Mow May offer a gateway into this, while less frequent mowing is recommended throughout the growing season.

6.2.1 Encouraging Residents to Make Their Gardens Wildlife-friendly

There are several avenues that the local authority can explore to encourage residents to carry out the above actions. These are outlined in the table below.

Method	Description
Use Council's Communications Channels	Disseminate wildlife gardening advice via the council's social media channels, website, press releases and e-newsletters. Ensure wildlife gardening toolkits (available from SWT) are downloadable from the Staffordshire Moorlands District Council's website. Launch a 'Wild about the Staffordshire Moorlands' e-newsletter, containing practical information and news about the authority's environmental work. For an example, see Staffordshire County Council's Sustainability E-newsletter.

Launch Online Survey of Garden Wildlife	Launch an online survey to collect data on how engaged residents are with wildlife gardening, what wildlife is currently visiting gardens and the type of advice and support that residents require. This data would be used to inform how best to engage residents on this issue and build a picture of wildlife populations and which species may need additional support. Survey could also ask participants if they would like to subscribe to Wild about the Staffordshire Moorlands E-newsletter to stay up to date.
Wildlife-friendly Garden Award Scheme	Develop an online Wildlife-Friendly Garden Awards scheme to incentivise action to support nature in the garden. This could be a simple tick list for example, that would encourage residents to work towards higher levels of action. A certificate could be downloaded and printed off after reaching certain levels, eg bronze, silver and gold. Actions could be tailored towards specific groups, eg residents, schools, businesses, care homes, etc
Wildlife Gardening Competition	A competition for a wildlife gardening project by a community group, school, etc. Winners would receive funding towards their project, in a similar vein to the council's climate fund.
Wildlife friendly Demonstration Garden	Establish a demonstration garden within a well-used local park to showcase ideas to residents on what they can do in their own gardens to support nature.
Nature-friendly Gardening Events	Run an event to promote nature-friendly gardening and wider behaviour change around sustainability. Event could include stalls from local environmental groups, as well as practical workshops and expert speakers

Team Wilder Create an activity calendar for residents and community groups to use to engage with nature.	This is in development with community group engagement creating simple tools people can easily do at home.

Team Wilder

Team Wilder is a growing national movement led by The Wildlife Trusts to encourage 1 in 4 people to take action for nature in their community. There are many ways to be involved with Team Wilder, from bringing together a group of local people to help improve a local greenspace for nature to campaigning on a particular environmental issue.

The idea underpinning Team Wilder is to empower communities to take action themselves on issues they care about. More information on Team Wilder is available at www.staffs-wildlife.org.uk/get-involved/be-part-teamwilder

6.2 Conservation Schemes to Promote Specific Local Priority Species

Curlew (*Numenius arquata*) and Hedgehog (*Erinaceus europaeus*) have both been selected as species for SMDC conservation schemes as they are both local priority species that are experiencing significant reductions in population. Curlew a rural species, while Hedgehog is both urban and rural providing opportunities for residents across the district to get involved in an area local to them. Any potential work undertaken to improve, increase or reconnect the habitats available for these species will also be beneficial to a wide variety of other species.

6.2.1 Curlew

The Curlew is the largest breeding wader in the UK. It nests on the ground in rough grassland and heath. It has declined significantly in the UK in recent decades and is on the red-list (highest) of Birds of Conservation Concern.

Its Staffordshire decline is mainly in the lowlands with the population in upland areas still being relatively strong. The lowland decline is largely due to intensive farming making much of the landscape unsuitable for nesting i.e. drainage, increase in grazing pressure and increase in intensive arable farming. Predation pressure (which has likely always been high for this species) then means that those few remaining pairs are unlikely to successfully raise chicks.

The Staffordshire Moorlands area certainly still holds a strong population in the Peak District and around Ipstones Edge, and probably still has some isolated pairs elsewhere.

Recent work in the Peak District as part of the South-West Peak Landscape Partnership Scheme delivered 50 'wader plans' to help landowners to manage their sites with Curlew in mind.

Other schemes across the UK are monitoring the fortunes of breeding pairs, protecting nests with temporary electric fencing and even captive rearing young birds to help bolster the population in the short-term.

To expand upon the Landscape Partnership work and move into the wider Staffordshire Moorlands Area it would be crucial to have landowner engagement and support. Locating and monitoring existing populations are the first step, followed by possible intervention measures such as nest fences or predator control if deemed necessary.

Actions

Note that this action plan applies to non-Peak District National Park areas of Staffordshire Moorlands Local Planning Authority (LPA). Currently, there is an RSPB-led project covering the Peak District which is a legacy project from the South-West Peak Landscape Partnership Scheme. It would be recommended to liaise with the RSPB team to see if this can all link together and use the same methodologies and resources.

Locate existing populations across the LPA

Action	How	When
Desk study for supporting information	Obtain historic records of Curlew from the area. Look at current habitat data for suitable breeding areas	ASAP
Ask for anecdotal records of Curlew breeding in the area	Liaise with local landowners Generate interest and ask for information via social media Engagement events	Throughout the duration of the project
Systematic surveys of suitable habitat	Follow-up desk study using systematic survey of suitable sites using standard methods (Brown and Shepherd etc but with additional species-specific methodology for Curlew)	April-June

Monitor populations across the LPA

Action	How	When
Repeat landscape scale surveys periodically	Repeat surveys of target areas using standard methodology.	Every 5 years (or interval TBD)
Site monitoring of a sub-set of locations that hold breeding Curlew	Use the wader warden set-up in use currently in the Peak District where specific 'wardens' monitor a site annually for breeding waders.	Annually between April and July

Monitor breeding success

Action	How	When
Monitoring of breeding success at specific sites	Attempt to determine any breeding success at sites with Curlew. Nest finding and monitoring would be very valuable but takes more expertise.	Annually between April and July
Collate and maybe follow-up ad-hoc records of Curlew with nests/young that are reported each year	A set of volunteers/staff able to respond to reports and make follow-up visits to determine breeding success.	Annually between April and July

Landowner liaison and advice

Action	How	When
Provide management advice to sympathetic landowners	Provide tailored 'wader plans' to landowners (in line with those produced by the South west Peak Landscape Partnership Scheme).	Anytime
Look at landscape scale action to create more connected Curlew-friendly areas	Look at spatial distribution of landowners involved with the project and suitable habitat and look for target areas to approach other landowners or carry out physical habitat interventions	Anytime

Practical interventions

Action	How	When
Temporary electric fencing	A proven technique to protect nests at egg stage with electric fences.	Annually between April and July
Habitat interventions	A number of physical interventions can be carried out to enhance	Autumn/winter

	habitat for waders including scrapes and ditch-blocking/re-wetting.	
Habitat management	Look for ways to help landowners with suitable management techniques outlined in wader plans including rush management, soil aeration, hydrological surveys etc.	Autumn/winter

Further studies and research

Action	How	When
Ringing and tagging of chicks	Various methods can be used to tag chicks in order to better assess their survival rates	Annually between April and July
Other studies and research	There could be opportunities to support research projects around this topic should there be students/researchers interested.	TBD

6.2.2 Hedgehog

Hedgehogs are generally very common in continental Europe and are classified as Least Concern on the International Red List of Threatened Species. While Hedgehogs are still widespread across the Great Britain they have been in decline for a significant period of time and can be scarce where they are present. In 2020, Hedgehogs were put on the IUCN Red List as vulnerable to extinction in Great Britain, emphasising Britain's status as one of the most nature-depleted nations in the world. It is a concerning situation to find ourselves in when a generalist species such as Hedgehogs have been in continual decline for so long.

In 2018, The Mammal Society estimated the total population to be 879,000, down from an estimated 30,000,000 in 1950, with approximately 25-30% of the current population now living in urban environments while Hedgehogs continue to be in decline in rural areas. This may represent an evolving habitat preference, with studies suggesting that Hedgehogs are migrating to semi-rural and urban areas. Counterintuitively, these areas may provide a higher abundance of invertebrates compared to intensively managed fields, and provide greater opportunities for shelter. This may have contributed to the recent stabilisation of urban populations and the potential increase in some urban populations.

As for many species, we do not yet understand the whole picture surrounding the decline of Hedgehog populations in recent decades, and it is not as simple as identifying an individual cause and there are relationships between many of the factors involved. Significant factors influencing the decline of Hedgehogs are;

- Habitat loss
  - As habitats are lost, the potential resources to support Hedgehog populations decreases.
  - Hedgehogs rely on the presence of multiple habitat types for foraging, sheltering, nesting and hibernating. The loss or significant reduction of any one could impact the ability of the remaining habitats to support a viable population.

- Habitat fragmentation
  - As suitable habitats and landscape features such as hedgerow, scrub, decaying wood or species rich grassland are removed from the landscape, suitable habitats can become separated by areas that provide limited or no potential sheltering habitat significantly increasing the risk of predation.
    In an urban context this may take the form of physical barriers separating existing habitats such as a garden fence, a building development or road between previously connected habitats.

- Invertebrate decline
  - Hedgehogs are mostly nocturnal and while they feed on a wide range of foods, they rely heavily on invertebrates. Habitat loss and

land management changes have resulted in a decline of up to 60% of flying invertebrates in the UK between 2004-2021.

- Resource Competition
  - Badgers can outcompete Hedgehogs for the same food resource, displacing them from their territory if competition for resources is high enough. As humans continue to reduce the size of habitats and increase fragmentation, these two species will be forced to compete over continually dwindling resources.

- Road Traffic
  - A UK based study has estimated that road casualties represent an annual mortality rate of 10–20% of the population, affecting the survivability of local populations and increasing the chance all local extinctions where habitats are fragmented. These findings are comparable to similar studies undertaken in Sweden and Poland.
  - Hedgehogs are reluctant to cross roads and will only do so when it can't be avoided. This reduced dispersal can lead to small isolated populations more susceptible to disease, inbreeding and local extinction events.

Actions

Locate existing populations across the LPA

Action	How	When
Review of existing data	Map existing records in district from SER and Staffs Mammal Group.	ASAP
	Map/review existing habitats within district.	ASAP
Consult with Staffs Mammal Group and SWT to promote scheme and enable local communities to undertake surveys	Through engagement events and publicity set up local groups to survey local public greenspaces and residential areas.	Throughout the duration of the project
	Liaise with schools in the district to educate children, and support schools to survey their playing fields.	Outreach in year 1 and continue throughout the duration of the project
	Support land managers to survey their land for Hedgehogs.	Throughout the duration of the project

Identify key areas for intervention

Action	How	When
Identify priority areas for landscape scale approach	Use habitat mapping to identify larger, more diverse, contiguous habitats, where restoration and reconnection of fragmented habitats would require less work to achieve.	ASAP
Reassess priority areas	As habitat creation/restoration is undertaken, reassess updated mapping to identify any potential new priority areas.	Throughout the duration of the project

Landowner liaison and advice

Action	How	When
Use priority areas to inform targeted landowner engagement	Contact landowners to discuss habitat improvement options that could be considered on their land, with site visits to identify specific areas.	Throughout the duration of the project
Provide management advice to other landowners	Landowners outside priority areas that make contact to be provided with advice and recommendations but without site visit.	As and when landowners make contact
Ensure developments have positive impact on Hedgehog populations	Provide advice to planning officers and developers on pre/mid development impacts to Hedgehogs and how habitats can be incorporated to provide for them after the development is completed.	During project development phase

Practical interventions

Action	How	When
Habitat Management	Stop pesticide use asthis will significantly reduce the number of prey species present. Manage habitats on rotation to provide constant foraging/sheltering/hibernating habitat in close proximity. Identify areas where management could be relaxed or removed. Ensure garden ponds are safe, to provide exit.	At the appropriate time of year for specific management measure.
Habitat Creation & Connection	Remove barriers between urban habitats i.e. holes in garden fences. Allow buffer strips around fields, hedgerow and scrub planting, reduce field sizes. Improve connections between existing habitats within the landscape through strategic placement of habitat creation.	At the appropriate time of year for specific management measure.

Monitor populations across the LPA

Action	How	When
Monitor sites/areas where practical interventions have been undertaken	Repeat surveys to determine whether Hedgehogs have dispersed to newly created/connected habitat.	Following establishment of suitable habitats
Determine effect on populations	Repeat surveys to determine whether Hedgehog populations have increased as a result of habitat works.	Every 5 years (or interval TBD)

6.3 Opportunities for Expanding the Wilder Churnet Project to District Level

6.3.1 What is the Wilder Churnet Project

Wilder Churnet was an 18 month project from 2021-23 following a successful funding bid by Staffordshire Moorlands District Council and Staffordshire Wildlife Trust to the Green Recovery Challenge Fund delivered by The National Lottery Heritage Fund in partnership with Natural England and the Environment Agency.

The River Churnet is vulnerable to flash flooding, with great volumes of water falling on the steep sided valleys of the uplands, leaving settlements such as Leek and Cheddleton. Oakamoor, Denstone and Rocester at risk of property damage through flooding. With more unpredictable weather events becoming more commonplace due to climate change, it is likely that flooding along the Churnet will increase. Additionally, the water course was deemed to be in a poor condition due to nutrient runoff from farmland in the headwaters, and elevated sediment levels. Bird and invertebrate species associated within the surrounding habitats are directly impacted by the water quality, including priority species which are listed as red species of conservation concern e.g. Curlew, Lapwing, Cuckoo and Snipe, because of a lack of wet grassland & rush pasture breeding grounds. The area is also at risk from the effects of climate change, such as increased risk of wildfire, evidenced by the summer of 2018 when three major wildfires in the locality where close to 50 hectares of countryside were destroyed.

This project was undertaken on land owned by Staffordshire Wildlife Trust and Staffordshire Moorlands District Council at the following eight nature reserves; Black Brook, Brough Park Fields, Cotton Dell, Gun Moor, Ipstones Edge, Ladderedge Country Park, Rod Wood and Thorswood. All of these reserves are in the catchment of the River Churnet in Staffordshire Moorlands, where the delivery of Natural Flood Management (NFM) works will improve water quality, slow the flow of flood waters, mitigate against climate change and provide restored habitats for wildlife. A variety of nature-based solutions were installed and created during the project including leaky dams, natural logjams and natural bunds which will have the combined effect of slowing the flow of flood waters in the headwaters of the River Churnet, filtering out impurities, improving water quality, and improving habitats for wetland species. The land around will be less vulnerable to wildfire, becoming boggier and holding water longer during drought conditions, with natural flood management across 2.5km of watercourses in the uplands directly restoring 45 hectares of wet grassland, rush pasture and wet woodland.

The work delivered will directly benefit the restoration of the following priority habitats;

- Ponds
- Rivers and streams
- Upland flushes, fens & swamps – rush pastures
- Wet woodland

And through the improvement of these habitats the project will help to restore breeding ground habitats for priority species including;

- Common Cuckoo
- Eurasian Curlew
- Northern Lapwing
- Skylark

6.3.2 What did the Wilder Churnet Project Deliver

Black Brook

Large woody debris was added to nearly 1000m of ditches in the plantation to the north of the site, and earth bunds have been created in the open area along with 6 scrapes to intercept and hold water, creating a linkage of ponds in the upper reaches of the site. These measures will ease flooding further downstream, while the earth bunds will help to re-wet the site and increase the habitat suitability for species such as Globeflower (Trollius europaeus) by raising the water level. The new pools created behind the bunds were occupied by breeding frogs less than a month after they were created.

Brough Park Fields

A new pond has been created to increase water storage on site and reduce surface runoff, while 255m of hedgerow has been planted to intercept surface runoff and increase infiltration from the slopes which will also act as wildlife corridor along the edge of the site. A new fence has been installed adjacent to the hedgerow to prevent livestock browsing on the new tree whips.

Cotton Dell

Large woody debris (LWD) was added to the water course running through the site. At normal flow, the water will filter through the log jam, but at spate the LWD will hold back water reducing the risk of flash flooding where the stream joins the main river. This will also serve to capture sediment behind the LWD as it will be depositing when the flow of water is decreased, filtering out impurities and improving water quality. LWD form a great habitat for both aquatic and terrestrial invertebrates, as there are more areas for fish to shelter and new pools and riffles created. Improved habitat for invertebrates means increased prey availability for a range of aquatic and terrestrial species. The LWD offers

new shelter and nesting spots for birds, especially dippers who suffer from a high level of disturbance due to the public right of way running close to the stream.

Gun Moor

There were 512m of existing drainage ditches blocked with peat and earth bunds, for a total of 22 bunds in total across 3 ditches. By blocking these artificial channels on site water retention will be increased, reducing surface runoff into the Meerbrook and Clough Brook while also working towards restoring the site to a natural damp state. This re-wetting of the land will help to encourage damp loving plants to recolonise as the habitat suitability improves while also making the site more resilient to climate change.

Ipstones Edge - Swineholes Wood

There were 11 peat bunds installed using machinery and 26 small leaky dams built by volunteers across approximately 300m ditches. The peat dams will improve water retention on-site by forcing the water to back up behind the dams and infiltrate in land adjacent to the ditches. The small leaky dams will help slow the flow of water during peak flow events and capture sediments which will filter out impurities in the water flow.

Ladderedge Country Park

There were 2 new offline ponds created, one of which has been fenced to prevent livestock and dogs from entering it. Work to the channel was undertaken to block a section of stream and divert the flow through the woodland, allowing the water to trickle slowly back down into the stream channel, creating an additional pool. Volunteers also installed small leaky dams in the stream in the upper woodland which are already doing a great job of holding back water in spate.

Rod Wood

There were 22 small leaky dams installed with volunteers on the outflow ditches from the ponds leading down through Mellors Wood to help slow the flow of water during spate and capture sediments. A new pond has been created while work has also been undertaken to improve one of the existing ponds through the removal of vegetation to create open water habitat and increase capacity. There were 33m of new fencing and 3 new gates installed, while 183m of old fencing was removed. This will improve the control of livestock movement across the site and will reduce poaching around the existing and new ponds.

Thorswood

A new dry stone wall bridge, built using locally sourced stone in keeping with the character of the area, has been constructed over the stream ford between two grazing compartments. This will allow cattle to cross the water course without excessively poaching it and reducing pollution entering the watercourse. New post and rail fencing was installed along the woodland edge to prevent cattle from accessing the woodland stream.

Project Legacy

Volunteer groups set up at specific nature reserves will continue to work on these sites now that the funded project has come to an end. This includes maintaining timber dams and other features that have been installed, alongside continuing with a variety of monitoring at sites such as fixed point photography, invertebrate and fish surveys, and monitoring floristic diversity which will help to inform management of the sites in the future.

6.4 Natural Flood Management (NFM) Approaches

The general approach to land management, especially over the last 50 years has greatly impacted the movement of water across the landscape, increasing the amount of water entering watercourses and reducing the riparian habitats ability to deal with flood events. Therefore, Natural Flood Management techniques seek to revert the changes that have occurred to habitats such as reintroducing meanders to rivers, lowering banks to allow rivers to flood onto surrounding land, intercepting run-off and strategically planting areas of woodland.

6.4.1 River and Floodplain Restoration

The meandering nature of watercourses has previously been seen as an inconvenience, and they have been channelised to enable the use of land up to the river banks for both farming and development, speeding up the flow of water and shortening the overall length of the river. Embankments along watercourses have been used in an attempt to protect vulnerable areas from flooding, however, the consequence of this is that the river is disconnected from the floodplain and water is prevented from leaving the watercourse potentially compounding flooding issues downstream.

River bank restoration (Sediment management)

Although the erosion of river banks is a natural process this can be artificially accelerated through human activity. This may be rectified through the installation of fencing to manage access that livestock have to the banks, allowing them to stabilise naturally as they re-vegetate, although depending on the severity it may require tree planting and sowing seed, or re-profiling the river bank.

River morphology and floodplain restoration (Floodplain storage/sediment management)

Rivers have been managed and altered to increase available land use through straightening. This has generally worked to increase the flow of watercourses and disconnect them from their floodplains, reducing surface water storage during times of high rainfall. Reversing both these measures by reinstating meanders and lowering banks to reconnect areas of the floodplain will reduce the speed and volume that water moves downstream.

Instream structures (Floodplain storage)

Previously watercourses have been managed to remove any blockages to maximise the amount of water they can hold and improve drainage off productive land. Reinstating these features created using large woody debris slows the flow of water, holding water back and therefore can work to reconnect areas of the watercourse with the floodplain.

Washlands and offline storage ponds (Floodplain storage)

These are areas next to watercourses where water is funnelled during spate. These storage ponds which can be artificially created will collect and hold back water during high flow and slowly release it back into the watercourse, reducing the risk of flooding as the time until it arrives downstream is delayed.

6.4.2 Land Management for NFM

As agricultural and forestry practices have become increasingly intensified and mechanised, soil has become increasingly compacted and there has been an increased loss of topsoil. Consequently less water is able to infiltrate into the soil increasing surface runoff and soil erosion which facilitate the deposition of sediment downstream which reduces the capacity of waterbodies to deal with high water events.

Land and soil management practices (Runoff reduction)

Surface runoff is increased and infiltration of water into the soils decreases in situations where there is higher soil compaction, soil erosion and reduced vegetative cover particularly over the winter months. Increasing soil aeration and reverting soil compaction can increase the capacity and readiness that infiltration can occur, while the use of cover crops and strategic hedgerow planting along contours of the land can slow the flow of water and give it more time to infiltrate into the soils.

Agricultural and upland drainage modifications (Runoff reduction)

Field drains on agricultural land and drainage ditches that have been created on land in upland areas such as peatland contribute towards the amount of water entering our watercourses. By breaking field drains and blocking up drainage ditches with peat bunds or timber/plastic frames, the flow of water is reduced and sediments are allowed to settle in the ditches and increase the chance of the water being retained within the soils where the drainage mechanisms are present.

Non-floodplain wetlands (Runoff reduction)

These are located outside of the floodplain and therefore work to store water in/on the land and prevent it from reaching our watercourses. Large drainage projects after the second world war to increase the productivity of the land have resulted in a significant reduction to our wetlands, but through restoration and creation of new wetlands surface runoff can be reduced.

Overland sediment traps (Runoff reduction/sediment management)

Sediment traps are excavations strategically located to reduce surface runoff, but also capture sediment and diffuse pollution within the surface run-off that is allowed to settle in the traps to reduce the amount entering our watercourses.

6.4.3 Woodland Creation for NFM

Trees are our first line of defence during high rainfall events as they intercept the rainfall and will prevent a proportion of it reaching the ground. Consequently, deforestation increases surface runoff and reduces the stability of the soil which can result in an increase of soil erosion. Through the planting and management of woodland areas at a range of scales throughout the catchment and headwaters we can reduce runoff and increase the storage capacity of the riparian environments.

Catchment woodlands (Runoff reduction)

Woodlands planted on land where water will runoff into streams. The flow of water over the land will be reduced through soil water storage, evapotranspiration and creating resistance to water flowing across the land.

Floodplain Woodlands (Runoff reduction/floodplain storage)

This type of woodland has the greatest potential for flood mitigation downstream, however the location of the woodland and its size can have a significant effect on its success as an NFM technique.

Riparian Woodlands (Runoff reduction/floodplain storage)

Typically planted to a width of up to 30m depth on each bank adjacent to the watercourse, increasing evapotranspiration, infiltration, and the resistance of water moving across the land, while also creating the potential for woody debris to enter watercourses naturally in the future.

6.4.4 Where Might Benefit from NFM

With the variety of techniques available, it is possible to undertake NFM at suitable locations across the catchment, from headwaters down to the floodplain. There can be a significant difference in the costs with river reprofiling being expensive, while altering the management of land or planting a hedgerow can be relatively cheap options.

When searching for sites that may be suitable for NFM techniques, it is important to consider the implications for the land surrounding the works. For example, if woody debris was to be installed within a watercourse there would be the potential for localised flooding of the riparian habitats as the debris works to slow the flow during spate events. Therefore, a key consideration when identifying suitable site for NFM relies on finding landowners who are amenable to temporary and permanent land use changes, such as flooding or woodland planting respectively.

With regards to the most suitable locations for the NFM to be implemented within SMDC, it is recommended that guidance be sought from the Environment

Agency and Natural England, as it can be possible to inadvertently synchronise the convergence of flood waters creating a higher water level, that would otherwise have entered a watercourse separately. When the Wilder Churnet project was being developed the advice received from the consultation directed our focus towards working in the headwaters of the River Churnet catchment, where small interventions on small water courses and streams can have a large combined impact, without any detrimental impact on neighbouring land. Whilst the entire project took place on land owned by SMDC or SWT with no predicted impact on neighbouring land, the neighbours were consulted to make them aware of the proposed work and reassure them of the outcomes.

There are three water catchments represented within SMDC, namely the Weaver Gowy Management Catchment, the Dove Management Catchment and the Trent Valley Staffordshire ManagementCatchment.

Details of the catchment areas can be found in Appendix D.

7. Next steps

Next Steps after approval

- Nature declaration adoption
- Create a glossy version of the plan plus a summary document with FAQs and a glossary of terms using the existing climate change and biodiversity branding
- If approved the Plan for Nature will require a governance structure established.
- Internally the Climate Change and Biodiversity Deliver Group includes the relevant Heads of Service and officers to establish and monitor projects and workstreams within the Plan
- The operational tracking tool for this programme needs oversight
- The methodology, what and when to measure to align with the targets will form a performance indicator framework. This includes defining the baseline situation.
- The Alliance has recently appointed a Biodiversity Officer who will lead on the developing the project strands and work with communities, external agencies and landowners to work through barriers and address opportunities.
- SCC Adaptation
- Scope and set up project plans to be ready to ac when funding becomes available. The council have not been able to respond to funding opportunities as there are no 'shovel' ready projects
- Create a comms and engagement plan
- Pull out all of the suggestions to scope potential projects and assess barriers, enablers, critical paths, adjacencies and risk profiles along with co-benefits
- Align project to grant funding types
- Prioritise initiatives
- Establish Green Spaces Strategy for parks and council land.

- Assign project leads for each project

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