State of Nature Report

for the

Liverpool City Region

Part I: Nature Baseline and Indicators

January 2022

LIVERPOOL CITY REGION
COMBINED AUTHORITY

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Contents

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Key Message

The Liverpool City Region (LCR) is in a state of climate and ecological emergency. The interdependency of climate resilience, and a restored and functional natural environment should not be separated. Climate and ecology are inextricably linked, their success being mutually-dependant on one another. This State of Nature report has shown that the natural environment of the LCR has suffered from a history of loss, degradation and pollution as a result it is currently in a much-degraded state. It is from this low depleted baseline that we now must restore and recover.

To allow the LCR to move forward and prosper as the cleanest and greenest city region and address the challenges of climate change for people and wildlife, nature recovery is essential.

Executive Summary

This is the first State of Nature (SoN) report for the Liverpool City Region (LCR). The report has the considerable task of collating, analysing and interpreting ecological information to assess the State of Nature within the City Region as a whole and in doing so provide an evidence base for the LCR Combined Authority for their emerging Spatial Development Strategy (SDS). This evidence base will also inform future natural environment strategies and wider nature recovery projects.

This SoN report Part I provides an overview of the status and trends of designated sites, habitat and species within the LCR as well as levels of ecosystem service provision and engagement with the natural environment by LCR residents.

The report has been compiled using the best available information. Primary data capture has been undertaken but much of the information is sourced from an existing evidence base of local secondary data and expert opinion. We have highlighted trends in the abundance and distribution of species and habitats, and pressures on nature and drivers of change. Ecosystem service capacity and extent of social action for the natural environment has also been evaluated.

The purpose of this report is to provide ecological evidence for the LCR Combined Authority to inform strategic natural environment policy for the SDS. This report will, however, help to inform the forthcoming Local Nature Recovery Strategy and more widely can act as a driver to set local nature conservation priorities for action, identifying management needs, investment and targeting of wildlife monitoring.

The trends found are clear, they show that biodiversity within the LCR is in a state of decline and urgent action is required. The report makes a number of recommendations (Part II) to halt this decline.

The LCR State of Nature report has identified the following key headlines:

Key Headlines

- Trends in species, habitats and designated sites are clear, they show that biodiversity within the LCR is in a state of decline and urgent action is required.

- Designated sites cover 41% of LCR area. It is our coastal and intertidal habitat which is recognised as internationally and nationally important and these areas form 66% of our designated site network. They protect sand dunes, saltmarsh and mudflats which provide habitat for specialist plant and animal species as well as providing important refuges for migrating and wintering birds. They represent a significant biodiversity resource within the LCR.

- The most recent assessment of condition of these sites found that only 37% of SSSIs are in favourable conservation status and many locally designated sites are not in positive conservation management. Factors affecting the condition and quality of designated sites and habitats include; lack of management, scrub encroachment, climate change, pollution transfer, impacts from invasive species and plant disease, impacts from recreational pressure.

- Since the early 1980's there has been approximately 5% loss of all habitats due to development pressure, notably 10% of our most biodiverse grasslands have been lost. This is considered to be an underestimate and does not reflect pre 1980s losses. Since 2000, however woodland cover has increased by 12%.

- Priority Habitat and NMBAP Habitat accounts for approximately 11% of total terrestrial land area. This is lower than national Priority Habitat cover (14%).

- Lowland raised bog, the most effective habitat for storing carbon, was once more widespread but is now critically rare and heavily degraded. This habitat now covers just 0.02% of all recorded habitat in the LCR. Yet 1,955 ha of the LCR is underlain by peat and if restored could increase habitat extent significantly and positively contribute to carbon storage.

- The LCR Natural Capital Baseline provides a strong basis from which to access ecosystem service capacity and demand. Designated sites provide high levels of ecosystems services and will underpin local nature recovery.

- Rivers within the LCR are heavily modified, and less than 1% are in good ecological status, compared to 14% nationally. This reflects declines in other urban areas which are occurring due to pressures from various sectors including: commerce and industry, agriculture, water industry, urban and transport (*The Rivers Trust, 2019*).

- The LCR is a stronghold and of conservation importance for species such as water vole, natterjack toad, sand lizard, pink-footed goose, whooper swan, red squirrel and highly specialised coastal plants and invertebrates.

- 15% of Priority Species recorded in the LCR, are likely to have gone locally extinct while a further 14% have not been re-recorded since 1990.

- Climate change is influencing and will continue to influence the natural environment within the LCR with a number of case studies showing the impacts of changing climate on species, notably natterjack toad, bats and birds. From 1975 around three new Priority Species have arrived in the LCR each year.

- Species of farmland habitats are showing the most substantial declines in occurrence and abundance. Species of woodland habitat in the LCR have also shown historic decline but with some recent recovery.

- The 'Engagement in Nature Liverpool City Region Survey' found that 40% of respondents spend their daily free time in greenspaces. 50% of respondents are spending more time in greenspaces since the coronavirus pandemic. Over 50% of those surveyed said they visited greenspaces to benefit their mental health. Of those surveyed nearly 45% actively engage with local or national environmental groups.

- Merseyside has a long history of naturalists, it is only because of the continued work of these naturalists, biological recorders and largely voluntary nature conservation groups who spend their free time surveying, recording and analysing data that we have been able to produce this report.

Introduction

Background

As recently reported, the UK has lost nearly 50% of its biodiversity, placing it in the most nature depleted 10% of countries in the world, and was last among the G7 group of nations (*Natural History Museum, 2021*). It is no coincidence that the UN Biodiversity Conference (COP15) took place 2-weeks in advance of COP26 as urgent action for biodiversity is needed and is a fundamental part of the Climate Emergency. The two cannot be separated.

The Liverpool City Region (LCR) Combined Authority declared a Climate Emergency in 2019. This coincided with a national Year of Green Action and highly successful LCR Year of Environment held across the City Region and co-ordinated by Nature Connected – the LCR Local Nature Partnership. The Year and first ever LCR Environmental Summit held in November 2019, highlighted the urgency of the situation and need to address declines within our natural environment. The high importance of nature to communities and well-being was also a strong theme.

In response to the climate and ecological emergency, and LCR Year of Environment 2019, a £0.5 million community environmental fund and Climate Partnership were put in place in 2020 to support action for the environment in our City Region (*MEAS, 2020*). The partnership subsequently published a Year 1 Climate Action Plan 2021/22 which includes several actions for habitats and biodiversity.

The importance of nature for people was further recognised during the Covid-pandemic of 2020-21 and successive national lockdowns saw our communities engage with the environment more so than ever. Unsurprisingly, this has placed the natural environment as one of the key issues for the emerging Spatial Development Strategy (SDS).


Photo credit: Anya Coffey

Purpose and scope of report

This inaugural LCR State of Nature (SoN) Report seeks to **provide a robust environmental baseline to inform the SDS** and ambitious strategic policy approach to shape local nature recovery for future generations.

Merseyside Environmental Advisory Service (MEAS) and Merseyside BioBank (Local Environmental Record Centre for North Merseyside) have been commissioned by the LCR Combined Authority to prepare a 'LCR State of Nature Report'.

For the purposes of this report and strategic planning, we felt it was appropriate to adopt a natural environment definition of 'nature'. The Environment Act 2021 defines the natural environment as:

> ***"natural environment"***
>
> *(a) plants, wild animals and other living organisms,*
>
> *(b) their habitats,*
>
> *(c) land (except buildings or other structures), air and water, and the natural systems, cycles and processes through which they interact.*

This report will form part of the Combined Authorities emerging LCR Spatial Development Strategy (SDS) evidence base and will provide a baseline and recommendations to help shape strategic natural environment policy and provide a framework to implement this at a local level.

This work will also provide an early opportunity to health check our baseline data, inform a future Local Nature Recovery Strategy (LNRS) and implementation of Biodiversity Net Gain across the City Region following the enactment of the Environment Act.

The LCR SoN Report includes a range of indicators to measure the status and trends of designated sites, habitats and species, ecosystem services as well as public participation in the environment across the LCR. The indicators are chosen to follow and/or broadly align with the 25 Year Environment Plan (*Defra, 2019*) and the national State of Nature Report (*State of Nature Partnership, 2019*) indicators. This approach has been taken so methods and results will be comparable against national trends and best practice and broadened where local data allows.

Table 1 sets out the indicators which the LCR SoN report has adopted. For ease of reference at an LCR level, we have created a 'SoN indicator reference'. Section 3 provides a description of these indicators.

Table 1: State of Nature report Indicator

SoN Indicator	25 Year Environment Plan Indicator	England Biodiversity Indicator
N1 – Habitat status and extent	D1 Quantity, quality and connectivity of habitats	2a. Status of Threatened Habitats; 2b. Status of Threatened Habitats: Habitats of European Importance; 3. Habitat Connectivity in the Wider Countryside
N2 – Designated sites	D2 Extent and condition of designated sites – land, water and sea	1. Extent and condition of designated areas
N3 – Abundance of widespread species	D4 Relative abundance and/or distribution of widespread species	5. Species in the Wider Countryside: Farmland; 6. Species in the Wider Countryside: Woodland; 7. Species in the Wider Countryside: Wetland; 8. Species in the Wider Marine Environment
N4 – Protected / priority species status	D5 Conservation status of our native species	4a. Status of Priority Species: Relative abundance 4b. Status of Priority Species: Distribution 4c. Status of Threatened Species: Species of European Importance

SoN Indicator	25 Year Environment Plan Indicator	England Biodiversity Indicator
N5 – Ecosystem services of habitats and species	B6 Natural functions of water and wetland ecosystems D7 Species supporting ecosystem functions	9. Biodiversity and ecosystem services: terrestrial
N6 – Social action for the natural environment	G4 Peoples engagement in the natural environment G5 People engaged in social action for the environment	No direct EBI
N7 – Invasive species	H2 Distribution of invasive non-native species and plant pests and Diseases	20. Trends in pressures on biodiversity: invasive species

The LCR SoN Report is evidence and data led. Trends are reported where data, literature and stakeholder review has established a high level of confidence.

The report has been compiled over summer and autumn 2021 assembling secondary data derived from a wider range of sources. Primary data capture of habitat information has also been undertaken to inform habitat trend analysis. A public questionnaire was also circulated online to inform understanding of social action for the environment.

A collaborative approach with key stakeholders (see acknowledgements) has been taken to ground truth and sense check trends. We give thanks for these invaluable contributions and welcome continued support in future iterations/review of the report.

Reporting Approach

The LCR SoN Report has been commissioned for the purpose of providing a natural environment evidence base to inform the Spatial Development Strategy (SDS). However, it is acknowledged that the content of this Report will also inform wider natural environment strategies including a Local Nature Recovery Strategy (LNRS) for the City Region.

The remit of the SDS and LNRS are very different. The SDS is a strategic planning document which will be prepared by the LCR Combined Authority. Many actions to recover nature stray beyond the strategic policy of an SDS. Therefore, two versions of the Report are to be published:

1. **LCR State of Nature Report – Spatial Development Strategy version; and**

2. **LCR State of Nature Report – Implications for Local Nature Recovery version.**

The aims of this **Spatial Development Strategy version of the Report** are set out below.

Aims of the Report

- **Inform the development of strategic natural environment policy for the Spatial Development Strategy.**

- **Bring together for the first time an ecological evidence base for the Liverpool City Region.**

- **Where data allow, produce trend analysis to facilitate assessment of changes in protected sites, habitats and species.**

- **To provide evidence from which long-term changes in the state of nature can be measured enabling success of policies and biodiversity net gain.**

- **To review and evaluate ecosystems service capacity and make recommendations for natural capital policy.**

Where does the data come from?

Despite the clear need and often desire to measure species trends at a local scale the data that might allow us to do so simply does not exist. Nationally, monitoring is undertaken via National Schemes and Societies who coordinate long term, structured, species monitoring projects.

At a national scale the sample size is sufficient to provide robust trends however the sample locations are often necessarily randomised and so the chances of there being sufficient sampling within the Liverpool City Region for any particular scheme to allow local analysis is piecemeal.

However, the LCR is in a fortunate position of having a strong legacy of involvement with natural history. The LCR is fortunate to have two Local Record Centres, Merseyside Biobank and Cheshire rECOrd who collate and coordinate biological records for the LCR. The use of 'data' in decision taking has come to the fore through the expanding community of individuals and organisations with an interest in the natural environment and biological recording. By giving up their time, often for free, we benefit from a steady flow of information available to inform better decisions for biodiversity. Many of these organisations can trace their early years and indeed establishment to the World Museum Liverpool and its world class natural history department which established biological recording activity in the City Region and remains relevant and essential to understanding our local environment today.

The Liverpool City Region has a long proud history of naturalists and of environmental action. There are, and have been, many environmental organisations and individuals working tirelessly to record and improve the regions environment often with little or no funding. The Liverpool City Region through the work of Tony Bradshaw pioneered restoration of post-industrial sites and environmental work in urban environments. This has continued through organisations such as Groundwork, the Mersey Basin Campaign, Mersey Rivers Trust, Landlife and Mersey Forest as a result the natural environment of the Liverpool City Region has gradually begun to recover from its industrial past.

History of Naturalist Group's & key events in Liverpool City Region

1875

1877
Lancashire and Cheshire Entomological Society founded

1895

1906
Liverpool Botanical Society founded

1914
Lancashire and Cheshire Fauna Society founded

1915

1929
North Western Naturalists' Union founded

1938
Eric Hardy founded the Merseyside Naturalists' Association

1935

1962
Lancashire Wildlife Trust & Cheshire Wildlife Trust was founded

1969
First broadcast of 'Countryside' on Radio Merseyside. Eric Hardy was the first naturalist to bring nature conversation into the daily lives of listeners in Merseyside.

Eric Hardy (1912-2002)

1955

1971
Northwest Biological Field Databank, Merseyside County Museums & Wirral Wildlife founded

1981
Tony Bradshaw pioneered the restoration of post-industrial sites and set-up the first Groundwork Trust in St Helen's.

Tony Bradshaw (1926-2008)

1975

1985
Lord Heseltine helps start the Mersey Basin Campaign. Which has transitioned into the Mersey Rivers Trust since 2017.

1994
North West Fungus Group founded

1995

2000
Cheshire RECORD founded

2005
North Merseyside Amphibian and Reptile Group founded

2007
Merseyside BioBank founded

2009
Cheshire Active Naturalists founded

2015

2019
Year of the Environment & Climate Emergency declared

2021
Environment Act becomes law. This legislation will improve air and water quality, tackle waste, increase recycling, halt the decline of species, and improve our natural environment.

Introduction to Liverpool City Region Natural Environment

The Liverpool City Region (LCR) covers the boroughs of Halton, Knowsley, Liverpool, Sefton St. Helens and Wirral. See Figure 1.

Figure 1: Liverpool City Region

The LCR is rich in natural assets and this brought prosperity to the region through the development of its ports and industries and which continue to play an important role in the region's economy today.

The area is characterised, in the west by the coast and the estuaries of the Dee, Mersey, Ribble and Alt which strongly influence the ecology of Sefton, Wirral, Halton and Liverpool. The coast and estuaries are recognised internationally and nationally for their importance for wildlife and provide not only a much-valued landscape and recreational resource for the residents of the LCR and beyond, but also vital coastal defences.

Halton is characterised by the Mersey which passes through the borough. Either side of the Mersey is heavy industrial development which in places has left a highly polluted legacy. However, sites such as Pickerings Pasture in Widnes, show how these sites can be restored for the benefit of both people and nature. Within the south of the borough is a network of irreplaceable ancient woodlands, a number of which are SSSIs.

Within the urban conurbations of Liverpool and east Wirral extensive parks provide a valued greenspace and space for nature. To the east the LCR borders productive and expansive farmland of the Lancashire plain. These areas provide valuable passage and wintering feeding grounds for migratory bird species such as the Pink-footed goose and whooper swan but also strongholds for species such as brown hare and water vole.

The Wirral Peninsula is formed between the Mersey and the Dee Estuaries. The landscape is characterised by the urban conurbations on the east and more rural areas for the west comprising former large country estates, farmland, natural coastlines and wooded sandstone ridges (*Natural England, 2014*). The sandstone ridges provide a network of lowland heath sites such as Thurstaston Common SSSI.

The areas of St.Helens and Knowsley comprise of a mosaic of farmland, scattered urban centres, industrial sites and derelict industrial sites. Many previously redundant industrial sites have now been reclaimed, either naturally or through restoration programs. These sites can be extensive and now provide important wildlife sites providing strongholds for many species as well as providing locally valuable recreational amenity and bringing local communities in close contact with nature. Notable examples include, Colliers Moss Common and Sutton Manor in St.Helens and Stadt Moers Country Park in Knowsley. In the area between St.Helens and Kirkby are the remnants of peatbogs of which only one site, Acornfield Plantation, is still a functioning peat bog, the other areas being either drained for agriculture or historic plantation woodland. Further peatbog remnants are present in the Bold area of St.Helens and around Colliers Moss Common. Within St.Helens the Sankey Valley provides an important wildlife corridor through the borough and into Warrington eventually reaching the Mersey. Whilst in Knowsley the River Alt and Netherley and Ditton Brook to the south provide vital wildlife corridors.

Natural Environment Context

The global trend is clear, biodiversity globally is under serious threat. Numerous reports have repeatedly identified significant global biodiversity loss. The 2020 global Living Planet Index (*WWF, 2020*) shows an average 68% fall in populations of mammals, birds, amphibians, reptiles and fish between 1970 and 2016. Humans are the cause, with our demands on nature far exceeding its capacity to provide us with the goods and services we depend on.

Despite clear and growing evidence, and ambitious global targets, our responses to biodiversity decline at the global and national levels have been woefully insufficient. The 2020 Global Biodiversity Outlook (*Secretariat of the Convention on Biological Diversity, 2014)* reported that none of the 20 Aichi Biodiversity Targets, set out in the Strategic Plan for Biodiversity 2011 – 2020, had been fully achieved.

Nationally centuries of farming, building and industry have made the UK one of the most nature-depleted countries in Europe. A recent study by the Natural History Museum (*NHM, 2021*) has found that the UK is estimated to have lost almost 50% of its biodiversity since the industrial revolution. The study revealed that the UK is in the bottom 10% and last among the G7 nations in terms of retained biodiversity. The national State of Nature report (*State of Nature Partnership, 2019*) identified that since the 1970s, 41% of all UK species studied have declined.

The Liverpool City Region was at the heart of the industrial revolution in Britain and losses to biodiversity seen nationally are reflected locally. Rapid industrial and urban growth in our area resulted in habitat loss and associated species loss. Contamination and pollution from heavy industry polluted our land, air and water leading to poisoning and degradation of habitats and loss of species. Draining of our wetlands for agriculture and coastal development led to loss of mossland, marshes and wetlands and release of carbon.

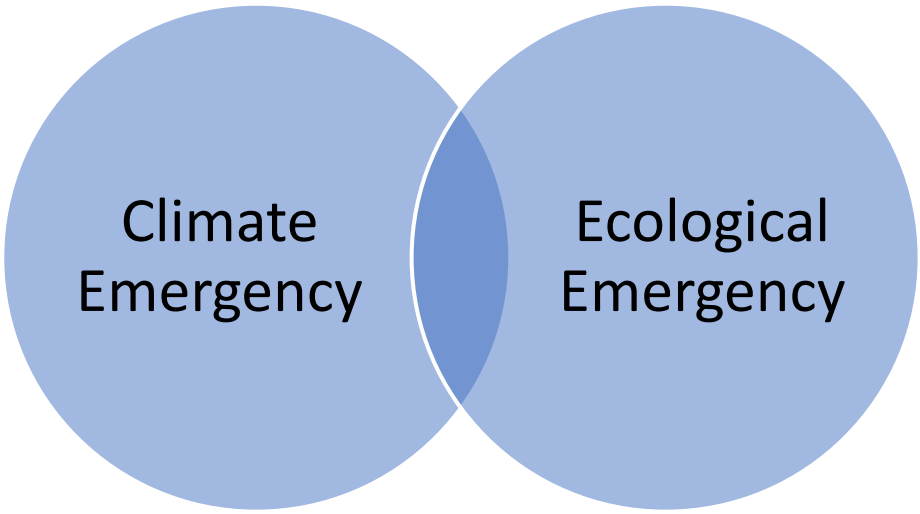
It is from this low depleted baseline that we now must restore and recover.

Moving forward

The Mersey once one of the most polluted rivers in the UK, through the concerted efforts of the Mersey Basin Campaign and others now supports improving fish populations with dolphins and harbour porpoise often sighted in the estuary. Organisations such as the Lancashire, Manchester and North Merseyside Wildlife Trust, Cheshire Wildlife Trust, the Mersey Rivers Trust, Mersey Forest, Groundwork, Mersey Gateway Environment Trust, Landlife and others have created new nature conservation sites and habitats across the region. However, we experience loss and decline of the natural environment due to a variety of factors.

Climate and Ecological Emergency

In May 2019, Metro-Mayor Steve Rotheram declared a 'Climate Emergency' on behalf of the Liverpool City Region. This was swiftly followed by all LCR Local Authorities declaring climate and environment emergencies. The interdependency of climate resilience, and a restored and functional nature environment cannot be separated. The two are interlinked and one cannot succeed without the other. Further, it is important to recognise that climate change is having an impact on the natural environment which through ecosystem services is vital for helping us mitigate and adapt to climate change.



The Metro-Mayor has set out a vision for the LCR to be the Cleanest and greenest city region in the country and for the LCR to be at the forefront of innovation in sustainable technology. The LCR Combined Authority has pledged the Liverpool City Region will become net zero for carbon by 2040. Further commitment has been shown through

the Metro-Mayor's recent attendance at COP26 in Glasgow and recent pledge to make the River Mersey free of sewerage by 2030 and discharge free by 2040.

The question now is how to achieve this. Boyle *et al.*, (*2019*) in their report 'Towards a green future for the Liverpool City Region' identifies that at a time when the LCR is seeking to continue to grow its economy it is also seeking to lead a green revolution. Their report asked the question: –

> ***"How might the LCR grow the Local Economy and progress its regeneration whilst also reducing its ecological footprint, mitigating growth threats to the natural world, arresting and remediating pollution, and securing for local citizens a new generation of growth which is simultaneously inclusive and green."***

This State of Nature report provides a baseline to highlight and begin to measure the effects on the current and historic ecological footprint of the LCR. It seeks to provide a baseline against which the LCR can measure its success in its ambition to become the cleanest and greenest city region.

Nature Conservation Legislative and Policy Context

The ambition to become the cleanest and greenest city region is set within a legislative and policy framework.

25 Year Environment Plan and Environment Act

The 25 Year Environment Plan sets out the Governments long-term approach to protecting and enhancing the environment in England for the next generation (*HM Government, 2018).* The goals are: cleaner air and water; plants and animals which are thriving; and a cleaner, greener country for all. The Environment Plan includes policies such as delivering a new environmental land management system, restoring vulnerable peatlands and ending peat use in horticultural products by 2030. Supporting the development of a new Northern Forest, developing a Nature Recovery Network.

The Environment Act (which received Royal Assent in November 2021) is one of a number of pieces of new legislation which will implement the 25 Year Environment Plan.

The Environment Act sets out new environmental frameworks for improvements to nature, air, water quality and waste. The Environment Act brings forward two provisions which have the potential to drive nature recovery, these are the mandatory requirement for the provision of a minimum of 10% biodiversity net gain for all

development and the preparation of Local Nature Recovery Strategies and a national Nature Recovery Network.

From November 2023, the Environment Act will require all development to provide a minimum of 10% Biodiversity Net Gain. This will require the retention, enhancement and creation of habitat on development sites and where this is not achievable off site. The Environment Act requires that these habitats are maintained for a minimum of 30 years.

Recent retrospective review of existing planning applications (*MEAS, 2021*) found that current levels of Biodiversity Net Gain provision across the LCR vary with some developments achieving a level of net gain but others not. Currently very few developments achieve 10% net gain. From the review it is clear that proposals will need to make space for biodiversity within development and practices such as build to the boundary will not achieve this.

The appropriate location of Biodiversity Net Gain as well as wider ecological recovery will be guided through the production of Local Nature Recovery Strategies (LNRS). The Liverpool City Region Combined Authority has been identified as the 'Responsible Authority' and the lead for the preparation of the Liverpool City Region LNRS by the Secretary of State. The LNRS will establish priorities and map proposals for specific actions to drive nature's recovery and provide wider environmental benefits. The ambition is that Local Nature Recovery Strategies will be a powerful new tool that will help the public, private and voluntary sectors work more effectively together for nature's recovery and enable effort to be focussed where it will have most benefit. With such a wide-ranging remit across sectors wide stakeholder engagement will be required. Collectively these Local Nature Recovery Strategies will then form the national Nature Recovery Network.

Nature recovery will further be driven by an enhanced Biodiversity duty on Local Authorities. Whilst the current Biodiversity duty[1] on Local Authorities requires them to "Conserve Biodiversity", under the Environment Act this duty will be extended to "Conserve and enhance Biodiversity" through its plans, policies and actions. In addition, Local Authorities will be required to undertake periodic review of the action the authority has taken in exercise of its Biodiversity Duty and must publish 5 yearly Biodiversity Reports reviewing their actions. This State of Nature report provides a baseline from which Local Authorities within the LCR can measure Biodiversity Net Gain.

The Environment Act therefore will become a cornerstone to environmental legislation in the England driving policy and decision making and setting the framework for ecological restoration.

[1] Section 40, Natural Environment and Rural Communities Act, 2006

Local Nature Conservation Policy Context

LCR Spatial Development Strategy

In early 2021 the LCR Combined Authority held a Spatial Development Strategy (SDS) Suggested Policy Approaches Consultation. This set out early issues and options for a natural environment policy. The consultation (LCR Listens 2) was highly successful and climate and the natural environment was one of the key themes which were important to consultees. The next consultation stage on the SDS is scheduled for summer 2022 and will present preferred policy options. This State of Nature Report will inform the preferred policy options for the natural environment, climate change and a natural capital approach.

Local Plans

All Local Plans and Unitary Development Plans within the LCR contain policies to protect nature conservation. Some Local Authorities have also gone further and published Nature Conservation Supplementary Planning Documents (SPDs), notably St.Helens and Sefton. These policies and SPDs set the framework for how nature conservation is addressed within development. In line with the National Planning Policy Framework (NPPF) these seek to conserve and where possible enhance biodiversity. More recent Local Plans go further and also support the protection and enhancement of the LCR Ecological Network. Moving forwards the Local Nature Recovery Strategies will replace the LCR Ecological Network and will need to be embedded within Local Plan and SDS policy.

In addition to local policy, both LCR Ecological Network and Local Biodiversity Action Plans have been adopted by the LCR Local Authorities.

LCR Ecological Network

LCR Ecological Network: VISION

By 2020:

- The LCR has explored opportunities to reconnect its strategic core biodiversity areas and is showing progress in the amount and quality of habitats provided in appropriate places, guided by the LCR Ecological Network.

- The strategic natural assets and their natural capital asset values are recognised and accepted. Strategic assets are being brought into positive conservation management through combination of policy and protection, funding, provision of ecological advice and guidance, using a Nature Improvement Area.

- Habitat losses have been reduced to a minimum. Using the 'avoid, reduce, mitigate and compensate' hierarchy, businesses are helped to plan for growth sustainably and are offered a range of ways to contribute towards securing and valuing our natural assets.

In November 2015, Local Planning Authorities approved the LCR Ecological Network and Nature Improvement Area (NIA) as part of their Local Plan evidence base. This forms the sub-regional ecological network required by NPPF and is founded on Lawton's principles of 'bigger, better and more joined-up' (*Lawton, 2011*). Local Plans have embedded this in their biodiversity and Green Infrastructure policy therefore the Ecological Network and NIA provide the only existing planning mechanism for nature recovery.

The vision of the LCR Ecological Network is suitably ambitious. However, by 2020 limited progress on this vision has been made. Future strategic policy for nature will have to go beyond minimisation of loss.

North Merseyside and Cheshire Biodiversity Action Plans

Biodiversity Action Plans were born out of the '*Convention on Biological Diversity*' signed at the 1992 Earth Summit in Rio de Janeiro by 189 countries including the UK government and resulted in the UK Biological Action Plan (UKBAP) being published in 1994.

The UKBAP laid out plans for conservation and detailed available resources. Specific Action Plans were drawn up for the most threatened habitats and species and national reporting was established on a 3 to 5 year cycle.

With successive conservation policy review and devolution UKBAP habitat and species have now been incorporated into country specific statutory conservation priorities. In England by Section 41 of the Natural Environment and Rural Communities (NERC) Act.

In addition to UKBAP, Local Biodiversity Action Plans (BAP) were devised to reflect local species and habitat of importance to enable prioritisation and targeting of conservation action and reporting. The LCR is covered by three local BAP areas, these are:

- North Merseyside Biodiversity Action Plan (NMBAP) covering the districts of Liverpool, Knowsley, Sefton and St.Helens;
- Wirral Biodiversity Action Plan; and
- Halton Biodiversity Action Plan.

The Local BAPs set local priorities for species and habitat and also implement national biodiversity targets. These action plans deliver conservation across the plan area and are material considerations in local strategy.

The Local BAPs are likely to be reviewed as part of the forthcoming LCR Local Nature Recovery Strategy with many of these local priority species and habitats likely to be adopted.

State of Nature Indicators

The State of Nature nationally

Before assessing the State of Nature for the Liverpool City Region it is important to understand the national picture. The LCR State of Nature report has deliberately reported against national indicators as this provides an opportunity to set the status of nature within the LCR against national trends.

A national State of Nature report was published in 2019. This report looked back over 50 years of monitoring to assess how nature had changed in the UK. It is based on the indicators used for the national report and therefore trends identified at the city region level can be compared with the national picture. It is worth noting that both the UK State of Nature report and the LCR State of Nature report have monitored trends since 1970, however, prior to 1970 the UK's wildlife had already been depleted by through habitat loss, degradation, persecution and pollution and therefore the 1970's baseline is a depleted one.

The national State of Nature report identified the following key trends:

- **More species have decreased than increased in abundance and distribution**. Since 1970 41% of species have decreased and 26% have increased in abundance, with the remaining 33% showing little change. Since 1970, 27% of species have decreased in distribution and 21% have increased, with 52% showing little change. This trend was reflected in both long term and short-term analysis, showing little progress to halt biodiversity loss;

- **Our wildlife is undergoing rapid change**. With 53% of species showing rapid changes in abundance either increasing or decreasing. This illustrates a rapidly changing environment.

- **15% of IUCN Red List species are classified as threatened** and therefore at risk of extinction**. 2% of species are known or considered to be extinct**.

- **Habitat change identifies historic and continuing losses in a number of habitats, including grassland and wetland.** 97% of wildflower meadows were lost between 1930's and 1984, an estimated 300,000 ha of lowland wet grassland were lost between 1970 and 1985, and 1.5 million ha of upland blanket peatland was drained in the mid-century. This trend has continued, between 2006 and 2012 over 1,000 ha of wetland was converted to artificial surfaces.

- **UK woodland cover is just 13.2%, one of the lowest rates in Europe, but has increased by 9% between 1998 and 2018.**

- Within the marine environment, the UK **Breeding seabird indicator shows a 22% decline in abundance**. However, **fish indicators show an increase in average abundance** in the Celtic and North Seas of 133% and 58% respectively since 1980.

- The State of Nature report highlights among **the most significant pressures are agricultural management, climate change, hydrological change, urbanisation, pollution, woodland management and invasive non-native species**.

- **Progress towards 2020 Aichi targets won't be met**. The Convention on Biological Diversity set out a strategic plan to halt biodiversity loss by 2020. The plan set out targets known as the 'Aichi'.

Methods and data limitations

The State of Nature report is evidence and data led. In following an approach reliant heavily on manipulation and analysis of secondary data it is important that data used, limitations and methods are transparent and replicable. Methods follow best practice and draw upon local expert knowledge and publications wherever possible. Species data has been sourced from Local Record Centres, Merseyside Biobank and Cheshire rECOrd.

The Technical Appendix 1 attached to this report provides full detail of data, limitations and methods.

N1: Habitat status and extent

Headlines

- In the LCR broad habitat type comprises 37% arable, 17% amenity grassland, 13% woodland, 6% grassland, 3% wetland and <1% heathland.
- Since the early 1980s approximately 5% of all habitat has been lost due to development. Limited habitat data is available to measure gains. However, this does not account for pre 1980s habitat loss and due to gaps in the habitat baseline overall loss is considered an underestimate.
- Woodland is the exception. Cover across the LCR has increased by approximately 12% since 2000 largely due to the Mersey Forest.
- Since 1980 at least 10% of our most valuable and biodiverse grassland has been lost to development pressures. 13% of the remaining area being on the Sefton Coast.
- Similarly, amenity grassland has declined by 10% in the LCR.
- Since the 1920s, 18 ha of Ancient Semi-Natural Woodland has been lost in the Merseyside area. By 1994 approximately 111 ha remained.
- Lowland raised bog, the most effective habitat for storing carbon (*Greg et al., 2021*), is now critically rare and heavily degraded. This habitat is 0.02% of all recorded habitat in the LCR. Yet 1,955 ha of the LCR is underlain by peat highlighting potential for restoration.
- Lowland heathland, one of the most biodiverse habitats, is rare and degraded. This habitat type is just 0.25% of habitat in the LCR.
- Although woodland cover has increased overall, there has been a loss of mature woodland (4.5%), whilst this has been replaced in areas by tree planting it will take several decades for this to mature and provide the same ecological value.
- Woodland, grassland, wetland and heathland broad habitat types (comprising Priority Habitat and North Merseyside BAP Habitat) accounts for approximately 11% of total terrestrial land area. This is slightly lower than national Priority Habitat cover (14%).
- Baseline Phase 1 Habitat Survey data is aged and has patchy coverage. Notably coverage of urban and coastal areas. Habitat condition and management data is limited to designated sites and not broken down to individual habitats. Habitat connectivity analysis is incomplete and requires refinement to underpin nature recovery.
- Our most distinct habitat types lack conservation management.
- Waterbodies are heavily modified, and less than 1% are in good ecological status. This reflects national and other city region trends.

Why consider habitat?

Habitat provides a home to our native flora and fauna. Habitat distinctiveness, condition and strategic importance are a proxy for biodiversity richness. Therefore, assessing habitat quantity and quality allows us to measure the available habitat for nature to thrive and recover, and in turn better understand their ecosystem services (see indicator N5).

Measuring connectivity allows us to quantify how well species can move through the landscape and thereby respond to negative factors such as climate change and habitat loss but also how readily species may colonise future habitat creation.

These considerations are embedded in Defra's biodiversity metric version 3.0 and will underpin measurable Biodiversity Net Gain which will become a mandatory planning requirement from November 2023.

How have we assessed this indicator?

Indicator N1 relates to **quantity**, **quality** and **connectivity** of habitats. In this section we draw upon local habitat data (Phase 1 Habitat Survey). Data is typically presented at broad habitat type level and at an LCR and Local Authority scale and supplemented by case-studies. This is set in the context of national trends.

Broad habitat types comprising highest distinctiveness habitat are discussed. Arable and amenity grassland are also included. Remaining habitats of lower nature conservation value or with poor coverage in the baseline habitat data e.g. coastal have been omitted from broad habitat type analysis. Analysis therefore is of broad habitat type only and does not cover all land in the LCR as the Phase 1 Habitat Survey baseline has incomplete geographic coverage. Figure 2 below shows that the Sefton Coast and intertidal areas are omitted which is a limitation. However, this has been addressed by using NVC survey and case study information provided by local experts.

Arable land due to its value for farmland species and non-breeding birds

Linear habitats e.g. hedgerow and field margins are not included in broad habitat analysis as data across the LCR is incomplete. These important habitats are however discussed under the district summaries section where data allows.

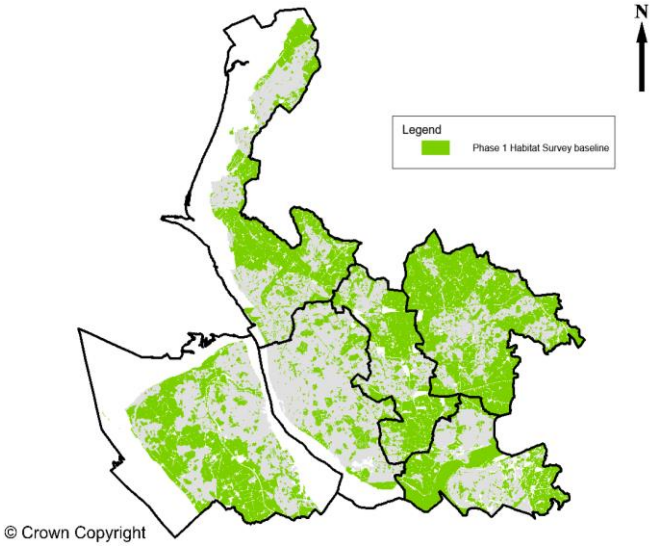


Figure 2: Phase 1 Habitat Survey baseline

Local habitat data presented in this section has limitations (see Appendix 1) associated primarily with agedness of survey, geographic coverage of coastal and urban environments and inconsistencies between survey across districts. However, these data are derived from field-based habitat survey methods, and despite limitations are considered best available data for the purpose of quantifying extent and change of habitats in the LCR.

Habitat loss is measured against a baseline derived from district level Phase 1 Habitat Survey data (c.1981-2006). Historic habitat trends i.e. pre-1980 are not quantified as no data is available. Data for habitat gains is limited to woodland plantation from 1990 to 2021 provided by the Mersey Forest (*2021*). This analysis of change focuses on losses from development as losses are directly measurable against the baseline. Non-development impact is considered also through review of literature and stakeholder contributions.

Using Geographic Information Systems (GIS) and built area data taken from Ordnance Survey MasterMap (2020) comprising residential and commercial uses, an area and percentage loss has been calculated for broad habitat types found in the LCR. The full method is set out in Appendix 1. Aside from woodland plantation, this method does not account for habitat creation, management or condition. However, case study information has been provided where possible to supplement data findings and affirm trends. This supplementary information considers non-development threats such as scrub encroachment, spread of invasive species and climate change impacts which are harder to quantify in terms of habitat quantity, quality and connectivity.

Data on habitat quality is very limited and typically recorded at designated site level (see indicator N2). For this indicator it has only been possible to report on river quality within the LCR derived from Catchment Explorer Data (*Environment Agency, 2019*).

The LCR Ecological Network and Nature Improvement Area (NIA), approved by Local Planning Authorities in November 2015 as part of their Local Plan evidence bases is used as a proxy for habitat connectivity. The NIA also provides a planning mechanism for improving habitat connectivity. However, it is acknowledged that further refinement of this data is needed to include modelling of species movements through the landscape and this is expected to come through the Local Nature Recovery Strategy process.

National Outlook

The National State of Nature report tells us that historic and continued loss of habitat is occurring, notably our most biodiverse grassland and wetland habitats. Nationally, a reported 97% of wildflower meadows were lost between 1930's and 1984 (*Fuller, 1987*).

It was recently reported (*Unwin, 2022*) that England has lost 90% of its wetlands over the past 1,000 years. 100,000 hectares of freshwater wetland was said to be disappearing annually during the mid-19th century. An estimated 300,000 ha of lowland

wet grassland were lost between 1970 and 1985, and 1.5 million hectares of upland blanket bog was drained by the mid-century. This trend has continued, between 2006 and 2012 with over 1,000 ha of wetland converted to artificial surfaces.

The Wildlife Trust (*2021*) notes that 500,000 ponds have been lost over the last 100 years. It also states that one in five remaining ponds are considered to be in poor condition.

Heathland extent has reduced by 85% since 1800, much of it in the last 100 years (*Parry, 2003*).

UK woodland cover is just 13.2%, one of the lowest rates in Europe, but has increased by 9% between 1998 and 2018.

There are 1.87 million hectares of terrestrial and coastal **priority habitats** recorded in the 2013 priority habitats' inventory for England. These habitats represent around 14% of the total land area. Deciduous woodland accounts for 39% of the total priority habitats resource in England, the largest proportion of any priority habitat group. Wetland habitats account for a further 29%, heathlands for 16%, and grasslands and coastal habitats for 7% each. Rarer habitats such as traditional orchards and limestone pavements together make up 1% of the total resource (*Defra, 2021*).


Photo credit: Anya Coffey

Liverpool City Region Outlook

Quantity

Table 2: Liverpool City Region Habitat Change

Broad Habitat Type	Baseline Area (ha)	All Habitat Baseline (%)	LCR Area (%)	Area Loss (ha)	Area Gain (ha)	Change (%)
All Habitat	36,165	100	40	1,652.8	Data incomplete	-4.6
Arable land	13,204.5	36.5	14.6	190.7	No data	-1.4
Amenity grassland	6,026.7	16.7	6.7	633.4	No data	-10.5
Woodland	4,633.2	12.8	5.1	209.0	769.2	+12.1
Grassland unimproved, semi-improved & marshy	1,990.4	5.5	2.2	198.0	No data	-9.9
Wetland	1,222.5	3.4	1.4	20.5	No data	-1.7
Heathland	87.7	0.2	0.01	1.5	No data	-1.7

Notes:
1. Baseline habitat data is from c.1981 (Wirral), 1996-2000 (Sefton, St.Helens and Knowsley) to 2000-2006 (Liverpool and Halton)
2. Some coastal and all intertidal areas are omitted due to data limitations
3. Area gain data not available with exception of woodland plantation
4. LCR area is 90,360 ha including intertidal area

Since the early 1980s, based on OS mapping analysis, overall, approximately 5% of broad habitat has been lost to development across the LCR. This figure is likely to be an underestimate and does not reflect historic pre 1980s losses. Data for habitat gain is limited to woodland cover. This shows a 12% increase in woodland since 2000. **Descriptions per broad habitat type are provided below**. However, the habitat baseline and analysis show the following key trends:

- Broad habitat types woodland, grassland, wetland and heathland (comprising Priority Habitat and North Merseyside BAP Habitat) account for approximately 11% of total terrestrial land area in the LCR which is slightly lower than national Priority Habitat cover.

- Excluding arable and amenity grassland, the most abundant Priority Habitat and North Merseyside BAP Habitat in the LCR comprises 58% woodland, 25% grassland, 15% wetland and 1% heathland.
- Lowland raised bog, one of the most effective habitats for storing carbon (*Gregg et al., 2021*), is critically rare and heavily degraded. This habitat is now just 0.02% of all recorded habitat in the LCR.
- At an LCR level our most valuable and biodiverse grassland has declined by at least 10% and as much as 14% in Wirral.
- Similarly, amenity grassland has declined by just over 10% and 14% respectively in Knowsley and Wirral. This has resulted in a loss of suitable alternative and accessible natural greenspaces (see indicator N2 and N5).
- Overall woodland cover has increased by approximately 12% since 2000. This has been driven locally by Mersey Forest and is a success story for the LCR.
- Aside from woodland plantation, habitat creation gains in other habitat types are not easy to collate and therefore less well understood.
- Compared with national trends (13.2%), LCR woodland baseline is similar comprising 12.8% of all broad habitat types but reducing to 5.1% when considered in the context of total LCR land area.
- Unimproved and semi-improved grassland sites are highly fragmented and have experienced greatest decline on their baseline year. In 4 of 6 council areas, our most biodiverse grasslands have reduced by 8-14% over a circa. 20-year period (40 years in Wirral). This reflects national trends of long-term decline of our lowland meadows, a Priority Habitat of high habitat distinctiveness. Factors causing grassland habitat decline include development pressure, change of habitat type i.e. through plantation and lack of management resulting in scrub encroachment.
- Heathland loss is shown to be limited. This is likely to be accurate as our remnant heathland sites are all designated at local and/or national level therefore protected by planning policy and legislation. Nonetheless, lowland heath is highly fragmented and by far the rarest broad habitat type in the LCR. Whilst sites have not been lost to development, this analysis does not account for condition or management. All of our heathland is degraded to some extent by scrub encroachment.
- Rivers within the LCR are heavily modified, and less than 1% are in good ecological status, compared to 14% nationally and 10% in Greater Manchester (*Groundwork, 2020*).
- Arable land accounts for 37% of all broad habitat types and 15% of all land area in the LCR. Data analysis shows a relatively small loss (1.2%). However, this is likely to be an underestimate as farmland on the urban-fringes of the LCR is under significant development pressure and at risk of further loss. Indicator N3 highlights the decline of farmland species linked to habitat loss.

Woodland

Ancient woodland is an irreplaceable habitat. It comprises land that has had a continuous woodland cover since at least 1600 AD. Ancient Semi-Natural Woodland (ASNW) retains a native tree and shrub cover that has not been planted, although it may have been managed by coppicing or felling and allowed to regenerate naturally, or plantation on ancient woodland sites (PAWS) where the original tree cover has been felled and replaced by planting, often with conifers, and usually over the last century (*Natural England, 2015*).

Due to their continuous tree cover and relatively undisturbed nature they have developed soils and complex and unique plant, invertebrate, fungi and animal communities and are therefore of signficant ecological importance.

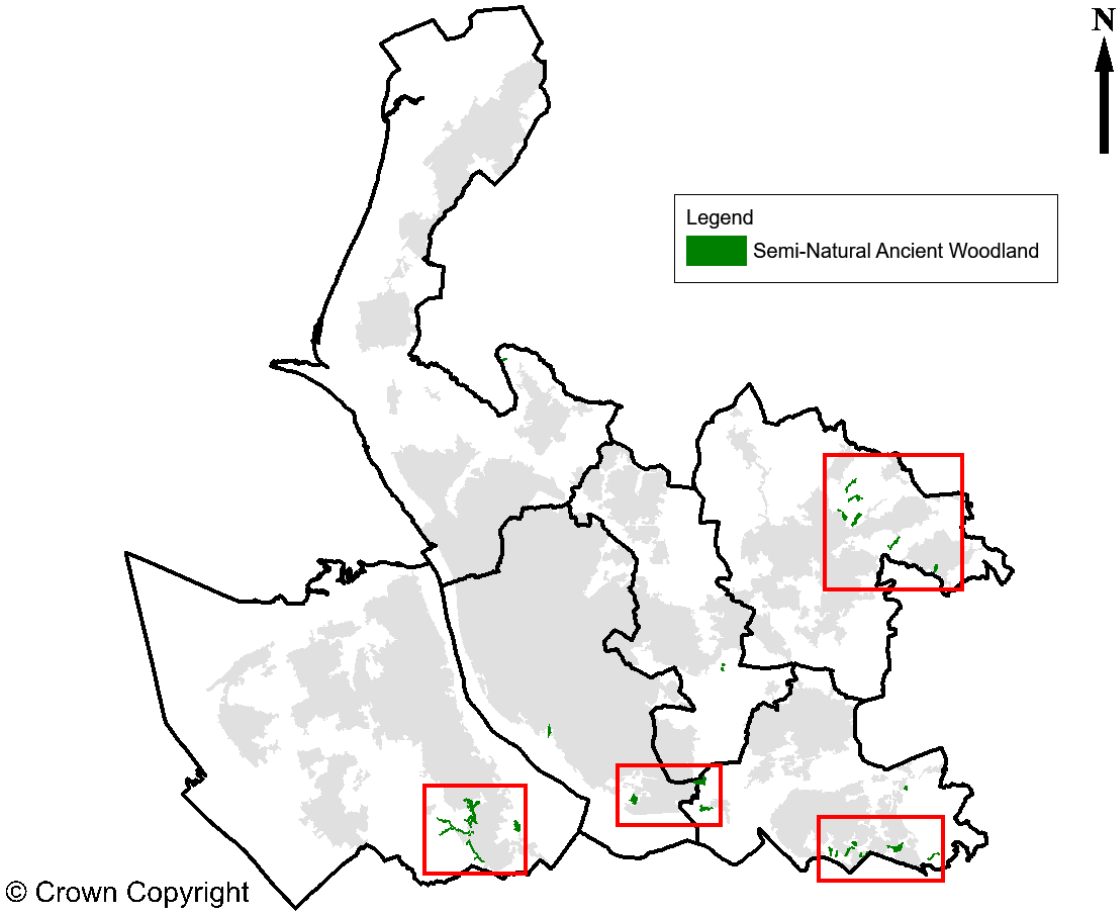


Figure 3: Ancient Semi-Natural Woodland in the Liverpool City Region

Since circa. 1920, 18 ha of Ancient Semi-Natural Woodland (ASNW) has been cleared in the Merseyside area and by 1994 a provisional figure of 111 ha remained *(English Nature, 1994).* As shown in Figure 3, ASNW is highly fragmented in the LCR with the most significant remnant areas in Dibbinsdale, the Sankey Valley, as well as pockets in south Liverpool and Runcorn.

Latest data derived from the LCR Ecological Network (*MEAS, 2015*) and Natural England sources show that 120 ha ASNW remains in Merseyside[2]. The difference in ASNW area figures is likely due to revised Natural England selection criteria therefore over the last 25 years, it is considered ASNW habitat extent has remained relatively stable. The status of Runcorn woodlands may also be factor in this discrepancy and should be confirmed through survey.

Ancient Semi-Natural Woodland, whilst seemingly relatively stable in recent times, continues to be under threat from development, invasive species, nutrient enrichment, recreational pressure and edge effects. Therefore, protection and conservation remains vital.

[2] Data present at Merseyside level (excludes Halton)

Natural England's ongoing Ancient Woodland project (*Merseyside BioBank, 2021*) found that of 9 sites monitored in Spring 2021, all remained present and 66% were in good condition with indicator species present (Figure 4).

The main threats and pressures identified include invasive species and recreational disturbance. Rhododendorn (*Rhododendron ponticum L.*), Himalyan Balsam (*Impatiens glandulifera*) and occasionally Japanese Knotweed (*Fallopia japonica*) were found. Signs of anti-social behaviour were also noted (*MEAS, 2021*a).

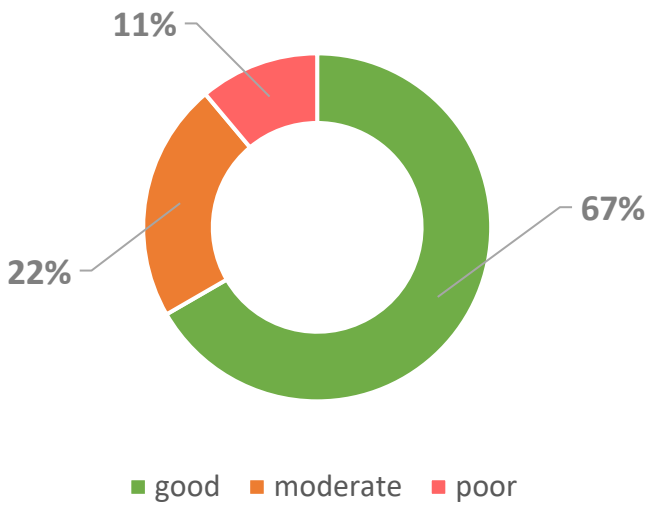


Figure 4: Ancient Semi-Natural Woodland condition in North Merseyside

Many of our Local Wildlife Sites (LWSs) comprise old woodlands which have previously been excluded from ASNW classification due to area thresholds applied in Natural England inventory data. The Dungeon, Harrock Wood and Lowfields Wood LWSs on Wirral, for example, are all likely to be of ASNW status (*Wirral Wildlife, per comms, 2021*). Therefore, whilst ASNW area may be greater than reported, it remains a very fragmented resource.

In addition to Ancient Semi-Natural woodland cover, semi-natural/plantation broadleaved, coniferous and mixed woodland is prevalent in South Runcorn, Formby, Knowsley Park, Sankey Valley, Bold Forest Park and Croxteth Country Park, Calderstones, Eastham Country Park and Royden Country Park – see Figure 5.

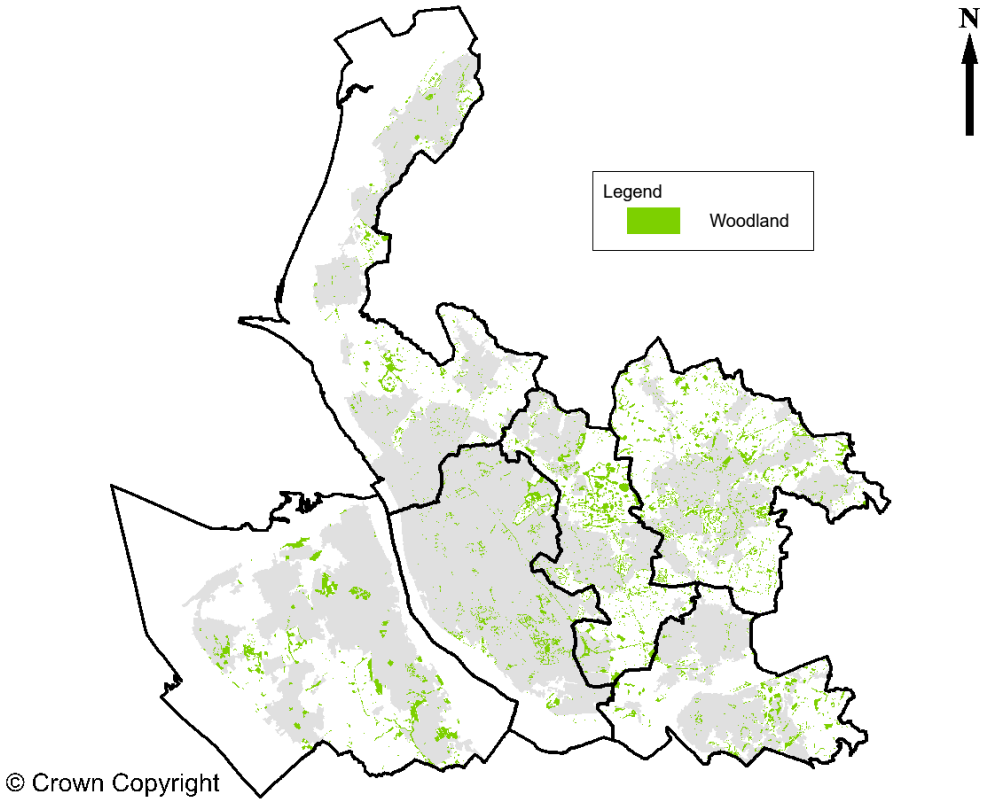


Figure 5: Woodland cover in the Liverpool City Region.

Over recent decades there has been significant efforts through the Mersey Forest to increase woodland cover across the LCR which is a success story in an otherwise trend of habitat decline.

To a certain extent, woodland creation has benefited from co-ordination through the Forestry Commission and funding for tree and woodland plantation. However, strong local partnerships in the LCR, led by the Mersey Forest working with communities, business and industry have been fundamental to create new woodland areas and achieve net gains.

The largest areas of woodland plantation in the LCR exist on restored landfill and post-industrial sites including Sefton Meadows, Bidston Moss, Key Woods, Colliers Moss Common, Sutton Manor and Lyme and Wood Pits. These sites are now community woodlands and managed largely for amenity use.

Data provided by Mersey Forest shows that between 1990/91 to 2020/21:

- **1,830.7 hectares of woodland has been planted;**
- **This comprises 5,426,307 individual trees.**

This period overlaps with the baseline data. Analysis of larger plantation sites found double counting of tree planted areas in the 1990s within the Phase 1 Habitat Survey baseline data which was largely captured pre 2000s. For this reason, woodland plantation since 2000 was taken as a more accurate reflection of habitat creation

against the baseline and has therefore been used to measure woodland gains. Post 2000, 769 ha of woodland has been planted and this off sets woodland losses of 209 ha by 250%.

On this basis, it is estimated that woodland and tree cover in the LCR has increased to 12% and from 5.1% to 5.7% of all LCR land area.

Grassland

For the purposes of this indicator in line with Priority Habitat descriptions (*JNCC, 2011*) and the LCR Ecological Network, unimproved and semi-improved neutral, acid and calcareous is included. Marshy grassland is also identified as of high biodiversity status. These grassland types are more species rich and biodiverse in comparison to amenity grassland and improved grassland which are often seeded and heavily managed or grazed.

At an LCR level, loss of grassland is 10% on the baseline year and as high as 14% loss in Wirral since the early 1980s.

As noted, baseline Phase 1 habitat survey data does not cover coastal areas, notably the Sefton Coast which has a significant grassland resource. However, National Vegetation Community (NVC) survey was undertaken in 2003/04 of the Sefton Coast and this recorded approximately 250 ha of coastal grassland communities (*The Environment Partnership, 2003/04*). This accounts for 13% of all higher value grassland in the LCR.

Urban areas are relatively poorly surveyed in the Phase 1 habitat baseline. However, the majority of grassland resource is likely to be amenity or improved grassland types therefore this does not significantly affect analysis of higher value grassland which is the focus of this report.

Except for heath and wetland e.g. lowland raised bog, unimproved grassland is our most fragmented and rare habitat type (see Figure 6). Urban fringe sites have increasingly been modified and taken into amenity use, and anecdotally from ecological observations (*MEAS, 2021b*) arable fields are being farmed to the boundary resulting in loss of valuable field margins. Lowland meadow in our rural areas are known to have been historically converted into agricultural use and this reflects national trends of decline (*Fuller, 1987*).

In the LCR, larger and more contiguous examples of semi-natural grasslands are found on the Sefton Coast, south Sefton, Sankey Valley, Bold Forest Park, North Wirral and Thurstaston. Good examples of isolated sites also remain e.g. Pickerings Pasture in Halton and Childwall Fields in Liverpool.

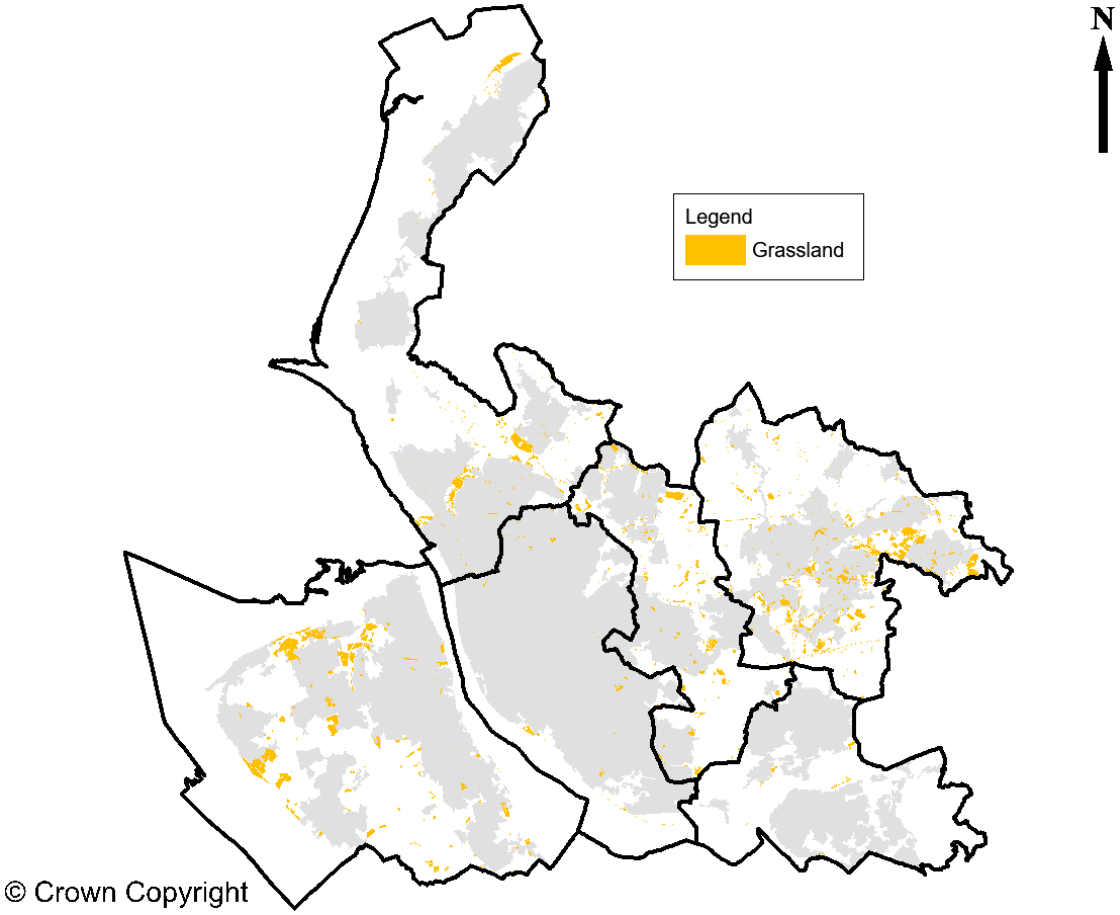


Figure 6: Grassland in the Liverpool City Region (Phase 1 baseline excludes Sefton Coast)

In addition to grassland loss from development pressure, the case studies in Figure 7 below show the relative change over 20 years of 3 Liverpool grassland sites which without positive conservation management are vulnerable to scrub encroachment. These sites have also been subject to woodland plantation.

Figure 7: Grassland succession examples in the Liverpool City Region.

At the former Garston Gas Works site, which is a privately owned and without conservation management in place, grassland has almost entirely succeeded to scrub. In 2019, analysis of imagery against the Phase 1 baseline shows 2.5 ha of marshy and unimproved grassland has been lost since 2000.

At Childwall Fields, it appears a change in habitat i.e. to incorporate woodland plantation on the east of the site and scrub encroachment have contributed to a reduction in semi-natural grassland area by appropriately 35%.

In contrast, 11.5 ha of semi-improved grassland at Festival Gardens largely remains with

scattered scrub becoming more prevelant by 2019. These examples are typically of many higher value grassland sites without positive conservation management in place.

Amenity grassland, of all broad habitats noted in Table 2 (page 33) has experienced greatest loss over the last 20 years (40 years in Wirral) due to development pressures. Most significantly in Knowsley where 145 ha (14%) of amenity grassland has been lost since 1998. Wirral has experienced greatest losses by area (193ha) owing largely to development but also creation of other habitats e.g. woodland (*Wirral Wildlife, per comms, 2021*).

Wetland

Figure 8 below shows areas of wetland e.g. ponds, dock systems, marginal vegetation/swamp, mire and remnant lowland peat bog. Also shown is the network of highly modified main rivers, brooks, field drains and canals. Note, due to the scope of survey in Halton, limited linear habitat data which would identify streams, brooks and ditch network is available. Intertidal areas are also excluded due to gaps in the wider Phase 1 habitat baseline.

The map shows high density of watercourses in 5 main locations all of which are NIA Focus Areas:

1. Formby Mosslands;
2. River Alt Corridor;
3. Sankey Valley catchment;
4. River Birket corridor; and
5. Netherley/Ditton Brook.

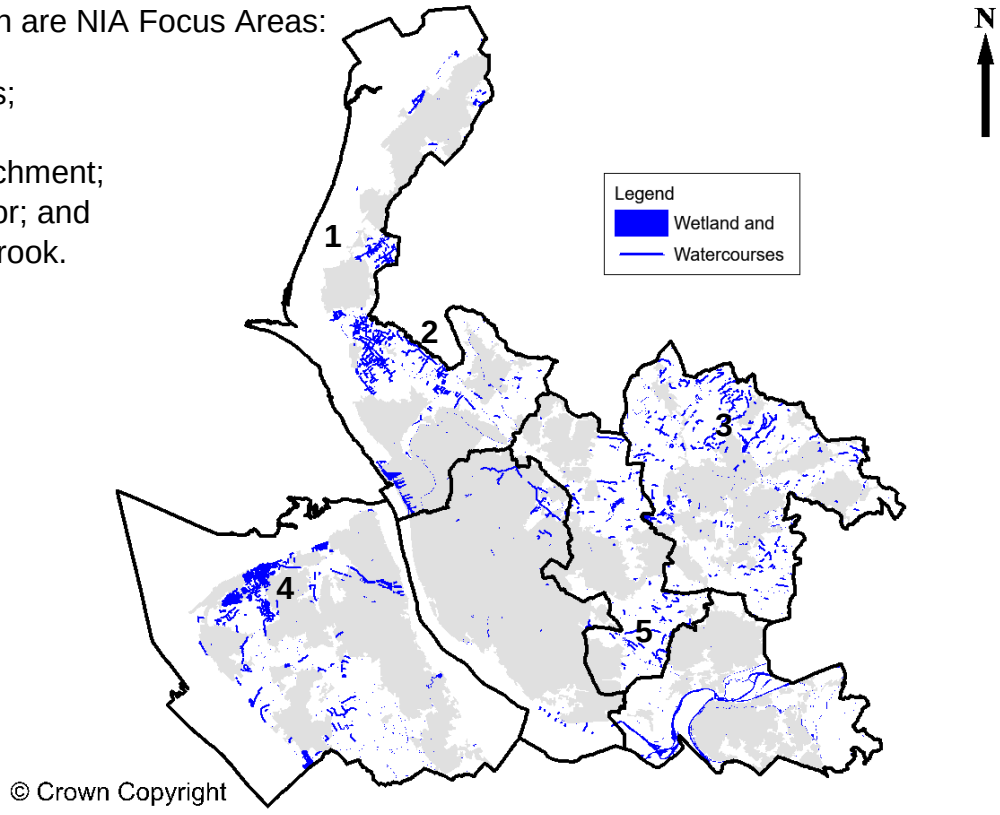


Figure 8: Wetland and Watercourses in the Liverpool City Region (excluding dune-slacks on the Sefton Coast)

These areas, notably areas 1 to 3 are remaining strongholds for Water Vole (*Arvicola amphibius*). Other riparian mammals e.g. Otter (*Lutra lutra*), have also recently been

recorded on the Alt and watercourses in the hinterlands of Sefton (*Corner, P., per comms, 2021*).

The baseline survey does not comprehensively record ponds. To address this issue, the LCR Ecological Network supplemented habitat data with topographic survey. Ordnance Survey MasterMap waterbody data was used to give a more comprehensive picture of pond coverage. 3,920 were identified in the LCR.

Merseyside BioBank in partnership with Edge Hill University are currently undertaking an 'old ponds project'. Led by an Edge Hill placement student (*Parker, 2021*) interim results found that of 1,510 ponds recorded in Sefton, Knowsley and Liverpool 93% have been lost on historic times.

The most significant remaining pond clusters are found in the areas 1 to 5 above as well as south Knowsley and are important habitats for amphibians and invertebrates.

Dune-slacks, are arguably the most important wetland resource in the LCR as the Sefton Coast has 38% of the dune-slack habitat in England (*Smith, P. H., per comms, 2021*). This is not identified in Figure 8 as the Phase 1 Habitat Survey data does not cover the Sefton Coast.

Figure 9 shows extent of dune-slack communities on the Sefton Coast comprising 204 ha which is 1% of the borough's administrative area (*NVC survey data 2003/04*).

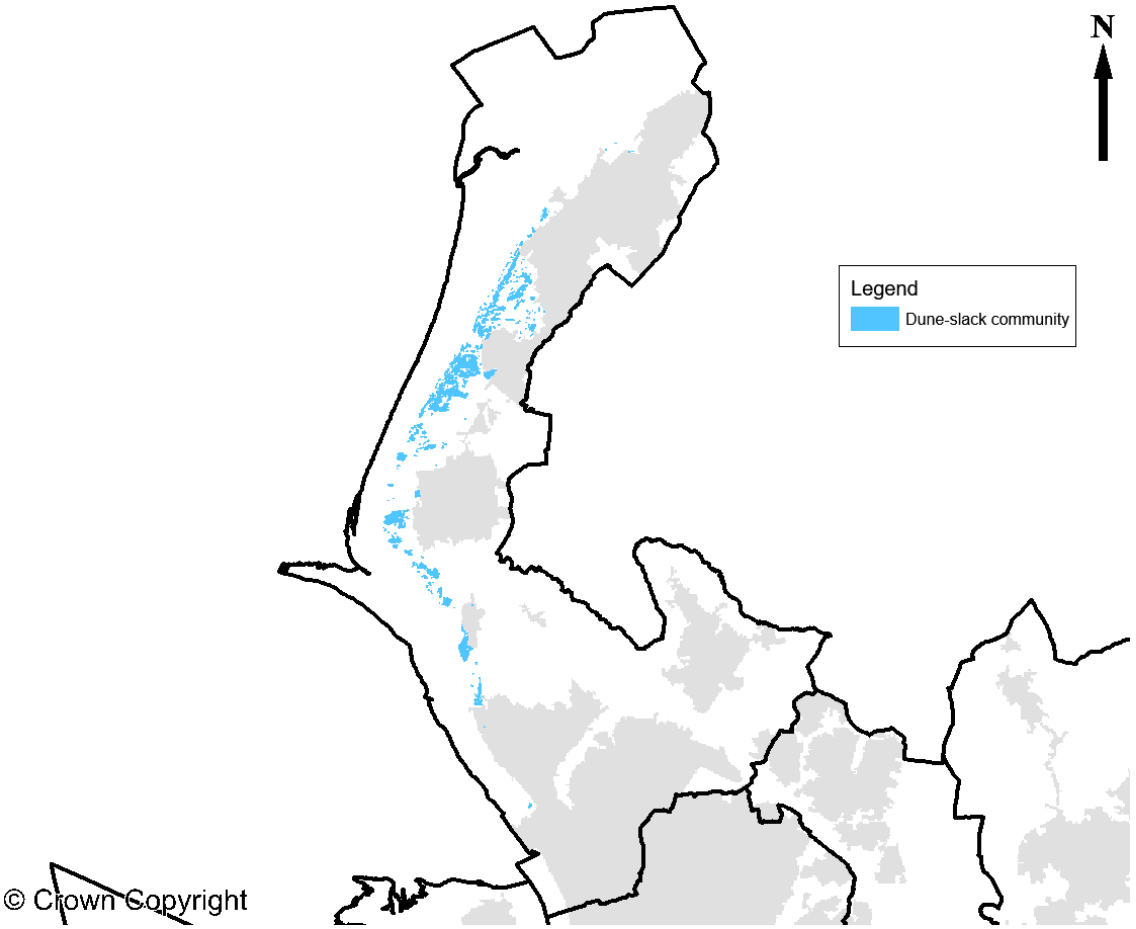


Figure 9: Dune-slack communities on the Sefton Coast

In Lancashire, Greater Manchester and North Merseyside 98% of the lowland peatlands have been destroyed (*Lancashire Wildlife Trust, 2021*).

Knowsley contains 5 ha of mire and peat bog habitat. Most of this habitat is concentrated around Kirkby/Simonswood Mosses. Areas in the wider landscape have historically been drained for agricultural purposes (see indicator N5 which shows extent of underlying peat).

Mire or peat bog habitat accounts for just 3 ha of St.Helens. These fragmented sites are amongst the largest remaining examples of this habitat type in the LCR. Remnant lowland raised bog sites are found at Holiday Moss, Kings Moss, Brown Birches, Colliers Moss, Highfield Moss and Reeds Moss in St. Helens.

These remnant bogs have historically been subject to peat extraction, landfill, woodland plantation and recent Local Wildlife Site monitoring has found several sites infested with invasive species e.g. Rhododendron ponticum L. (*Local Sites Partnership, 2021*). Scrub encroachment is also a management issue.

Acornfield Plantation in Knowsley, a fragment of the once extensive Simonswood Mosses (24% of former extent remains), is the best example of a functional mire/bog habitat in the LCR.

Thomas and Walker (*2004*) in a study of mosslands in Lancashire, Greater Manchester and North Merseyside surveyed several LCR mossland sites. This included the St.Helens' mosses noted above, Acornfield Plantation and Formby Moss. Acornfield Moss was found to be in good condition and comprised 2 ha of acid peat. Local Wildlife Site monitoring in 2021 (*MEAS, 2021a*) found the site to be in moderate condition. Rhododendron (*Rhododendron ponticum L.*) and woodland scrub is encroaching on the mire. Management was evident but largely for amenity purposes only. Lancashire Wildlife Trust (LWT) plan to undertake peatland restoration works and removal of rhododendron at the site in 2022 with the aim of achieving good ecological status.

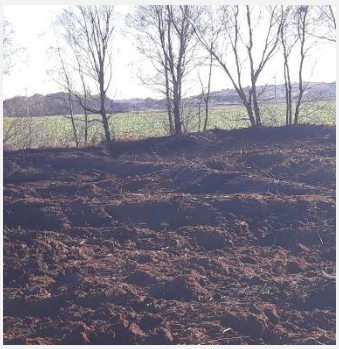
The remaining sites surveyed from Thomas and Walker's (*2004*) study were in poor or moderate condition with limited or no management in place. Opportunities to repeat this study in the LCR would help update our baseline on lowland raised bog which is now 17 years old.

Recently Lancashire Wildlife Trust (*2021*) launched a peatland restoration project targeting the remaining 2% of mossland cover in Lancashire, Greater Manchester and North Merseyside. In the LCR this includes Holiday Moss and Highfield Moss SSSI.

Case Study: Holiday Moss

By Lancashire Wildlife Trust (2021)

Holiday Moss is a stark reminder of how man has ignored our vital peatlands over the centuries. This small fragment of raised bog once formed part of a 50 ha peatland that also incorporated Kings Moss.



Sadly, Holiday Moss is now highly fragmented and is all that remains after the rest of the site was subject to landfill, and historic peat extraction. Despite this degradation, Holiday Moss is one of only two sites in Merseyside supporting Bog Myrtle (*Myrica gale L.*).

Luckily, Holiday Moss is bouncing back. As part of the peatland project, restoration work on Holiday Moss began in November 2021 initially putting in a network of bunds and ditch blocks, followed by stage 2 due to take place in Spring and Autumn 2022. Stage 2 aims to revegetate and rewet the site with bog vegetation including Cotton grasses (*Eriophorum sp.*) and *sphagnum L.* species.

This will help restore Holiday Moss creating a fantastic mosaic of peatland, woodland, fen and open water habitats support everything from Common Lizard (*Zootoca vivipara*) to Black Darter (*Sympetrum danae*) and Reed Bunting (*Emberiza schoeniclus*). Recovery of the moss will also have positive impacts for ecosystem services e.g. carbon storage and flood alleviation.

Quality

As previously stated very little comprehensive data is available to assess habitat quality across the LCR. The case study below provides an assessment of river quality as reported under the Water Framework Directive.

Analysis of the Environment Agency's Catchment Data Explorer indicates the following activities are reasons for not achieving ecological 'good' status and deterioration of waterbodies including rivers and canals:

- Poor soil management
- Private sewage treatment
- Urbanisation – urban development
- Poor nutrient management
- Barriers – ecological discontinuity (from industry)
- Land and transport drainage
- Flood protection structures

Case Study: A focus on Rivers

In 2016, just 14% of rivers in England are considered to be at 'good' ecological status (*Rivers Trust, 2019*). The national State of Nature Report (indicator B3) notes improvement in water quality in recent decades has not continued and evidence of a decline in the number of rivers that were at good ecological status is apparent from 2014.

In the LCR rivers (including main rivers and canals) are heavily modified, and less than 1% are in good ecological status in 2019 (see Table 3). 75% are of moderate status for ecology and 25% poor or bad. This is reflected in other urban areas such as Greater Manchester, where 10% are in good status and the majority are achieving only moderate status (*Groundwork, 2020*).

Table 4 below shows status by LCR catchment across terrestrial, transitional and coastal waterbodies. No data was available for the Dee.

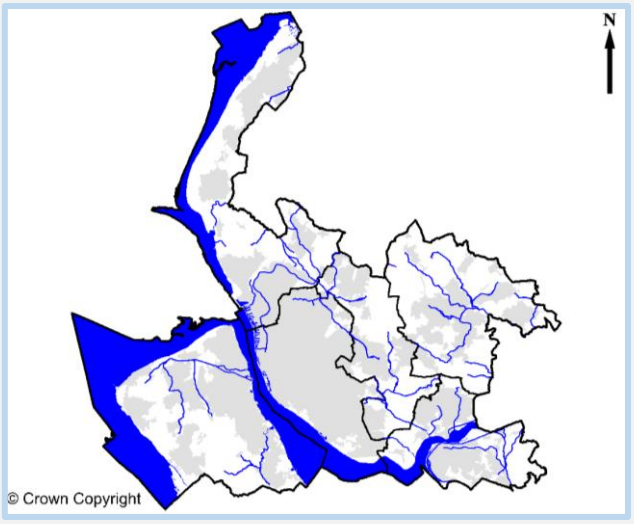


Figure 10: Rivers and coastal waters in Liverpool City Region.

Ecological Status (%)	
Good	0.7
Moderate	74.2
Poor	18.2
Bad	6.7

Table 3: Ecological status of rivers in the Liverpool City Region.

Table 4: Ecological status (2019) of catchments in the Liverpool City Region.
Source: https://environment.data.gov.uk/catchment-planning/

Catchment	Ecological status (%)			
River and canal waterbodies	**Good**	**Moderate**	**Poor**	**Bad**
Alt and Crossens (121)	2.5 (3)	87.5 (106)	6.0 (7)	4.0 (5)
Lower Mersey (269)	0.4 (1)	70.3 (189)	21.9 (59)	7.4 (20)
Weaver Gowy (22)	0.0	81.8 (18)	9.1 (2)	9.1 (2)
Transitional and coastal waterbodies				
Ribble Estuary (11)	0.0	18.2 (2)	63.6 (7)	18.2 (2)
Alt Estuary (11)	0.0	100 (11)	0.0	0.0
Mersey Estuary (11)	0.0	3.4 (4)	9.1 (6)	53.5 (1)

Heathland

Lowland heath, like our lowland raised bog, ancient woodland and meadows has experienced dramatic national declines. 85% of heathland extent has been destroyed since 1800 (*Parry, 2003*).

Lowland heath is highly fragmented in the LCR and remaining habitat exists in pockets – notably at Freshfield and Thurstaston Common. Bidston Hill and Runcorn Hill Heath are other smaller areas of this habitat. Degraded remnant heath is also found at Caldy Hill, Cressington and Colliers Moss in St.Helens.

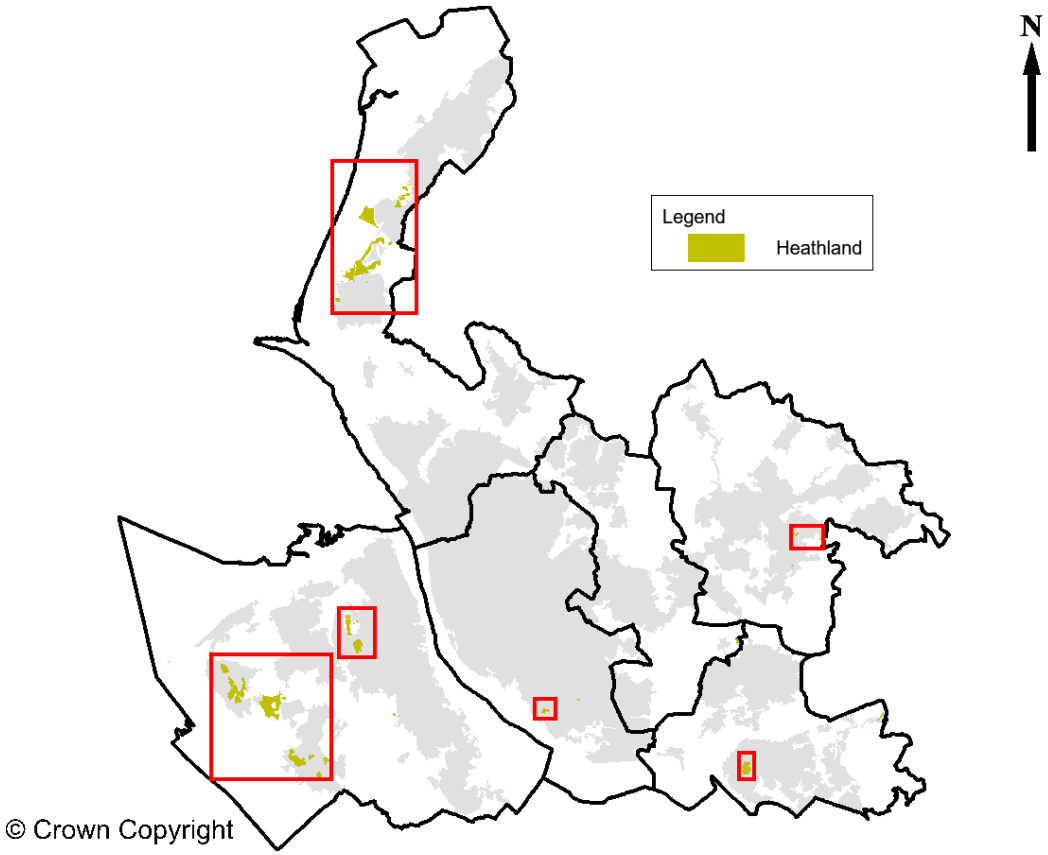


Figure 11: Heathland in the Liverpool City Region.

The following case studies highlight three lowland heath sites:

Cressington Heath Local Wildlife Site

In 2017, this habitat mosaic totalled 4 ha. However, as shown by Figure 12 the extent of heath has reduced significantly between 2009 and 2021 largely due to scrub encroachment. Local Wildlife Site monitoring in 2010 (*MEAS, 2021a*) confirmed that whist an area of unimproved acid grassland and Heather (*Calluna vulgaris*) remained, this was under the threshold to qualify as heathland habitat. Management and restoration could however reinstate heathland at this site.

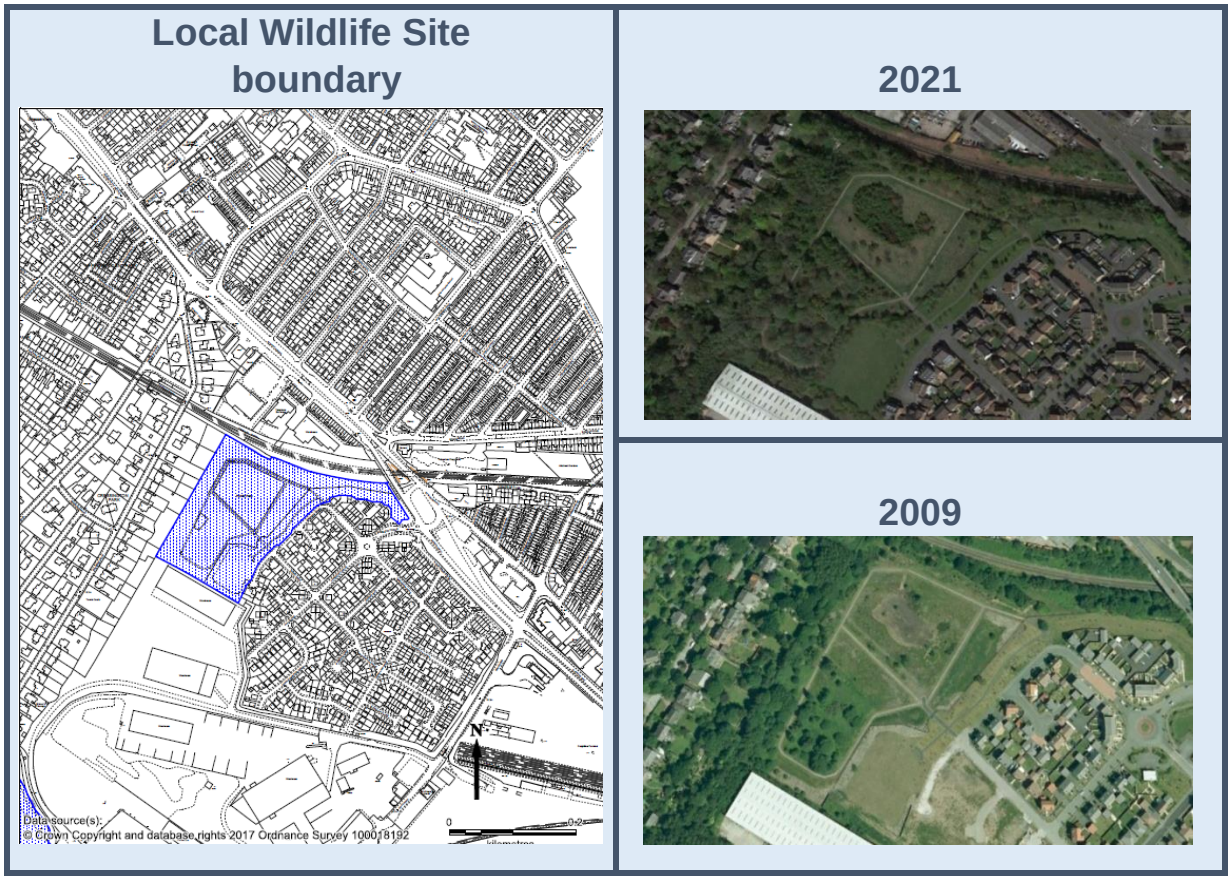


Figure 12: Cressington Heath Local Wildlife Site

Pex Hill Local Wildlife Site

Pex Hill is Knowsley's only lowland heath. Lowland heath at this site covered 1.2 ha in 1996-1998. However, as with many heathland sites, without regular management the site is naturally succeeding to woodland scrub (see Figure 13) and over 20 years since survey, the area of heath is now significantly reduced by at least 50%. Tree and scrub removal would help restore this heathland site.

Figure 13: Heathland Succession at Pex Hill

Freshfield Dune Heath

Freshfield Dune Heath comprises a 35 ha heathland reserve (*White, S, per comms, 2021*) comprising one of the largest dune heathland sites in North West England. The site has been managed by Lancashire Wildlife Trust since 2004 and is a mix of dry and wet heath with dense scrub and mixed woodland. The site and Montague Road Triangle adjacent form part of the Sefton Coast SSSI and a 61 ha Local Wildlife Site 'Freshfield Dune Heath, Woodvale Airfield and Willow Bank Caravan Park'. The LWS in addition to heath is also designated as a significant breeding bird and over-wintering/passage site with reptiles including sand lizard present.

Whilst, the area of heather was estimated at 18 ha in 2004 (*White, S., per comms, 2021*), over a 20 year-period due to self-seeding of early pioneer species e.g. silver birch (*Betula pendula*) the heath has fallen into poor condition.

Through Natural England's Dynamic Dunescapes project, heathland restoration is taking place. Removal of woodland scrub took place in early 2020 at Montagu Road Triangle which forms part of the wider LWS. These works will help restore one of the rarest habitats in the LCR which will benefit reptiles, Dune Helleborine (*Epipactis dunensis*) and Small Copper butterfly (*Lycaena phlaeas*). In April 2021, of the 3.5 ha Montagu Road Triangle site approximately 1.4 ha of mixed woodland scrub has been cleared (*Natural England, per comms, 2021*).

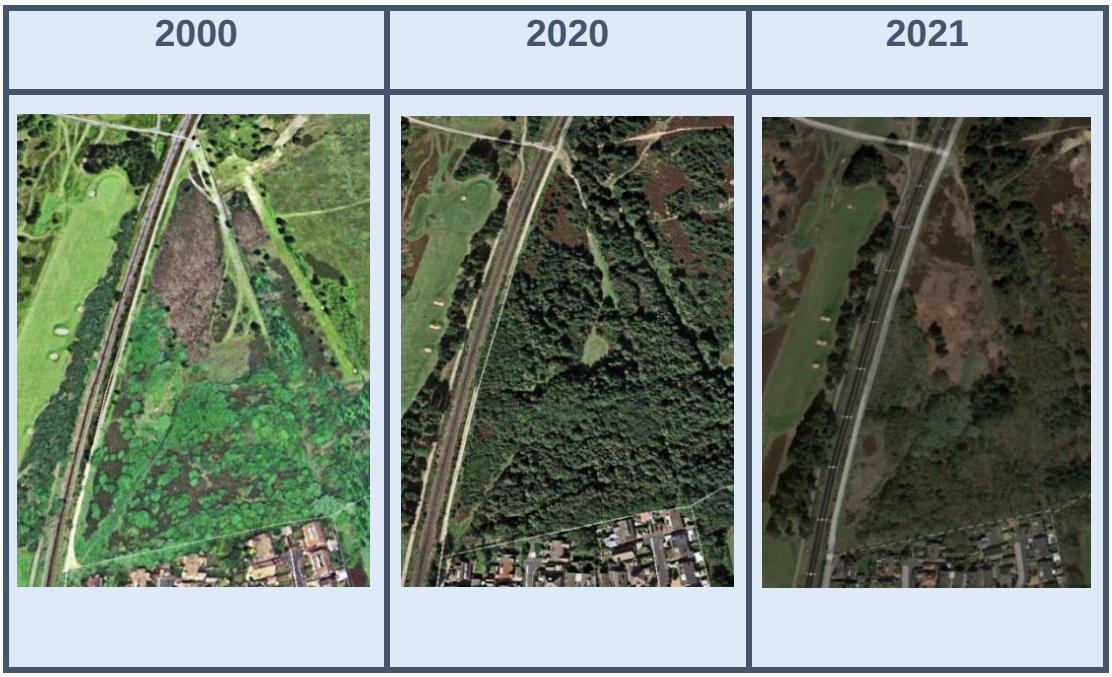


Figure 14: Heathland restoration at Montague Road Triangle.

Connectivity

The JNCC (*2021*) defines habitat connectivity as:

"…a measure of the relative ease with which typical species can move through the landscape between patches of habitat. Habitat loss and fragmentation can reduce the size of populations and hinder the movement of individuals between increasingly isolated populations, threatening their long-term viability."

In 2015, the LCR Local Planning Authorities adopted the LCR Ecological Network and Nature Improvement Area as part of their Local Plan evidence base. This was in response to national policy (NPPF) and the Lawton Report (*Lawton, 2011*) principles i.e. bigger, better and more joined up and the increasingly fragmented network of our most distinct and biodiverse habitats.

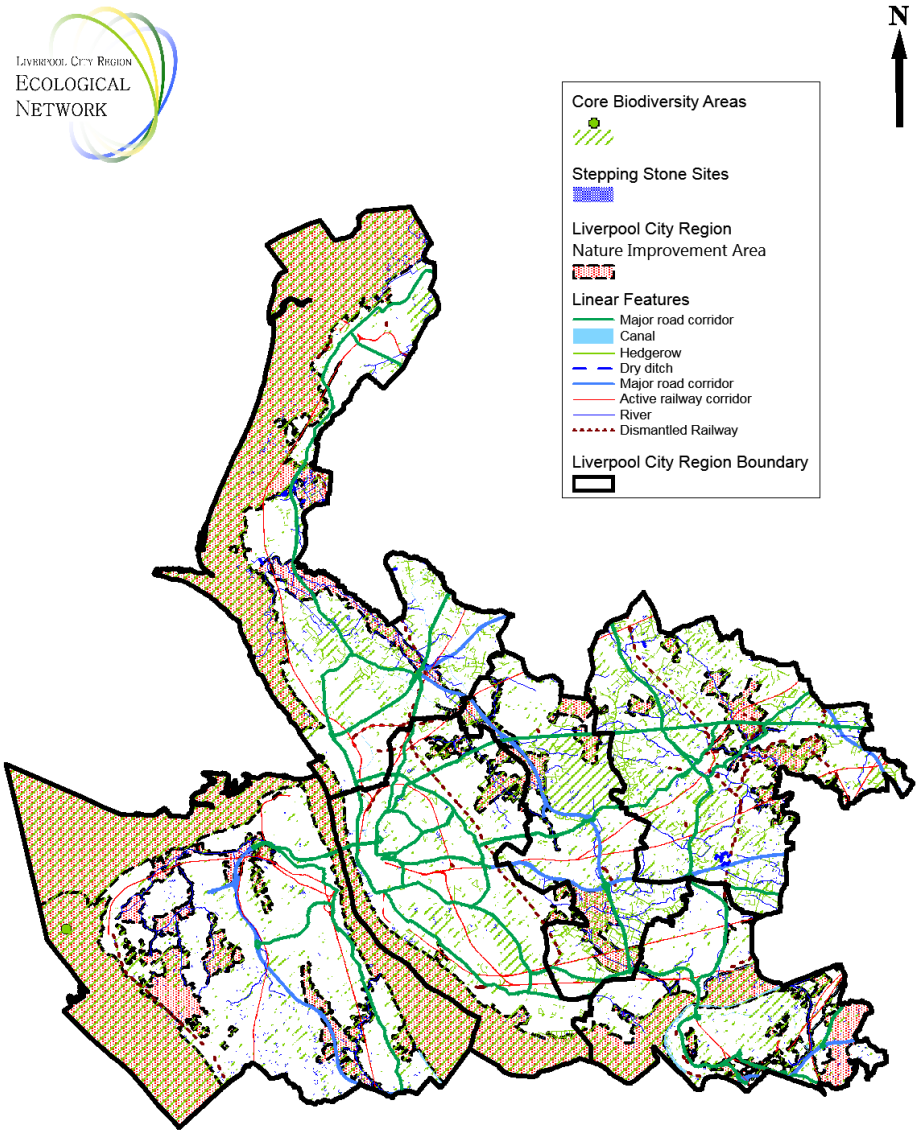


Figure 15: Liverpool City Region Ecological Network and Nature Improvement Area

Mapping of strategic ecological assets and Core Biodiversity Areas, stepping stone sites and linear habitats was undertaken, and this network was used to develop a Nature Improvement Area (NIA). The NIA is drawn around the LCRs strategic biodiversity assets e.g. river corridors, estuaries, remnant mosses, Sefton Coast and ancient woodland and this provides a proxy for habitat connectivity across the City Region. This approach is habitat and designated site led. Therefore, it is acknowledged that refinement to take account of species movements through the landscape will be required through preparation of a local nature recovery network.

However, at this time the NIA provides the only approved planning mechanism to secure nature improvement in the LCR.

District Habitat Summaries

The following subsection discusses the habitat baseline in greater detail at Local Authority level using the Phase 1 Habitat Survey baseline. Broad habitat types including arable and amenity grassland are discussed. Linear habitat data is also drawn upon where available.

'Wetland – other' category presented in charts below comprises standing and running water, marginal vegetation and swamp. Bog/mire has been separated out from other wetland habitats due to its rarity and strategic significance for carbon storage (see indicator N5).

Halton

The borough of Halton comprises dynamic intertidal habitats associated with the Mersey Estuary as well as locally rare Ancient Woodland and Lowland Heath. Ditton and Keckwick Brooks and the Bridgewater Canal are also strategically important to biodiversity (*MEAS, 2015*).

Broad habitat types are set out in Figure 15 which derived from Halton Council's Phase 1 Habitat Survey 2006. The broad habitat types comprise 54% of all recorded Phase 1 habitat and 28% of the borough.

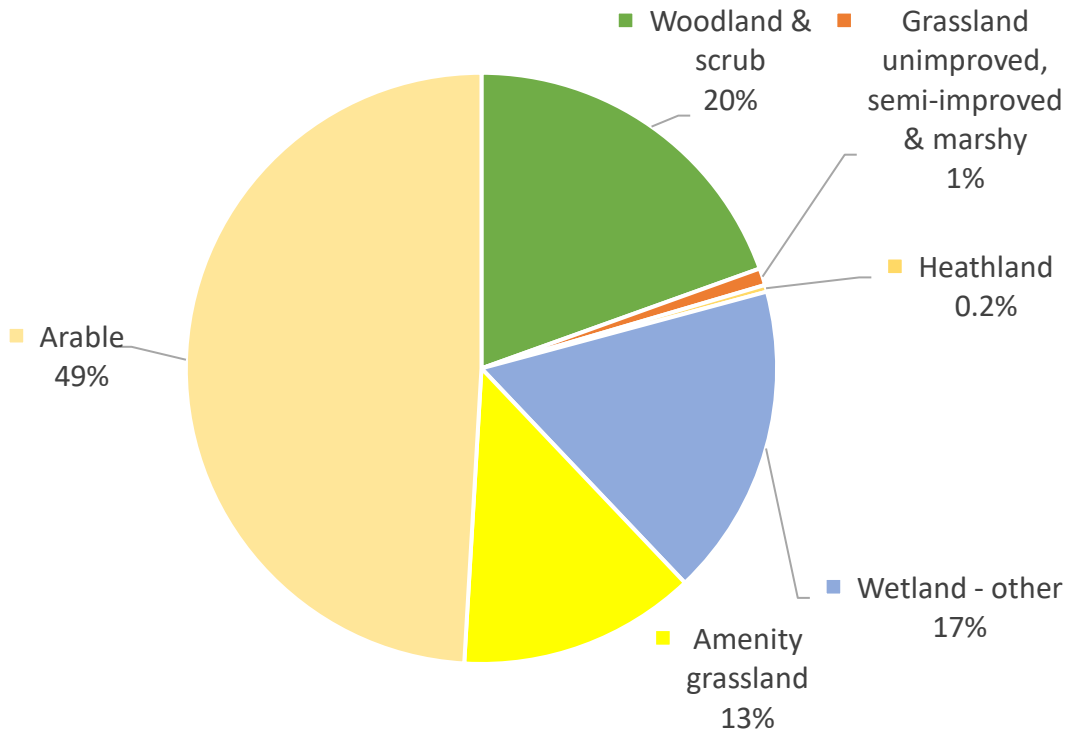


Figure 16: Halton broad habitat types

In Halton, arable land comprises almost 50% of broad habitat types (see Figure 16). This habitat is important for farmland species e.g. brown hare (see indicator N3) and fields around Hale are known to be used by wintering birds and linked to the Mersey Estuary. Woodland and scrub accounts for 20% of broad habitat types. Analysis shows that approximately 2 ha of woodland has been lost to development since 2006.

Heathland is limited to an 8 ha site at Runcorn Hill, a sandstone escarpment rising west to east from the Mersey. This habitat is rare in the borough and accounts for less than 1% of broad habitat types. Despite the rarity and fragmentation of this habitat type, the site is the 5th largest example in the LCR after Thurstaston Common, Freshfield Dune Heath, Heswall Dales and Caldy Hill. Analysis indicates that none of this habitat has been lost to development however imagery (GoogleEarth) shows scrub encroachment across the site.

17% of broad habitat types are wetland. Running and standing water habitat comprises canal, the river network including Keckwick Brook and Mersey channel which is shown to be largely unchanged since 1999 habitat survey. Bog/mire habitats are less than 1% of total recorded habitat in 2006. Coastal habitat data is not presented due to coverage limitations. However, review of imagery shows saltmarsh extent is relatively unchanged east of the Silver Jubilee Bridge since the baseline year.

Amenity grassland comprises 13% of recorded broad habitat. However, grassland excluding amenity and improved, is highly fragmented and rare (1%). Whilst historic losses have undoubtably occurred in line with national trends (*Fuller, 1987*), analysis against the baseline (2006) shows that the borough's remaining and most valuable

grassland is still present in 2020. However, condition of this important habitat type is unknown.

Pickerings Pasture and Clifton Lagoons are amongst the best examples of unimproved grassland in Halton and are protected and managed (Pickerings Pasture) by virtue of their designation. Clifton Lagoons calcareous grassland is under threat from development.

Knowsley

In Knowsley, River Alt, Kirkby Brook, Knowsley Brook and Croxteth Brook and M57 corridor are strategic assets and have been identified for nature improvement (*MEAS, 2015*).

Habitat data presented in Figure 17 below is from 1996-1998 Phase 1 Habitat Survey of Knowsley. The broad habitat types comprise 80% of all recorded habitat and 46% of the borough's land area.

The three most prevalent broad habitat types in the borough include arable 46%, woodland and scrub 24% and amenity grassland 21%.

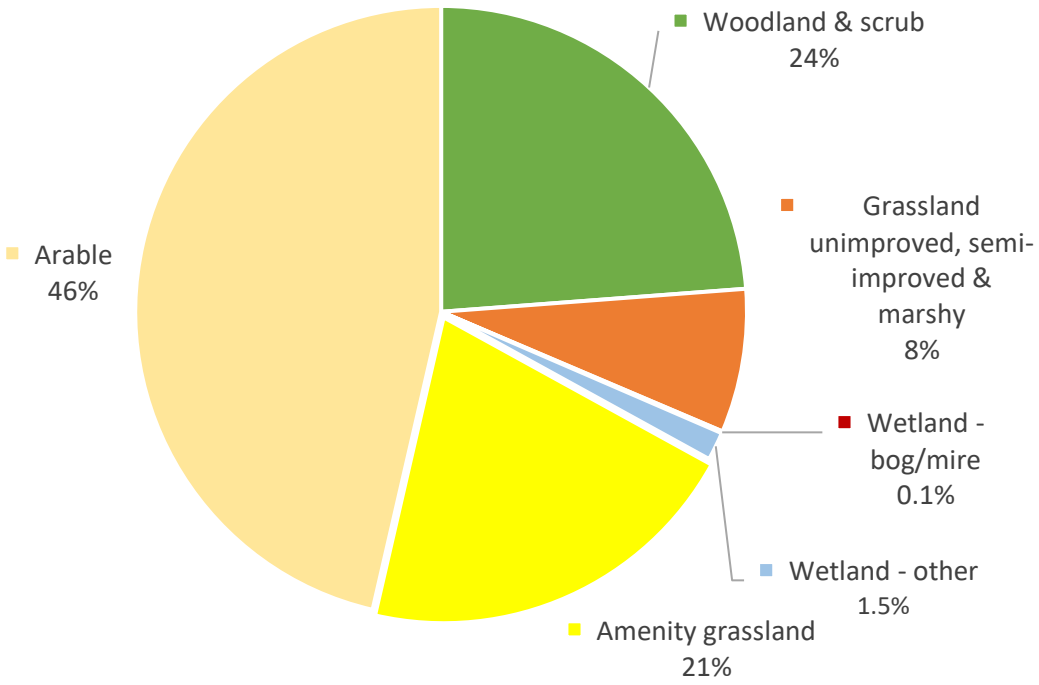


Figure 17: Knowsley broad habitat types.

Several higher distinctiveness habitats are fragmented and poorly represented in Knowsley. These include lowland heath, the only site being Pex Hill. Bog/mire comprises 5 ha located in the Kirby moss area and is the largest extent in the LCR. However, both heathland and lowland raised bog account for less 1% of broad habitat

types. Porter (*2005*) notes that other poorly represented habitat includes species rich hedgerow and other wetland habitats.

Analysis against real world change indicates approximately 4% of woodland cover was lost to development since 1998. However, this has likely been offset by Mersey Forest plantation since that date.

Unimproved, semi-improved and marshy grasslands account for 8% of broad habitat types and 6% of the borough's land. Analysis shows that approximately 12% was lost to development since the baseline year (1998).

Acid grassland, a Priority Habitat, covers just 12 ha of the borough. The largest fragments are located in Knowsley Safari Park and Halsnead Park. The latter under increasing development pressure from urban extensions proposed as part of the Halsnead Park Garden Village.

Amongst the largest pond clusters in the LCR occurs in the south of the borough. The baseline survey recorded 304 ponds.

In 1998, Knowsley had approximately 108km of hedgerows. Of these just over 1km were species rich. Species rich hedgerows in Knowsley are found in short unconnected sections widely spaced across the borough and typically associated with arable areas (*Porter, 2005*).

Liverpool

The City of Liverpool is a highly urbanised area. Larger remaining areas of semi-natural habitat are found within urban parks such as Sefton Park, Calderstones and Croxteth Country Park and post-industrial sites e.g. Festival Gardens. Speke-Garston Coastal Reserve and Oglet Fields on the coast are amongst the few wilder places in the City. The River Mersey with large expanses of intertidal mudflat and saltmarsh, and soft maritime cliff and rock forms the single most contiguous habitat.

The river and Ancient Woodland in the south of the City are strategically important.

Figure 18 is derived from Phase 1 Habitat Survey undertaken by White Young Green. This survey targeted greenspace areas and is a combination of desktop survey (aerial maps from June 2000) and ground-truthing visits which were undertaken between December 2005 and February 2006.

The broad habitat types comprise 86% of all recorded habitat and 16% of the borough's area.

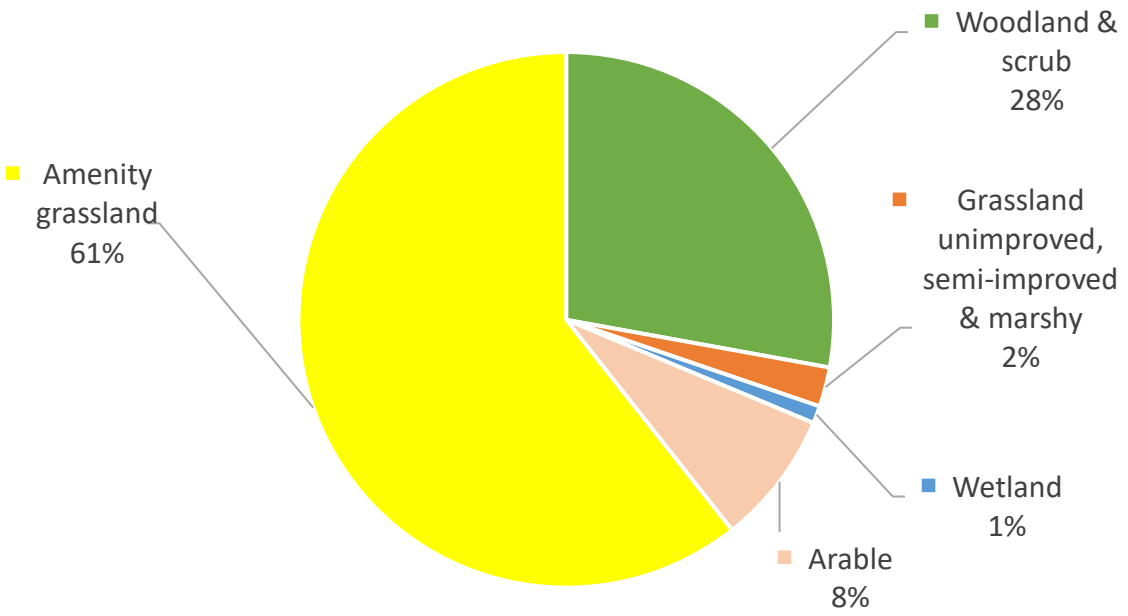


Figure 18: Liverpool broad habitat types.

Unsurprisingly in a predominantly urban landscape, amenity grassland accounts for 45% of all recorded habitat and 61% of broad habitat types. Analysis shows that approximately 8% of this has been lost to development since the baseline year (2006).

Species rich grasslands occur as fragmented pockets scattered throughout Liverpool and account for just 2% of broad habitat types. The single largest expanse of unimproved neutral grassland in Liverpool is 15.5 ha located at Childwall Fields including grasslands adjacent Liverpool Loopline. Semi-improved grassland at Festival Gardens and former Garston Gas Works also comprise larger albeit isolated grassland areas in the City (*White Young Green, 2006*). Analysis of real world change shows that in recent times loss has slowed and just 1% of higher value grassland has been lost since 2006.

Woodland and scrub accounts for 28% of broad habitat type. Additionally, White Young Green identified 41km of hedgerows, but none were recorded as species rich. The most extensive areas of woodland cover in Liverpool are associated with Liverpool's main parks, Croxteth Country Park in the north and Calderstones and Sefton Park in the south.

The most valuable woodland area occurs in the south of the City, which comprises fragmented Ancient Semi-Natural Woodland. Mill Wood at Speke Hall, Stockton Wood near Liverpool John Lennon Airport and Otterspool Gorge.

Analysis shows that woodland area has reduced by 3% since 2006 however this does not take account of woodland plantation. Data was not available at an LCR level.

Wetland i.e. ponds and swamp, account for just 1% of broad habitat types. The River Mersey dominates the landscape. However, there are several heavily modified watercourses which the baseline measured as 21km. This includes:

- River Alt;
- Fazakerley Brook;

- Tue Brook;
- Knowsley Brook;
- Netherley Book; and
- Mill Brook.

The Leeds to Liverpool Canal, an NMBAP habitat, cuts through the north of the City before connecting with the docklands. Despite issues of pollution, fly-tipping and limited bankside habitat Water Vole (*Arvicola amphibius*) has been recorded on stretches of the canal at Bootle.

The baseline survey identified 180 ponds scattered throughout Liverpool. White Young Green (2006) noted that this is an average density of 1 waterbody for every 62 ha. This density is approximately a third of the average density of waterbodies in rural areas in England based on a survey undertaken in 1996 (*Williams et al., 1998*).

Sefton

The Sefton Coast, Formby Mosslands and River Alt Corridor are strategic assets and are identified as such for nature improvement (*MEAS, 2015*).

The 1999-2000 Phase 1 Habitat Survey did not comprehensively record coastal habitat and some urban areas have limited coverage so are omitted from Figure 19 below.

Broad habitat types shown in Figure 19 comprise 77% of all recorded habitat and 26% of the borough's area.

Indicator N2 provides a summary of the Sefton Coast and for the purposes of this indicator, NVC Saltmarsh Survey 2003 and Sefton Coast NVC survey 2003/04 (*The Environment Partnership, 2004*) is accessed to quantify coastal habitats.

Saltmarsh survey identified 1,461 ha of this habitat type in Sefton. This is known to be accreting in the Ribble and Alt estuaries therefore extent of this habitat is likely to have increased since 2003. Any updated habitat baseline should include intertidal areas as a priority.

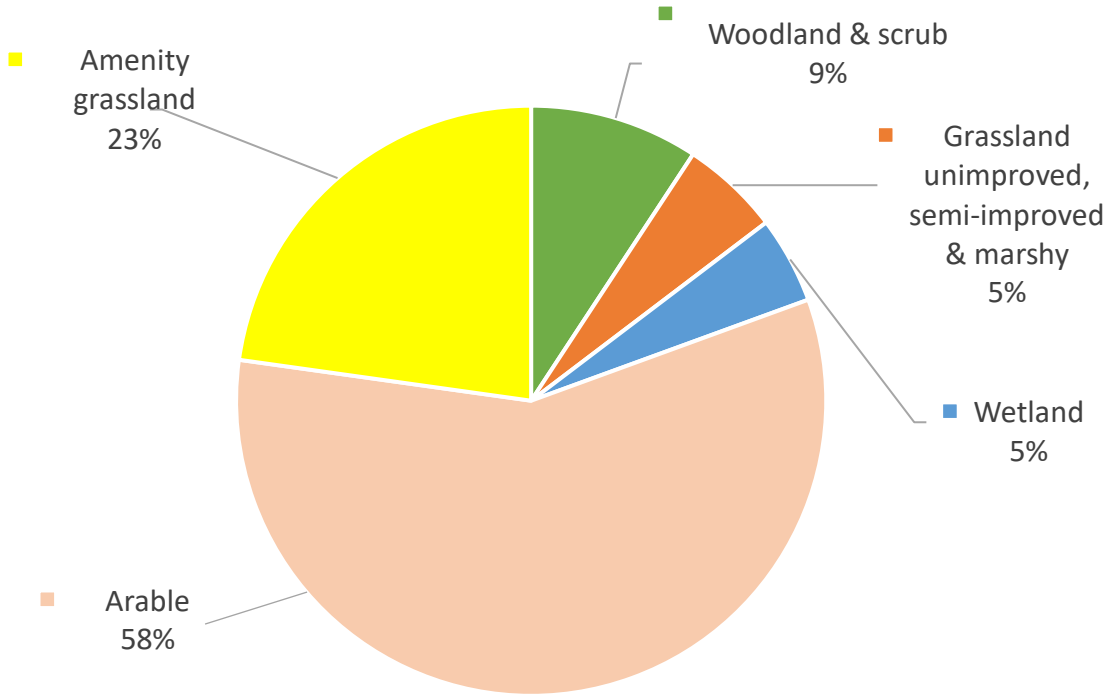


Figure 19: Sefton broad habitat types.

Excluding the Coast (see Figure 20 (page 60)), the broad habitats with the greatest area cover were arable land (58%), amenity grassland (23%) and woodland and scrub (9%), these habitats account for approximately 90% of broad habitat types. Analysis of real-world changes shows 7% of amenity grassland has been lost to development since 2000.

Woodland habitat away from the coast has decreased by 5% however as previously stated this does not account for plantation since the baseline year or coastal woodlands.

The coniferous woodland on the Sefton Coast covers an area of approximately 293 ha (*The Environment Partnership, 2003/04*) which is not included in Figure 19. Coniferous woodland provides the main habitat and food source for Red Squirrel (*Sciurus vulgaris*) and the coastal woodlands form the Sefton Coast Red Squirrel Refuge area *(Porter, 2006*).

Noting the significant grassland on the Sefton Coast (Figure 20), the Phase 1 Habitat Survey baseline found that unimproved and semi-improved grasslands are concentrated in the south of the borough and account for just 2% of all recorded habitat. This higher distinctiveness grassland has reduced by approximately 8% since the baseline year due to development pressure.

Lowland acid grassland is recorded on the Sefton Coast as part of the dune habitat mosaic, however, away from coastal areas it occurs only as small, isolated fragments.

Clustered distribution of ponds is noted in 3 main areas:

1) Formby Moss;
2) Homer Green – Ince Blundell area; and
3) the Lydiate – Melling area.

There is a relative lack of ponds in the north of the district. Creation of pond networks could be targeted for improving connectivity i.e. as stepping stone habitats. Areas with few ponds or 'ghost ponds' i.e. locations where ponds were historically found could be targeted.

The largest bodies of water found within Sefton are the docks in the south of the borough and the marine lakes at Crosby and Southport. These water bodies cover an area of approximately 104 ha and provide important sites for passage and over wintering birds.

Seaforth Nature Reserve, within the dock estate, is nationally important for breeding Common Tern (*Sterna hirundo*) and is also designated for its coastal lagoons, fresh and brackish water, grassland and array of national and regionally important plant species. Southport Marine Lake is important for over wintering Mute Swan (*Cygnus olor*) and more recently, a roost/nesting colony of Egrets (*Egretta sp.*) have formed on the northern-most island. Spoonbill (*Platalea leucorodia*) has also regularly used the lake in 2021 (*Dempsey, J., per comms, 2021*).

Sefton has approximately 95km of hedgerow, of which just 2.9km is species rich and found almost exclusively in short sections within the Lydiate and Maghull area.

Phase 1 Habitat Survey c.1981 identified an extensive network of arable field margins in Sefton which correlates strongly with the hedgerow and watercourse network. Whilst arable field margins are known to have declined nationally, analysis of survey found no significant decline in Sefton between 1980 and 2000.

Figure 20 shows the habitats of the Sefton Coast.

The Sefton Coast comprises 59% shingle, strandline and predominantly sand dune communities including dune-slacks. 20% is largely coniferous woodland plantation and the remainder are coastal grassland communities. 2% of the coast is heathland a hind dune habitat found most extensively at Freshfield.

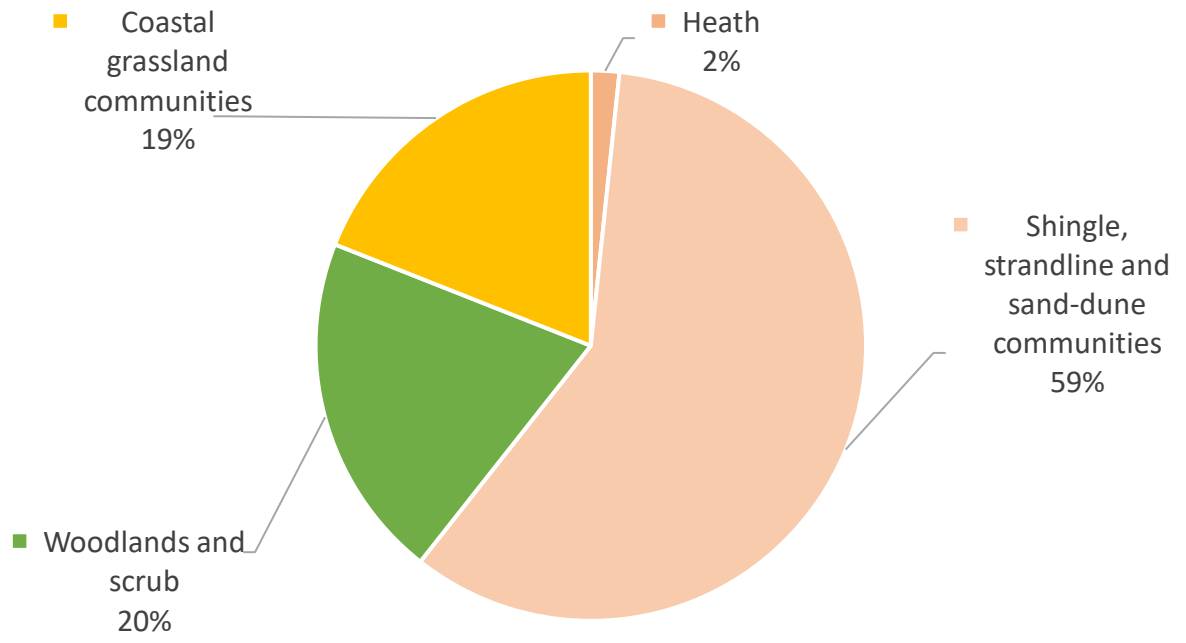


Figure 20: Sefton Coast NVC habitat types.

St.Helens

Outside of Knowsley, the second largest remnant mossland exists in St.Helens, notably at Kings Moss and Holiday Moss east of Rainford. Black Brook, Stanley Bank Meadows and Carr Mill Dam and the Sankey Valley corridor are of strategic importance and are identified for nature improvement (*MEAS, 2015*).

Broad habitat types shown in Figure 21 comprise 86% of all recorded habitat and 40% of the borough's land area.

Similarly, to other districts, the baseline survey (1999-2000) found arable land accounted for 62% of broad habitat types and 37% of land. Woodland and scrub is 15% and amenity grassland 12% of broad habitats. These habitats comprise approximately 89% of recorded broad habitat.

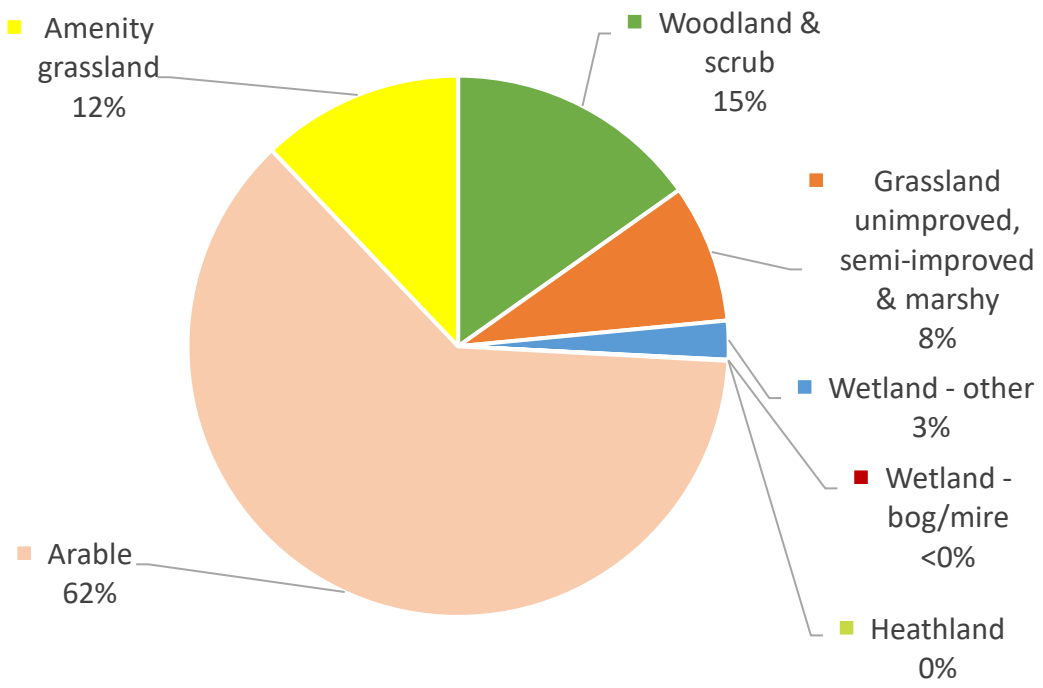


Figure 21: St.Helens' broad habitat types.

Porter (*2005*) notes that habitats poorly represented in St.Helens, include lowland heath, bog/mire, other wetland and species rich hedgerows.

The total woodland, trees and scrub habitat recorded accounts for 8% of St.Helens land area and 15% of recorded broad habitat. These figures are likely to have increased since 2000 due to extensive woodland planting by the Mersey Forest on large sites such as Sutton Manor, Lyme and Wood Pits and Colliers Moss Common. Broadleaf plantation makes up just over half of this figure covering 533 ha and semi-natural broadleaf woodland just under a third of the total woodland area covering 302 ha.

Amenity grassland has declined by 8% since the baseline year. Unimproved, semi-improved and marshy grassland habitat types account for 8% of recorded broad habitat in St.Helens. Analysis of real-world changes shows that 9% (60 ha) of this higher value grassland has been lost to development since 2000.

Urban grasslands are North Merseyside Biodiversity Action Plan (NMBAP) Habitats and some are Priority Habitat. Of these, unimproved and semi-improved grassland habitat types, unimproved neutral grassland covers the largest area (472 ha). Lowland acid grassland covers only 0.36 ha, the main area found at Billinge Beacon. Both acid and calcareous grasslands are very rare in St.Helens.

Just 2.3 ha of lowland heath was recorded in St.Helens and this Priority Habitat accounts for <1% of broad habitat types in the borough. Areas of lowland heath have been previously recorded on Penlake Industrial Estate, Parr Flat, and east of Parr Industrial Estate. Porter in 2005 notes at least 0.8 ha has been lost to development since 2000 and subsequent analysis shows 0.2 ha have been lost to development.

The wetland habitat covering the largest area in St.Helens is standing water, which includes ponds, lakes and some ditches. Ponds are widely distributed across St.Helens, with particular concentrations being to the south east of Marshall's Cross and Bold, and in the Rainford and Billinge area. Carr Mill Dam is the largest waterbody supporting breeding Kingfisher (*Alcedo atthis*) and Great Crested Grebe (*Podiceps cristatus*).

Baseline survey recorded almost 193km of hedgerow in St.Helens. Of these hedgerows there are approximately 1.5km of species rich hedgerows. These species rich hedgerows are found in short unconnected sections widely spaced across St.Helens (*Porter, 2005*).

Wirral

The peninsula of Wirral is dominant by coastline and intertidal habitat. The River Mersey, North Wirral Foreshore and Dee Estuary comprise intertidal mudflat and saltmarsh which is internationally important. On land, the Birket Catchment, Dibbinsdale Ancient Woodland, heathlands of east and west Wirral are strategic assets and identified in for nature improvement (*MEAS, 2015*).

Broad habitat types shown in Figure 22 comprise 66% of all recorded habitat and 20% of the borough's area – this includes a significant intertidal resource which is not recorded in the baseline survey.

The baseline Phase 1 Habitat Survey undertaken c.1981 covered 7,750 ha of Wirral. Of this arable (36%), amenity grassland (28%) and woodland and scrub (17%) account for 81% of broad habitat recorded. Since the baseline year (i.e. over a 40 year period) 9% of woodland cover and 14% of amenity grassland have been lost to development and creation of other richer habitats such as woodland (*Wirral Wildlife, per comms, 2021*). However, as stated previously, woodland losses have likely been offset by woodland creation including approximately 30 ha of broadleaved plantation at Bidston Moss former landfill site.

Unimproved and semi-improved grassland is the next highest recorded habitat (13%) in Wirral. Since the early 1980s however this has reduced by 14% due to development pressures. The largest and most distinctive examples remain around Meols comprising floodplain and grazing marsh and neutral unimproved grassland. This includes Meols Meadows SSSI which is 7.1 ha. Caldy and Thurstaston and grassland either side of the M53 at Bidston are the other significant areas of neutral unimproved in the borough.

Wirral Wildlife (*per comms, 2021*) note habitat declines are likely to be greater and this would be demonstrated through updated survey.

Lack of management and development threats are the principle issues. For example, grasslands in Royden Park are scrubbing over despite best efforts of the ranger service. Grasslands around the M53 corridor at Bidston are also scrubbing up and lack management. Further, Meols Meadow SSSI is considered to be in poor condition with

one field turned to reed-marsh suggesting parts of this SSSI meadow may have been lost.

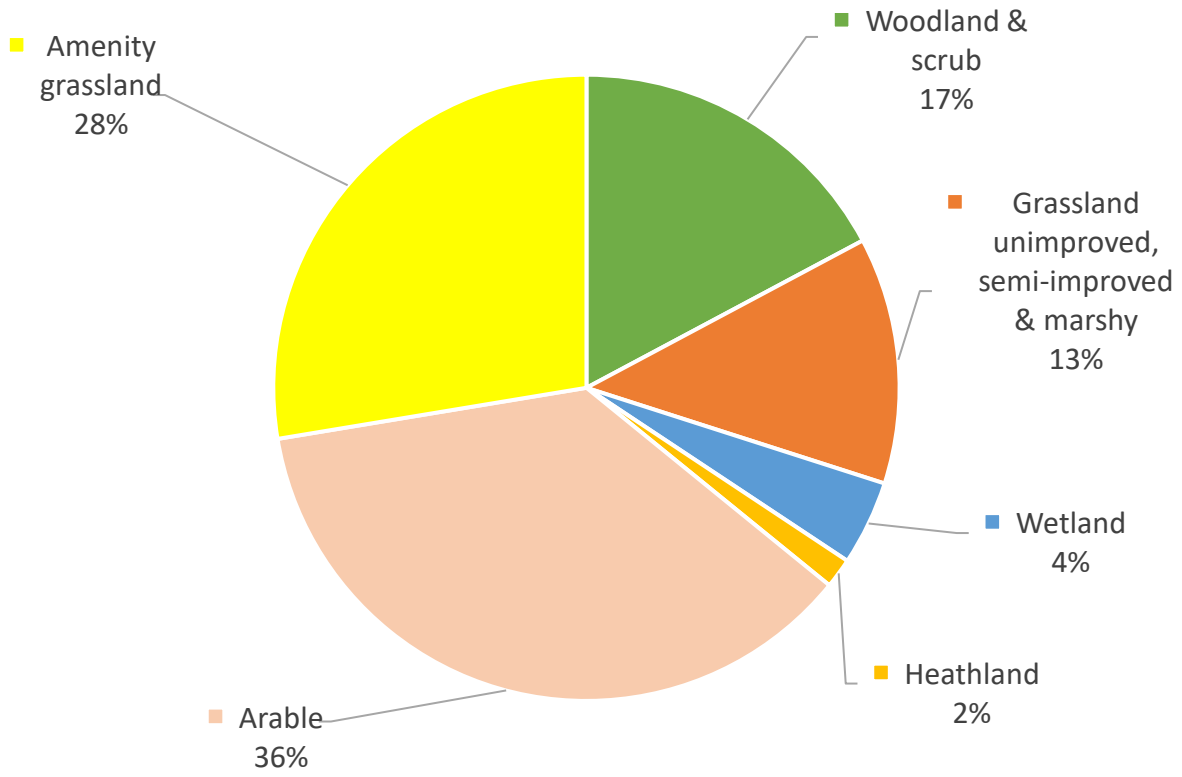


Figure 22: Wirral broad habitat types.

Whilst lowland acid heathland comprises just 2% of recorded broad habitats on Wirral, heathland in the borough accounts for 83% of all heath in the LCR. As found in other Local Authority areas, heathland loss is relatively low (1.5%) on the baseline year. This is likely due to the majority of heathland sites being protected through nature conservation designation. However, as discussed, this analysis does not account for management or condition and many heathland sites on Wirral and the LCR are vulnerable to scrub encroachment and recreational pressure (See Indicator N2).

Information provided by Wirral Wildlife (*per comms, 2021*) notes that Caldy Hill is largely scrubbed over however other heathland sites are faring better.

Bidston Hill continues to support reasonable areas of heath, owing to efforts of the ranger service and Heswall Dales SSSI was surveyed by Wirral Wildlife in 2020-2021. Heathland areas mostly remain in reasonable condition, through constant efforts by the rangers and volunteers.

Thurstaston Common SSSI is predominantly in good condition and this is supported by continuous monitoring over a 40 year period (*Ash et. al, 2021*).

Intertidal areas are significantly under recorded and have been omitted from this analysis.

The baseline survey recorded 1,821 standing waterbodies. This includes significant pond clusters in farmland areas of central Wirral as well as the Birket catchment. Several ponds and pond clusters are locally designated for their amphibian interest e.g. Great Crested Newt (*Triturus cristatus*).

Wirral Wildlife undertake re-assessments of ponds under the LWS Cheshire region criteria adopted in 2017 by Wirral Council. Most are failing to qualify as LWS. Piped water to farm stock, lack of management and pollution of farm ponds, is accounting for many ponds being in poor condition. Natural succession to willow carr has happened to many more. Ponds on public open space are often subject to unregulated fishing, invasive species and eutrophication e.g. Woodslee Pond and Sandbrook Lane Pond. Those ponds managed by fishing groups vary but are often now so intensively used they have lost all wildlife value.

Survey over the last 5 years found ponds in good condition are those on golf courses (Caldy, Bromborough, Arrowe). Great Crested Newt (GCN) populations are low at previously good sites e.g. Backford Road pond which is thought to be owing to intensive farming. The exception being Caldy Golf course, where the GCN population seems to be stable. Therefore, only a small number of the once-abundant ponds in Wirral are now of value to wildlife (*Wirral Wildlife, per comms, 2021*).

91 ha of brackish standing water is recorded including Birkenhead and Queen Elizabeth II dock systems and the marine lakes at New Brighton and West Kirby. These areas are commercially active dock or well-used for recreation which are pressures on foraging and roosting birds e.g. Cormorant (*Phalacrocorax carbo*). 121km of watercourses are recorded in the borough with a high density of field drains found in the Birket catchment. No hedgerow data was available at the time of writing this report.

N2: Designated sites

Headlines

- Designated sites cover approximately 41% of the Liverpool City Region, which is much higher than the 8% national average for England. This is due to our extensive intertidal habitats which form 66% of designated sites in the LCR.
- Our coastal environments, including the Sefton and Wirral coasts and Mersey, Dee and Ribble Estuaries are recognised as internationally and nationally important and are designated and protected by law. These sites include valuable habitats such as sand dunes, saltmarsh and mudflats provide habitat for specialist plant and animal species as well as providing important refuges for migrating and wintering birds.
- The Sefton Coast sand dune system is the largest in England and by far its most diverse.
- 37% of the Liverpool City Regions Sites of Special Scientific Interest (SSSIs) are in favourable condition. This is just below the national figure of 38.9%. Within the Liverpool City Region 79% of SSSIs are in favourable or unfavourable recovering condition, compared to a national figure of 93.1%.The Governments 25 Year Environment Plan sets a target of restoring 75% of terrestrial and freshwater protected sites to favourable condition.
- The Liverpool City Region has 3 National Nature Reserves, 29 Local Nature Reserves and 388 Local Wildlife Sites.
- Monitoring of Local Wildlife Sites in North Merseyside during the period between 2020 and 2021 found only 40% of sites to be in positive conservation management.

Photo credit: Anya Coffey

Designated sites

Designated sites are areas of land, inland water and the sea that have special legal protection to conserve important habitats and species in England. These include our Sites of Special Scientific Interest (SSSIs), Marine Protected Areas (MPAs), Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and Ramsar sites. Designation brings a level of legal or policy protection.

This indicator has 2 components: (a) extent (hectares) of designated sites on land, water and at sea and (b) condition of protected sites on land, water and at sea.

This indicator follows national indicators and therefore allows comparison of Liverpool City Region trends with national trends.

Why consider designated sites?

Designated sites conserve the most important habitats and species and can be of international and national significance. The condition of these sites therefore indicates how well these important ecological assets are being protected and conserved. Designated sites also provide an important stronghold for nature within the wider landscape.

How have we assessed this indicator?

To assess this indicator, data has been collated from national sources and locally. Extent of designated sites have been provided. However, trends in extent of designated sites have not been assessed within this report for the LCR. This is because this is the first State of Nature (SoN) report for the LCR and therefore the extent of designated sites sets the baseline for future monitoring.

For the purpose of this indicator we have included statutory and non-statutory designated sites. This provides a more complete coverage of the LCR's most valuable nature sites and makes use of locally held timeseries data. Condition of designated sites has been provided where data are available, this is largely for SSSIs and Local Wildlife Sites (LWSs). Trends in condition have only been possible for LWSs. Nationally all SSSIs are subject to condition monitoring through the 'Common Standard Monitoring' which is undertaken and reported by Natural England. This monitoring data has been collated for the LCR to allow reporting within this SoN report. Locally, LWSs are subject to condition monitoring using the biodiversity metric version 3.0 habitat condition assessment sheets (*Natural England, 2021a*). Monitoring has been patchy over the last 10 years, with only Wirral continuing with a monitoring programme during this period, however, a programme of LWS monitoring in North Merseyside was relaunched in 2020 and therefore data from site monitoring from 2020 has been used to compare with previous data to produce trends.

National outlook

Nationally the total extent of land, water and sea protected in England through national and international protected areas increased between 1999 and 2018 (see Figure 23). This is largely due to an increase in marine designated sites, for example the Liverpool Bay SPA. The extent of terrestrial and water sites has remained fairly constant over the monitoring period. Protected sites in England of terrestrial and freshwater areas, represent about 8% of the land area.

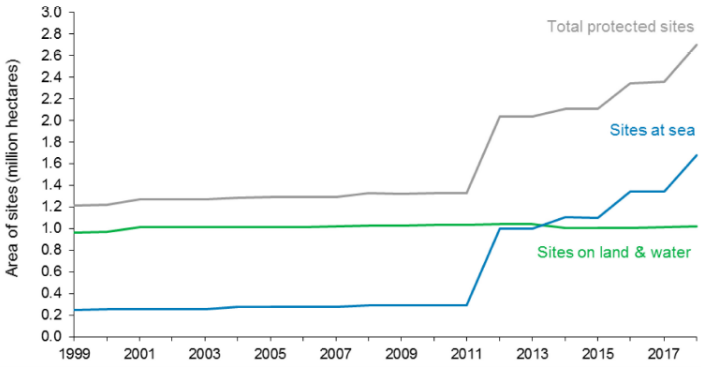


Figure 23: The extent of protected sites in England from 1999 to 2018. Source: Natural England

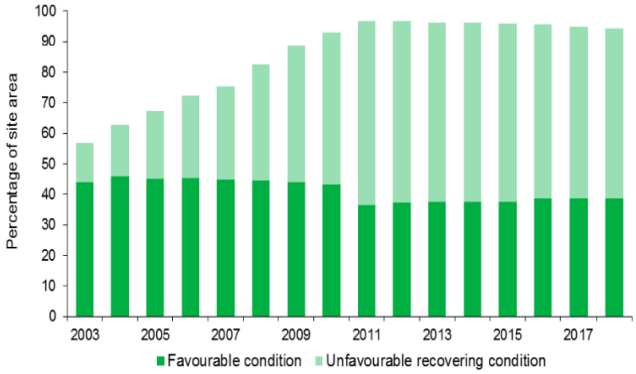


Figure 24: The condition of SSSIs in England between 2003 and 2018. Source: Natural England

There has been a net decrease in the area of SSSIs in favourable condition; down from 44% in 2003 to 38.8% in 2018 this is largely due to a more rigorous application of the 'Common Standard for Monitoring' protocols in assessing feature condition (*Natural England, 2021b*). However, over the past 7 years, there has been a small increase in the area in favourable condition, from 36.6% in 2011 to 38.8% in 2018 (*Natural England, 2021b*). The area of SSSIs in unfavourable recovering condition has increased substantially from 13% in 2003 to 55.5% in 2018 (see Figure 24).

The Government's 25 Year Environment Plan sets a target of restoring 75% of terrestrial and freshwater protected sites to favourable condition (*HM Government, 2018*).

Liverpool City Region Outlook

In the Liverpool City Region (LCR), it is primarily our coast and estuaries which are recognised as being of international and national importance providing habitat for specialist species such as the Sand Lizard (*Lacerta agilis*) and Natterjack Toad (*Epidalea calamita*) and also providing vital wintering and migratory grounds for thousands of bird species. The LCR also holds important heathland, woodland and grassland sites as well as remnant peatbogs.

Within the LCR 40% of the land area is within a designated site (see Figure 25) this compares with 28% nationally (*JNCC, 2021*). It is worth noting that a large proportion of this area is within the intertidal zone.

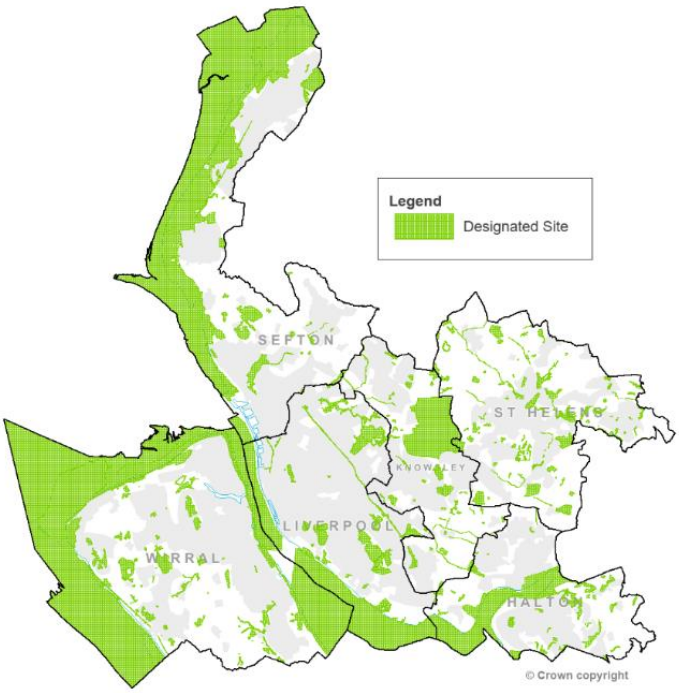


Figure 25: All designated sites in the Liverpool City Region.

All designated sites are selected based on qualifying habitat and species features. Each site being accompanied by a citation setting out reasons for selection. These citations in most cases are out of date and require review by Natural England or the relevant Local Sites Partnerships covering the LCR.

Internationally designated sites

International sites include Special Protection Areas (SPAs) and Special Areas of Conservation (SACs). These are sites which are identified as being of European Importance and which are designated and protected through the Conservation of Habitats and Species Regulations 2017, commonly referred to as the 'Habitats Regulations.' The network of SPAs and SACs is termed the National Sites Network.

Ramsar sites are wetlands of international importance designated under the Ramsar Convention.

There is much overlap between site boundaries of the SACs, SPAs and Ramsar sites. For example, the Dee Estuary is designated as a SAC but also is an SPA and Ramsar. Further overlap exists between the SSSI and LWSs network.

Special Protection Areas (SPAs)

Within the Liverpool City region there are five SPAs (see Figure 26) which are all designated largely due to their international importance for passage and wintering waterbirds which occur during the autumn and winter months in internationally important numbers. (N.B. Mersey Narrows and North Wirral Foreshore SPA is also designated due to breeding common terns.) These sites are afforded strict legal protection and cover much of the LCR coastline and estuaries.

The total area of SPAs within the LCR is 17,902 ha. The most recently designated SPA is Liverpool Bay SPA which was designated in 2010 with additional updates and boundary amendments in 2016 and 2017. Following national trends this most recent designation is a marine designation.

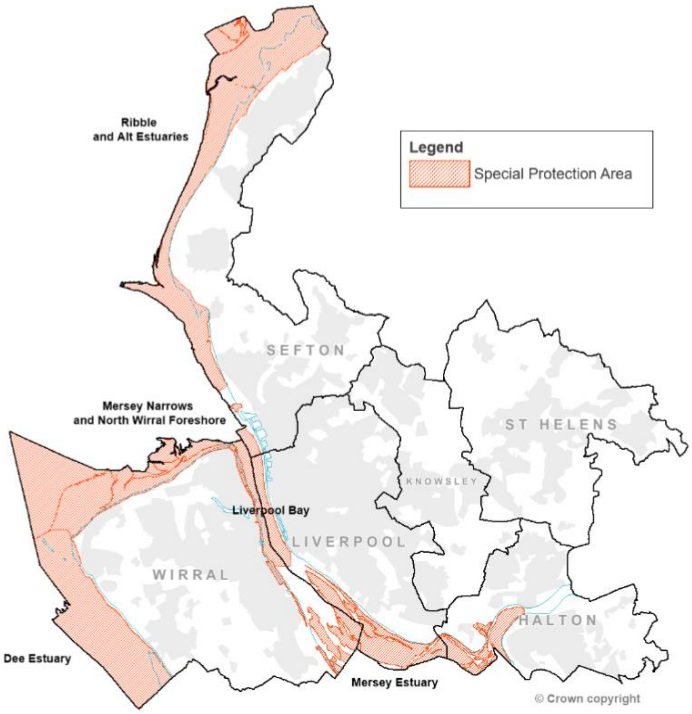


Figure 26: Special Protection Areas (SPAs) in the Liverpool City Region.

Ramsar sites

Within the Liverpool City region there are four Ramsar sites (see Figure 27) which are all designated due to their international importance for passage and wintering and waterbirds which occur during the autumn and winter months in internationally important numbers and the associated mudflat and saltmarsh habitats. The Ribble and Alt Estuary Ramsar site is also designated due to its important dune slack wetlands to natterjack toad.

The total area of Ramsar sites within the LCR is 15,166 ha.

The SPAs and Ramsar sites form a network of sites with considerable bird movement and interchange between all sites.

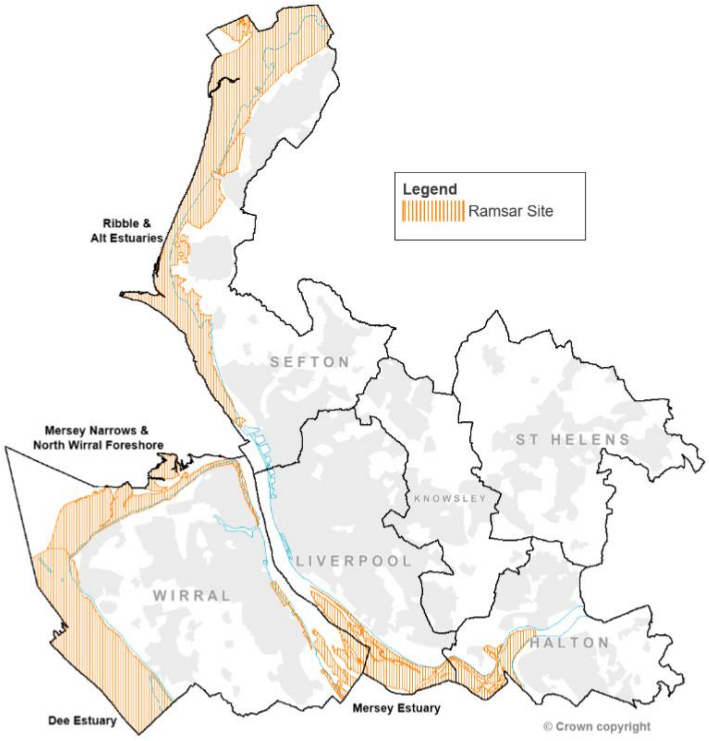


Figure 27: Ramsar sites in the Liverpool City Region.

Bird use outside of Designated Sites (Functionally Linked Land)

Whilst our coastal sites are important and designated for their passage and wintering bird assemblages it is worth noting that the designated sites are not the only areas used by these species. Farmland inland of these coastal sites is also of importance for a number of qualifying bird species.


Photo credit: Debby Allen

For example, whilst Pink-footed Goose (*Anser brachyrhynchus*) and Whooper Swan (*Cygnus cygnus*) roost within the designated sites, during the day they fly inland, to feed on largely arable farmland on crops such as potatoes, arable stubble fields and sugar beet.

‘Functionally Linked Land’ –

Areas outside of a designated site, but which are considered to be critical or necessary for the ecological or behavioural functions of a qualifying species of a SPA/ SAC /Ramsar site.

Other species often recorded on farmland include Lapwing (*Vanellus vanellus*), Curlew (*Numenius arquata*), Oystercatcher (*Haematopus ostralegus*), Shelduck (*Tadorna tadorna*) and Golden Plover (*Pluvialis apricaria*).

Areas of Functionally linked land (FLL) within the LCR have been mapped through a number of studies (*Youngs and White, 2008; MEAS, 2012 and Natural England, 2021*). The main areas (tetrads) of FLL are shown on Figure 28 below. These areas coincide with farmland areas in the whole of Sefton, Wirral particularly farmland adjacent to the Dee and North Wirral Foreshore, including Hoylake, Thurstaston fields, Parkgate south to Ness and Meols, St.Helens, particularly the areas around Rainford and Billinge, Knowsley particularly around Kirkby, farmland around the Liverpool-East Lancashire Road and Knowsley Park. The farmland bordering the Mersey from Oglet to Hale and east to Widnes.


Photo credit: Phil Smith

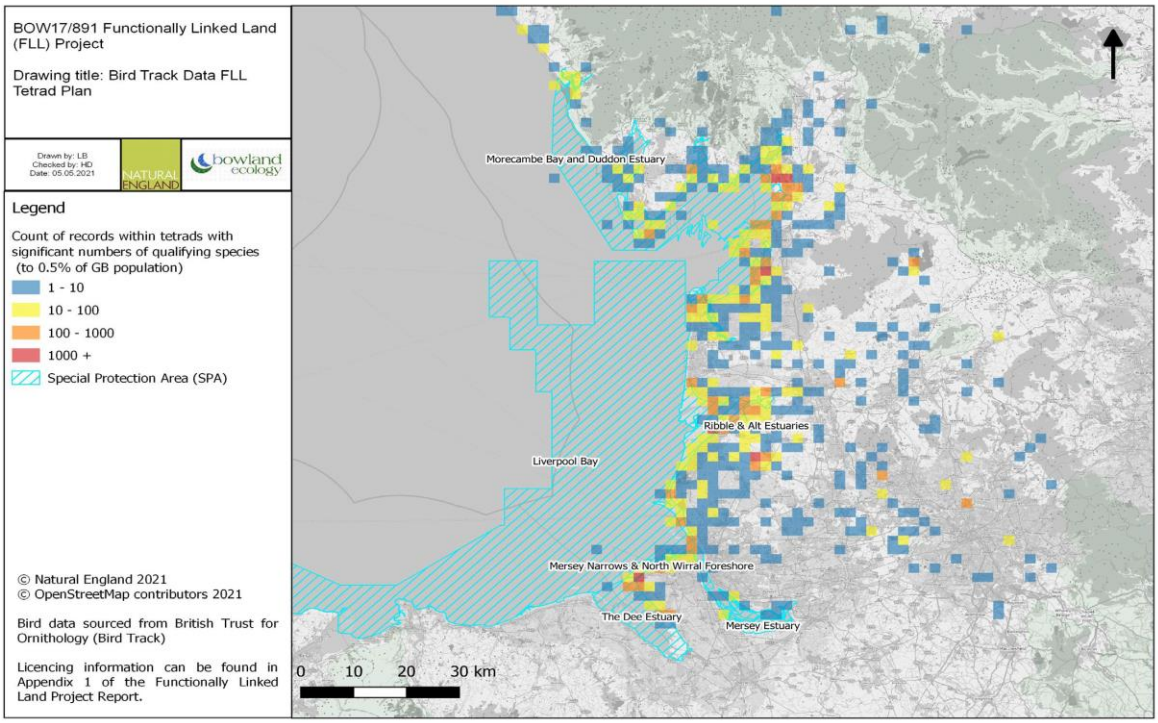


Figure 28: Tetrad data showing locations of FLL within the LCR
Source: Natural England (2021) Report NECR361

Whilst these areas are not designated, they are covered by the same legal requirements of the Habitats Regulations 2017 (as amended) and therefore any impacts to FLL through projects, development or plans require assessment through Habitats Regulations Assessment (HRA).

Special Areas of Conservation (SACs)

Within the Liverpool City Region there are two SACs (see Figure 29). These sites are designated due to their coastal habitats, including extensive sand dunes, saltmarshes, intertidal mudflats and sand flats and sea cliffs. These sites are also designated for their qualifying species including Petalwort (*Petalophyllum ralfsii*), Great crested newt (*Triturus cristatus*), River and Sea lamprey (*Lampetra fluviatilis and Petromyzon marinus*) .

The total area of SACs within the LCR is 10,260 ha.

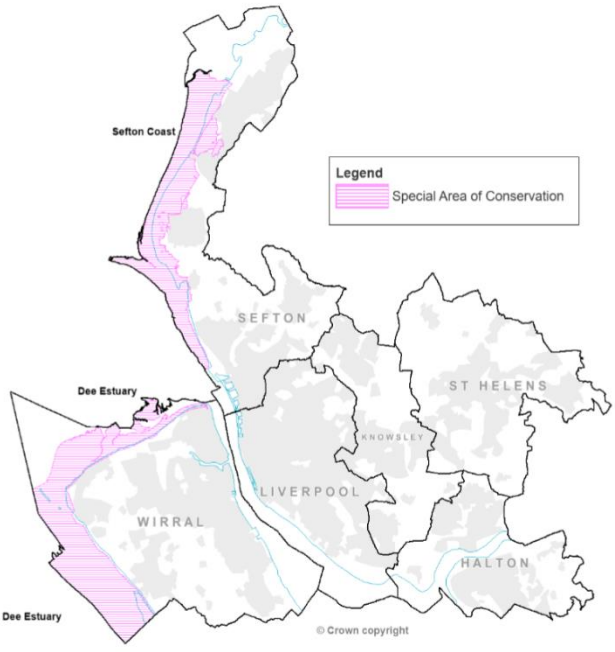


Figure 29: Special Areas of Conservation (SACs) in the Liverpool City Region.

Sefton Coast, general habitat and species trends

By Dr. Philip H. Smith, August 2021

Habitats: sand-dunes

The Sefton Coast supports the largest coastal dune system in England and by far its most biodiverse (*Smith, 2009*). In common with other dunelands in Britain and Western Europe, the Sefton sand-dunes are becoming increasingly overgrown by coarse vegetation and scrub, with associated loss of bare sand. Delgado-Fernandez *et al.,* (*2019*) measured a reduction of over 80% in bare sand since 1945. Multiple factors are responsible for this, including natural succession, introduction of non-native trees and shrubs, reduction in grazing, especially by Rabbits (*Oryctolagus cuniculus*), management to stabilise mobile dunes, aerial deposition of nitrogen from agricultural and industrial sources and climate change.

There are a few notable exceptions to the trend towards overgrowth, including the 'Green Beach' features that have formed on the shore between Birkdale and Ainsdale since 1986 (*Smith and Lockwood, 2021*). These have provided species-rich, early stage successional habitats, though they are increasingly restricted to the southernmost section near Ainsdale.

The loss of frontal dune habitat at Formby Point has been exacerbated by marine erosion over a 5km stretch, pushing back the foredunes towards the conifer plantations, causing 'coastal squeeze'.

Recreational pressures on the coast and dunes are increasing. Heavy human trampling at recreational hotspots leads to large-scale destruction of vegetation and re-mobilisation of sand, while light to moderate trampling can be beneficial in maintaining shorter swards and sandy footpaths (*Smith, 2009*). In some areas, the latter represent almost the only surviving examples of bare-sand habitat which is vital to many invertebrates (*Smith and Kinsella, in press*). Recently, even in lightly-used areas of duneland, there has been a large increase in dogs, often poorly controlled (*Smith, 2017b*). Apart from adverse impacts on other users, wildlife and livestock, what they leave behind may be contributing to soil eutrophication and associated vegetation changes.

Sand dune species trends

Higher plants:

- 1300 vascular plants have been recorded for the coastal zone, more than 1200 of them in the sand-dunes Smith (*2015).*
- An average of 11 taxa being added annually to the inventory since 2005. Over 230 plants are regionally or nationally notable.
- Many require short, open vegetation and patches of bare ground in which to thrive.
- Only about 65 species are known to have become extinct in the dune system; The North West Rare Plant Initiative, is attempting to re-introduce some of these lost species.

Bryophytes:

- 225 taxa for the dunes, representing about 21.5% of the British bryophyte flora including the first British records for several species (*Smith 2017c*).
- Twenty-three are regionally or nationally 'notable', five being Section 41 species.
- Three of these are regionally extinct, while two other notable species are also thought to be extinct, leaving only 18 of the coast's notable bryophytes still extant.

Petalwort (*Petalophyllum ralfsii*)

Invertebrates:

- 3300 invertebrates recorded for the Sefton Coast sand-dunes.
- The dunes are particularly rich in ants, bees and wasps.
- One of the most important Sefton Coast insects is the Northern Dune Tiger Beetle (*Cicindela hybrida*), with only two British localities. This Section 41, Red-listed 'vulnerable' species is wholly dependent on bare sand for basking and breeding.

Northern Dune Tiger Beetle *(Cicindela hybrida)*

Hornet Hoverfly *(Volucella zonaria)*

- Most of the recently added species have moved north in response to warming temperatures, e.g. Hornet Hoverfly (*Volucella zonaria)* reached Merseyside in 2015 and is now regularly seen along the coast. The number of dragonflies (*Odonata*) recorded for the dunes has more than doubled since the mid-1970s (*White & Smith, 2015*), this being mainly due to southern species extending their distributions northwards.

Habitats: saltmarsh

Sefton lies on the southern flank of the Ribble Estuary, which supports one of the largest areas of saltmarsh in Britain; it is also growing in area due to siltation in the estuary. Thus, as beach levels rise, new saltmarsh habitat is rapidly forming at Marshside and Birkdale. There is also a small saltmarsh on the Alt Estuary near Hightown (*Smith, 2021b*). All are relatively species-rich. Apart from their considerable nature conservation value, the saltmarshes contribute vitally important coastal protection.

Species: saltmarshes: higher plants

Sea-lavenders, Marshside

Sea-lavenders (*Limonium*) colonised the saltmarsh at Marshside in 2008 and then increased rapidly due to the recent growth of suitable ungrazed habitat (*Smith and Lockwood, 2016*).

Nationally designated sites

Sites of Special Scientific Interest (SSSIs)

The Liverpool City Region has eighteen SSSIs (see Figure 30). As with the international sites these include our coastal sites, however there are also a number or other nationally important sites which include woodland (e.g. Flood Brook Clough and Dibbinsdale SSSIs), lowland heath (e.g. Thurstaston Common SSSI) and meadows (Stanley Bank Meadow and Meols Meadows SSSIs). SSSIs designated solely for their geological features include The Dungeon and Red Brow Cutting.

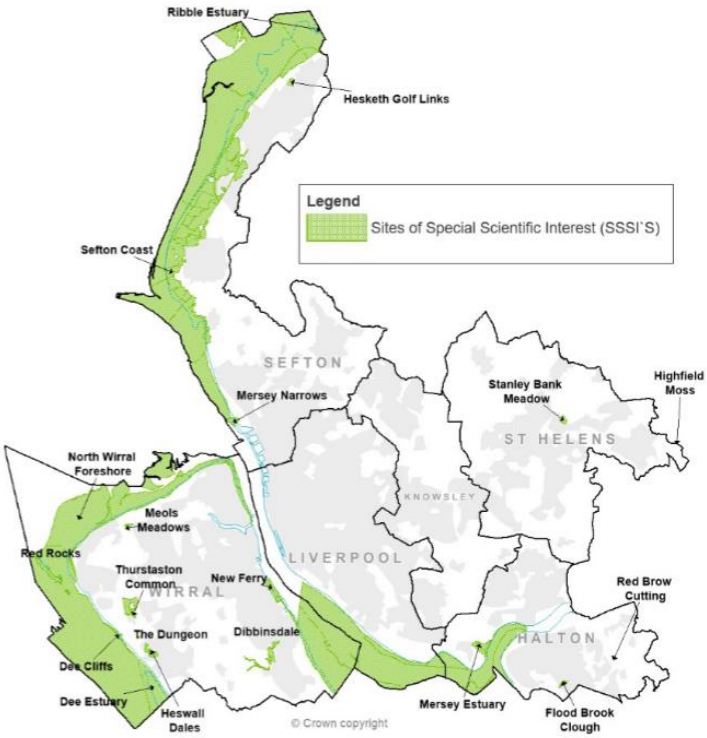


Figure 30: Sites of Special Scientific Interest (SSSIs) in the Liverpool City Region.

The total area of SSSIs within the LCR is 22,924 ha. The distribution of SSSIs is not even across the Liverpool City region with most SSSIs being located in Wirral and Sefton, with only one SSSI in Liverpool, three in Halton, two in St.Helens and no SSSIs in Knowsley.

Many SSSIs cross administrative boundaries and are landscape scale. Condition monitoring by Natural England therefore breaks down sites into compartment or SSSI units (*Natural England, 2021b*). SSSI monitoring shows that SSSI condition varies across sites and SSSI units. Monitoring data shows that across the LCR 79% of sites are in favourable or unfavourable recovering condition (see Figure 31 and 32). This compares with a national average of 94.3%. The Governments 25 Year Environment Plan sets a target of restoring 75% of terrestrial and freshwater protected sites to favourable condition. Within the Liverpool City Region 37% of sites are in favourable condition, which compares closely with a national figure of 38.8%. Factors affecting favourable condition of these sites are discussed in more detail below.

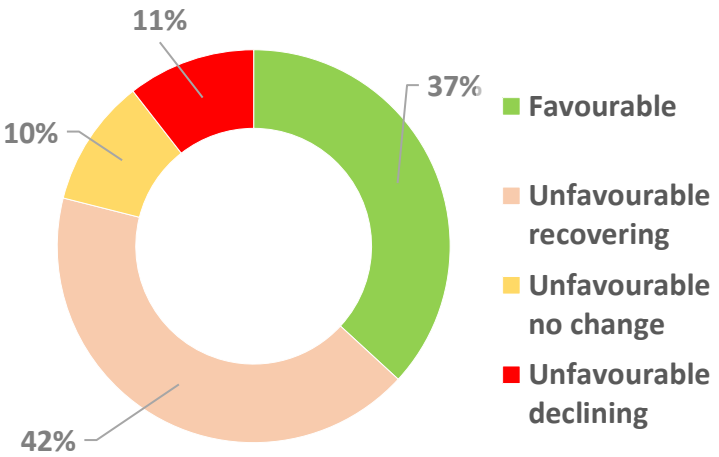


Figure 31: The percentage of Sites of Special Scientific Interest (SSSIs) in different conditions in the Liverpool City Region.

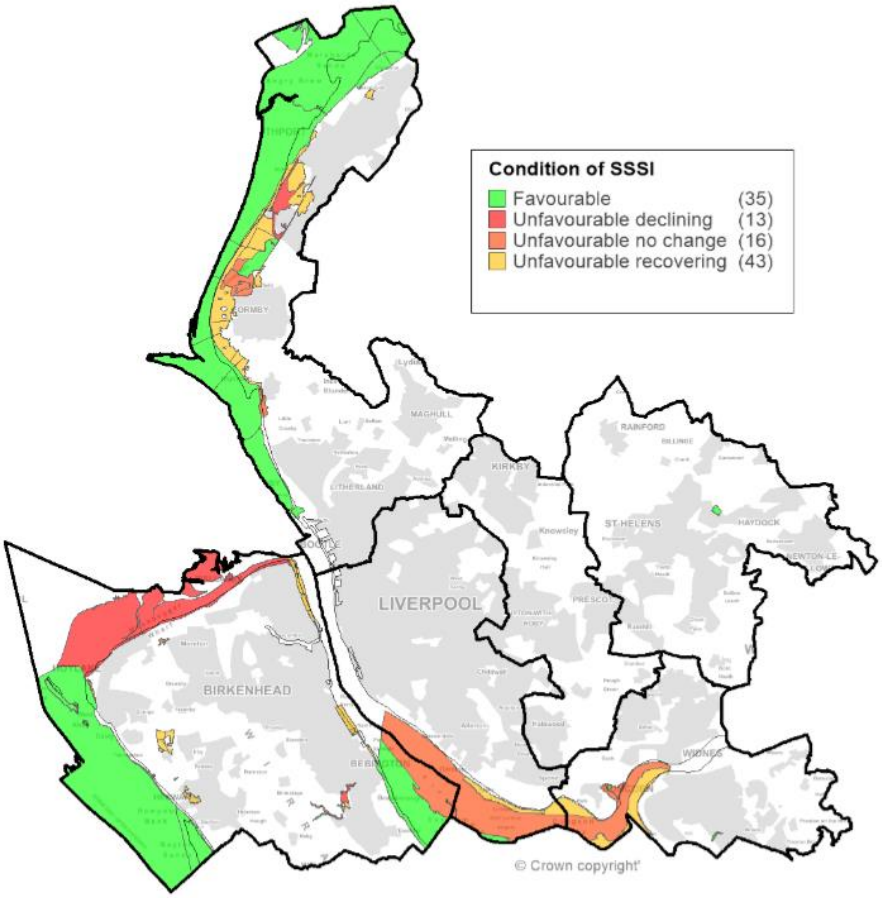


Figure 32: Condition of Sites of Special Scientific Interest (SSSIs) in the Liverpool City Region.

National Nature Reserves

The Liverpool City Region has three National Nature Reserves (NNRs) all of which are located on the Sefton Coast, which can be seen in Figure 33.

The area of National Nature Reserves within the LCR is 980 ha.

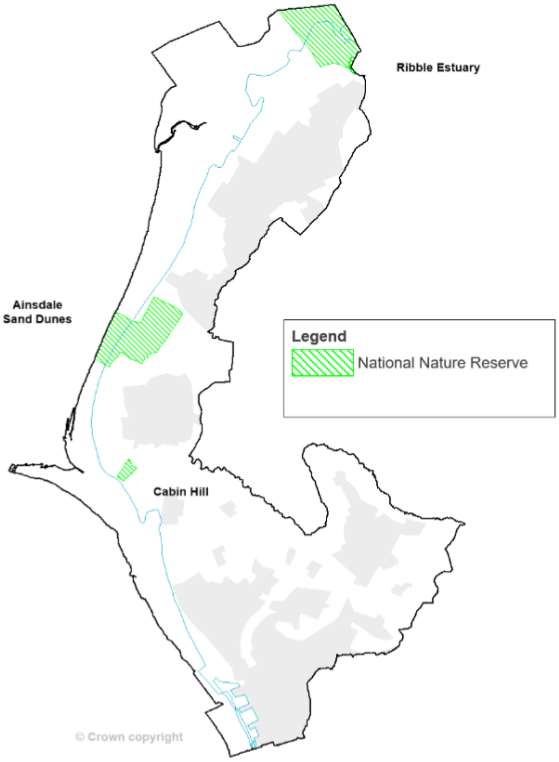


Figure 33: National Nature Reserves (NNRs) in the Liverpool City Region.

Factors affecting condition of International and National sites

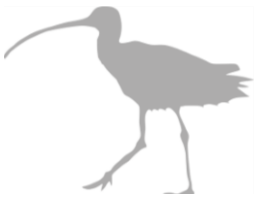
There are a number of factors affecting the condition of international and national sites within the Liverpool City Region. Some relate to wider environmental effects such as climate change, food availability and water quality. However, due to the densely populated nature of the LCR our international and national sites are heavily used for recreation and this can result in the most damaging effects which impact on site condition. This section of the report describes these factors.

Factors affecting waterbirds

Major declines for at least one of the species of qualifying waterbird for all SPAs within the LCR have been reported. Declines have been particularly severe on the Mersey and North Wirral Foreshore (*Ross-Smith et al., 2015*). Bird populations (e.g. Pintail) have crashed yet invertebrate communities have improved following water quality improvements. Declines in some bird species can be related to food availability, climate change and wider population changes. Declines in bird numbers on the North Wirral Foreshore have been attributed to loss of feeding habitat and disturbance (*Ross-Smith et al., 2015*). SSSI condition monitoring for the North Wirral Foreshore (See Figure 31 above) shows this site to be in unfavourable declining condition. This is attributed to declines in qualifying bird populations resulting from amongst other factors, recreational disturbance (*Natural England, 2012*)

"The waterbirds can be particularly vulnerable to certain disturbing recreation activities, the greatest periods of sensitivity are largely around the over-wintering period"

Disturbance can displace birds, meaning areas otherwise suitable are not used by the birds. Repeated disturbance can expend energy, alter behaviour and reduce time available for feeding which may have implications for survival and fitness of those birds. A concern is the prevalence of disturbance to birds linked to dog walking in shoreline and estuarine locations. Dog ownership has increased greatly during the Covid pandemic and therefore disturbance due to dogs may become a greater issue moving forwards. Birds are particularly vulnerable towards high tide when they are displaced off the intertidal flats and tend to accumulate in very large densities along the advancing tide line or on coast defence structures.



Factors affecting Sand dune habitats

Sand dune habitats (as found predominantly on the Sefton coast SAC and SSSI and also Dee Estuary SAC and Red Rocks SSSI) are vulnerable to damage and trampling all year round, but intense trampling during busy periods in the spring and summer (when visitor numbers peak) will coincide with the growing season and be particularly damaging. Areas close to access points, car parks and near major routes are most vulnerable.


Photo credit: Anya Coffey

"Trampling of habitats damages plants, additional impacts from accidental fires exacerbate damage to habitats."

Fires are also a threat on sand dune habitats during dry weather and in the spring/summer fires are more damaging. Fires are usually more frequent during the holiday season which can coincide with dry weather and may be caused by barbeques, discarded cigarettes, beach fires and arson.

Other impacts at this time of year can include changes to grazing management (grazing animals avoiding areas with people, sheep worrying by dogs, gates left open etc.). Recreational pressure impacts are recognised as a pressure within Conservation Objectives for the Sefton Coast (*Natural England, 2019*).

There have also been ongoing declines in Natterjack toads (for which the Sefton Coast supports 40% of the UK population). Ponds close to car parks and access points are most vulnerable to impacts from dogs (swimming in ponds creates turbidity and there is a risk of contamination from flea powders and other chemicals) and trampling (damage to fringing habitat). The ponds are critical for the amphibians and these are most vulnerable during the breeding season (March-July). Dog fouling is an impact all year round and is relevant to the dune systems and SAC habitats including ponds and slacks.

There is now recognition of the effects of visitor pressure on these sites and that this pressure is likely to increase given housing targets, policies for housing and tourism within Local Plans. To protect these sites from the effects of recreational pressure and to ensure the requirements of the Habitats Regulations 2017 (as amended) are being met, a Recreational Mitigation Strategy (RMS) for the Liverpool City Region is being developed.

The RMS is currently at the evidence gathering phase with recreational use surveys being undertaken at coastal sites during 2021 with the completion of the RMS timetabled for early 2023. The RMS will set out a strategy to minimise and mitigate the effects of recreational pressure on the coastal National Sites Network and Ramsar sites. The strategy will set a tariff for new development to support the management of our coastal designated sites. The proceeds of which will fund a range of provisions, including habitat management within the designated site, education and public awareness raising, creation and management of suitable alternative natural greenspaces (SANG) for recreational use away from the coast.

Whilst we have focused on the factors affecting coastal sites, international and national sites as these make up the majority of our designated sites it is worth noting that similar factors also impact on our inland SSSIs. With a number of popular SSSI sites also suffering from the effects of recreational use, these include Thurstaston Common SSSI and Dibbinsdale SSSI.

Other factors affecting our international and national sites include:

- **Scrub encroachment –** scrub encroachment due to lack of management results in the loss of valuable habitats such as, meadows, heathland, dune grasslands and dune slack and explains the unfavourable condition of many SSSIs where these habitats are present, e.g. Heswall Dales SSSI, Thurstaston Common SSSI and Sefton Coast SSSI. On coastal sites non-native scrub such as Japanese Rose (*Rosa rugosa*) and Sea Buckthorn (*Hippophae rhamnoides*) is a significant issue.
- **Invasive species –** There are a number of invasive species impacting on SSSI, as described above Japanese Rose and Sea Buckthorn are a significant issue across our coastal sites. However, other species such as Himalayan Balsam (*Impatiens glandulifera*), Japanese Knotweed, Rhododendron ponticum L. as well as garden escapes such as Variegated Yellow Archangel (*Lamium galeobdolon subsp. argentatum*), Crocosmia and Cotoneaster sp. are also an issue. These invasive species often produce a dense canopy or ground cover and thereby prevent or out compete native plant species. This has knock on effects of impacting on invertebrates and other fauna which rely on these native plant species.
- **Plant diseases –** For example Ash die back is a contributing factor to the condition of some woodland SSSIs within the LCR and is specifically identified as an issue contributing the unfavourable condition of Dibbinsdale SSSI. Anecdotally, there is evidence of lack of swift action by Local Authorities when diseases such as Ash die back are identified on sites and this is likely to lead to further spread.

The Government's 25 Year Environment Plan sets a target of restoring 75% of terrestrial and freshwater protected sites to favourable condition. To achieve this within the LCR the factors listed above must be addressed.

The impacts identified above are also negative factors in the condition of the LCR Local Wildlife Sites (LWS) (See LWS section on page 83).

Case Study: Natterjack Toad (*Epidalea calamita*)

Natterjack Toad is a sand dune specialist which is found on the Sefton Coast and North Wirral Foreshore. Natterjacks hibernate in burrows in the sand overwinter emerging in the spring. With males calling from the edge of ponds within dune slacks to attract female mates. The female lays spawn strings within the ponds. The Sefton Coast supports the largest remaining population in Britain. Due to declining populations the Natterjack toad is highly protected by British and European Law.

The Natterjack toads on the Sefton Coast have been subject to long term monitoring. This case study presents the findings of 31 year study (*Smith and Skelcher, 2019*) Natterjack toads have been subject to conservation efforts on the Sefton Coast since at least the 1970s. Natterjack toads are sensitive to environmental conditions particularly water levels within the scrapes, scrapes drying out before toadlets have emerged leads to failed breeding success. Whereas high water levels lead to scrapes being invaded by large number of competing common toads, great crested newts and invertebrate predators. Changes in terrestrial habitat around scrapes can also affect use of the scrapes. As with other dune systems across Europe they are becoming increasingly stable with increased vegetation growth. Increased vegetation growth affects Natterjacks through restricting foraging opportunities, encouraging colonisation by other competitors such as common toad. Management actions on the coast such grazing have been used to reduce vegetation and create bare sand patches.

Long term monitoring of natterjack toad breeding scrapes has been undertaken across the Sefton Coast since 1987. Monitoring shows a decline in natterjack toads over a 31 year period (see figure 34 and 35 below). Monitoring showed that spawning mostly took place during April or early May depending on weather conditions.

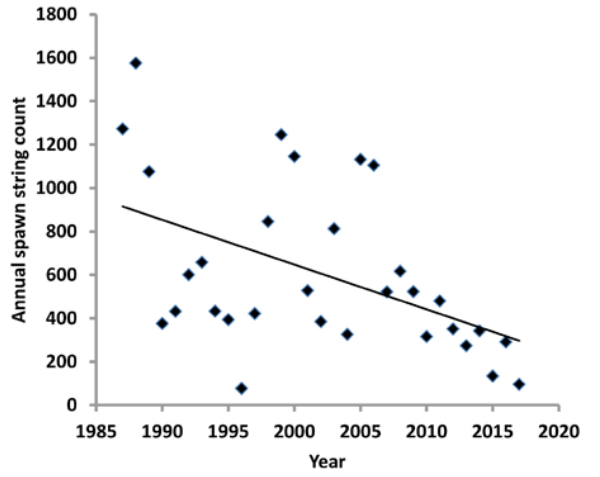


Figure 34: Spawn string production between 1987 and 2019

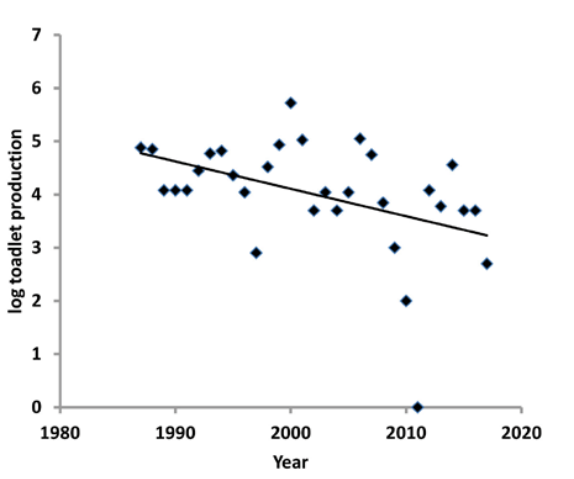


Figure 35: toadlet production between 1987 and 2019

Monthly rainfall for the study period was collated and shows a decrease in average April rainfall over the 31 year study period. With declining April rainfall correlating with toadlet success. Potentially showing the effects of climate change on this species. With lower April rainfall in the UK linked to warming over Greenland.

Natterjack toad population size is limited by the number of suitable breeding pools and between 2010 and 2015 24 new scrapes were created on the Sefton Coast with nearly all successfully used by natterjacks and demonstrate the importance of conservation efforts to create new scrapes as well as other management such as control of vegetation, particularly scrub.

Local Nature Reserves

There are 29 Local Nature Reserves (LNRs) within the Liverpool City Region covering an area of 974 ha (see Figure 36).

Local Nature Reserves are designated and declared by Local Authorities under the National Parks and Access to the Countryside Act 1949 with approval from Natural England. LNRs are designated for their community and biodiversity value.

Michaelmas Daisies Childwall Woods and Fields Local Nature Reserve

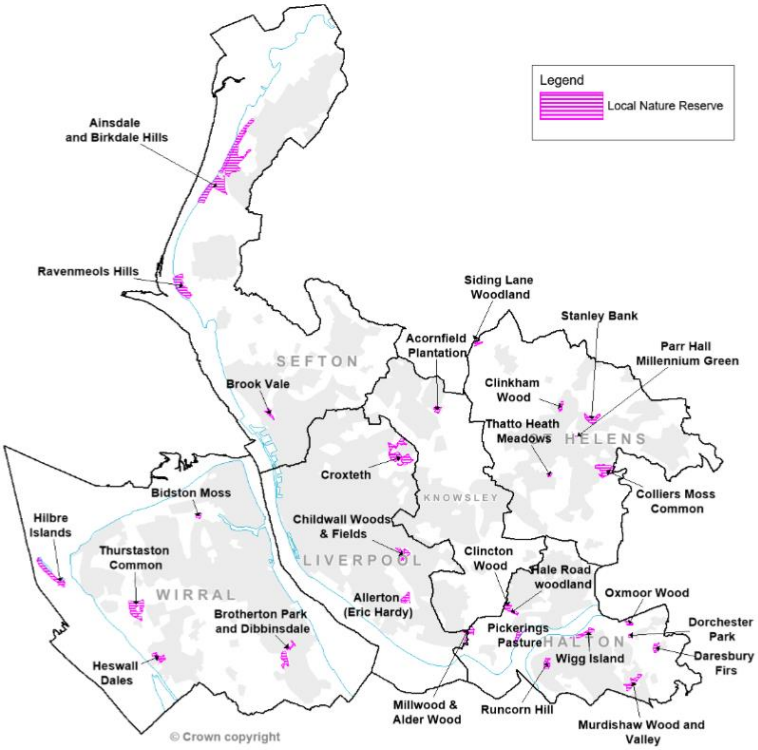


Figure 36: Local Nature Reserves in the Liverpool City Region.

Table 5: A district breakdown of Local Nature Reserves in the Liverpool City Region.

Local Authority	Number of LNRs
Halton	9
Knowsley	1
Liverpool	4
Sefton	3
St.Helens	7
Wirral	5

The number of Local Nature Reserves designated by each Local Authority within the Liverpool City Region varies with some Local Authorities having more LNRs than others. It is evident from the results of this SoN that some Local Authorities have been more proactive than others in designating LNRs (Table 5, indicator N2). This is unlikely to be due to a lack of potential candidate sites and therefore a levelling up across the LCR districts in LNR provision would be beneficial for both nature and people.

Local Wildlife Sites

There is a total of 388 Local Wildlife Sites (LWSs) within the Liverpool City Region. These sites are designated due to their local nature conservation value. LWSs within the LCR cover an area of 15,732 ha or 24% of our area, which compares to 5% nationally (The *Wildlife Trusts, 2018*). The LWS network is therefore of landscape scale importance and underpins our ecological network.

Table 6: Number of Local Wildlife Sites per district in in the Liverpool City Region

District	Number of Local Wildlife Sites (LWSs)
Knowsley	65
Liverpool	31
Sefton	56
St.Helens	115
Wirral	69
Halton	52
Total	**388**

Within the LCR the Local Sites system is run Local Sites Partnerships (LSPs), these include North Merseyside LSP (covering Knowsley, Liverpool, Sefton and St.Helens), Wirral LSP and Cheshire LSP. These partnerships are made up of Local Authorities, statutory organisations, conservation organisations, local recorders, 'friends of' groups and other. The role of these LSPs is to identify and designate LWSs, co-ordinate monitoring and to provide and co-ordinate management.

Condition

LWSs are subject to monitoring. This is undertaken by Merseyside Environmental Advisory Service (MEAS), Wirral Wildlife and conservation volunteers. Monitoring helps to assess the condition of sites overtime and provides information to feed into management plans. The method used to determine habitat condition is derived from Defra's biodiversity metric version 3.0 (*Natural England, 2021a*).

Voluntary group Wirral Wildlife has surveyed and monitoring Wirral LWSs on a 10 year rota since the mid 1980s with data provided to Cheshire rECOrd Local Record Centre (*Wirral Wildlife, 2021*). Condition monitoring of sites within the districts of Sefton, St.Helens, Knowsley and Liverpool has resumed after a period of abatement. During the period of 2020-2021 50 sites have been surveyed and their condition monitored.

When comparing condition of these sites to their condition at the time of previous monitoring in early 2000's analysis shows that the percentage of LWSs in good condition has fallen dramatically from 61% to just 20% (see Figure 37) (*MEAS, 2021a*). The reasons for this decrease are largely related to lack of management. It is worth noting that survey in 2020-2021 focussed largely on Local Authority owned sites and the lack of management reflects the cuts to ranger services and greenspace teams over the last 10 years.

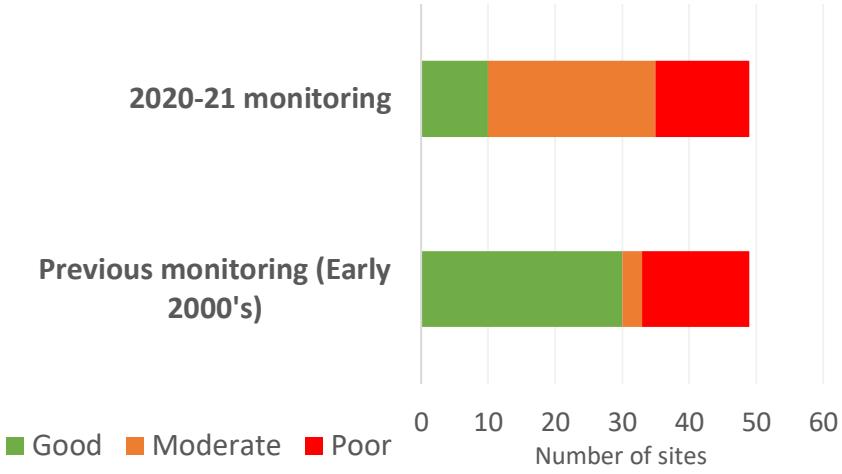


Figure 37: The condition change of Local Wildlife Sites surveyed across Knowsley, Liverpool, Sefton and St.Helens' in 2020-21 compared to previous condition data (2000 to 2018).

The UK State of Nature report highlighted the lack of public funding for nature conservation reporting a decline both in absolute terms and as a percentage of GDP – the latter by 42%, from 0.038% to 0.022%, between 2008/09 and 2017/18 (*State of Nature Partnership, 2019*).

Monitoring of Wirral LWSs has been routinely undertaken for nearly 10 years (*Wirral Wildlife, 2021).* However, due to the pandemic only 6 LWSs were surveyed between March 2020 to August 2021. Of those sites, 1 was found to be in good condition, 3 moderate and 2 poor (*Wirral Wildlife, 2021)*. We have omitted the data for Wirral LWS in the figure above due to lack of previous condition information. Furthermore, unfortunately no data was available for Halton LWSs.

Figure 38 shows that ownership of LWSs across North Merseyside is almost evenly split between public and private landowners. Publicly owned LWSs account for 43% of all LWSs in North Merseyside, whilst there are slightly more in private ownership, with 50%.

Although information is available as to whether a LWS is publicly or privately owned, there are gaps in landownership details for privately owned sites.

Unfortunately, given time constraints to collect data, no LWS land ownership data was included for Halton and Wirral.

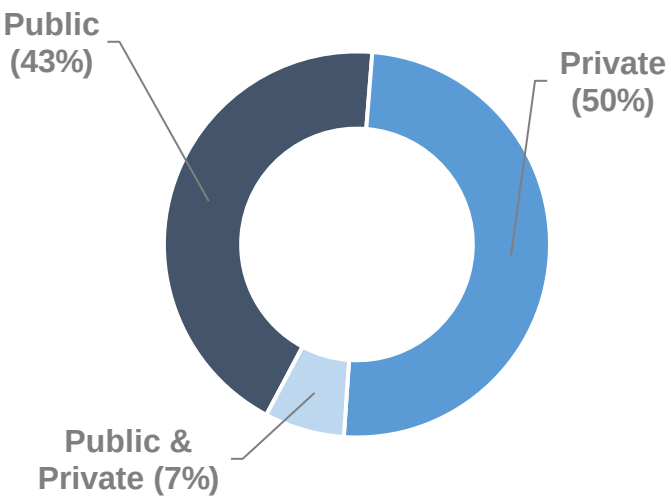


Figure 38: Land ownership of Local Wildlife Sites in North Merseyside: Knowsley, Liverpool, Sefton and St.Helens.

Factors affecting Local Wildlife Sites

LWS monitoring has identified a number of factors affecting the condition of Local Wildlife Sites, notably:

- Lack of management;
- Inappropriate management i.e. amenity prioritised;
- Scrub encroachment;
- Impacts of invasive species, particularly, Himalayan Balsam, Japanese Knotweed and Rhododendron; and
- Visitor recreational pressure.

Interestingly, despite the development pressures within the LCR, loss due to development is not a major factor affecting LWSs. Just 4 North Merseyside LWSs have been lost to development over the last 20-year period although there has been partial loss of some sites. LWSs are protected through Local Plan policy and the low number of losses illustrates that strength of protection Local Plan policy provides and Local Planning Authority commitment to protection of these sites.

Glasshouse Close Wood LWS, St.Helens

Local Wildlife Sites in positive conservation management

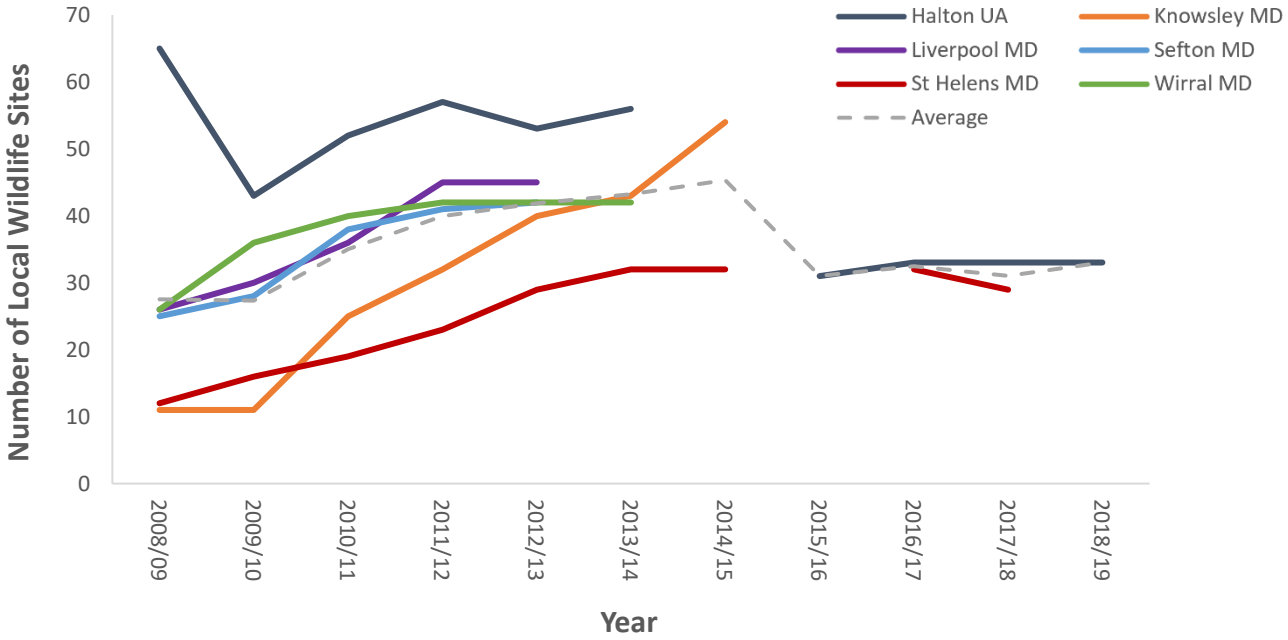


Figure 39: Percentage of Local Wildlife Sites which are under positive conservation management in the Liverpool City Region.

Source: Annual Government Single Data List 160-00

Trends in lack of management are also reflected in Defra's Single Data list reporting on indicator 160-00 which showed a steady increase in the percentage of LWSs in positive conservation management between 2008 and 2015 (*Defra, 2020*). However, from 2015 onwards reporting was inconsistent and coincides with Local Authority funding cuts. Where reporting has occurred the percentage of sites in positive conservation management has decreased. During this time there has been significant cuts to Local Authority ranger services and this has resulted in lack of conservation management of publicly owned LWSs.

Figure 39 shows, within the LCR of those Local Authorities which reported just 33% of LWSs were in positive conservation management a rise of 5% from first reporting in 2008/9 but a fall of 12% from a high of 45.3% in 2014/15. This is below the national average of 47% (*Defra, 2020*). As monitoring has found, many LWSs with management in place are not necessarily being managed for biodiversity and their designation features. Management for amenity and recreational use tends to be prioritised.

Case Study: Northwood Forest Hills Local Wildlife Site

Northwood Forest Hills LWS located in Kirby, Knowsley has been created on a site of former residential development and industrial land. Regeneration work in the 1990's saw the residential development demolished and closure of a railway line. The site was then left for over 20 years unmanaged and unused. The site was in poor condition and not valued by the local community. This neglect resulted in the site slowly being reclaimed by nature. A partnership including Knowsley Council, the local community, Mersey Forest and Groundwork set out to transform this area into a local natural greenspace, creating new wetland and woodland as well as creating new entrances, signage and access paths along with seating and bins. The site now supports a large pond and reedbeds, unimproved neutral grassland and woodland supporting a diverse range of plant species including a number of locally rare species. As a result the site was designated as a Local Wildlife Site by the North Merseyside Local Sites Partnership in 2010 and is now a well used and valued greenspace.

N3: Species of the wider countryside

This chapter explores the UK Biodiversity Indicator group (D4) relating to multi-taxa species groups which while widespread can be seen to indicate changes in our countryside are impacted by changes in habitat, management, climate or wider environmental pressures.

Headlines

- Farmland species are under significant negative pressure and demonstrate the strongest declines most apparent in the occurrence index for Butterflies (25%) and arable plants (16%) but demonstrated in most taxon groups.
- Woodland species are overall faring better in the LCR but invasive species are suppressing gains that might be made by woodland retention and creation schemes and some of our most sensitive species continue to decline.
- Knowledge of freshwater species in the LCR is lacking except for a handful of charismatic taxa.
- The LCR is a national stronghold for water voles and has a special responsibility in their conservation and national monitoring.
- The presence of conservation priority, migratory and predatory species moving into our estuaries and their tributary's points to improving water quality and recovering biodiversity.
- The use of research and novel methods such as eDNA sampling could greatly improve our understanding of the freshwater and marine environments as demonstrated by the Mersey Gateway Environment Trust (MGET) and Mersey Rivers Trust (MRT).
- Our ability to infer trends at the Liverpool City Region scale is highly dependent on a long history of expert volunteer naturalists and their institutions.
- Long term monitoring schemes provide robust markers on which to 'truth' broader scale trends. However, coverage is limited.
- There is a high level of risk for responsible authorities on evidencing future decisions unless monitoring is appropriately resourced.

Distribution of widespread species

The consideration of 'widespread species' may at first appear to conflict with the aims of monitoring change in wild species populations as we do not necessarily consider the known rare and threatened. However, it is in the widespread and more readily recognisable that we are more able to depend on greater levels of monitoring and reporting. Within the widespread species it is also still possible to select species which are sensitive to change in a habitat and so can be usefully applied as indicators and cross referenced to N1 change in habitat. The selection of each of the following species groups has been undertaken at the national level through partnership of public, not-for-profit and charitable organisations including statutory agencies, government advisors and national taxonomic recording schemes and societies.

The broad groupings are Farmland, Woodland, Wetland and the Marine environment all of which remain dynamic components of the natural environment within the Liverpool City Region (LCR).

While there is a great local interest in nature and biological recording. In the local area broad scale structured monitoring remains generally absent except for some long-term site-based monitoring of specific taxonomic groups or habitat e.g. Wetland Bird Surveys (WeBS) counts of birds using estuaries, the Sefton Coast dune system or Bat hibernation roost counts. These are incredibly useful and informative, but caution must be applied when considering these trends across the whole of the six local authorities.

The generation of species atlases, annual bird reports and the breeding bird surveys remain the most current and comprehensive information available. In our area these are largely produced by the Lancashire & Cheshire Fauna Society however their coverage includes Lancashire and North Merseyside. This presents some limitations as Wirral and Halton fall into Cheshire so information must be sourced separately and are not available as a species atlas. Further, the atlas' and interpretation that exist consider a large area of Lancashire outside the LCR.

"One of the clearest examples of how farmland management has affected biodiversity is the trend in farmland birds; the suite of bird species most closely associated with farmland have declined more severely than birds in any other habitat, with a fall of 54% in the Farmland Bird Indicator since 1970."

To contextualise the expert led, published species distributions, other data relating to the broad indicator groups have been reviewed in addition to information held by the two Local Environmental Records Centres (LERCs) which cover the LCR (Cheshire rECOrd and Merseyside BioBank). LERC held species observations are sourced from a wide range of sources including individual recording effort, species projects, structured survey and data sharing from a range of national and local based natural

history focused organisations, recording schemes and societies in addition to a range of other private, public and charitable sector organisations. Data available for the indicators and the coverage over space and time is therefore strongly linked to recorder effort.

The collection of both opportunistic and structured recording data is heavily bias towards the last two decades (particularly so for birds) with relatively little information available on these species in the local area prior to 1980 (Figure 40), much of our local review is therefore restricted to this timeframe.

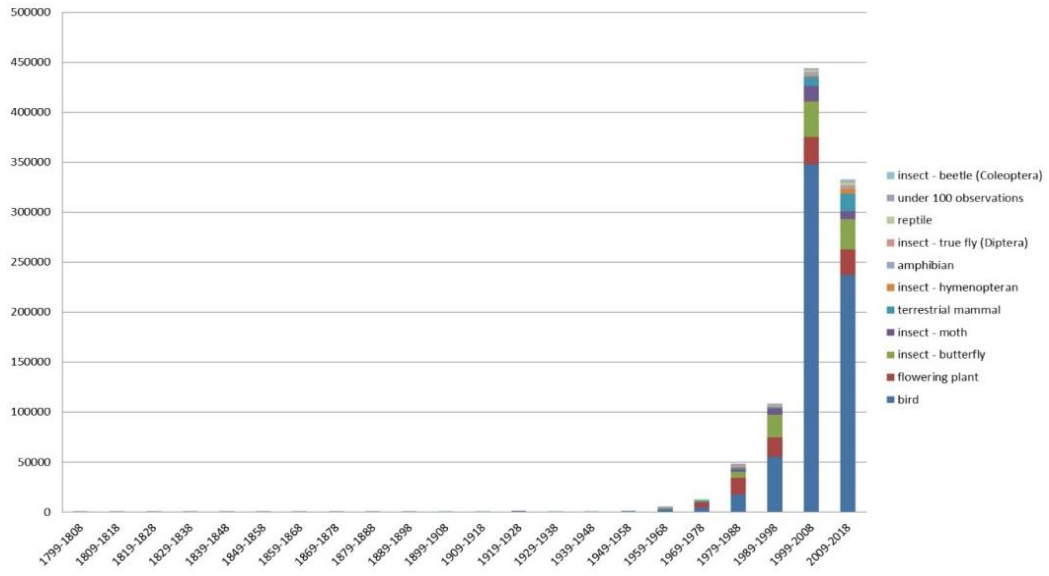


Figure 40: Numbers of records across all species indicators by decade and taxon.

Species in the Wider Countryside: Farmland

Farming methods and land management are a major consideration when discussing ecosystems, nature and biodiversity. Farming has shaped our countryside for centuries and arable land makes up a significant portion (see indicator N1) of the land available to wildlife and its management has historically been relatively stable allowing time for species to adapt and so support increased and distinct biodiversity.

In modern times significant and rapid changes to farming practices have outpaced species ability to adapt and removed aspects of land management on which they relied.

Within the LCR this indicator is also particularly relevant as historically much of the our region was farmland and while areas have been lost to urban expansion farmland continues to make up a significant portion of greenspace and is the dominant form of land use (37% of recorded broad habitat - see indicator N1) with farmland still existing particularly in the rural hinterlands of Sefton, St.Helens, Knowsley and Wirral.

National Outlook

The State of Nature Report UK (2019) clearly outlined the declining status of many farmland species. Long term declines have been identified from the UK Biodiversity Indicators (C5, C6 and C7; JNCC). The farmland bird index was shown to have declined by 55% of its 1970 value (Figure 41). While the farmland specialist butterfly species index dropped by 61% (Figure 42). The index for butterflies of the wider countryside also fell by 22%.

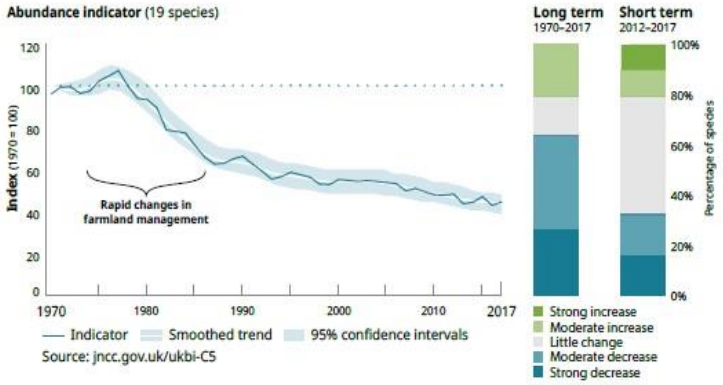


Figure 41: UKBI: National trends in breeding farmland birds in the UK.

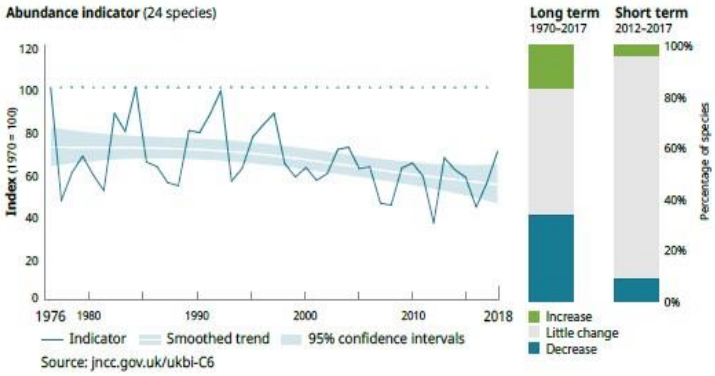


Figure 42: UKBI: National trend: Insects of the wider countryside – butterflies.

Separate indicators based on plants of arable fields and lowland grassland also show fluctuation with the arable index declining overall by 27% and that of lowland grassland having declined then risen to a 5% loss on the 2015 baseline.

There are a range of research publications investigating the causes behind the declines in farmland species. Historically species adapted over time to our methods of farming and land management but major changes to farming practices in recent years, as a result of intensification and a changing climate, have negatively impacted on species breeding cycles and feeding opportunities.

For example; the shift to autumn sowing has resulted in a fall in **Skylark** (*Alauda arvensis*) breeding productivity as cereal crops become too tall and dense in the breeding season, and the loss of overwinter stubbles has meant poorer survival for granivores such as **Yellowhammer** (*Emberiza citrinella*). Increased pesticide use has resulted in less invertebrate food for young **Grey Partridge** (*Perdix perdix*), while the drainage of wet grasslands and the loss of mixed farming systems has led to a decline in **Lapwing** (*Vanellus vanellus*)**.**

Agricultural productivity, linked to the intensification of land management and the decline in farmland species, is still increasing, although with government funding some farmers have adopted wildlife-friendly farming. Still thousands of hectares of farmland,

woodland and wetland are built on every year to meet the needs of our increasingly urbanised population.

Liverpool City Region Outlook

Underpinning the importance of the region's farmland is the presence and distribution of those indicator species used in the national analysis. Of the 19 specialist bird species 13 have been recorded as present here and their presence coincides strongly with areas of farmland (Figure 43). Farmland species are supported within the North Merseyside Biodiversity Action Plan (NMBAP) which includes action plans for specialist species such as Skylark, Lapwing, Brown Hare (*Lepus europaeus*), and Purple Ramping-fumitory (*Fumaria purpurea*) among others. Halton's BAP also includes Skylark while Wirral's includes Brown Hare and Barn Owl (*Tyto alba*).

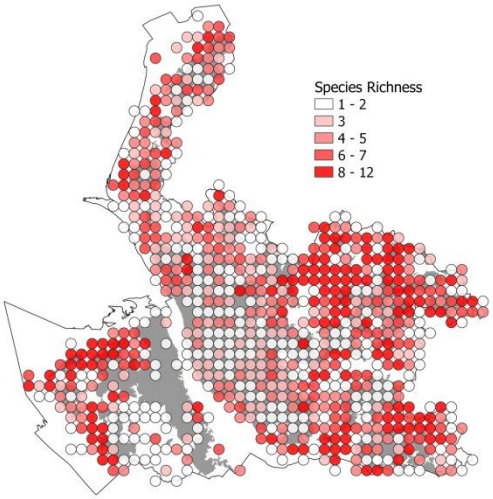


Figure 43: D4.5 Farmland specialist bird species richness. 1km distribution styled on richness/quartile. Presence only.

Comparatively, a modelled occurrence trend (Figure 44) using the presence of arable specialist plant species shows an overall decline of around 16% while lowland grassland plants show a similar trend of decline of 20%.

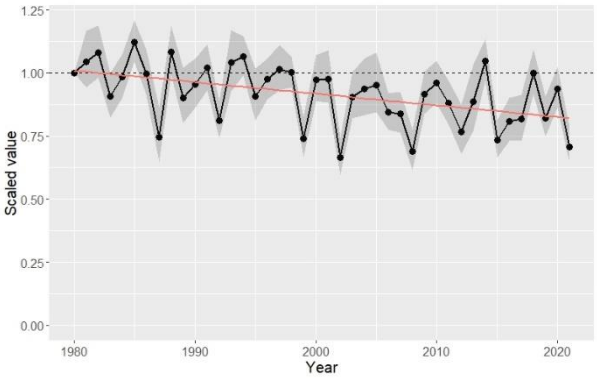


Figure 44: Modelled multi-species occurrence trend based on presence of arable plant species by 1km site. Shaded area indicates confidence on the index.

It is important to recognise that the data limits modelling in this case to the 1980 start point. Information on the distribution of these species prior to this date is not available for analysis. However, it is considered that historical farming methods supported much higher botanical diversity. The 1980 start point here is considered to represent already depleted botanical diversity in the region.

Similar trends also appear in the multi-species indicator modelled trends for Farmland Butterflies (18 species; 25% decline in distribution) and generally agree with the national analysis detailed above.

Information on status of species associated with farmland in the local area can only be inferred from case studies based on the knowledge and publications of local taxonomic specialists and natural history organisations. A selection of farmland case studies are presented below.

Species Study: Brown Hare (*Lepus europaeus*)

Brown Hare is recognised as an indicator for the habitat quality of lowland agricultural landscapes (*Cowan, 2004*). National level data indicates a 75% decline in brown hare since 1960 (*Game & Wildlife Conservation Trust*). While there are no local monitoring data declines in population density and disappearance in some areas as well as ongoing wildlife crime are being reported anecdotally in the Liverpool City Region and would reflect national declines. The 2008 North Merseyside Species Action Plan (*MBG, 2008*) highlighted primary causes of decline in the local area as;

Brown Hares seen on arable field in the LCR

- Habitat fragmentation caused by pressure from new housing developments, particularly in green belt;
- Reduction of compulsory set aside to 0% in 2008;
- Expansion of the equestrian sector reducing habitat diversity and richness;
- Illegal hunting and shooting;
- Simplification of the agricultural landscape.

Nationally the causes are similar and considered to have been due to farming intensification which has reduced foraging and breeding success. The Brown Hare population has also been affected by predation, disease and persecution (*Cowan, 2004).* A survey conducted in North Merseyside in 2008-10 revealed that over 50% of brown hare sightings were on arable land, with 23% on cultivated meadows and 21% seen on pasture or grassland (*Deed, 2010*).

There is a lack of structured monitoring of this species both nationally and in the LCR, resulting in limited data available to reliably analyse population trends.

However, in just two years (2010-12), the North West Brown Hare Project had increased the number of brown hare records by 48% to give a better understanding of Brown Hare population and distribution in the North West (*North West Brown Hare Project, 2013*).

Within North Merseyside Brown Hare as not been re-recorded in 20% of 2km squares in the last 20 years and further 21% in the last 10 despite the activity of the Project. Taken at face value the data suggests a loss of 41% of this species range at 2km resolution in the last few decades.

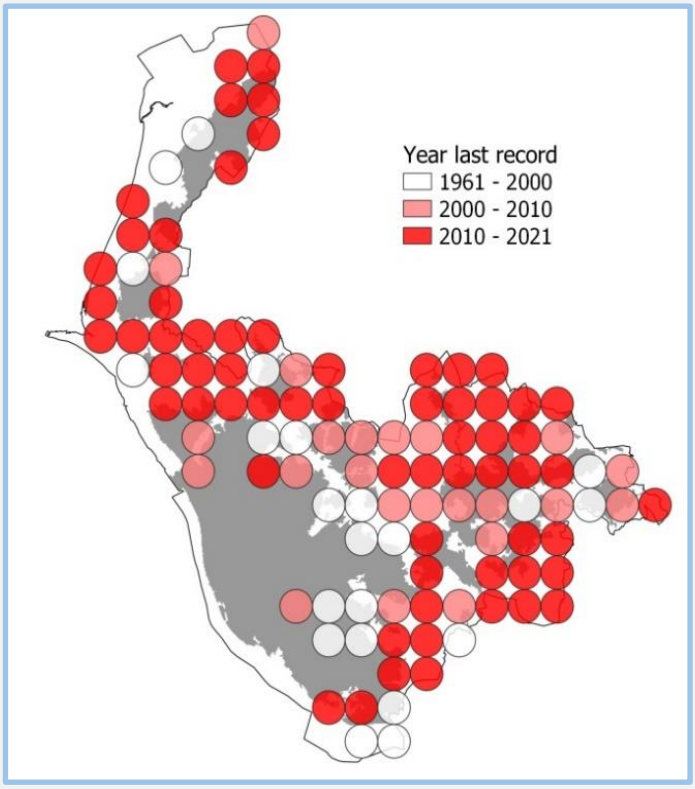


Figure 45: 2km distribution of Brown Hare in North Merseyside demonstrating apparent range contraction.

More broadly the Lancashire & Cheshire Fauna Society has reported the Brown Hare remains distributed widely in North Merseyside and Lancashire being historically present in 75% of 2km squares, apparent losses since 1990 (e.g. figure 45) being attributed to a lack of recording (*Lancashire & Cheshire Fauna Society, 2017*). The same account also remarks on population densities; 4.3-7.7/km^2 'mossland', 2.09-2.33/km^2 'sandy farmland' with coastal landscapes and nature reserves seeing 3.15-5.01/km^2 Bolton (*2013*).

Species Study: Small Copper (*Lycaena phlaeas*)

Small Copper (*Lycaena phlaeas*)

The Small Copper is a charismatic small Butterfly which can occur in a wide range of habitat but are typical of warm and dry grassland and open habitat such as arable field margins, heathland and sparsely vegetated brownfield sites. As such can be considered a useful indicator of arable and open grassland habitat and forms part of the UK Biodiversity multi-species indicator for farmland.

Interestingly this species carries no conservation status despite demonstrating an overall rapid decline in abundance of 37% between 1976 and a change in occurrence of 16% over the same period leading to an overall status of Stable (UK Butterfly Monitoring Scheme/UK Biodiversity Action Plan).

Causes of the national declines are unknown but likely to be due to loss of habitat and fragmentation caused by changes in farming practice, intensification and in particular the use of pesticides, herbicides and pollution in both farming and the natural/urban environment (road verges and brownfield sites). Urban extension and commercial warehouse development is also likely to have resulted in direct habitat loss. Butterflies in general are also particularly sensitive to weather in the short-term year on year and as a result will also be impacted by large scale and long-term climate change effects on weather patterns.

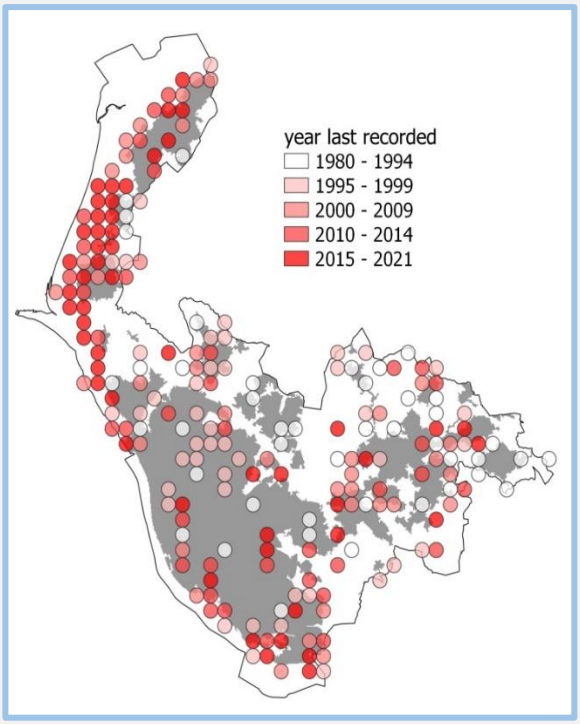


Figure 46: 1km distribution of Small Copper butterfly in North Merseyside styled by year last recorded.

This species occurs throughout the LCR appear in scattered and discrete populations away from the coastline at the monad scale this species appears to be undergoing a range contraction. Potentially loss has occurred from 88 of 215 1km squares (41%; Figure 46) in North Merseyside and 153 of 371 1km squares (41%) at the LCR scale where it has been previously recorded as present. An examination of data and trends by the Lancashire & Cheshire Fauna Society (LCFS) at a Lancashire scale note a broad 2km range contraction of 12% in the county comparing 2015-2018 range to pre-2015 data. The LCFS go further to note that within that range the species appears to have shifted to a large extent having disappeared from 195 2km squares since 2005 (to 2018). In particular, from North Merseyside with the exception of the stronghold, that remains today, on the Sefton Coast.

Species in the Wider Countryside: Woodland

This indicator relates to the 25 Year Environment Plan indicator D4 and UKBI C4b. The indicator seeks to detect changes in distribution of woodland species using three indicator groups, butterflies, birds and plants. The species within these groups have been chosen as indicators due to their ecological sensitivity to changes in woodland habitat condition and due to the availability of long-term granular data.

Woodland provides habitat from canopy to ground level, important food resources for birds and butterflies, as well as nesting opportunities for birds and cover from predators. Plants are a large part of the fundamental fabric of which habitats are made and directly indicate changes to environmental conditions and habitat management providing essential habitat and food for wildlife, and essential ecosystem services for humans, such as reduced erosion, nutrient cycling, oxygen production, flood control, noise reduction and climate regulation (see indicator N5).

National Outlook

National indicators show declines in woodland species over the long term with a deteriorating or no change to short term trends. This is thought to be a result of a combinations of factors likely to include changes in woodland management (reduction in coppicing), loss of connectivity (such as via hedgerows), a lack of thinning of plantation woodland and changes and loss of associated habitat such as farmland.

Woodland Butterflies (National)

National trends using a composite of 23 species have shown that since 1990, the population of woodland butterflies has been decreasing (*Defra, 2020*). However, there has been some recovery since it reached an all-time low in 2012 (see Figure 47). The long-term decline of woodland butterflies is thought to be mainly due to changes in woodland management resulting in habitat degradation, loss and fragmentation. Since 2015 there has been no short-term change in woodland butterflies' species (*Defra, 2020*).

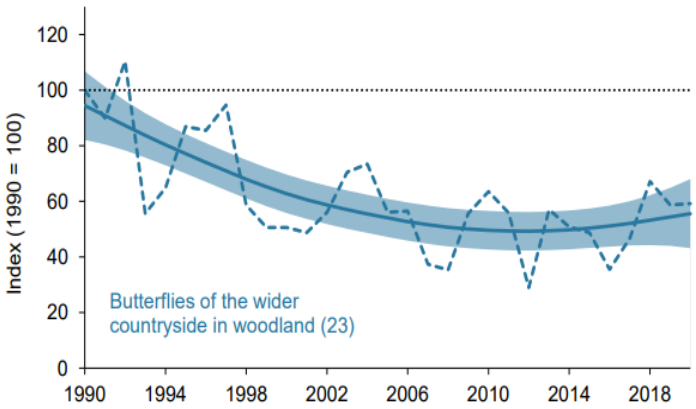


Figure 47: Butterflies of the wider countryside in woodland in England, 1990 to 2020 (*Defra, 2020*).

Liverpool City Region Outlook

The history of woodland in Liverpool City Region is of particular interest. Like much of the country pre-historic woodland was largely cleared with land increasingly used for farming and settlement (see indicator N1). However, by the time John Speed mapped "*The countie pallatine of Lancaster*" in 1610 there existed a number of hunting 'forests' (likely a mix of woodland and pasture) in Liverpool, Knowsley and St.Helens (*Speed, J. 1610; Lancashire County Council, 2021*). These areas, some of which persist today, may represent near un-broken ancient semi-natural woodland coverage and present significant value as an asset for local biodiversity.

Most recently the work of The Mersey Forest has undertaken large scale tree planting and woodland creation across the Region. Reclaiming disused industrial, brownfields and waste sites many of these new woodlands are beginning to reach maturity and as a result may be maintaining woodland species populations and attracting woodland species to re-colonise.

Figure 48 shows the richness of woodland indicator plant species by 1km resolution for the Region. As can be seen based on the data available distinct areas of richness remain in west Wirral, south of Liverpool and Knowsley as well as areas of Halton, St.Helens and Sefton and correspond to woodland habitat.

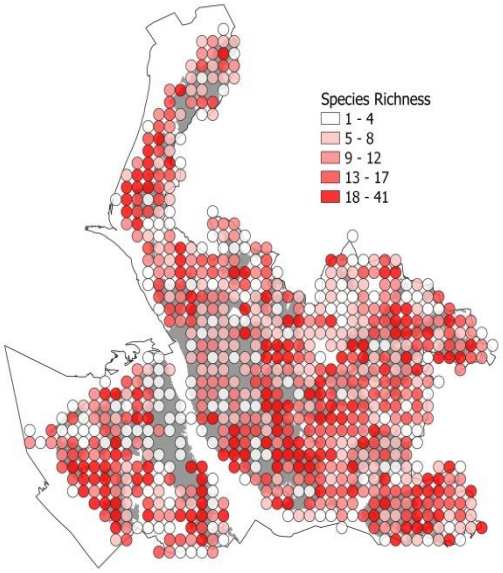


Figure 48: 1km species richness of woodland indicator plant species.

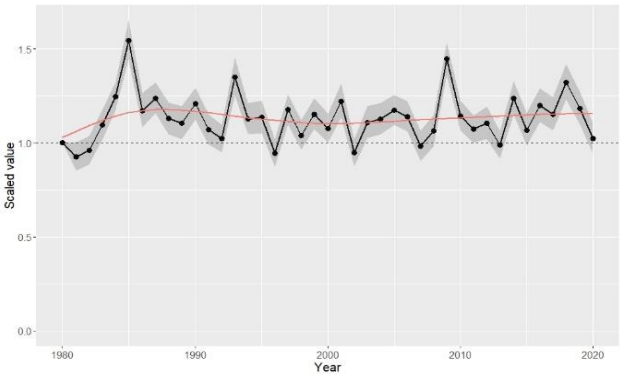


Figure 49: Modelled multi-species occurrence indicator trend using plant species associated with woodland habitat at 1km sites. Grey area indicates confidence on the index.

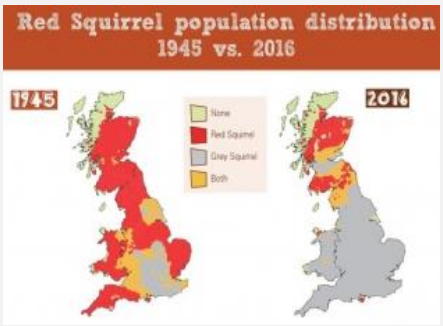
The overall multi-species indicator for plants shows a trend of stability since the 1980's (Figure 49). As with any indicator this is limited to the availability of sufficient data which in this case runs from 1980. Trends of previous decades are obscured.

While the modelled indicator suggests no significant change since 1980 this is clearly not the full picture and nuance exists behind the trend and there remains a complex range of pressures on woodland species diversity beyond tree coverage alone. Lesser Spotted Woodpecker (*Dendrocopos minor*) has not been confirmed as breeding since 2008 and may have become locally extinct and Rhododendron remains significant and unmanaged in many of the regions woodlands degrading their condition (see indicator N2). Meanwhile Willow Tit (*Poecile montana*) appear to be retaining their breeding range in St.Helens and nearby areas while they continue to show a national decline.

Species Study: Red Squirrel (*Sciurus vulgaris*)

Red Squirrel (*Sciurus vulgaris*)

Red Squirrel continue to be one of the most charismatic species in the UK. The species is under threat nationally and considered Endangered in England. Resident here for at least the last 10,000 years the species has declined significantly in the last 150 years from 3.5 million to just 140,000, with around 120,00 of these records occurring in Scotland (*LWT, 2021* and *Lancashire & Cheshire Fauna Society, 2017*).



Source: Lancashire Wildlife Trust

The Sefton Coast and adjoining parts of West Lancashire is recognised as a red squirrel stronghold, one of the last and most southerly in England. Elsewhere within the LCR their range is limited and while occasional sightings do occur, they are generally of short-lived individuals.

The well-established decline in the region has been due largely to the increasing prevalence of grey squirrel though red squirrel are also threatened by tree felling both commercially and in residential gardens and habitat fragmentation can restrict the species ability to expand their range. The presence of the non-native Grey Squirrel (*Sciurus carolinensis*) is the main threat to the red population in the region. Grey Squirrels out-compete Red Squirrel for food and resources and transmit squirrel-pox, a virus which is deadly to Red Squirrels. It is this combination of factors that is considered to have caused the recent loss of the Red Squirrel population in Knowsley.

The Sefton Coast population is at constant threat from squirrel-pox outbreaks which have led to significant declines and threaten the continued persistence of this species in the region.

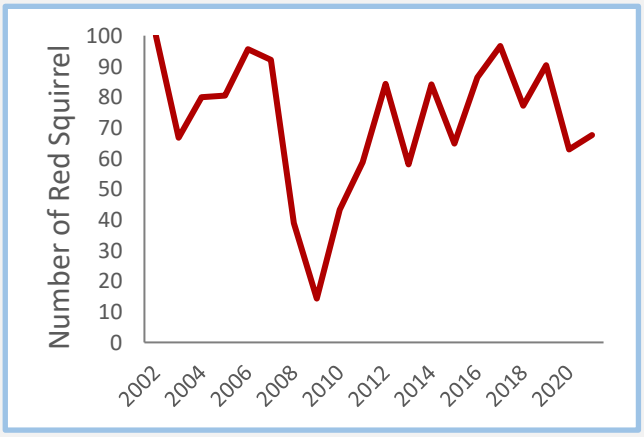


Figure 50: Changes in overwinter survival in the spring Red Squirrel reserve population between 2003 and 2020. Source: Lancashire Wildlife Trust

Structured long-term monitoring undertaken by the Lancashire Wildlife Trust and its partners on the Sefton Coast, has shown red squirrel are highly vulnerable to squirrel pox, the most recent outbreak being detected in 2021.

Historically the population crashed in 2008 due to a large outbreak, demonstrated clearly in Figure 50. Furthermore, an outbreak in 2019 has already seen

a significant decline in red squirrel population in Formby. In 2020, monitoring data revealed that the current red squirrel was at just 75% of the peak recorded in 2002.

Case Study: Woodland Biosecurity (Ash Dieback & Dutch Elm)

Woodland habitat in the UK plays a vital part in supporting biodiversity. Species of plant, animal and fungi have co-evolved together with specific human management techniques over thousands of years (such as Coppicing, c3,000 BC) to form stable and biodiverse communities around native species and certain forms of sustainable management.

As a result negative impacts on native woodland tree species or changes to historic management can have enormously detrimental results on species diversity.

In recent decades tree disease has increasingly become a concern as poor biosecurity has allowed the arrival of new tree pathogens at the same time that many trees and woodland are becoming stressed by changes in climate and land management. Some of these diseases have and continue to be particularly destructive and have progressed largely un-hindered throughout the UK including our region.

Dutch Elm Disease (*Ophiostoma* sp.)

Figure 51:. Scolytus sp. gallery on a dead Elm left in situ at Walton Hall Park.

First detected in the UK as early as 1927 (*Jones, 1981*), this disease is having been spread by beetles (largely *Scolytus* sp.) which can travel up to 10 miles feeding beneath the bark of the Elm (*Ulmus* sp.) tree. The beetle itself is just the vector however and the actual disease is caused by a fungus (*Ophiostoma ulmi*). Initially the disease was not considered a threat and a major text noted "*Recovery from the disease are very common in nature*" (*Peace, 1962*). However, by 1974, 4 million Elms were classed as dead or dying. It was later discovered that a new strain of the fungus (*Ophiostoma novo-ulmi*) had been imported back into the UK from North America in the 1960's. Now present across the UK having reached Scotland in just 10 years. It has led to the death of over 30 million native Elm trees.

This disease is thought to spread by taking hold in weakened or damaged Elm trees where the beetle breeds and from where it disperses to feed on and infect healthy trees. Beyond the direct impact on the tree itself many species feed or rely on Elm for part of their life-cycle for example the White-letter Hairstreak (*Satyrium w-album*)

butterfly breeds only on Elm and has declined significantly as a result of this disease resulting in a priority conservation status.

In the LCR structured monitoring is lacking though Elm remains a part of our local flora in both rural areas and urban parks. However, recent visits to parks in Liverpool have highlighted ongoing issues. Elms are still dying and are not always being cleared (Figure 51). Diseased dead and dying trees become catalysts for the infection of other trees in the immediate and wider area and can result in significant negative impacts on biodiversity, tree retention in parks, risks to public safety and increasing costs to local authorities for their removal. Whilst resource is likely to be the reason for non-removal, the long-term cost of allowing the disease to spread is far greater.

Ash Dieback (Hymenoscyphus fraxineus)

How ash dieback arrived in Britain is not clearly understood though it appears to have originated in eastern Asia and is thought to be the case of significant Ash death in Poland from 1992. The species was only formally recognised and described in 2010 adopting its current name in 2014 (International Botanical Congress).

The fungus was confirmed arriving in the UK with infected Ash trees from the Netherlands in 2012 which prompted a Forestry Research study uncovering *H. fraxineus* in 'the wider environment' in Britain and is thought to have been spreading here since before 2006 (Figure 52). The 2012 discovery resulted in immediate control measures being enacted. Ash dieback is a significant concern as the Ash (*Fraxinus excelsior*) is an important component of our British woodland communities and support a high level of associated woodland biodiversity.

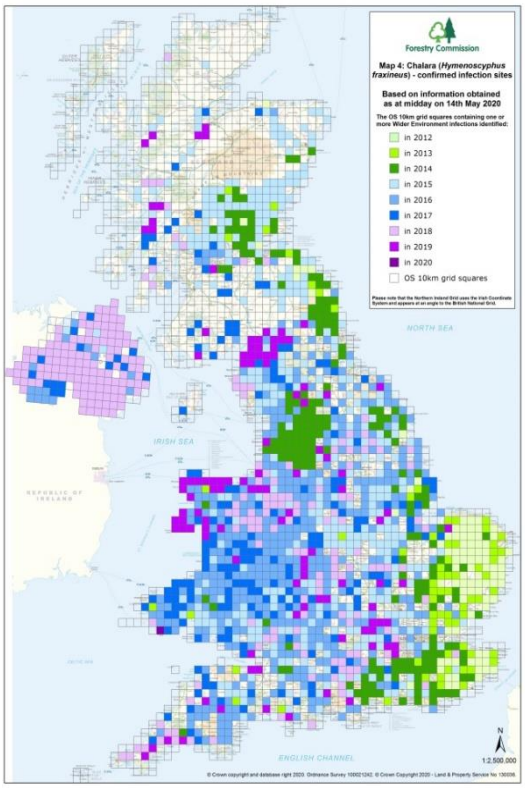


Figure 52: Year of first confirmed infection of Ash Dieback by 10km square (Forestry Commission).

In particular lower plants, lichens and invertebrates. Without mitigation Ash could be lost from woodlands in the UK in the next 20-30 years (*Broome and Mitchell, 2017*).

In the Liverpool City Region, there is no formal monitoring or structured surveillance currently being undertaken. The Mersey Forest reported that *H. fraxineus* was not known to be present in the region (*The Mersey Forest, 2012*). Since then Ash trees have been increasingly noted as dying from this disease in the local area, the earliest confirmed infection reported in Sefton in 2014 and throughout the LCR by 2016.


Photo credit: David Mark

Ash dieback is now known to be killing trees in rural areas and the regions greenspace and parks. Dibbinsdale SSSI on the Wirral has recently been assessed as in unfavourable declining condition due to the extensive presence of *H. fraxineus* throughout this site largely comprising of ancient woodland. *H. fraxineus* is now known to occur throughout our region and the wider North-west.

Strong biological control measures around nurseries and particularly the import of Ash from other areas remain one of the primary control measures as does the rapid removal of infected trees. Local, co-ordinated promotion and support of Citizen Science and monitoring as early warning systems could aid control.

A guidance and support pack for local authorities is available: **https://treecouncil.org.uk/wp-content/uploads/2019/11/Tree-Council-Ash-Dieback-Toolkit-2.0.pdf**

This should be promoted widely through planning, parks and greenspaces teams.

Species in the Wider Countryside: Wetland

This section explores the current information and trends available on our wetland environment. The Liverpool City Region (LCR) benefits from a range of wetland habitat including an extensive network of rivers and canals but also a legacy of historic reservoirs, ponds and marl pits, wet woodland, coastal slacks and remnant peat-bog mossland. More recent post-industrial flashes from the collapse of old mine workings also provide opportunities for species where natural habitats did not previously exist.

This section does not consider the brackish interface of the tidal estuaries, they can be found under the section relating to the marine environment. However, there will inevitably be cross over and these two loosely defined habitat types and the species they support are fundamentally intertwined.

This section very loosely aligns to UK Biodiversity Indicator C5c. However, that indicator reports solely on breeding birds of wetland habitat and of that list we have just one species recorded as present and so sufficient information for the LCR is not available to assess the multi-species indicator 'like-for-like' as in previous sections. Here we, instead, review species associated with wetland habitat and case studies of freshwater species where they exist.

National Outlook

UK Biodiversity Indicator (2021) C5c relates to breeding birds of wetland habitat. This indicator has been assessed nationally as presenting long-term declines of 14% over the period 1975-2018 with short term population stability 2013-2018 (a nominal 1% increase).

> ***"The breeding water and wetland bird measure can be disaggregated to four sub-habitat indicators (birds of fast flowing water, birds of slow and standing water, birds of reedbeds and birds of wet grasslands) although each is composed of relatively few species. Birds of slow flowing and standing water, including mallard and tufted duck, have shown the most positive trend. In 2019 the index for this group was 33% higher than in 1975 although there has been a significant 7% decrease in the short-term period between 2013 and 2018.***
>
> ***The index of birds of wet grassland, including a number of wader species, has decreased by 52% since 1975, and the index for birds of fast flowing water (including dipper) decreased by 29% compared to 1975"***
>
> – UK Biodiversity Indicators 2021

UK Biodiversity Indicator (2021) C7b makes use of national monitoring undertaken as part of the National Plant Monitoring Scheme (NPMS) to detect changes in plants associated with wetland and bog habitat. The indicator is based on 41 species and shows an initial decline of 34% from 2015 followed by a rise to 17% below the 2015 baseline. The national indicator is still considered experimental and no conclusions have been drawn.

Liverpool City Region Outlook

An analysis of the same species used in the national wetland breeding bird indicator (C5c, breeding birds) is not possible due to the lack of breeding bird data of a resolution (1km) required by the method. Similarly, a review of observations of species listed by (C7b, plants) was possible but very limited by the lack of a structured data.

The term wetland is applied here to include a range of freshwater habitats but primarily considering the network of flowing water (rivers and canals) and water-bodies (ponds, reservoirs and areas of inundation). Combined these habitats provide essential flood control to the LCR, support a distinct biodiversity and are subject to particular pressures. The general habitats trends of wetlands are explored in greater detail in chapter (N1). Here we consider what the species of these habitats might tell us.

Waterways


Photo credit: Anya Coffey

As previously stated, species of the grand estuaries of the LCR are considered under the section on the marine species. However, the extensive catchment of rivers and canals that come off the main rivers, are a fundamental component in the support of wetland biodiversity. Aquatic communities are complex and often sensitive to changes in the environment. As a post-industrial and increasingly urbanised region our waterways have been subject to significant changes in the levels of pollution, temperature and course. The Sankey, for example, has a legacy of contamination from industrial workings and more recently from agricultural workings and ‘mis-connections’ to private property and waste-water.

St.Helens Sankey Catchment Action Plan (2018) details species of particular concern with regards to waterway management and while designed to target action on the Sankey catchment will apply to waterways elsewhere. Key species of riverine habitats are detailed as water Vole (*Arvicola amphibious*), Eel (*Anguila anguila*), Bullhead (*Cottus gobio*) and Otter (*Lutra lutra*) while Willow Tit (*Poecile montanus*) is noted as an important species of associated wetland.

Little is known of freshwater species communities in the LCR more generally a broad diversity of migratory and non-migratory freshwater fish are likely to be present and will include native species in addition to wider introductions from stocking by the numerous fishing groups in the region. Migratory species such as Salmon, Trout and Eel are known to breed in the region's waterways confirmed by recording at fish-passes (Mersey Rivers Trust) and research with Mersey Gateway Environment Trust (MGET) (eDNA sampling).

Wetland vertebrates are better studied though data is sparse, and monitoring is largely absent. Six native amphibians are known to be present the most highly protected, aside from the coastal restricted Natterjack Toad (*Epidalea calamita*), beating the Great Crested Newt (*Triturus cristatus*) which occurs in all six districts. Otter is also known to occur in the region though it remains elusive and is thought to be the result recent re-colonisation. The few current sightings are of hunting and foraging activity on the Mersey and inland migrating animals. Populations are not yet known to be established and breeding.

Water Vole (*Arvicola amphibius*)

North Merseyside is a stronghold for Water Vole and it is considered a local priority Local Biodiversity Action Plan (LBAP) species in North Merseyside and Wirral (*Merseyside Biodiversity Group, 2008; Wirral Biodiversity Technical Partnership, 2003*).

This species is the fastest declining native mammal in the UK (*The Vincent Wildlife Trust, 2003*). The North West Lowlands Water Vole Project (*Lancashire Wildlife Trust, June 2011*) found that this species is also under serious threat due to habitat loss, changes in land-use, riparian management, pollution transfer into our waterways and predation from the introduced American Mink (*Neovision vision*).

Results of the Water Vole Project, which covered parts of Lancashire, North Merseyside, Greater Manchester and Cheshire, indicated that water voles may have been lost from up to 56% of previously occupied sites within the Northwest Lowlands over the last 10 years.

Current data on water vole distribution show their range in the Formby moss-lands area of Sefton and in arable and sub-urban areas of south Knowsley are contracting and the species is increasingly restricted to upper tributaries of the River Sankey Catchment in St.Helens which it is strongly suspected to be due to the invasion and spread of American Mink and the absence of ongoing control. Similarly, one of North

Merseyside's highest populations of Water vole on the river Alt and area surrounding Lunt Meadows in Sefton is heavily depleted as a direct result of Mink predation.

The LCR is one of a handful of locations in the UK where sightings of water vole have been reported consistently to the People Trust for Endangered Species (PTES) in support of the National Water Vole Monitoring Programme. This programme data is due to underpin the pilot of an action plan led by Natural England in 2022, ongoing monitoring and reporting is therefore essential to support and drive water vole conservation action.

Species in the Wider Marine Environment

The LCR includes a significant marine component starting with the four main estuaries of the Ribble, Alt, Mersey and Dee which flow out into Liverpool Bay, which itself merges seamlessly with the Irish Sea. The estuaries and inshore Bay area are largely comprised of mobile sediments of sand and fine muds with some areas of mixed gravel. Generally weak tides mean that deposition rates can be high and shape the coastlines of the Wirral and Sefton. Likewise, the marine species that make use of the Bay are by their nature highly mobile or well suited to life in sediment. Major assets with regards to biodiversity in the LCR the estuaries support particularly high concentrations of marine biomass which in turn support significant bird populations, fish and other predators in the marine environment and have resulted in the multiple marine and international designations over these areas (*DECC, 2005*).

National Outlook

The national indicator for the marine environment is based on change of 11 seabird species breeding relative abundance on the English coastline with data delivered by the Seabird Monitoring Programme (SMP).

> ***"In 2019, the breeding seabird index in England was 11% higher than in 1986. The indicator has increased to the current level between 1986 and about 1992 since when it's been stable with fluctuations. In the short term, the index increased by 4% between 2013 and 2018."***

Relevance of this indicator to the LCR is minimal due to the lack of coastal locations for large scale colonies of these species. However, Seaforth Nature Reserve is an exception to the rule and supports one of the largest breeding colonies of Common Tern (*Sterna hirundo*) in the North of England and is significant in Britain. Common Tern have developed a stronghold at Seaforth, where they have become of international importance, due to the addition of floating rafts for breeding. This has helped the population here to remain stable when compared to declines elsewhere in Liverpool Bay (*White et al., 2008*).

Liverpool City Region Outlook

Beyond breeding sea-bird colonies, marine species monitoring is targeted in several areas and specific taxa which will be explored here, species specific examples are expanded on as indicative of or with relevance to the local context;

- WeBS counts of the regions estuary habitats provide excellent trend information on use by wetland birds;
- Since its establishment the Mersey Gateway Environment Trust (MGET) has undertaken and supported monitoring of species and habitats on and in the Mersey often working partners such as The Mersey Rivers Trust (MRT) to scope wider impacts on species ecology;
- Statutory agencies including the Environment Agency, Inshore Fisheries Conservation Authority and Marine Management Organisation undertake and commission species surveillance, and
- Universities in the local and wider area have undertaken research projects either in isolation or in partnership with local stakeholders.

A research project supported by the MGET conducted sampling of the upper and lower Mersey to test the effectiveness of novel eDNA sampling when compared to established electrofishing methods (*Perkins, 2020).* The study based on methods used on a Huddersfield canal (*McDevitt et al., 2019)* and uncovered 30 species of marine and freshwater fish including species such as European Eel, Sea Lamprey (*Petromyzon marinus*) and River Lamprey (*Lampetra fluvitalis*) as well as confirming current use of the Mersey by migratory breeding Atlantic Salmon (*Salmo salar*) and Trout (*Salmo trutta*) both also regularly identified from MGET monitoring data.

This coincides with catch records from the Mersey Pirates angling group which demonstrate an increased presence and size of Rays and other bony fish making use of the Mersey in addition to other larger predators such as Harbour Porpoise (*Phocoena phocoena*), Grey Seal (*Halichoerus grypus*) and Otter.

While comprehensive long-term monitoring is not available to produce trends in most cases the demonstrated increasing prevalence of predator species and migratory fish species against a historic background of high levels of pollution and disturbance (*Wilson et al., 1988*) and recent improvements to water quality of the Mersey catchment support inference of a gradual ecosystem recovery.

Similarly, priority species which have undergone significant declines in the local area and elsewhere have been recently confirmed as present. For example, Smelt (*Osmerus eperlanus*), once fished industrially, and probably to local extinction (*Maitland, 2003*) from the Mersey and Dee, where they occurred in good numbers, have been recorded as occurring once again on the Mersey and Dee Estuaries in recent years with the Ribble obtaining Marine Conservation Zone (MCZ) status for the presence of this species.

The Estuaries

Mersey

The River Mersey has a history of chronic pollution from industrial discharges and raw sewage, resulting in very poor water quality. The development of industry in the Mersey basin included textile production, tanning, metal processing and chemical industries, liquid waste was unprocessed and allowed to flow into the basin and ultimately Mersey as did domestic wastewater, sewage and surface run-off produced by an ever-increasing regional population (*Langston et al., 2006*).

The Mersey fishery which was still productive and viable by the 1930's (*Porter, 1973*) became an ecological 'dead zone' by the 1940's and all commercial fishing in the tidal reaches had ceased (*Environment Agency 2008*), the River Mersey had become the most polluted river in Europe. Jones (2006) provides a detailed examination of the historic decline and subsequent drivers for recovery of the Mersey, ultimately led by the Mersey Basin Campaign alongside changing industrial practices and improved water quality legislation.

Over the past 25 years over one billion pounds has been invested in cleaning up the River Mersey, to improve river health and fish populations, coinciding with decreases in industrial activity along the banks of the river.

As a result, water quality has been vastly improved, most evidenced by the recovering fish populations. Although coarse fish species have seen the fastest recovery, a recent study by the Environment Agency identified a modest and recovering population of Atlantic salmon (*Billington, 2012*), a species that was declared locally extinct up until the mid-1990s. (*Ikediashi et al., 2012*).

While the Mersey is now undoubtably in an improved state and fish populations and species diversity can be shown to be recovering. Issues remain regarding the legacy of metals and chemical pollutants stored in sediment which can continue to be disturbed and distributed by strong tidal action or human activity such as dredging or infrastructure development. Nutrient load from upstream human sources also remains elevated and has been significantly correlated with coastal chlorophyll a concentration. These heightened nutrient levels may be supporting bird abundance (see also WeBS) (*Nedwell et al., 2002; Burton et al., 2002 and Langston et al., 2006*).

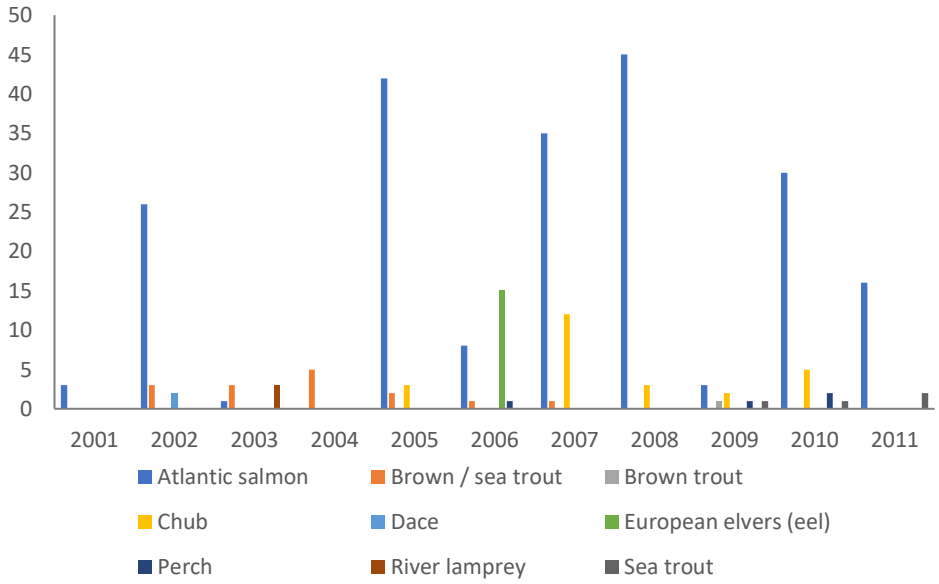


Figure **53:** Fish trap catches at Woolston weir between 2001-2011

Dee

To investigate the extent and cause of in-river and estuarine mortality of salmon smolts in the River Dee, 101 smolts from the upper and lower Dee catchment were tagged and tracked in 2017. Mortality was high 70% for smolts from the upper catchment, and lower, but still significant 13% for smolts from the lower catchment. This equated to an overall mortality rate of 0.45% per km migrated. It is thought that mortality was due to predation. Smolt losses occurred in the middle and the lower river, where predator densities are greatest. The timing and location of smolt losses showed that tagged fish were surviving for, on average, at least 12 days after they were tagged, suggesting that tagging/handling was not the direct cause of mortality. However, it is considered that smolts may be made more vulnerable to predators by being tagged, and therefore it is possible that these levels of mortality may be higher than that occurring in the untagged smolt population.

Although there were no confirmed losses in the harbour, as all tags were detected exiting the harbour, the behaviour of six tagged smolts (11%) was unusual and could be due to the tagged fish being eaten by a predator, and hence it was the movements of the predator that was detected. Total in-river and estuarine mortality is therefore estimated as 48% (*The River Dee, 2018*).

River lamprey, a qualifying feature of the Dee Estuary SAC, were recently recorded on BBC SpringWatch 2021 spawning in large numbers (c.200) on the upper reaches of the Dee, North Wales which is a good indicator of river health (*Jack Perks Wildlife Media, 2021*).

Ribble

Fish pass counter data for the Ribble shows an annual run of Salmon between 2,500 and 3,500 fish per year (approx.) between 2013-2020. (*Environment Agency, 2020*). Despite numbers remaining relatively stable over this period, it is understood the Ribble Salmon and Sea Trout net fishery has recently closed due to long term declines of returning salmon (*Environment Agency, 2020*).

Smelt, a feature of the Ribble Estuary Marine Conservation Zone, also migrate from Morecambe Estuary into the lower Ribble to spawn though we have no survey data to show this currently.

Marine mammals

Coupled with improvements in water quality and recovery of fish and invertebrate stocks, marine mammal sightings in the LCR are increasingly frequent and notable around the peninsula of Wirral and Mersey Estuary. Regular monitoring of a non-breeding Grey Seal population at Hilbre Island frequently records numbers in excess of three hundred individuals through peak season (going much higher in some years) hauled out on West Hoyle sandbank in the Dee Estuary. Grey Seal use the Liverpool Bay area to feed, haul out and moult. Small numbers of Grey Seal venture into the River Mersey (*Cheshire Wildlife Trust, date unknown*).

The Sea Watch Foundation, a national marine environmental charity working to improve the conservation of cetaceans in the seas around Britain and Ireland, which co-ordinates public scientific monitoring published sightings for the LCR (*Sea Watch Foundation, 2021)* over a 2 year period (July 2019 to September 2021) recorded multiple observations of Harbour Porpoise with a peak count of 11 recorded at Otterspool in the Mersey in May 2020. Dolphin species have recorded less frequently including Bottlenose Dolphin (*Tursiops truncatus*) with a peak count of 7 recorded at Southport in August 2020. A single record of fin whale was recorded in the Dee Estuary in June 2020.

Most cetacean sightings are off the North Wirral Coast and in the Mersey Estuary. Presence in our estuaries is likely due to cetaceans following fish up river and potentially taking advantage of bass nursery grounds in the shallower waters. The Dee Estuary is a designated nursery ground.

WeBS

Wildfowl and waders. The BTO's annual Wetland Bird Survey (WeBS) provides a comprehensive structured monitoring data from 1966 of water bird use of the LCR's estuaries. Long term declines of wintering wetland birds are the prevailing trend in all three estuaries with the greatest losses being seen on the Ribble and Alt (38%) compared to declines of 28% on the Mersey and 21% on the Ribble and Alt. Below we examine the status of the SPA qualifying passage, breeding and non-breeding birds associated within our 4 estuaries: Mersey, Dee, Alt and Ribble.

The most significant winter loss from the regions estuaries in terms of species is Pintail (*Anas acuta*) which has declined by 91% on the Mersey, 63% on the Ribble and Alt and 31% on the Dee. The Mersey and Ribble and Alt exceed declines seen in England of 38% between the period 1993/1994 to 2018-2019 (and a 9% increase in Wales) with the Dee being most comparable. Teal (*Anas crecca*) has also shown significant declines (76% at Mersey and 27% at Ribble and Alt sites) despite an overall upward trend of 18% in England (and upward trends in Scotland, Northern Ireland and Wales).

The largest gains have been seen in Black-tailed Godwit (*Limosa limosa*) where the increase in England (169%) is matched by 100% increases on the Mersey, 169% on the Ribble and Alt and 31% on the Dee.

Declines are likely to be due to a range of factors. Recreational pressures causing disturbance are driving site-based loss where public access exists (*Cook et al., 2013; Ross-Smith, et al., 2013*) and this has been previously highlighted as a concern in particular on the Ribble and Alt count sectors (*Armitage et al., 2004*). This is likely to be a significant driver on the Ribble and Alt and Wirral foreshore. However, other factors are likely to be impacting birds on the Mersey where the areas of highest use by waders (Manisty and Ince Bank) are not accessible to the public. Improvements to the treatment of wastewater linked to a reduction in Biochemical Oxygen Demand (BOD) has been correlated to a decline in 10 of 17 waterbird species (*Burton et al., 2002*).

Broadly, climate change is also considered to be an influencing factor where warmer winters are causing birds to remain on the continent rather than migrating to British estuaries. Other factors raised include the observed decline in forage (e.g. the reduction in Sea Spurrey (*Spergularia marina*) at Ince Bank) and changes in tidal current and accumulation of sediment resulting in altered mud flat extent and availability of suitable habitat.

With specific regard to the Mersey Estuary, the WeBS team have provided data which provides a more comprehensive outlook over time. While they do caveat that the data should be interpreted with caution; bird populations fluctuate year on year and some counts may appear lower than reality due to undercounting in some years. The overall trend across all waterbirds since 1971 is that of a slight increase with changes seen in the types of species seen to occur.

In general duck species have declined significantly (e.g. Wigeon (*Mareca penelope*)) although Shelduck (*Tadorna tadorna*) have bucked the trend and are doing well with the 7th highest count recorded this year at over 14,000 making the Mersey Estuary is the number 1 site in the UK for moulting Shelduck through July and August.

Waders have in general increased with Redshank (*Tringa totanus*) showing a steady rise in numbers and new roosting sites recently located at Eastham Locks. The estuary now supports the 3rd best location for Ringed Plover (*Charadrius hiaticula*) in the UK. Dunlin (*Calidris alpina*) also remains a significant species for the Mersey estuary where it is bucking the national trend of decline with sustained increase since 1970 (Figure 54).

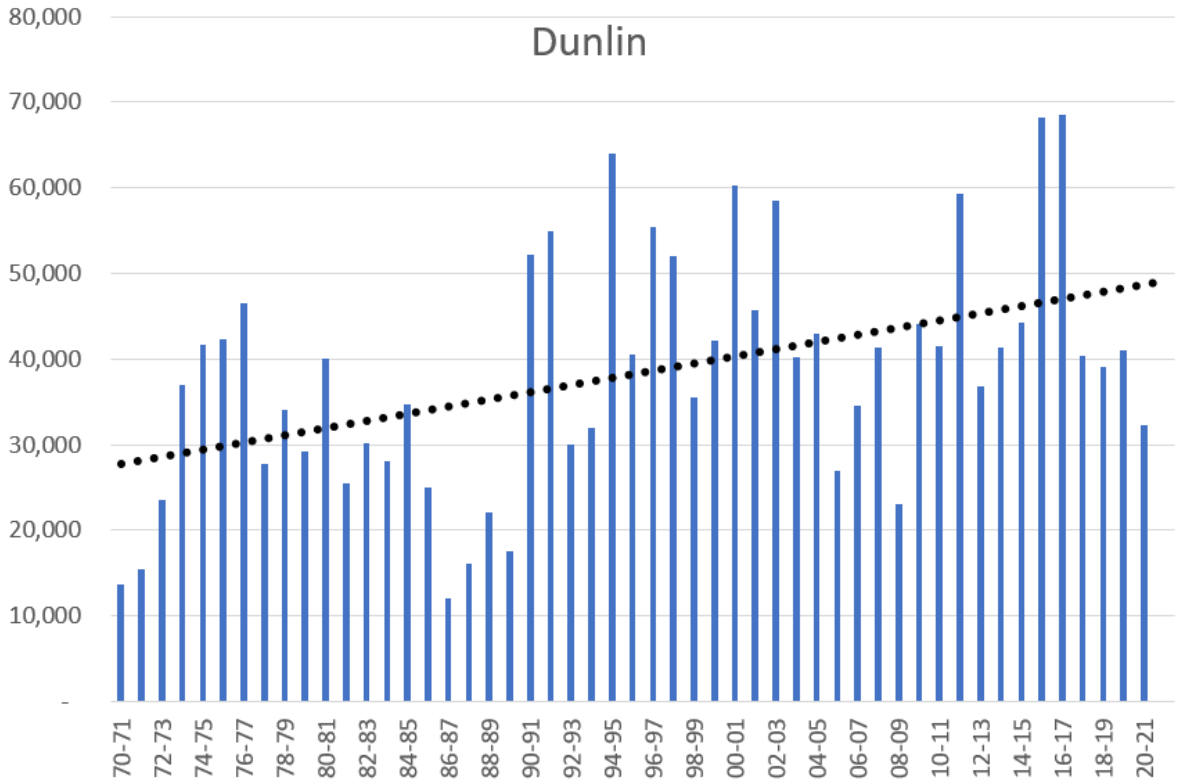


Figure 54: Counts of Dunlin on the Mersey Estuary demonstrating a long term of increase.

The Mersey is also increasingly being used by new species; notably Pink-footed Goose (*Anser brachyrhynchus*), Cormorant (*Phalacrocorax carbo*), Little Egret (*Egretta garzetta*) and Avocet (*Recurvirostra avosetta*).

The LCR continues to support internationally significant important roosts of a range of wader species, including those shown to be in decline for which these areas have been designated. Review by the British Trust for Ornithology (BTO) has identified knowledge gaps to better understand the movement of populations within and outside of the LCR which should be considered of strategic importance when designing

surveillance and understanding impacts on these populations in the future (*Still, Calbrade and Holt, 2014).*

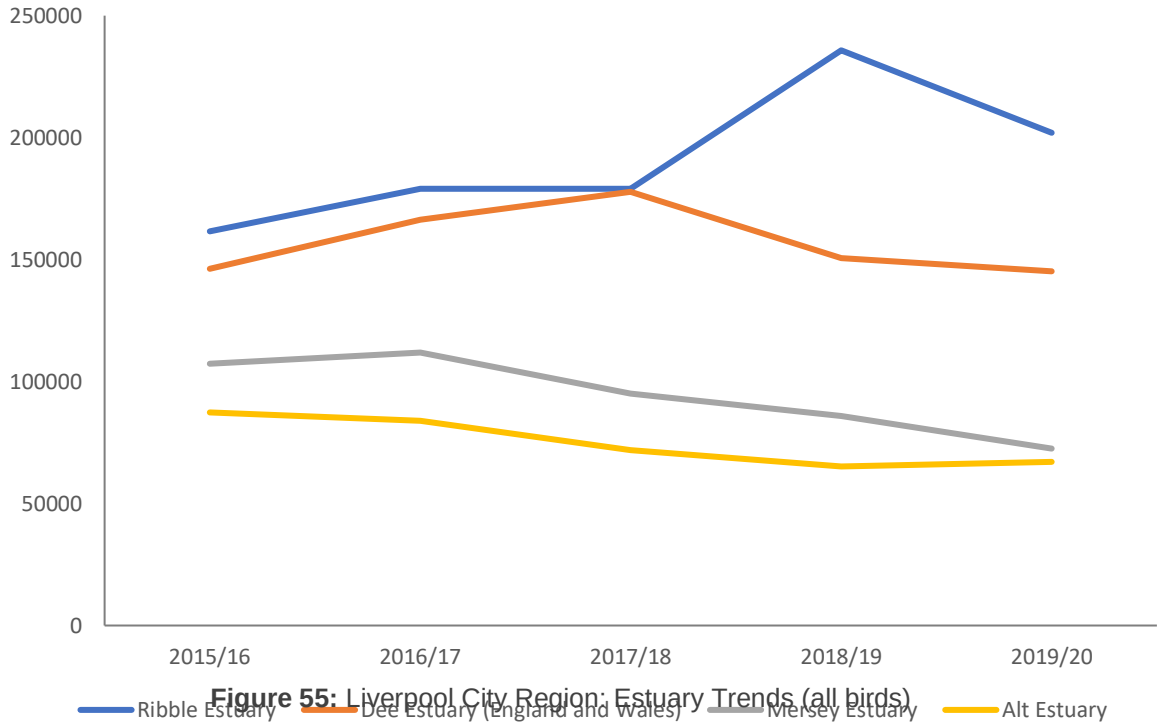


Figure 55: Liverpool City Region: Estuary Trends (all birds)

Mersey Estuary SPA (BTO Alerts)

Since the 1995/1996 winter baseline:

- loss of Pintail (91%) and Teal (76%)
- Notable loss of Shelduck (42%), Golden Plover (*Pulvis apricaria*) (49%), Redshank (40%)
- increase in Black-tailed Godwit (100%)
- Overall decline across the wintering assemblage (28%).

Ribble and Alt Estuaries SPA (BTO Alerts)

Since the 1995/1996 winter baseline:

- Serious declines in Bewick's Swan (*Cygnus columbianus bewickii*) (99%), Pintail (63%), Grey Plover (*Pulvialis squatarola*) (78%), Bar-tailed Godwit (*Limosa lapponica*) (68%), Dunlin (50%).
- Notable declines in Wigeon (35%), Teal (27%), Golden Plover (39%), Knot (*Calidris canutus*) (47%)
- Increases in Ringed Plover (66%), Black-tailed Godwit (169%), Ruff (*Philomachus pugnax*) (47%)
- Overall assemblage decline (38%).

Dee Estuary SPA (BTO Alerts)

Since the 1995/1996 winter baseline:

- Serious declines in Bar-tailed Godwit (60%)

- Notable declines in Shelduck (26%), Pintail (31%), Grey Plover (40%), Curlew (*Numenius arquata*) (46%), Knot (29%), Dunlin (45%)
- Increases in Black-tailed Godwit (31%)
- Overall assemblage decline (21%).

N4: Conservation status of our native species

Unlike N3 relating to widespread species trends this chapter focuses on the conservation of species with trends and review of these species which are known to be conservation priorities due to declines evidenced at a national or international scale. These species carry direct relevance to responsible authorities as they are recognised by conservation policy and legislation.

Headlines

- LCR supports a significant proportion of priority species.
- Coastlines are of high priority for the conservation of this group.
- Outside of coastal designated sites Priority Species occur in pockets of high diversity but do not receive the same level of protection, resource or interest.
- By far the most numerous of Priority Species in our area are moths which number 68 (28%) this is followed by birds 40 (16.5%) and flowering plants 39 (16%) which together amount to 60% of the total.
- Overall, there has been a 40 year decline in broad comparison to a national even trend.
- Based on data available for Section 41 species in the Liverpool City Region 36 have not been seen since 1970 and could be considered locally extinct. A further 34 have not been seen since 1970-1989, and 18 are un-recorded since the period 1990-1999.
- Data is restricted and limited to a few robust monitoring programmes.
- Resourcing of monitoring and investment is directed at the coastal designated sites but not elsewhere.

Status of Priority Species: Distribution

This indicator aligns with the UK Biodiversity Indicator C4b which tracks a national occupancy index to report on the detected changes in distribution of priority species where the data allows. The priority species included in the national indicator include those detailed as country species of principle importance for conservation of biodiversity under the Natural Environment and Rural Communities Act (NERC) (2006). For the purposes of our work the list only includes those under Section 41, England.

Section 41 of the Act list many of our rarest, most threatened and rapidly declining species and for which were considered priorities for conservation action as part of the Government's *Biodiversity 2020* strategy.

"By 2020, we will see an overall improvement in the status of our wildlife and will have prevented further human-induced extinctions of known threatened species." *- Priority Actions Needed (B2020-008)*

Post 2020 this indicator continues to represent priority species and is being used to measure the effectiveness of conservation across the country including through action by local authorities and other responsible authorities under their NERC *Duty to conserve biodiversity*.

National Outlook

The latest update to the national indicator was published in October 2021 and combines 2,890 priority species across England, Wales, Scotland and Northern Ireland. Overall, the national picture is of a very slight long-term decline of 4% though this is based on just 476 of 2,890 species where the data was robust enough to be considered statistically viable (Figure 56).

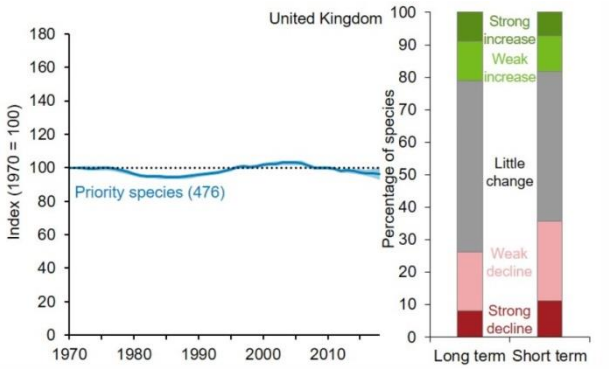


Figure 56: National indicator C4b Change in distribution of UK priority species, 1970 to 2018.

As a result, the overall assessment must be used with caution. By their nature the species included in the list are declining, rare or threatened and so robust datasets are difficult to compile, and omitted species may be considered likely to be in decline. Additionally, this indicator does not reflect population density or abundance, the range of a species may remain steady but the number of plants or animals within that range may be decreasing.

Indeed, the national picture for major taxon groups within this composite indicator, when separated out, shows that only Bryophytes and Lichens demonstrate an increase in distribution. However, they make up 120 of the 422 species analysed and in effect 'pull up' the indicator resulting in an overall result of no long-term change. Bees, wasps and ants and moths make up a further 210 species and each show declines while the remainder 92 'other taxa' also show decline.

Nationally a separate indicator C4a exists to represent those trends, over the same period it shows 21% of species presenting a strong or weak increase in abundance while 60% showed

strong or weak declines. A lack of abundance data means we cannot attempt to replicate that analysis scale of the Liverpool City Region.

Liverpool City Region Outlook

Of the species listed as priority species in England 243 have been recorded as present across the 6 local authority areas of our region (at an accuracy of 1km or greater in the last 40 years). These represent 24 different taxonomic groups and underline the importance of the wide range of habitats present here. By far the most numerous of priority species in our area are moths which number 68 (28%) this is followed by birds 40 (16.5%) and flowering plants 39 (16%) which together amount to 60% of the overall number of species (Figure 57).

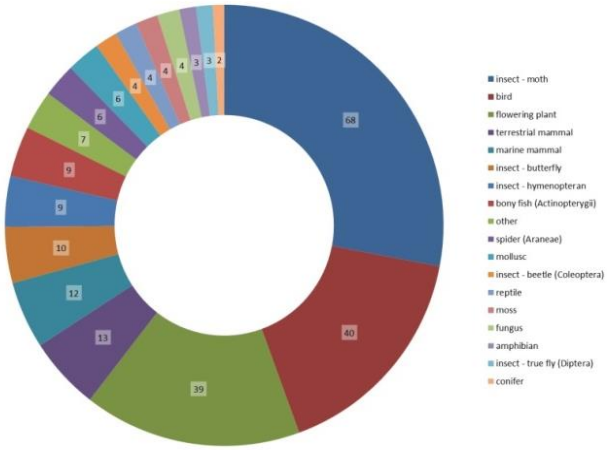


Figure 57: Priority species summarised by taxon group.

It is useful to consider the number of species to the amount of data available to analyse these species. This gives us an idea as to where data collection effort is being directed which in turn will influence the detection of these species regardless of their conservation status or significance as a component of the priority species list. Immediately we can see that while bird species amount to just 16% of listed species they represent almost half (47%) of the data available on priority species. Conversely, flowering plants which make up 16% (39) of the priority species found in our area amount to just 5.7% of the data available (Figure 58).

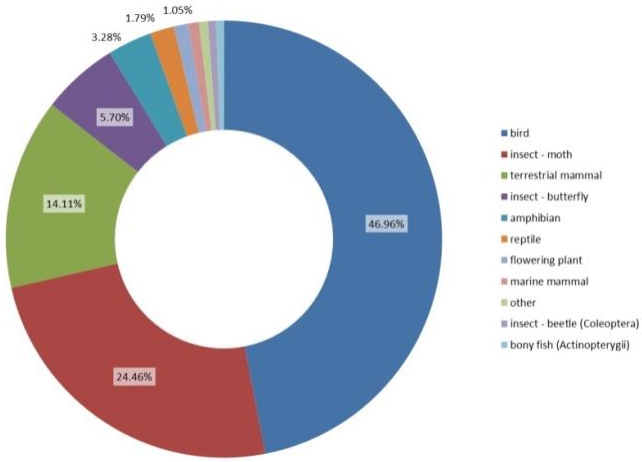


Figure 58: Number of unique observations by taxon group for priority species.

The amount of data available and effort it represents is important as the data informs our understanding of the distribution and status of these species in the local area. This is particularly important when considering priority species which may be difficult to detect or have a sensitive status. Poor data coverage may make it difficult to ascertain the true range of species status. As a result, there will be a clear bias towards the analysis of better recorded taxonomic groups while those that are less charismatic or difficult to detect will be less well represented or absent from trends.

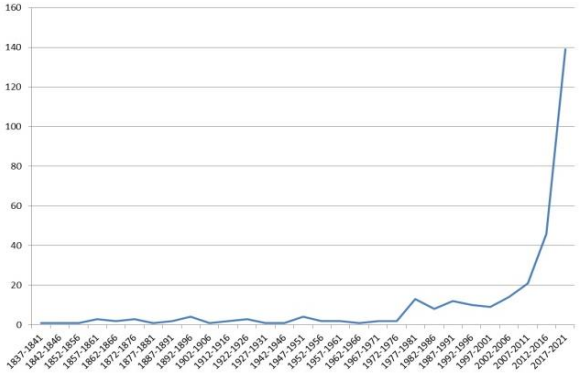


Figure 59: Year section 41 species last recorded in the Liverpool City Region. Observations over 50 years old may suggest local extinction.

Based on data available for Section 41 species in the Liverpool City Region 36 have not been seen since 1970 and could be considered locally extinct. A further 34 have not been seen since 1970-1989, and 18 are un-recorded since the period 1990-1999 (Figure 59). Conversely,

detection of new species arrival in the area appears generally consistent over time aside initially a small number of peaks in detection rate to an apparent gradual increase in recruitment in more recent years. The reasons for this are unclear but may be an artefact of increased recording effort (better detection rates) or a genuine result of species range shifts at national scale in response to climate change and other factors (Figure 60).

The distribution of priority species richness in the LCR unsurprisingly favours fewer urban areas with a particular richness of species occurring on the specialist habitats of the Sefton and Wirral coastlines (Figure 61). These habitats are not in isolation however and the distribution shows that relatively high numbers of priority species also occur throughout more rural and less disturbed areas of St.Helens and Halton.

Overall, the experimental modelled trend for this multi-species indicator suggests a long-term decline in occurrence within the region by 25% though a short-term recovery is suggested perhaps in part to the arrival of new priority species in recent decades (Figure 62).

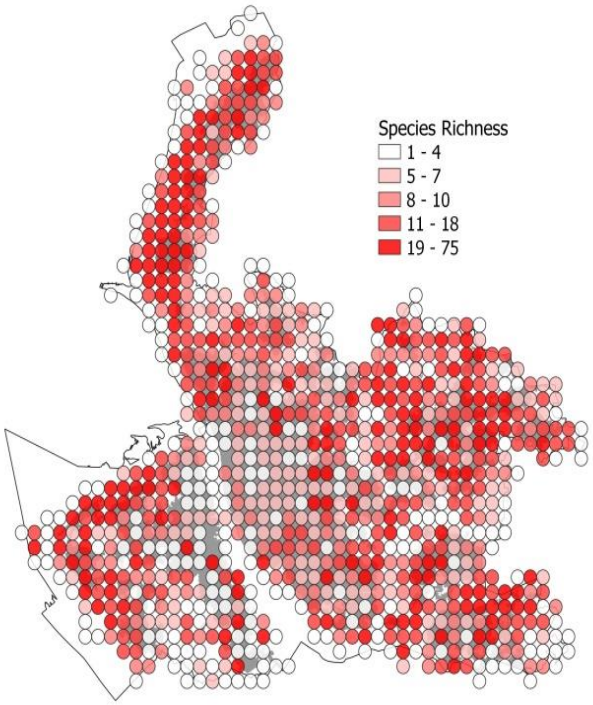


Figure 61: 1km distribution of species richness for section 41 conservation priority species recorded within the LCR.

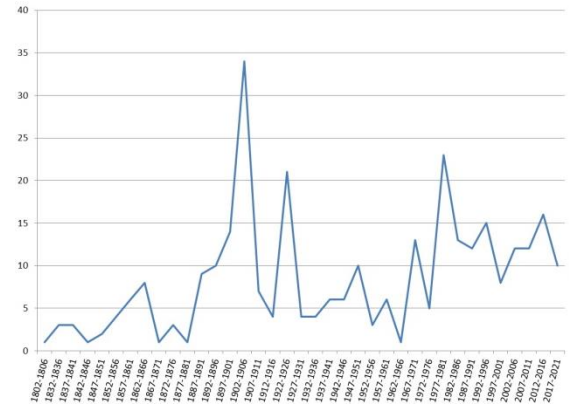


Figure 60: Year section 41 species first observed in the LCR.

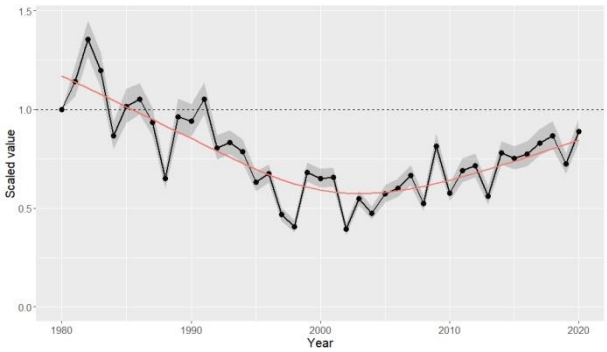


Figure 62: Modelled multi-species occurrence indicator trend of section 41 species at 1km resolution or better clipped to 1980 where data available.

Species study: Skylark (*Alauda arvensis*)

The Skylark is a Priority Species which occurs widely across the country in open grassland habitats but is most often associated with farmland habitat where the hovering song flight of the male are a joyful sign that summer is just around the corner. Much of the Skylark life-cycle is restricted to open habitat which is required for successful breeding through spring and early summer and the likes of arable stubble fields which provide the necessary food supply.

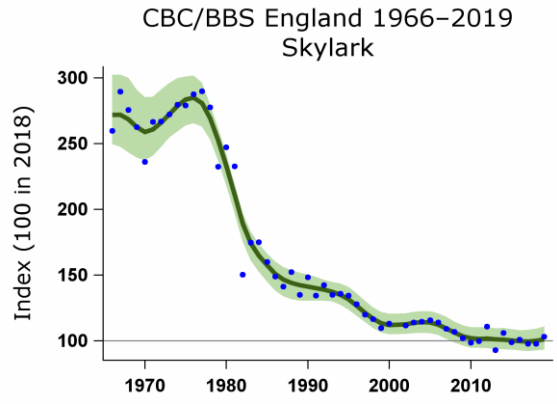


Figure 63: Smoothed population index, relative to an arbitrary 100 in the year given, with 85% confidence limits in green Source: BTO/JNCC; Woodward *et al.,* 2020.

National Outlook

Nationally this species has become a powerful totem of the loss and change in management of our farmland habitat. The Common Bird Census and Breeding Bird Survey (BTO) clearly shows a precipitous decline in this species from 1970 (Figure 63) which is reflected as a 24% decline in England between 1995-2018 (*Woodward et al., 2020*).

Liverpool City Region Outlook

There is currently no region wide monitoring undertaken specifically within the LCR. However, the LCFS reported on Breeding Birds in Lancashire and North Merseyside in 2008 noting that while Skylark continued to be widespread at broad scale (by 10km square) abundance within that range is thought to have declined significantly and finer scale range is likely to have reduced within those 10km grids.

In addition to the work of the LCFS specific population study is available at Hightown and Blundellsands (*Wolfenden, 2021*).

Case Study: Hall Road, Crosby – Hightown population

Monitoring of breeding birds in this area has evidenced enormous declines in the breeding bird population in excess of 90%. The population possibly exceeded 100 pairs (minimum 80 pairs) during the 1970's – early 1980's but declined to 3-5 pairs by 2020-21. During this time a colour ringing study allowed accurate recording of the decline in numbers of pairs.

Table A: Hall Road, Crosby colour ringing study data.

Year	Pairs	Year	Pairs
1999	54	2009	6-8
2000	47	2010	5-6
2001	36	2011	c6
2002	c16	2012	c6
2003	c10	2013	6-8
2004	12+	2014	4-5
2005	c10	2015	6-8
2006	c15	2016	c6
2007	6	2017	4-5
2008	6-7	2018	Not known

"The slow decline accelerated between 2001 – 2002 when the population more than halved to about 16 pairs. It then remained at about 10-16 pairs until 2007 when it again halved, remaining at about 4-8 pairs until 2017, when the last count was made. The population in 2020-21 was thought to be 3- 5 pairs at the most." - *Wolfenden, 2021*

This study concludes that the near total loss of this breeding population in the last few decades has been due to a combination of factors and pressures;

- Loss of habitat due to housing development.
- Loss of suitable habitat due to natural habitat succession with increased density and height of grasses and the spread of scrub.
- Increased disturbance through recreational pressure by members of the public, particularly from dog walkers.
- Increased predation of nests and young from a higher population of corvids, particularly Magpies.
- Changes in farming practices reducing winter food availability. Some, possibly most, birds spent some of the winter on nearby farmland.

There is now very little suitable breeding habitat for Skylarks in this study area due to natural succession. Supporting recovery of this population and it's breeding success would involve the removal of scrub, grassland management and significant control and reduction of recreational pressures, particularly dog activity. Wider strategic implementation of the NMBAP for this species would also improve winter forage.

Skylark (*Alauda arvensis*)

Waterloo – Blundellsands population study: A colour ringing study from 2017 onwards

As the Skylark breeding population at Hall Road, Crosby declined to its current levels a population was found to have established on newly formed dune habitat and amenity grassland a short distance to the south. Ringing activity followed the population.

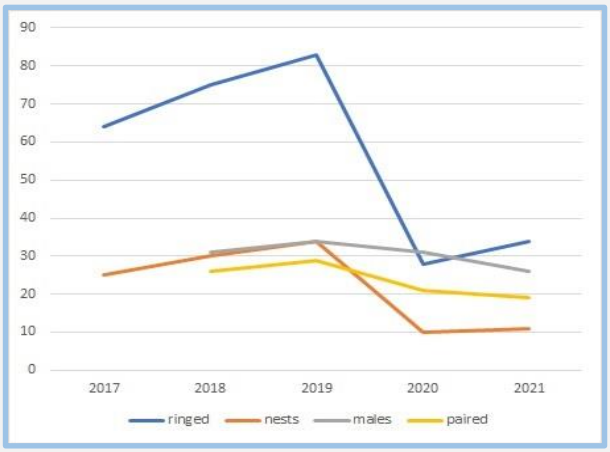


Figure 64: Ringing and monitoring data from Waterloo-Blundellsands study population (*Wolfenden, 2021*)

Comparably higher numbers were detected numbering between 20-25 pairs in 2017-18. Both the population and numbers of pairs are seen to peak in 2019 with 83 pulli (nestlings) ringed, 29 paired and 34 nests. Since 2019 this population has also seen significant decline with just 10 nests located in 2020 and 11 in 2021 (see Figure 64). There has also been far fewer nesting attempts and young reared since a peak in 2019.

While not all nests are located, a similar effort in finding them has been made in all years so it is likely that the trends are a true finding.

This study concludes that the population has undergone a decline in recent years as evidenced by the data. The causes specific to this population are a result of a number of factors;

- Habitat succession in some areas with taller thicker vegetation and scrub development (including Sea Buckthorn (*Hippophae rhamnoides*) and Japanese Rose (*Rosa rugosa*)).
- The loss of areas of suitable habitat through degradation due to wind-blown sand.
- Greatly increased public disturbance since covid lockdowns, including more disturbance from dog exercising. Overall increase in recreational pressure.
- Increased predation from corvids, particularly Carrion Crows (*Corvus corone*). A non-breeding flock of up to 65 birds is now present during the breeding season and observed to gather and feed in an area favoured by breeding larks, consequently there has been little breeding success in that area in the last two years.
- Poor insect supply during the breeding season due to weather and habitat changes.

It is likely that this population will continue to decline unless remedial actions are taken.

Case Study: Reptiles in the LCR

Common Lizard (*Zootoca vivipara*) is a Priority species which is almost entirely restricted to the Sefton Coast in North Merseyside, Wirral and limited recent records on the Speke Garston Coastal Reserve. A scattering of old records in the Kirkby/Knowsley and St. Helens area are found where it is likely local extinctions have taken place.

Common Lizard (*Zootoca vivipara*)

Observations from North Merseyside Amphibian and Reptile Group (NMARG) note the Common Lizard appears to be declining on the Sefton Coast. It is likely habitat management, invasive species and fragmentation will be playing a part. On the Wirral Common Lizard are thought to remain present but the status of the species is largely unknown due to a lack of monitoring and recent data.

Traditionally found in gardens, Slow-worm (*Anguis fragilis*) have suffered greatly as domestic gardens are increasingly paved over, close mown and tidier. Semi-natural habitats for these reptiles including grasslands are also in dramatic decline. In England and Wales, an estimated 97% of unimproved grassland was lost between 1932 and 1984 (*Fuller, 1987*). This is also the case in North Merseyside.

The range and presence of Slow-worm and Grass Snake (*Natrix natrix*) have significantly declined in North Merseyside over the last 100+ years. Recent records of slow-worm are confined to sites in the north and south of Sefton only and grass snake has not been recorded in North Merseyside in the last 20 years. NMARG have observed declines at these isolated sites and local extinctions of these species have almost certainly occurred.

Slow-worm (*Anguis fragilis*)

The rare Sand Lizard (*Lacerta agilis*) is a Priority species restricted to the Sefton Coast in the LCR. As Britain's only native egg-laying lizard, the Sand Lizard is found exclusively in open sandy habitats. Their ideal habitat comprises a varied topography with multiple aspects for basking and small areas of bare ground surrounded by a mixed vegetation structure to provide invertebrate prey and cover to retreat to. Open sandy areas on southerly-facing slopes are essential for egg-laying.

The UK's coastal dunes and sandy heaths are in serious decline and according to ARC Trust, research shows around 81% of bare sand has been lost since 1945 on the Sefton Coast alone. As a result, the Sand Lizards on the Sefton Coast have also undergone substantial declines. They are found in scattered colonies primarily along the frontal dunes between Altcar and Southport but also in a series of isolated, more inland dune sites which have been effectively cut-off from the active coastline by urban development.

Sand Lizard (*Lacerta agilis*)

Besides the loss of suitable sandy habitat, reasons for their decline also include urban expansion, spread of invasive species such as Sea Buckthorn and Japanese Rose, increased levels of nitrogen deposition, recreational disturbance, reduction in Rabbit (*Oryctolagus cuniculus*) populations and a lack of habitat management in general.

Although the frontal dune populations are at risk from habitat degradation and increased recreational disturbance, our inland populations are even more vulnerable to change and without effective management, are becoming increasingly isolated and would greatly benefit from improved habitat connectivity.

Status of Threatened Species: European Importance

National Outlook

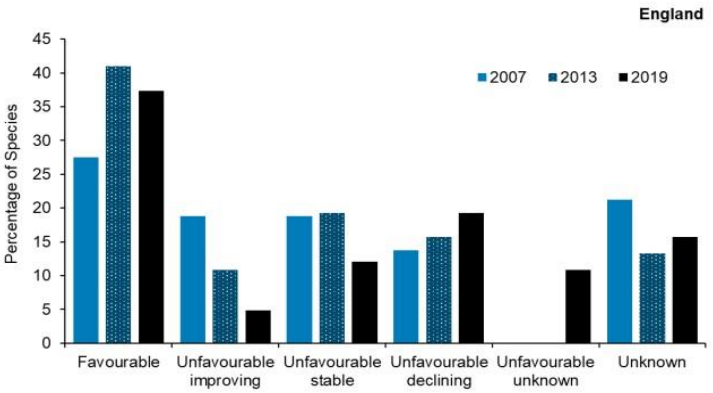


Figure 65: UK Biodiversity Indicator (2019) Conservation status of species of European importance occurring in England 2007, 2013 and 2019.

The status of 'European species' (*JNCC, 2019*) has previously been monitored and reported on as part of a requirement for EU member states. Since the transition this indicator has not been reported on or updated as a part of the UK Biodiversity Indicators the last update having been in 2019. While the requirement no longer exists the selection of species of European importance reflects species of significance at an international scale and facing international conservation concern. The same species, sites and habitats have also been adopted into UK legislation and so continue to carry significance under UK law as part of the Conservation of Habitats and Species Regulations (Amendment) (EU Exit) 2019 (*Gov.UK, 2021*).

In 2019 this was reported as (Figure 65);

- In 2019, 37% of species occurring in England that are listed in Annexes II, IV or V of the Habitats Directive were in **favourable** conservation status.
- 19% of the species was **unfavourable-improving** in 2007, it decreased to 11% in 2013 and 5% in 2019.
- 14% of the species were considered **unfavourable-declining** in 2007, this increased to 16% in 2013 and 19% in 2019.
- A further 14% were determined as **unfavourable-stable** in the same year.
- 11% of species were categorised as **unfavourable-unknown** in 2019

Overall this indicator was assessed as deteriorating in England in the short term (2013 – 2019 and deteriorating in the long term (2007 – 2019).

Liverpool City Region Outlook

Locally we are fortunate, largely through extensive high quality coastal and estuarine habitat, to support a range of these highly protected species. Unsurprisingly, the greatest concentration of species of European significance is along the well-recognised Sefton Coast. However, it is also worth recognising that pockets of diversity of designated species do occur throughout our region (Figure 66).

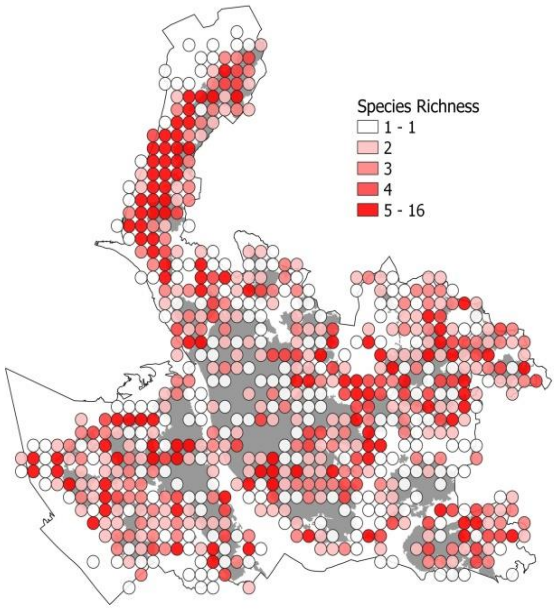


Figure 66: 1km distribution of richness for species of European Importance (annex II, IV & V).

The most well recorded of this species designation group are the amphibians and reptiles which includes the likes of Sand Lizard, Natterjack Toad and Great Crested Newt (*Triturus cristatus*) but also Common Frog (*Rana temporaria*). Mammals including all Bats and Otter (*Lutra lutra*) but also a range of marine mammals which have been sighted in the estuaries and Liverpool Bay (e.g. Common Porpoise (*Phocoena phocoena*), Grey Seal (*Halichoerus grypus*) and Common Seal (*Phoca vitulina*)).

Of these based on available data the Natterjack Toad has been lost from 27% 1km squares where it had been recorded as present prior to 2010. This coincides with a 70% decline in the abundance of spawn-strings counted over the last 30 years on the Sefton Coast (*Smith and Skelcher, 2019*). The Natterjack Toad requires seasonally-flooded, shallow, unvegetated pools in which to breed, together with bare sand for burrowing and foraging and its decline in the LCR is thought to be due to the deterioration of habitat from vegetation overgrowth and loss of bare sand in both breeding and terrestrial habitats, coupled with the increased frequency of spring droughts since about 2000, the latter being linked to climate change (*Smith and Skelcher, 2019*). In a similar trend to the above data on Sand Lizard suggests they have been lost from 30% of 1km squares where they had been previously recorded prior to 2010. (See Natterjack case study on page 80-81 for more information.)

The Sefton Coast is well recorded and benefits from recent projects such as 'Gems in the Dunes' which supported recent volunteer recording and conservation management in addition to the already existing strong history of intensive volunteer monitoring and conservation undertaken by members of the North Merseyside Amphibian and Reptile Group.

However, information on species away from the coast is much more difficult to come by and no structured monitoring is in place. A similar assessment of Great Crested Newt occurrence with the LCR prior to 2010 years suggests a loss of 50%. However, on examination 28% of presence has only been detected for the first time in the last 10 years. This is likely due to a lack of recording effort and that a significant proportion

of data that does exist being sourced from populations surveyed (and subsequently lost) due to development for which the survey was undertaken.

Bats

Bats, listed largely under Annex IV, are included in this section as they make up the most widespread group of species and that for which there exists relatively more information.

At a national scale data from four long-term monitoring surveys coordinated by the Bat Conservation Trust are used to produce population trends: Roost Count, Hibernation Survey, Field Survey and Waterway Survey. At present sufficient data are collected by the National Bat Monitoring Bat Programme (NBMP) to produce national population trends for 11 of Great Britain's 17 breeding bat species.

> ***"Overall, the species reported on are considered to be stable or to have increased since the baseline year of monitoring (1999 for most species). However, it should be remembered that these trends reflect relatively recent changes in bat populations (since 1999 for most species). It is generally considered that prior to this there were significant historical declines in bat populations dating back to at least the start of the 20th century. This suggests that current legislation and conservation action to protect and conserve bats is being successful, and it is vitally important that this continues."*** - Bat Conservation Trust, 2020

Locally there is insufficient general or structured sampling information to inform the status of bats as a whole across the LCR. Within the region 9 species of bat are known to be present while records exist for a further 3 in Wirral and Halton only. Bats in the LCR occur in every habitat (notably Nathusius' Pipistrelle (*Pipistrellus nathusii*) has been repeatedly recorded on the Sefton Coast) with some generalists being widespread and making extensive use of even our most urban environments while more sensitive species are ecologically restricted to certain locations favour more natural habitat.

Bats move throughout the region and beyond, indeed ringed Nathusius' Pipistrelle have been recaptured having migrated from Latvia and Lithuania to as far as Somerset (*BCT, 2021*) and Northern Spain (*Alcalde et al., 2021*) demonstrating the interconnected geography of these species. Similarly, a local example of Natterer's Bat (*Myotis nattereri*) ringed in St.Helens was re-captured 8km away (*Irwin, 2021*).

A number of interesting curiosities also exist; a single historic location for a roosting Lesser Horseshoe (*Rhinolophus hipposideros*) on the Wirral, found in someone's basement! As well as several bats have appeared and are suspected to have been imported with shipping containers or imported wood products including; the Mediterranean Savi's Pipistrelle (*Hypsugo savii*) found on the Wirral (1996), North American Red Bat (*Lasiurus borealis*) arrived by ship (1998), southern European Kuhl's Pipistrelle (*Pipistrellus kuhlii*) discovered in St.Helens and most recently Silver-

Haired Bat (*Lasionycteris noctivagans*) another north American species discovered at Liverpool docks (*White et al., 2017*).

All Bats are legally protected species[3] and Priority species[4]. Sufficient long-term monitoring data to allow trends analysis of bat species is not available for the Liverpool City Region. Within the region, any bat monitoring undertaken is completed by volunteers of the Merseyside and West Lancashire Bat Group (MWLBG). However, the following two case studies provide results of bat monitoring at two sites within the LCR.

Case Study: Bats

Provided by Mr S Irwin, Merseyside and West Lancashire Bat Group

Case Study 1: Bat Hibernaculum

This site in St.Helens is the only monitored true subterranean hibernation site within the LCR. Owing to its hibernacula value the site is designated as a Local Wildlife Site within Merseyside. Monitoring for hibernation bats commenced at this site in 1994. Hibernation surveys are undertaken on two occasions over the hibernation season i.e. December-March.

In 2012 acoustic monitoring was undertaken over the autumn swarming season during which time six of the nine species currently recorded in Merseyside were identified:

- Brown Long Eared (*Plecotus auritus)*
- Daubenton's (*Myotis daubentonii)*
- Natterer's (*Myotis nattereri)*
- Whiskered (*Myotis mystacinus)*
- Brandt's (*Myotis brandtii)*
- Common Pipistrelle (*Pipistrellus pipistrellus)*

Hibernating Natterer's Bat

Swarming activity is described as *"the gathering of bats at the entrances of underground sites in late summer and throughout the autumn months. The practice is not fully understood but is believed to be associated with mating/social behaviour and/or investigation of hibernation opportunities"* **- Bosch *et al.*, 2015.**

In more recent years catching bats with mist nets confirmed those species. Captured bats were "ringed" with the use of lightweight forearm rings and have been recaptured during subsequent swarming surveys in addition to ringed bats being found hibernating within the mine. This trend of bats swarming at the entrance to underground hibernation sites has also been found in other studies (*Bosch et al., 2015*) and illustrates site fidelity to this roost site.

[3] Habitats Regulations 2017 as amended, and Wildlife and Countryside Act 1981 as amended.
[4] Priority species are those identified by Section 41 of the Natural Environment and Rural Communities Act (NERC) 2006.

Sample data was taken over twenty years for comparison purposes and to quantify any population trend the sample period was divided into two ten-year blocks. 2000 was selected as a start date due to the hibernation surveys by then being more regularly conducted by several people, which gives a greater chance of bat detection, and that more experience and knowledge of the site was achieved since the initial survey during 1994.

Monitoring Results

Similar to most hibernacula the species and numbers that utilise this site will be subject to a number of influencing factors, listed below:

- Species variable seasonal times of entering hibernation
- Ambient temperatures during or just before the hibernation season
- Temperature and humidity fluctuations within hibernacula
- Changes to an entrance or change of features within
- Disturbance

Given these influencing factors to allow meaningful analysis of species trends long-term monitoring is required.

Figure 67: below illustrates the percentage use of the site by species during the two 10-year periods.

The survey results reveal several distinct trends notably a decrease in Daubenton's and Brown Long Eared bats and an increase in Whiskered/Brandt's* and Natterer's bats.

Influencing factors described above may account for number variations, however taking into consideration the long-term survey periods it can be concluded that the data reflects a reasonably robust indication of species trends.

Whilst the data is site based it should be noted that a ringed Natterer's bat from the site was recaptured during summer at a site over 8 kilometres away illustrating that this hibernaculum attracts bats from a wide radius and therefore is probably representative of bat trends over a wider area then the immediate site.

**Whiskered & Brandt's bats are very similar species which can usually only be differentiated in the hand therefore they are generally referred to for record purposes as Whiskered/Brandt's*

Table 7: Species numbers and percentage increase/decrease.

Species	Year	Number	Increase/decrease %
Brown Long Eared	2000-2010 2011-2020	48 33	Net decrease of 15 = 31.25% decrease
Natterer's	2000-2010 2011-2020	52 81	Net increase of 29 = 55.7% increase
Whiskered/Brandt's*	2000-2010 2011-2020	78 94	Net increase of 16 = 21.51% increase
Daubenton's	2000-2010 2011-2020	106 66	Net decrease of 40 = 37.7% decrease

Table 8: National Species population trend.
Source: Bat Conservation Trust, 2020

Species	Survey type	No. of sites in trend analysis	Base year	Long-term trend since base year	Average annual change and 95% CI (%)
Daubenton's bat	Hibernation	236	1999	24.8	1.1 (0.01 to 2.5)
Whiskered/Brandt's bats	Hibernation	173	1999	38.6	1.6 (-0.4 to 3.6)
Natterer's bat	Hibernation	396	1999	149.1	4.4 (2.0 to 5.9)
Brown long-eared bat	Hibernation	371	1999	-20.8	-1.1 (-2.9 to 0.5)

Apart from Daubenton's bat the National monitoring by the Bat Conservation Trust (BCT) data for English hibernation sites (see table below) appear to show similar trends with an increase/decrease in the same species as our site, particularly relative to an increase in Natterer's bats. A decrease in Brown Long Eared bats may be linked to a trend for warmer winters as traditionally this species tends to enter hibernation late in the hibernation season when temperatures are reaching their coldest. Despite surveys being undertaken at the mine during the anticipated coldest time of the year i.e. January; evidence indicates a percentage reduction of this species.

Reasons for the discrepancy in Daubenton's bats between this site and BCT data are difficult to determine. Monitoring at this site showed a decrease in bat numbers hibernating, however, nationally the long-term trend shows an increase of 24.8%. However, BCT data for Daubenton's bat hibernation trend also notes: -

"The smoothed index is currently 24.8% above the 1999 base year value, equivalent to a mean annual increase of 1.1% (95% CI 0.01% to 2.5%). The value of the smoothed index was relatively stable between 1999 and 2011. From 2011 it began to increase, reaching a peak in 2016, before falling again in recent years. The index was significantly higher than the baseline year between 2000 and 2002, and again more recently from 2013. Currently the smoothed index is just significantly higher than the 1999 base year value, however this result is provisional and could be revised up or down as further years of monitoring data are added, so this finding should be treated with caution"
– Bat Conservation Trust 2020

It could therefore be concluded that the fall in numbers of Daubenton's bat at this site reflects a more recent fall in Daubenton's bat numbers nationally from 2016. Based on the above then it will be of interest to see the trend results of BCT further monitoring in comparison to Daubenton's bat and this site.

Case Study 2: Ainsdale NNR Bat Box Scheme 2011-2021

Between 2011- 2021 a total of 23 bat boxes of two designs. Schwegler 1FF and 2F have been monitored for bat occupancy.

Due to covid restrictions[5] in 2021 only those bat boxes which could be monitored from ground level with the aid of a torch could be undertaken.

Bat boxes at Ainsdale National Nature Reserve (NNR) are currently used by three bat species; Brown Long-eared Bat, Noctule Bat and Common Pipistrelle.

Brown Long Eared bats are essentially a woodland species more notably found in broadleaf where they will often glean moths from tree foliage. Historically they will have been tree hole dwelling bats hence they readily adapt to bat boxes. In modern times they are now associated with loft spaces/voids and frequently referred to as “loft dwelling” species.

It is interesting to note that to the south of Ainsdale NNR a long-standing Brown Long-eared bat maternity roost is present in a loft space immediately adjacent to coniferous plantation into which they enter following emergence. Whilst coniferous plantation may not appear to be ideal foraging habitat for bats it is evident that within the NNR and in another part of the Sefton Coast coniferous plantation Brown Long-eared bats are clearly foraging within them although there are also isolated broadleaf woodland pockets within the NNR. Noctuid moths form a large percentage of Brown Long-eared bat prey items and data obtained in relation to moth trapping at the NNR (*Mr R Moyes*) revealed numerous records of noctuid and other moth species. During a number of research projects remains of this species group has been frequently been identified within Brown Long-eared bat droppings. (*Susan M Swift 1997*). From the moth trapping data it appears that the coniferous woodland supports an abundance of favoured prey items.

Noctule bats will commute many kilometres to preferred foraging grounds that includes open pasture, waterbodies, woodland edge and is the species most associated with tree roosting; it is therefore particularly vulnerable to loss of roosts. Generally coniferous plantations lack the same number of roost opportunities, such as natural rot or woodpecker holes to that of broadleaf woodland and therefore the provision of bat boxes has improved roosting potential within the NNR for this species. The presence of this species in a coniferous plantation is therefore a matter of interest in as much as are they are either actively seeking out roost opportunities or opportunistically locating them whilst on foraging excursions.

[5] During 2021 the 2F boxes were not checked in accordance with the International Union for Conservation of Nature (IUCN) guidelines in as much as human-bat close contact should be avoided wherever practical due to risk of human-bat Covid transmission

In providing bat boxes as alternative roost opportunities then that provision should be considered to be of value as frequently roost features are lost to "woodland management" or natural degradation of trees. Bat boxes can also act as a night roost whereby commuting bats can use them as "stop overs" instead of using valuable energy to return to a roost on the same night.

Common Pipistrelle bats have been recorded in 2F bat boxes albeit in singular numbers, therefore this species has not been included in these results as low numbers will not currently reflect any clear trend in context with an increase or decrease in overall numbers.

Monitoring Results

The first evidence of bat occupation occurred in 2018 seven years after the erection of the bat boxes and entailed 2 Noctule bats hibernating in a 1FF box. Whilst during the summer of 2018 a maximum of 11 Brown Long-eared bats were located in the same bat box design in addition to 1 Noctule Bat. Figure 68 and Table 9 below indicate the upward trend of bat box occupation. Showing that although it can take some time for bats to occupy bat boxes once found more bats will be attracted to them.

Table 9: Bat box occupancy by year

Year	Number of bat boxes occupied	% of total 23 bat boxes occupied
2011-2017	0	0
2018	3	7
2019	4	17.4
2020	5	21.7
2021	7	30.4

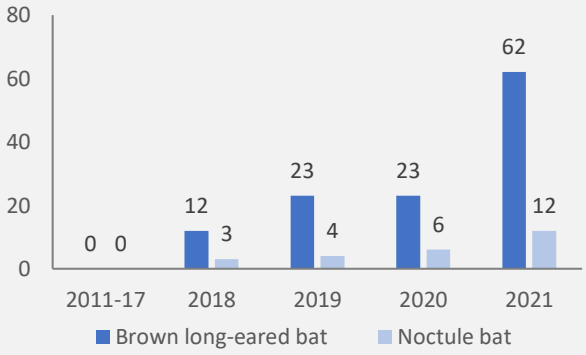


Figure 68: Bat box use at Ainsdale NNR by year for Brown Long-eared bat and Noctule bat.

Figure 69 and Figure 70: show the location of occupied bat boxes.

Figure 69:

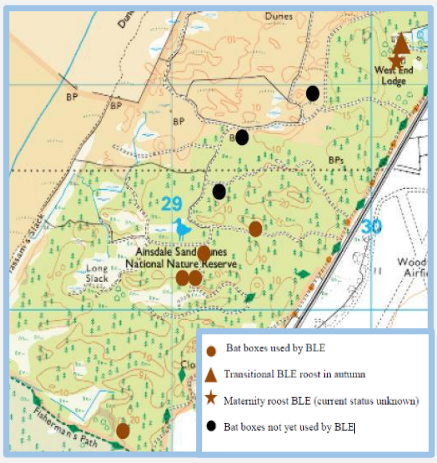
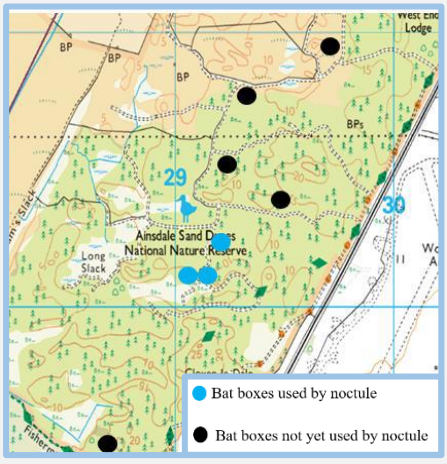


Figure 70:



It is notable that Long-eared and Noctule bats tend to use a cluster of bat boxes more so in one specific location i.e. adjacent to Slack 39. In Figure 69 the bat box record at the southern end of the NNR is isolated from the boxes to the north that are used more regularly. Previous records of Brown Long-eared bats to the south include Formby Golf Course, and maternity roosts around Victoria Road. It is probable that this bat box record is an individual from one of those roosts as opposed to a separate roost to the north.

Conclusions

From the 2011-2021 results it is clear that the trend shows an increase in both species relative to the frequency of bat box occupation. Use of the boxes and numbers of Brown Long-eared bats have significantly increased. Typically bats interchange from one box to another but also show a tendency to return to "favourites". The total number of Brown Long-eared bats in Figure 68: 2021 will need to be treated with caution when considering population trends as it is more than probable that the colony is at times segregating and dispersing into various boxes during the year. Due to different survey dates this may have resulted in double counting. Taking this into account the count on any given day it is considered that the 2019 figure of 32 is the most accurate as surveys which recorded Brown Long-eared bats were undertaken on a single day in this year.

Survey of bat boxes shows that the boxes are being used at a variety of times during the year and supporting a range of functions including maternity roosts, hibernation, as well as transitional and day roosts.

What is apparent is that the use of bat boxes shows a clear upward trend which will have future benefits when considering the potential population expansion of these species at Ainsdale NNR or if for any reason an existing roost is lost.
Whilst Noctule bat numbers are low relative to Brown Long-eared bats the use of the boxes remains relatively stable. Currently the highest number of Noctule bats recorded on any one day within 4 bat boxes is six (most recent survey 7.11.2021). Bat boxes offer roost opportunities in a habitat that generally does not provide a high number or roost potential features. Ainsdale NNR is used by Great Spotted Woodpecker *(Dendrocopos major)* although general observations throughout the reserve appear to suggest that there is not an abundance of woodpecker holes. Noctule bats frequently take advantage of unused woodpecker holes, hence the presence of Great spotted woodpecker will be of benefit to the tree dwelling Noctule bat as will the retention of standing deadwood, which is used for woodpecker nest sites.

N5: Ecosystems services of habitats supporting ecosystem services

Headlines

- The LCR Natural Capital Baseline provides a strong basis from which to access ecosystem service capacity and demand. There is a strong confidence in mapping and analysis of woodland services. Other habitat types, e.g. lowland raised bog and higher-value grassland are detected with lower confidence due to availability and accuracy of underlying data sources.
- The designated site network provides high levels of ecosystem service provision.
- Woodland and tree cover provide the highest provision of air purification and noise regulation capacity.
- Broadleaved woodland (42%) and intertidal habitats (30%) have the highest carbon sequestration function of all LCR habitats.
- Carbon storage capacity of woodland is well understood. However, other habitats notably lowland raised bog, as well as standing water bodies and hedgerow with higher or significant carbon storage potential are understood with lower confidence due to habitat data limitations.
- 1955 ha of the LCR is underlain by peat deposits. However, less than 10 ha of lowland raised bog remains and just 0.5 ha forms part of a ‘functional’ bog and many of these sites are in a degradaded state.
- Our estuaries and woodland have strong temperature regulating capacity.
- Provision of water flow and quality in the LCR is relatively good, with woodland, heath and saltmarsh habitats playing an important role. Opportunities for creation of nature-based drainage solutions should be explored and promoted.
- Pollinators are essential but declining for a number of reasons. Including use of herbicides/ pesticides in agriculture and greenspaces and negative impacts of honey bee-keeping.
- Low provision of accessible natural greenspace is found in our urbanised centres and rural hinterlands.

About this indicator

This indicator assesses the ability of species and habitats within the Liverpool City Region in supporting ecosystem services. This chapter explores the ability of habitats and species within the LCR to provide wider environmental services for society and the economy, such as carbon sequestration, flood alleviation and temperature regulation and pollination.

Indicator N5 is derived from national indicators:

- B6 Natural functions of water and wetland ecosystems;
- D7 Species supporting ecosystem functions.

Why consider ecosystem services?

An ecosystem services approach seeks to quantify and place a natural capital value on our biodiversity assets for the benefit of people and the economy.

Defra guidance (2021) states that understanding nature as an asset which provides flows of services to deliver benefits provides us with a framework to manage it well to deliver for society's needs.

By taking an approach which quantifies biodiversity assets can reduce the risk of the value of the natural environment being ignored or undervalued in decision making.

A natural capital approach such as LCR Natural Capital Baseline also provides a mechanism to secure wider environmental net gain in line with aims of the 25 Year Environment Plan (*Defra, 2018*).

How have we assessed this indicator?

Indicator N5 is broadened to measure ecosystem service capacity derived from all habitat types found in the LCR. This indicator reports on capacity of the following functions and services:

- accessible nature;
- air purification;
- carbon storage;
- carbon sequestration;
- local climate;
- noise regulation;
- water flow; and
- water quality.

Data and analysis is based upon the work by the LCR Natural Capital Working Group led by Liverpool John Moores University (*Holt et al., 2020*). The baseline comprises a habitat asset register and ecosystem models for the above functions. The LCR Natural Capital Baseline does not currently include a model for measuring biodiversity flows and their capacity and demand, and benefits to society.

As found by the National State of Nature Report, measurement of species ecosystem services requires significant further research and development to include a range of species. Therefore, in line with the national approach we have used an interim indicator showing trends in distribution of pollinators.

Figures set out below are overlain with Local Wildlife Site boundaries to illustrate the relative ecosystem service capacity of the non-statutory designated site network and their habitat compositions. Examples taken from each Council area are inset on the figures and services are presented at a 10m by 10m pixel resolution. Carbon storage and sequestration maps are presented as tonnes per hectare and all other services are shown as relative scores (0-100%) where 100% is the highest value / provision of service occurring on the map.

National Outlook

There are various national tools which have been developed to facilitate natural capital accounting of biodiversity services such as Natural England's Integrated Wetland Network Tool.

In July 2021, in support of the biodiversity metric version 3.0 and small sites metric (beta), Natural England has released an Environmental Benefits from Natural (EBN) Tool (*Natural England, 2021a*).

According to Natural England, this tool *"…is designed to work alongside Biodiversity metric 3.0 and provide developers, planners and other interested parties with a means of enabling wider benefits for people and nature from biodiversity net gain."*

The recently assented Environment Act (2021) means that a 2-year transition period to mandatory biodiversity net gain (BNG) has begun. From November 2023, the majority of planned development will be required to achieve a mandatory net gain of at least 10%. There is therefore a pressing need for trial and testing of the biodiversity metrics and new EBN tool to facilitate implementation of BNG and wider environmental benefits within our planning systems.

Implementation of environmental net gain remains discretionary.

Liverpool City Region Outlook

Habitats

The following ecosystem services maps highlight the level of provision LCR habitat assets have for ecosystem service and services. These maps are overlain with the LCR Local Wildlife Site (LWS) boundaries to demonstrate the typically higher-level of provision from habitats of greatest nature conservation value. Examples of LWSs from each Council area are provided for context. This includes:

- Halton – Runcorn Hill LWS – a publicly accessible lowland heath;
- Knowsley – Knowsley Park LWS – a privately owned estate comprising woodland, grassland and waterbodies;
- Liverpool – Sefton Park LWS – a publicly accessible City Park comprising woodland, grassland, amenity space and waterbodies;
- Sefton – Birkdale Hills LWS – a publicly accessible dune system and intertidal area;
- St.Helens – Colliers Moss LWS – a publicly accessible remnant mossland with a mosaic of woodland, scrub, grassland and wetland habitat; and
- Wirral – Thurstaston Common LWS – a publicly accessible lowland heath.

Photo credit: Anya Coffey

Accessible Nature Capacity

Figure 71 below is a meaure of publicly accessible natural greenspace. The highest provision (reddest areas) tends to be either the coastal areas, or along the urbanised River Mersey, where there is good access, and high perceived naturalness which is a unique draw for recreational users. However, this does not consider limitations of access in intertidal zones e.g. tide times and risks associated with accessing mudflats and marsh.

Other areas that have high public access capacity are our country parks, public open space, woodlands and many of our LWSs in public ownership – note low provision at Knowsley Park LWS which is privately owned. There is typically an even distribution of access to natural greenspace in both urban and urban-fringe locations e.g. Sankey Valley where parks and public open space are evident. However, more rural areas of Sefton and St.Helens where the primary land use is agriculture, show fragmented and lower levels of provision. It is not clear to what extent public rights of way have been included in the model as rural hinterlands of the LCR are accessible by an extensive footpath and bridleway network. The lowest provision is found in our urbanised centres where there is a greater proportion of sealed surfaces and as N1 indicator demonstrates many amenity grasslands have been lost (*Holt et al., 2020*).

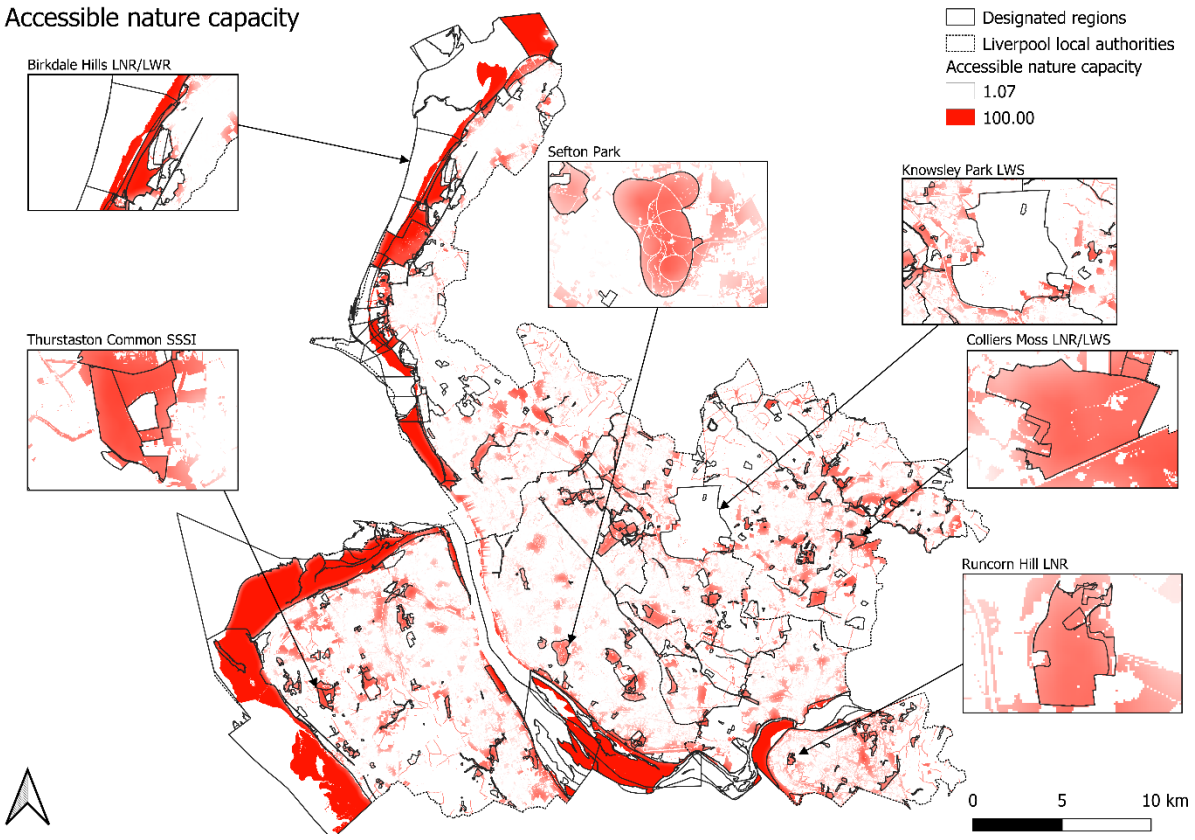


Figure 71: Accessible Nature Capacity

Air Purification Capacity

Figure 72 shows the capacity of the natural environment to intercept and absorb the pollutants PM2.5 (particles that have diameter less than 2.5mm) and SO_2 (sulphur dioxide). Excessive SO_2 contributes to acidification and potential changes in soil, water quality and vegetation (*Holt et al., 2020*).

Holt et al., (2020) found areas that are best at regulating pollution do not coincide with the areas of highest demand for this service i.e. urban areas. Therefore, habitat creation in urban areas should be given priority to improve air purification levels.

As can be seen on the inset maps this measure is largely a measure of relative tree cover (showing redder). Whilst woodland provides high purification of air, other habitats including heathland, grassland and saltmarsh also have a mitigating effect on air pollution, however Figure 72 shows they do so at a reduced rate (pinker areas on map). The white areas, with lowest or no provision, are manmade sealed surfaces and water. However, it is worth noting that woodland and scrub in the wrong place can affect the biodiversity and wider environmental function of our most distinctive habitats e.g. heathland, raised bog and meadows.

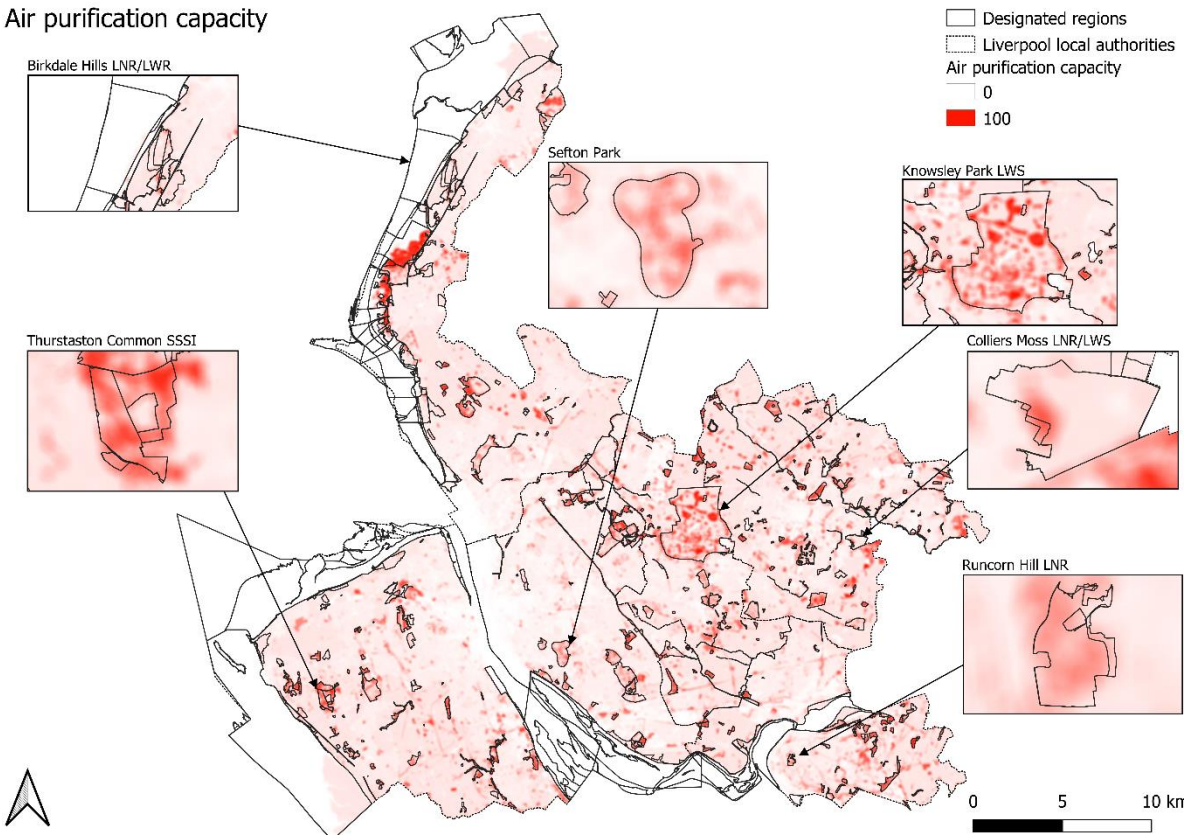


Figure 72: Air Purification Capacity

Carbon Storage

Figure 73 shows the amount of carbon (tonnes of carbon per hectare) stored naturally in soil and vegetation. The model used to produce the map estimates the amount of carbon stored in the vegetation and top 30cm of soil. This does not take into account habitat condition or management, which can cause variation in amounts of carbon stored (*Holt et al., 2020*).

Habitats showing redder provide highest carbon storage capacity and it is noteworthy that in addition to woodland which is well understood, mossland, heath and saltmarsh in our estuaries also show strongly.

In addition to woodland cover, there is also a clear correlation between the areas of highest capacity for carbon storage and coincidence with designated sites, particularly Local Wildlife Sites. This highlights the importance of these sites and the wider benefits they bring. However, as identified above the level of carbon storage capacity can depend on the condition of habitat on site and illustrates the importance of appropriate conservation management.

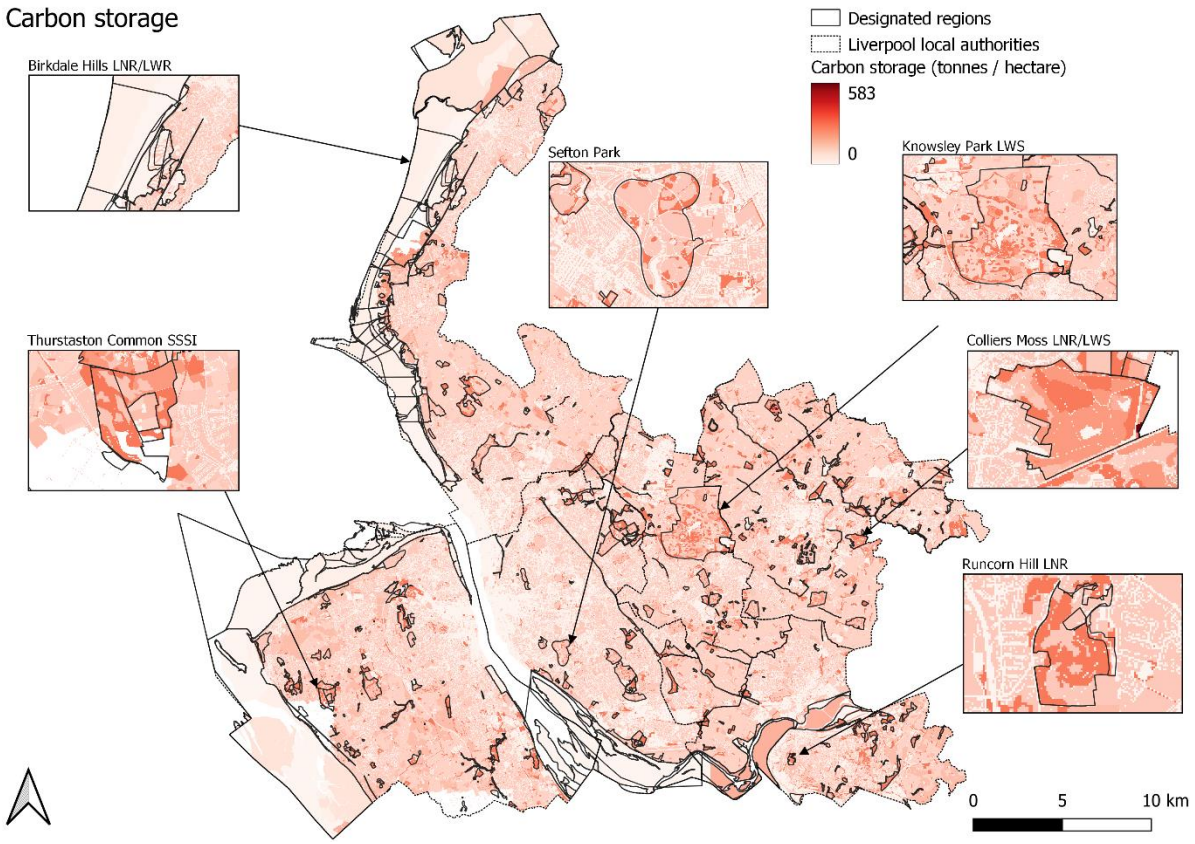


Figure 73: Carbon Storage Capacity

A Natural England report by Gregg et al. (*2021*) recommend that we draw upon a wide range of habitats/nature-based solutions to tackle climate change. In addition to woodland which are reliable carbon sinks, coastal and marine habitats such as

saltmarsh, seagrasses and intertidal mudflats as well as heath, species rich grassland, rivers, lakes, ponds, floodplain and lowland raised bog all have significant carbon storage potential.

A recent position paper (*CIEEM, 2021*) on habitat creation and restoration notes that woodland is not the panacea for tackling climate change as carbon lost on establishment can in some cases outweigh that being stored for many decades while a tree plantation matures. Note Figure 74 which shows that a woodland must be established e.g. 30 years before a significant carbon return can be realised. Therefore, in the short-term habitats which establish more quickly e.g. ponds, reedbed could provide an important part of the carbon solution in addition to woodland.

Figure 74 below taken from Gregg et al., (*2021*) shows the relative carbon storage potential for semi-natural habitats. This shows that mature and semi-mature woodland are significant carbon stores but by far the most effective habitats at storing carbon are blanket bog, fen on deep peat and lowland raised bog.

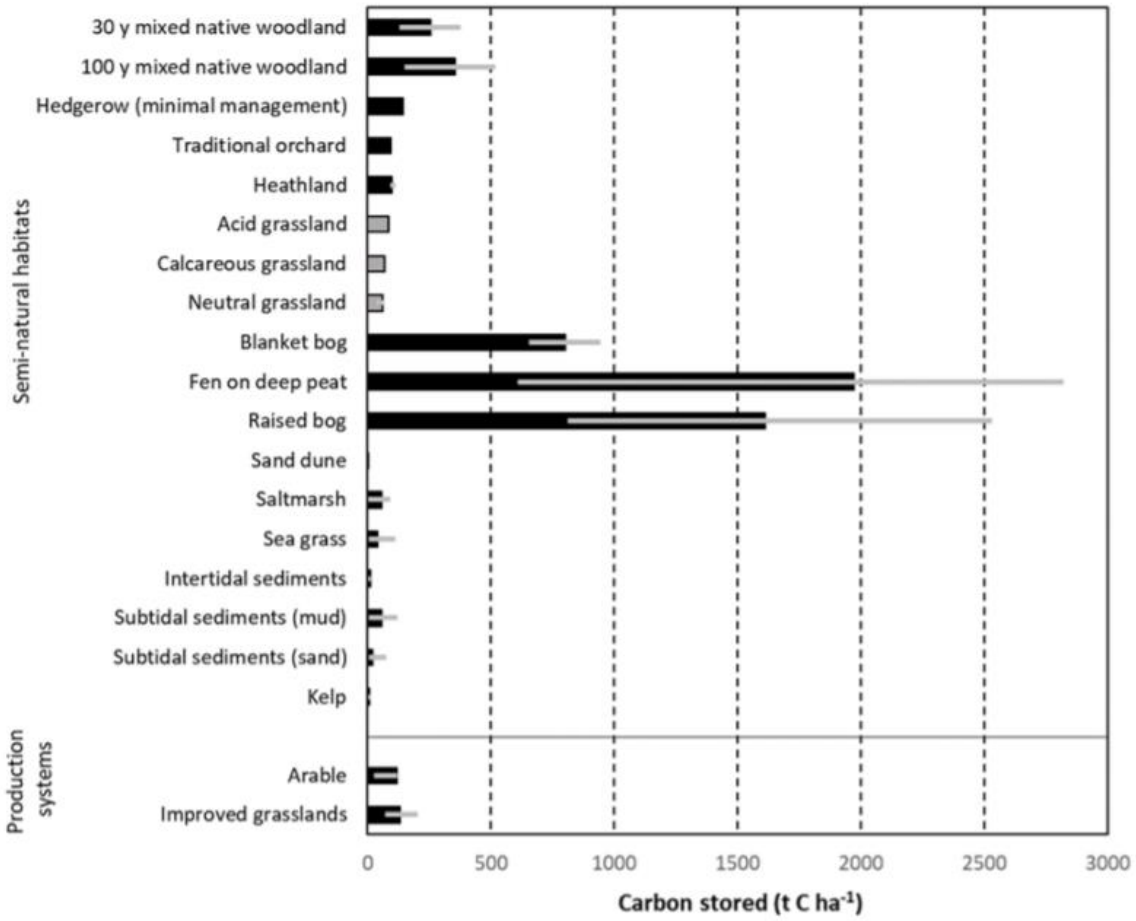


Figure 74: Carbon storage potential of semi-natural habitats

Within the LCR remnant lowland raised bog is fragmented and degraded – see indicator N1 (case study: Holiday Moss). Data from British Geological Survey shows that 1,955 ha of the LCR is underlain by peat deposits (Figure 75). This is 2% of the City Region area. Predominantly in Knowsley and St.Helens, less than 10 ha of

lowland raised bog remains. Therefore, just 0.5 ha of peat forms part of a ‘functional’ bog and many of these sites are in a degradaded state.

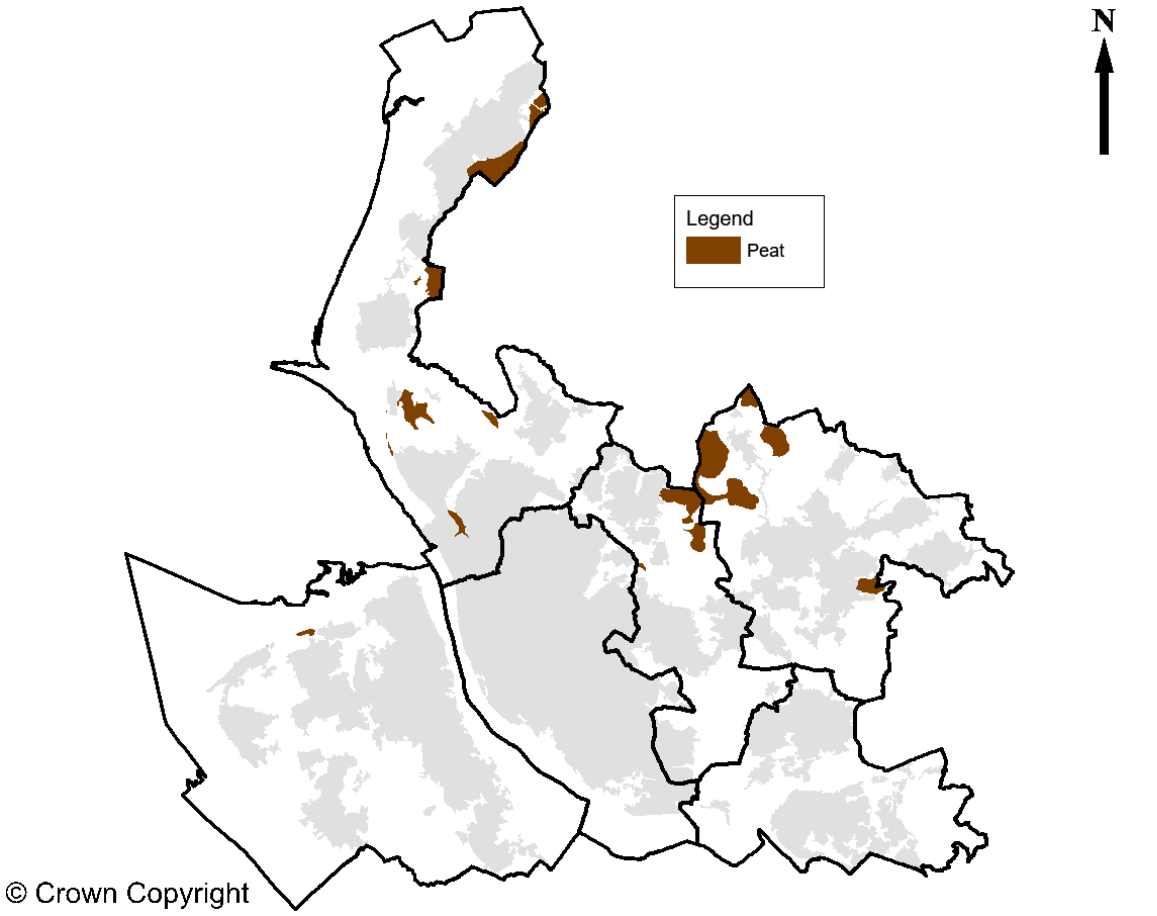


Figure 75: Peat extent

The restoration of peat bog and fen on peat habitats provides a signfiicant opportunity to fix and add to carbon storage capacity within the LCR and reduce emissions from these degraded areas.

Figure 74 shows that woodland over 100 years old has significant capacity to store carbon illustrating the importance of protecting and managing our older / anicent woodland not only for its ecological value but also for its carbon storage and sequestration functions. Figure 74 also shows that hedgerow, heath and unimproved grassland are valuable carbon stores.

As indicator N1 shows, many of our habitats are in poor condition and indicator N2 identifies that a significant proportion of our LWSs are not in positive conservation management.

A robust habitat baseline which incorporates habitat condition data is fundamental to success of ecosystem services assessment and implementation in the LCR.

Carbon Sequestration

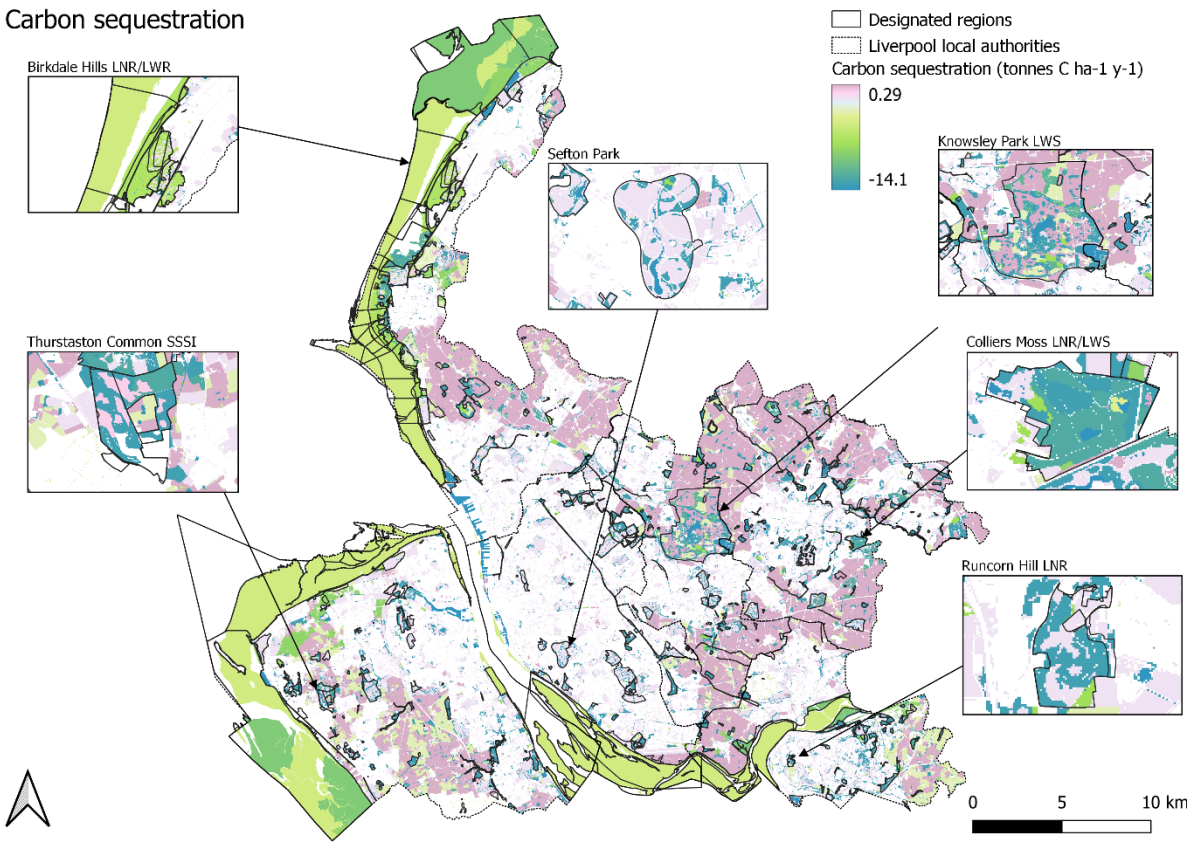


Figure 76: Carbon sequestration

Estimates in Figure 76 above are based on average carbon sequestration rates for semi-natural habitats (*Gregg et al., 2021*). Figure 76 shows that areas of woodland and intertidal mudflat and saltmarsh are most effective at carbon sequestration.

Carbon sequestration is the uptake of carbon by plants as they grow. While carbon storage measures the stock of carbon in the natural environment, carbon sequestration measures its annual flow (*Holt et al., 2020*). Woodland is known to be particularly effective at carbon sequestration, but other habitats e.g. saltmarsh can also contribute to a lesser degree (see Table 10 below). Plants that are harvested annually (e.g. arable crops, improved grassland) will be approximately carbon neutral over the course of a year as the sequestered carbon is immediately harvested. Arable fields can even be emitters of carbon due to their management and soil respiration.

Table 10 below shows the relative effectiveness of different habitat types at sequestering carbon annually. Broadleaved woodland and intertidal habitats collectively account for 72% of all carbon sequestration in the LCR.

Table 10: Carbon sequestration rates by habitat type.

Habitat	Area (ha)	Av. sequestration rate (tC ha^{-1} y^{-1})	Carbon (tC y^{-1})	Contribution to sequestration (%)
Woodland, broadleaved	3698	-13.6	-50407	42.0
Intertidal	18369	-2.0	-36371	30.3
Woodland, mixed	722	-13.2	-9505	7.9
Saltmarsh	1741	-5.2	-9035	7.5
Woodland, coniferous	371	-12.7	-4709	3.9
Scrub	1047	-2.9	-3016	2.5
Grassland, improved	4556	-0.6	-2514	2.1
Trees / Parkland	758	-2.9	-2191	1.8
Sand dune	842	-2.2	-1837	1.5
Other habitats	596	-0.7	-399	< 1

Local Climate Regulation (temperature regulation)

Figure 77 shows measures of local climate regulation capacity i.e. temperature regulating effects of habitats. The model used to create this map includes the proportion of the LCRs covered by woodland and scrub and water features as these habitats are understood to provide the most significant effects (*Holt et al., 2020*). Holt et al., note (*2020*) that development of this model should seek to include all habitat types. High values (red) indicate areas that have the highest capacity to regulate temperatures, keeping them cool in the summer and warmer in the winter. The temperature regulating effects of our estuaries and woodland show strongly. However, the map shows that in an urban area, where temperature regulation is of greatest need there is currently a lack of natural climate regulation provision. Again, modelling shows the importance of designated sites including both coastal sites and the LWS network in providing climate regulation.

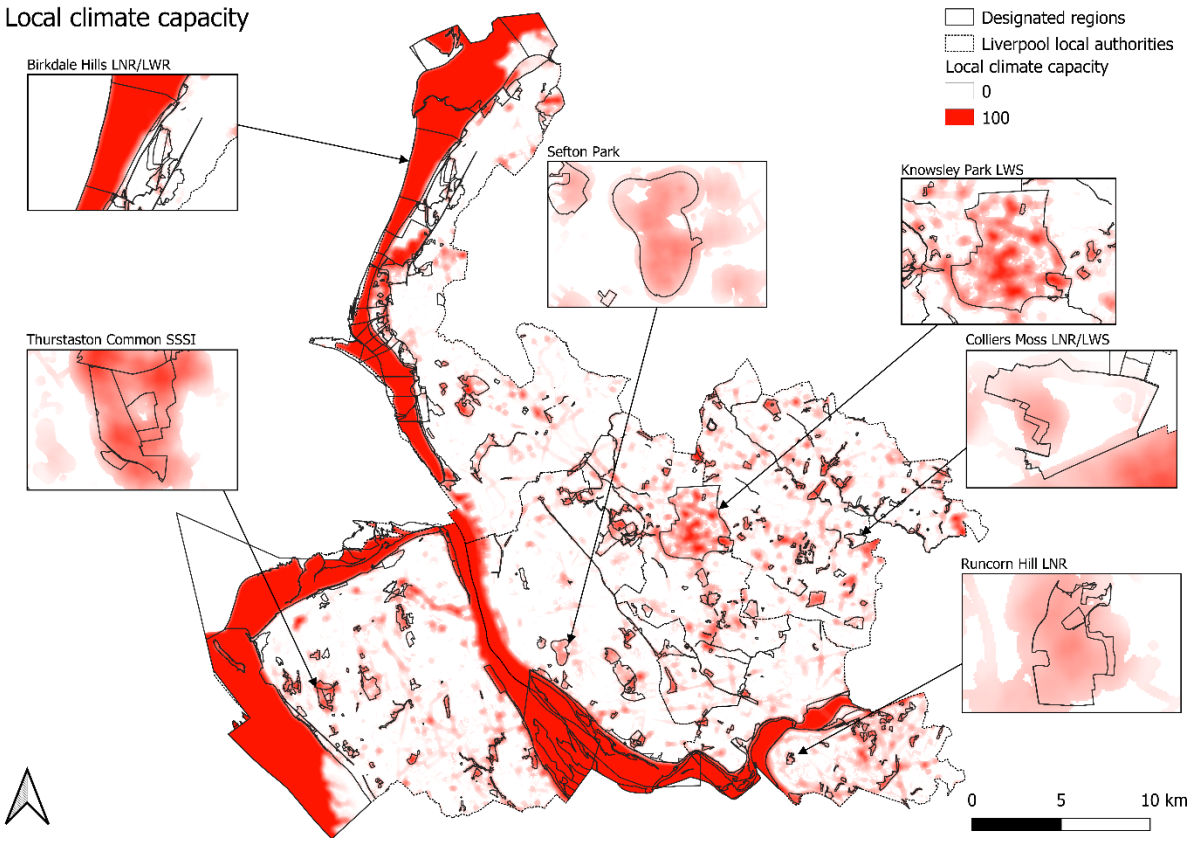


Figure 77: Local Climate Capacity

Noise regulation capacity

Figure 78 below shows that noise regulation is relatively low across the LCR and is largely dependent on tree and woodland cover, the majority of which occurs outside of the urban centres where the need for noise regulation is greatest (*Holt et al., 2020*). LWSs and undesignated areas with woodland cover therefore show redder in terms of their noise regulation provision. Open water habitats including the intertidal area and docklands also show strongly in terms of regulation.

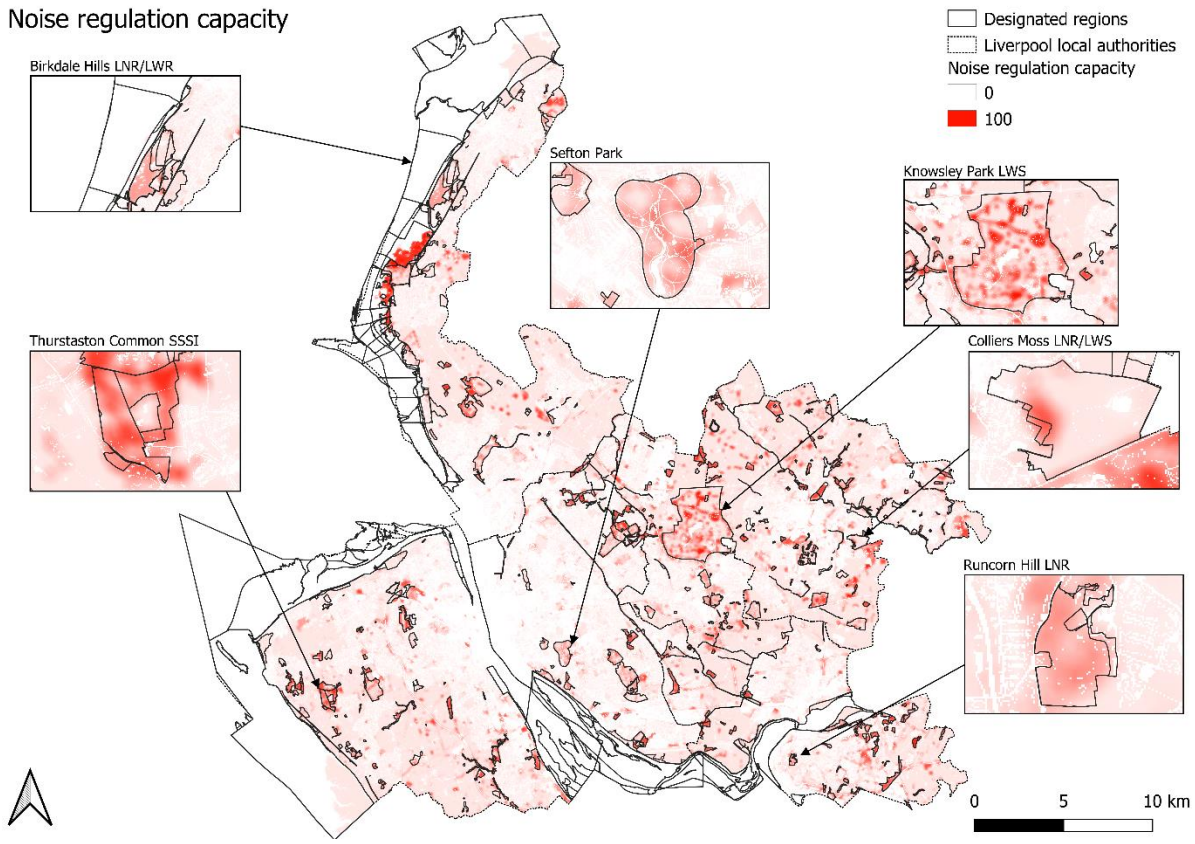


Figure 78: Noise Regulation Capacity

Water flow capacity

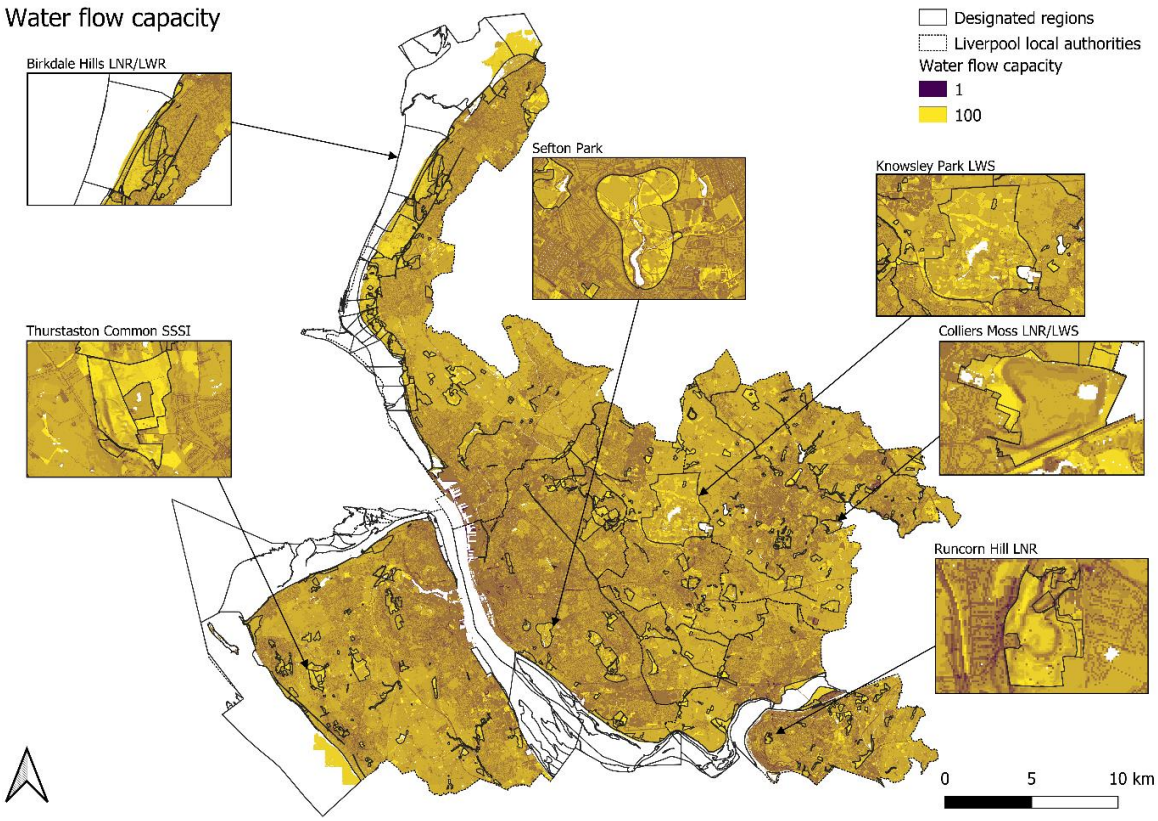


Figure 79: Water Flow Capacity

Water flow regulation is the capacity of the land to slow water runoff and thereby potentially reduce flood risk downstream (*Holt et al., 2020*). Figure 79 and 80 demonstrate that provision of water flow and quality in the LCR is relatively good, with woodland, heath and saltmarsh habitats playing an important role. Analysis found that areas of arable and improved grassland in more rural areas (lighter shading) are also relatively successful at slowing the flow of water. The worst performing areas are urban centres with sealed surfaces (darker areas). Given that sealed surfaces result in higher levels of run off investment in natural sustainable urban drainage solutions within urban areas could improve water flow provision.

Water Quality Capacity

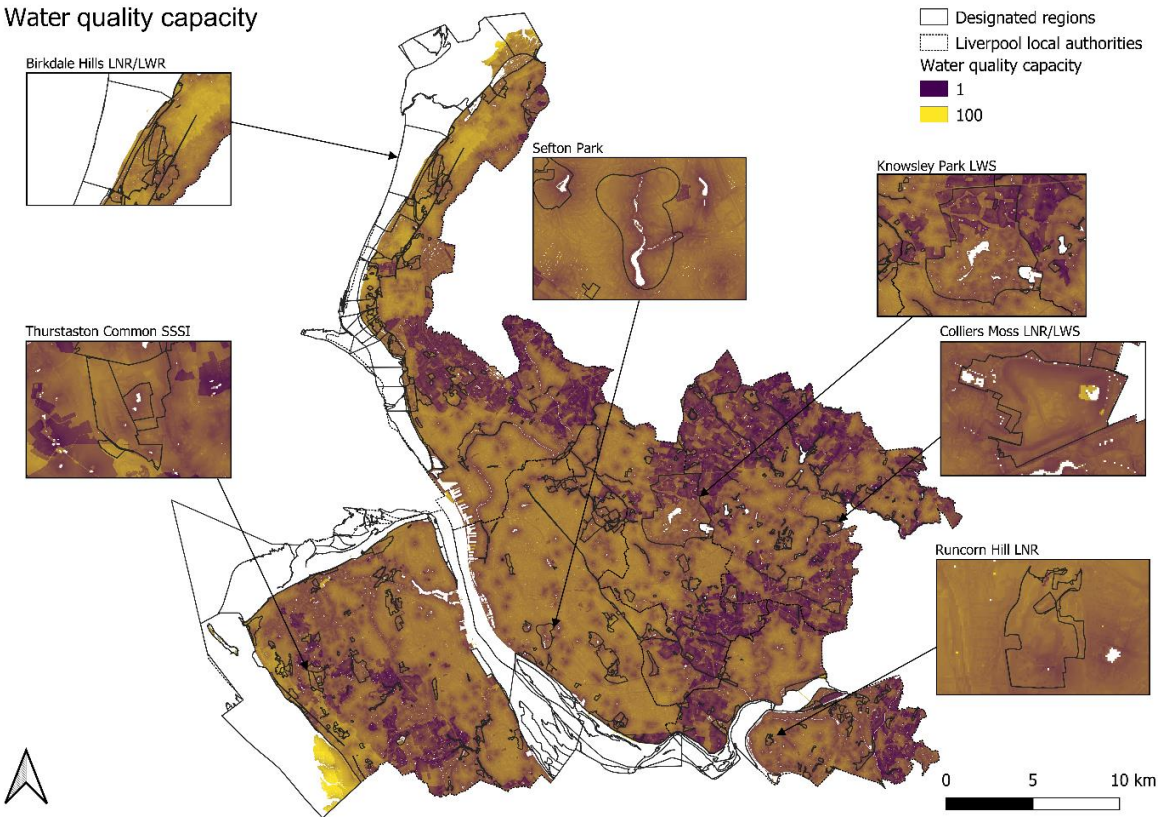


Figure 80: Water Quality Capacity

Water quality capacity maps the risk of surface runoff water becoming contaminated with high pollutant sediment loads before entering a watercourse (*Holt et al., 2020*). Urban areas have been excluded from this model. The model focuses on sedimentation from agricultural diffuse pollution. Figure 80 above shows farmland in the LCR has the lowest provision of water quality most likely due to nitrate run off from agricultural fertilisers. Run off in urban areas from transport is also a significant issue.

The areas of highest water quality provision are the saltmarsh habitats in Halton, Sefton and Wirral. Many of these habitats area designated sites.

Nutrient loading from nitrate and phosphates which in excess can cause eutrophication of habitats and designated sites are issues for further investigation. In the south of England, this is a significant issue arising mainly from agricultural sources and wastewater from housing and other development (*Natural England, 2020*). Nature-based drainage solutions and landscape scale habitat banking areas offer a viable planning mechanism for mitigation and meeting strategic aspirations for a discharge free Mersey by 2040.

Habitat data on marginal vegetation/swamp habitat which provide pollutant filtration services is limited. Nonetheless, N1 indicator shows that these habitats are scare within the LCR and in decline. Promotion of nature-based drainage schemes should be prioritised to address gaps in water quality provision. Implementation of biodiversity net gain and the need for a habitat banking platform will be a key driver and several Local Authorities are exploring their options.

Discussion of ecosystem services

Need for integration of habitat condition data into the habitat asset register is necessary to fully understand the relative provision of ecosystem services. As N1 found, <1% of our main rivers and just 12% of LWSs (surveyed in 2019/20) are in good ecological condition. It is likely that much of the LCR's semi-natural habitats are in a similarly suboptimal condition. Therefore, ecosystem services which flow from our habitats are also likely to be depleted.

Habitat survey, management and restoration projects is therefore critical to maintain and improve ecosystem services for people and the economy.

Species

Pollinators: Why consider pollinators?

Pollinators form a crucial component of our biodiversity. Known and increasingly recognised for the provision of ecosystem services relating to food production they are key and often specialised components in any health natural ecosystem.

Pollinators are considered within the UK Biodiversity Indicator for ecosystem services. A decline in species or species diversity being suggested as a proxy for ecosystem service delivery. However, this measure is considered experimental and following discussions with local taxonomic experts it was decided that it was not appropriate for us to consider that measure here and in the local context.

Nonetheless, pollinators are very much deserving of recognition in this report. Species decline is increasingly well publicised for reasons that are of local significance. The impact of the loss of pollinator species has the potential for consequences to local biodiversity and the local economy. In addition, pollinator species are by their nature

sensitive to changes in the natural environment including the impact of climate change which brings with its considerations regarding co-ordinated strategy and forward planning.

How have we assessed this indicator?

The term wild pollinator is very broad and includes a range of taxa, largely invertebrates (6,700 flies; 2,200 butterflies and moths; 250 Bees and a range of other groups (*Buglife, 2021*). Here we consider a subset where information is more readily available to produce trends based on species compiled for national reporting by Bees Wasps and Ants Recording Scheme (BWARS) and the Hoverfly Recording Scheme (HRS). Species richness of pollinators is shown in Figure 81.

National Outlook

Updates to the national indicator for wild pollinators consisting of 377 species was released in 2021. Key findings are as follows:

- Over the long term (1980 to 2017), the pollinator indicator showed 30% decline, and was therefore assessed as declining. Temporal patterns of change in the pollinator indicator showed a steady decline from 1987 onwards.
- Over the long term, 19% of pollinator species became more widespread (7% showed a strong increase), and 49% became less widespread (24% showed a strong decrease).
- By contrast, over the short term, a greater proportion of species were increasing (46%; with 34% exhibiting a strong increase) than decreasing (43%; with 36% exhibiting a strong decrease).
- As individual pollinator species become more or less widespread, the communities in any given area become more or less diverse, and this may have implications for pollination as more diverse communities are, in broad terms, more effective in pollinating a wide range of crops and wild flowers.

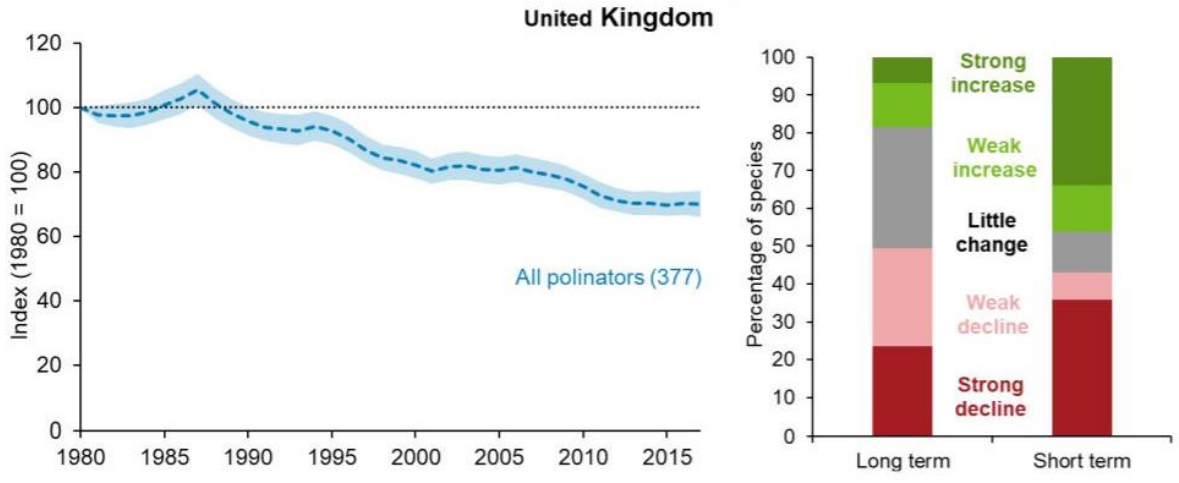


Figure 81: Change in the distribution of wild pollinators (n = 377) in the UK between 1980 and 2017. Source: JNCC (UKBI 2021)

Invertebrates are significantly under-represented in conservation policy and pollinators are no exception despite increasing recognition of their vital function and close association to habitats which are considered local and national priorities (e.g. lowland grasslands and meadow). Indicator N1 demonstrates since the 1980s our best grassland sites have declined by 10%.

There has been increasing activity around the creation of wildflower habitat with funds often directed towards community groups and parks to seed artificial meadows such as the Head North for Beauty Project (see Case Study page 149).

Wildflower meadow, Princes Park, Liverpool

No structured monitoring is in place therefore the impact of these transformational activities is impossible to know and while these created habitats can have a positive impact on wild pollinators this largely hinges on their ongoing management and longevity (*Conservation Evidence, 2021*).

Recent years have also seen a boom in public interest in Bee keeping, in part due to national press conflating the Honey Bee (*Apis mellifera*) and wild pollinators resulting in drives to save the Honey Bee which have omitted the wide range of other, native pollinators.

Unfortunately, it has now been demonstrated that over population of Honey Bee can have lasting negative impacts on native pollinator biodiversity and as a result pollination services (*Stevenson, et al., 2020; Valido et al., 2019).* Stevenson *et al.,* (*2020*) also demonstrated that in London diversity of wild pollinators could be much higher than in the wider countryside so the potential for competition between Honey Bee and native species could be much greater in the urban environment.

Case Study: Community Environment project is blooming great!

By LCR Combined Authority July 2021

Stunning wildflower meadows sown by local children and residents have transformed derelict land in Liverpool City Region – bringing colour and nature to urban communities.

The ten sites – now in full bloom – were created by the Head North for Beauty project with a £49,000 grant from the £500,000 LCR Community Environment Fund, established by Metro Mayor Steve Rotheram.

They form part of a new wildflower meadow trail from Everton in North Liverpool, through to Litherland in Sefton.

The sites were ploughed in April and schoolchildren from All Saints Catholic Primary School and local residents helped sow the new meadows.

Before and after images reveal the incredible difference, the project has made to the communities in built-up areas – bringing a splash of vivid colour to often derelict land which would usually be grassed over. The meadows are now being looked after by volunteer community wildflower rangers.

Source:https://www.liverpoolcityregion-ca.gov.uk/community-environment-project-is-blooming-great/

Bees and Hoverflies are not formally monitored in the LCR though a recent publication 'The Bees, Wasps and Ants of Lancashire' (*Hargreaves and White, 2021*) goes some way towards collating available information on Bee species across Lancashire and North Merseyside. Recording of Hoverfly species has certainly increased as a result of ongoing activity of the Hoverfly Recording Scheme (HRS) and the recent work of The Tanyptera Project based out of the World Museum Liverpool which is invaluable.

The data available shows that important areas for pollinators (selected from 377 HRS and BWARS species) are along the coastlines of Sefton and Wirral, South Liverpool and south Halton (see Figure 82).

There are also pockets of high species richness of pollinators along the Speke to Garston shoreline and old industrial sites in St.Helens. The value of ex-industrial sites and the interest in St.Helens due to the underlying geology of fine sands has been demonstrated via the ongoing Plan Bee project (*Lancashire Wildlife Trust, 2017*).

Hargreaves (*2021*) also stresses the special value of open habitat for diversity of bees; such as that of coastal dune and heath systems and post-industrial land such as Pex Hill and Billinge Hill in maintaining healthy and diverse pollinator assemblage.

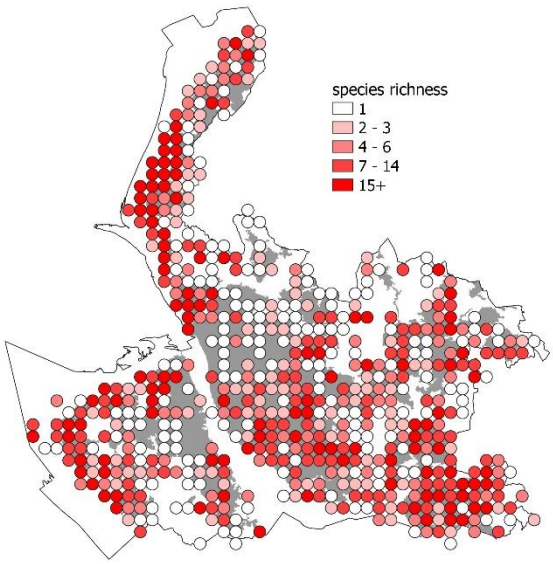


Figure 82: 1km distribution of species richness for BWARS and HRS selected species.

Pollinator species are highly susceptible to climate change with many species already increasing their ranges in a northerly direction in response to warming temperatures. Habitat connectivity and appropriate management are essential to enabling movement of these species.

To this end Defra produced the National Pollinator Strategy (*Defra, 2014*) and commissioned the conservation NGO Buglife to create a national network of 'B-Lines' to target pollinator habitat creation and conservation action. The current version was developed through stakeholder consultation and data review in 2020 and launched in early 2021 and forms part of the national evidence base for strategic pollinator conservation.

B-lines provides an opportunity to link up with a national pollinator network and this opportunity should be explored further through the Local Nature Recovery Strategy (see Figure 83).

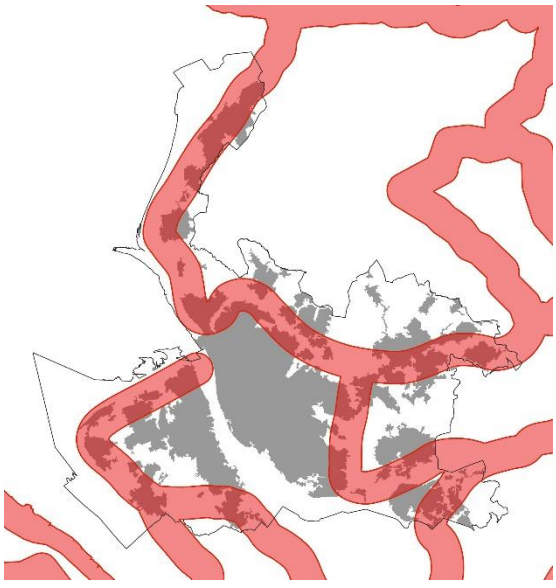


Figure 83: National B-Lines published as part of the national pollinator strategy for England.

N6: Social action for the natural environment

Headlines

- 270 people responded to the 'Engagement in Nature Liverpool City Region Survey' which aimed to help us understand people's social action and engagement with the natural environment in the Liverpool City Region (LCR).
- Over 40% of people who responded spend their daily free time outside in greenspaces.
- Over 50% of people are spending more time visiting greenspaces since the coronavirus pandemic. This finding agrees with national trends of 46%.
- Over 50% of people responding to the survey said that one of the main reasons for visiting greenspaces was to benefit their mental health.
- Of those 270 people surveyed, nearly 45% actively engage with local and national environmental groups in the LCR. Leaving 37% who are not part of an environmental group but still actively engage with the environment.
- Furthermore, almost 40% of people surveyed took environmental action at home i.e. wildlife gardening/ sustainable living.
- In the LCR the main reason for people taking action is their own personal interest and concern for the environment.
- Whilst volunteer numbers across many environmental organisations were significantly down in 2020/21 due to the coronavirus pandemic, the amount of people participating in BTO's Big Garden Bird Watch in Liverpool has doubled from 2020 to 2021.

About the indicator

Peoples engagement and appreciation of the natural environment is key to its protection. This indicator has two components: (a) people's engagement in the natural environment and (b) people's social action for the environment.

This indicator follows two national indicators (G4) Peoples engagement in nature, and (G5) people's engagement in social action. By measuring these two indicators it is possible to assess levels of engagement in the natural environment across the LCR but also how this translates into social action for the natural environment.

Why consider people's engagement in the natural environment?

To care for the environment and nature, people need to experience and appreciate it. This indicator will track changes in people's engagement with the natural environment. Spending time in the natural environment improves our health and wellbeing and this has become increasingly evident during the Covid 19 pandemic. However, even before there was a growing appreciation of the positive effect of experiencing nature has on lives, with a number of studies making this link and this has increasingly been taken forward into measures such as green prescribing through the NHS or green gyms promoted by The Conservation Volunteers (TCV) and Wildlife Trusts. In fact, in July 2020 the government announced a £4 million investment project aimed at preventing and tackling mental health through green social prescribing. By bringing individuals and communities together, through engendering a greater appreciation of nature, people learn to value and protect the environment.

By measuring these indicators, it is possible to assess the level of importance the residents of the city region place on their natural environment and how this is translated into action.

How have we assessed this indicator?

To assess this indicator data has been collated through a number of methods:

- The circulation of an online questionnaire to the residents of the Liverpool City Region and collation of results;
- Consultation with a number of national environmental organisations to obtain data on volunteer hours over the past two years i.e. BTO, TCV and National Trust;
- Consultation with a number of local environmental groups to obtain data on volunteer hours and participation i.e. Lancashire Wildlife Trust and Merseyside BioBank; and
- Collation of results from the Liverpool City Region Year of the Environment 2019.

National Outlook

The Governments 25 Year Environment Plan sets a target of:

'Making sure that there are high quality, accessible, natural spaces close to where people live and work, particularly in urban areas, and encouraging more people to spend time in them to benefit their health and wellbeing.'

Nationally, there has been an increase in the proportion of adults visiting the natural environment more frequently (see Figure 84). Around 90% of people agreed that natural spaces are good for their mental health and wellbeing (*Natural England, 2020*). The pandemic has highlighted the value of green spaces to the health and wellbeing of our local communities. Given the urban nature of much of our region this target is of particular relevance.

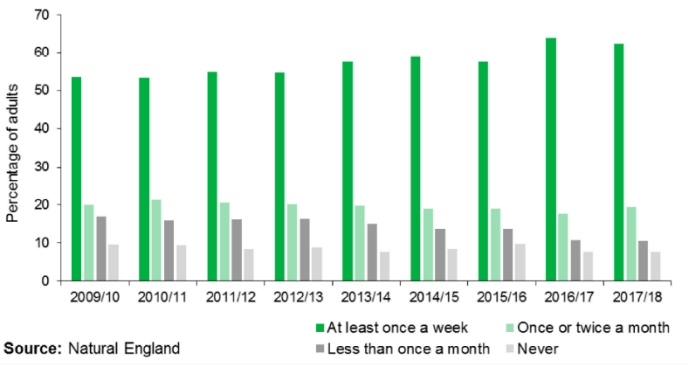


Figure 84: Frequency of visits to the natural environment in England between 2009/10 and 2017/18.

The proportion of adults visiting the natural environment at least once a week, increasing from 54% in 2009/10 to 68% in 2020/21. However, the proportion of the population never visiting natural environment has remained the same, indicating that more needs to be done to engage with these people and identify the potential barriers that are causing some of the population to not access the natural environment.

Volunteers play a vital role in helping to protect and conserve our natural environment. Between 2000 and 2016, the index of the amount of time contributed by environmental volunteers in England has increased by 35% (see Figure 85). It is estimated that around 7.5 million volunteer hours go into collecting biodiversity monitoring data every year (*State of Nature Partnership, 2019*). This biological data provides an evidence base that underpins conservation, decision making, forward planning and development throughout the Liverpool City Region so helping to conserve and protect biodiversity in our area.

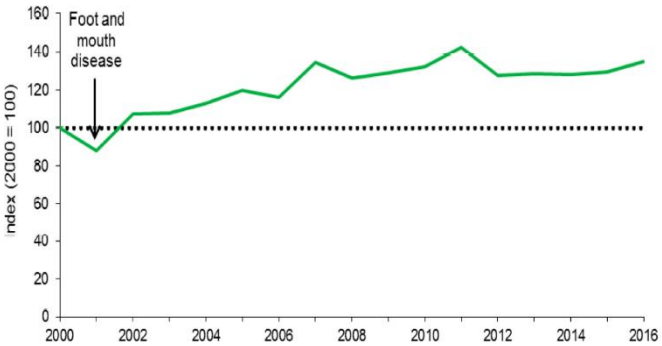


Figure 85: Volunteer time spent on the natural environment in England between 2000 and 2016. Frequency of visits to the natural environment in England between 2009/10 and 2017/18.

Source: Natural England

Liverpool City Region Outlook

Engagement in Nature Liverpool City Region Survey

To understand people's social action and engagement with the natural environment in the Liverpool City Region an online questionnaire was circulated with **270** people from varied backgrounds responding.

The survey focused on people's engagement with greenspaces and environmental social action. The results of the survey allow us to assess the level of importance the residents of the city region place on their natural environment and how this is translated into action. The key findings from survey are outlined below:

Over 40%
of people spend their
daily free time
outside in greenspaces.

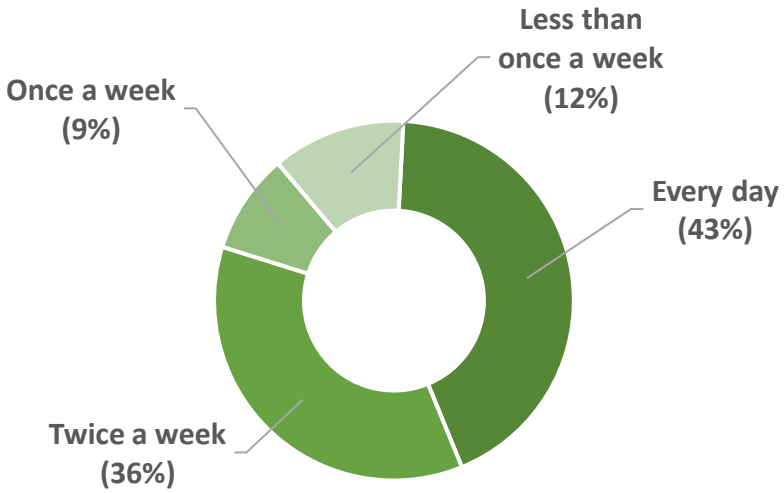
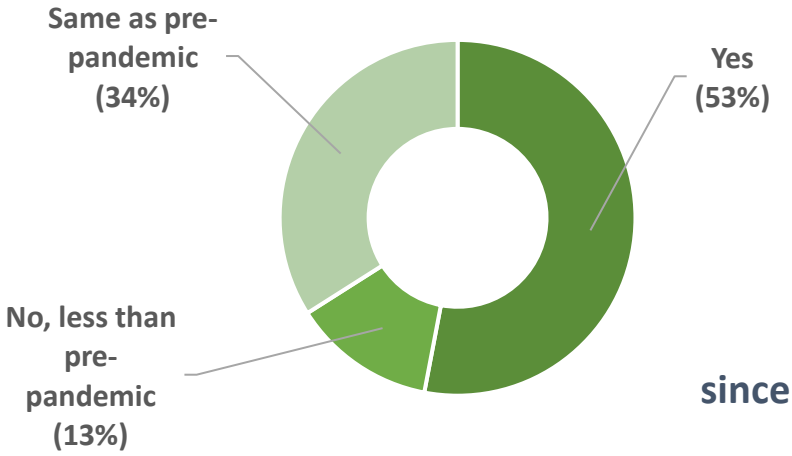


Figure 86: Results from the following question: 'On average how often have you spent free time outside in greenspaces?'



Over 50%
of people are spending
more time
visiting greenspaces
since the coronavirus pandemic.

Figure 87: Results from following question: 'Has the amount of time you have spent visiting greenspaces increased since the coronavirus pandemic?'

A recent study has found that depression, stress and anxiety were all higher during the pandemic period compared with usual population levels (*Jia et al., 2020*). The value of green spaces to the health and wellbeing of our local communities has been highlighted during the pandemic.

Over 50% of people

said that one of the main reasons for visiting greenspaces was to

benefit their mental health.

Nearly 45%

of people

actively engage with environment groups.

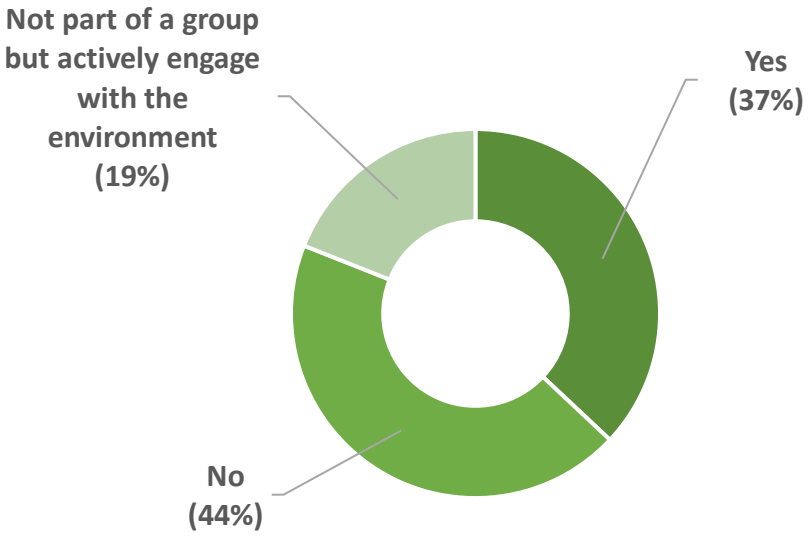


Figure 88: Results from following question which was asked as part of the 'Engagement in Nature Liverpool City Region Survey': 'Do you actively engage with an environmental group (s)?'

Of those 270 people surveyed, nearly 45% actively engage with local and national environmental groups in the LCR.

Additionally, almost 20% of people who are not part of an environmental group still actively engage with the environment on some level.

The survey found that the main reason for people taking action is their own personal interest and concern for the environment.

Almost 40%

of people

took environmental action at home

i.e. Wildlife gardening/ sustainable living

BTO Big Garden Bird Watch

The British Trust for Ornithology (BTO), run an annual bird counting event called the 'Big Garden Bird Watch', with results feeding into national monitoring on bird species. Last year's event saw record numbers of people enjoying nature and submitting bird counts across the country.

The same trend was true in Liverpool with the number of surveys submitted doubling between 2020 and 2021 (Figure 89).

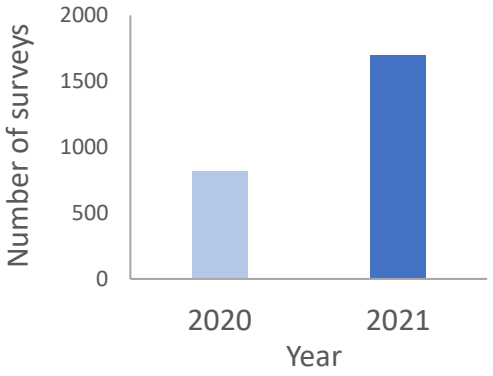


Figure 89: The total number of BTO Big Garden Bird Watch surveys submitted in 2020 and 2021 in Liverpool.

Figure 90 shows that the number of adults participating in the Big Garden Birdwatch more than doubled between 2020 and 2021. Although the number of children participating decreased significantly this was due to the pandemic which caused school closures affecting the number of children participating in this event. It is also likely to have affected children accessing other nature-based educational resources schools may provide.

More adults are participating in the Big Garden Bird Watch in Liverpool. This is likely linked to more of the population working from home and people's increased desire to spend more time in their gardens (*White et al., 2021*).

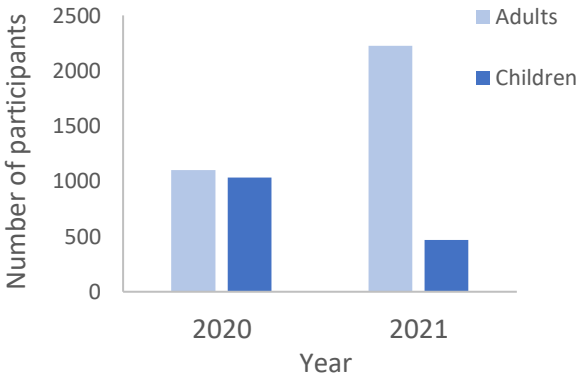


Figure 90: *The number of children and adult participants in the BTO Big Garden Bird in 2020 and 2021 in Liverpool.*

Volunteer engagement with local environmental groups

Volunteers are fundamental to the existence of many environmental groups. Volunteer activities can range from recording wildlife to litter picking and habitat management.

Before the pandemic, Lancashire Wildlife Trust had 115 volunteers contributing nearly 5,000 hours to various projects across the LCR, this fell by 64% to 1,725 hours in 2020 as seen in Figure 91.

Volunteer participation is slowly increasing back to pre-pandemic levels. However, volunteer numbers are still lower than usual across many environmental groups. This may be due to people's apprehension towards the social gathering nature of many volunteer events due to the ongoing coronavirus pandemic.

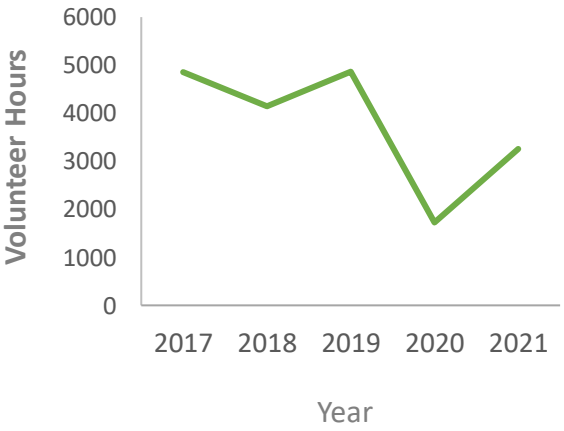


Figure 91: The number of hours volunteers have contributed to projects with the Lancashire Wildlife Trust in the Liverpool City Region across five years.

In total **174 volunteers** contributed **6,617 hours** during the financial year **2019/20** at **National Trust places** within the **Liverpool City Region.** The figures represent volunteering activity in conservation and environmental roles at Formby, Speke Hall and at our countryside places on the Wirral including Thurstaston Common, Heswall Fields, Caldy Hill and Harrock Wood.

In total **30 people** from The Conservation Volunteers (TCV) contributed **1,435 hours** during the financial year **2019/20** engaging in environmental volunteering projects across the LCR.

Merseyside BioBank manages over **2** million biological records made by nearly **18,000 observers** in North Merseyside. In total, office-based volunteers contributed around **2,000 hours** to projects such as record harvesting and habitat mapping.


Photo credit: LWT


Photo credit: Mersey Rivers Trust


Photo credit: National Trust


Photo credit: Anya Coffey


Photo credit: New Brighteners


Photo credit: Anya Coffey

Year of the Environment 2019

In 2018, the Government launched its 25 year plan for the environment, pledging that we would be the first generation to leave our environment in a better state than we found it (*HM Government, 2018*).

As part of the plan, 2019 was declared as a national Year of Green Action across the UK. The Liverpool City Region's Local Nature Partnership, Nature Connected, took the initiative, along with the Combined Authority, the Environment Agency and Natural England, to help deliver a Liverpool City Region focused Year of Action.

The Year of the Environment (YOE) 2019 was a year of green action across LCR where people from all backgrounds had the opportunity to get involved in projects which aimed to help leave a better environment for the next generation to inherit and make our area one of the best places in the country to live, work and flourish (*MEAS, 2020*).

Year of the Environment 2019 Highlights

- 580 events and activities with 1,000s people engaging;
- Over 1,700 pledges were made by partners, members of the public and organisations throughout the year:
  - 85.7% of participants actively followed their pledge;
  - Making a pledge had a positive impact on the individuals, with 71.4% of participants agreeing that it had made them more aware of their actions.
- Mersey Forest also held 40 tree planting events at schools, planting a total of 33,468 native broadleaved trees;
- £0.5m annual community environment project fund.

Discussion of N6 indicator

Millions of people across the UK love and care for the environment. The evidence gathered to assess this indicator show that people in the LCR place high value on nature, understand environmental issues and want to engage in environmental action.

Volunteers are vital to the existence of many environmental organisations and charities. Many people show their support by donating time as conservation volunteers. Whilst not a comprehensive figure of all environmental volunteering across the LCR, results show that across just four organisations, Lancashire Wildlife Trust (LWT), National Trust (NT), The Conservation Volunteers (TCV) and Merseyside Biobank, a total of around 15,000 volunteer hours was undertaken in 2019/20. Nationally the measure of this has increased by 46% since 2000 and it is estimated that around 7,500,000 volunteer hours go into collecting biodiversity monitoring data every year (*State of Nature Partnership, 2019*).

Thanks to the efforts of volunteers, contributing alone and in collaboration with citizen science projects, collecting vital ecological data, we have a better understanding of the state of our natural environment.

Benefits to wellbeing

The information gathered from our 'Engagement in Nature LCR' survey supports other evidence that shows increased engagement with nature significantly helped to support many people in maintaining their physical and mental health and wellbeing. This has been even more evident during the restrictions and stresses of living through the global pandemic.

A recent study found that depression, stress and anxiety were all higher during the coronavirus pandemic compared with usual levels (*Jia et al., 2020*). In 2020, around 9 in 10 people surveyed by Natural England agreed that natural spaces are good for mental health and wellbeing. More than 40% noticed that nature, wildlife, and visiting local green and natural spaces have been even more important to their wellbeing since the coronavirus restrictions began (*Natural England, 2020*).

In the LCR, over 50% of people responding to our online survey said that one of the main reasons for visiting greenspaces was to benefit their mental health. Once again, this result highlights the importance of greenspaces to the wellbeing of local people in our communities.

Increased recreational pressure

The results of the online survey show that LCR residents value their greenspaces with more time now spent in greenspaces and the coronavirus pandemic has served to increase this desire and appreciation. However, results of our questionnaire and national trends show that this pattern is not short lived with 50% of respondents stating

that time spent in greenspaces has increased since the pandemic and 90% will continue to access greenspaces more often in the future.

The increase in visitor numbers at many of our region's most important natural spaces indicates that there is unmet demand for outdoor recreation space locally. This has brought a number of environmental and land management issues to the fore as discussed in indicator N2 and as illustrated by scenes in the press of crowded beaches and the resultant litter at our region's most iconic coastal hotspots (*Liverpool Echo, 2021*).

Encouraging people to benefit from the great outdoors, whilst at the same time respecting and protecting nature, needs strategic planning in more suitable places for a range of outdoor recreation activities. The issue of recreational pressure has been recognised as a threat for our designated coastal sites by the LCR Local Authorities and as a result there is emerging LCR Recreational Mitigation Strategy.

Access inequality

Only 45% of adults in England living in the **most deprived areas** had **visited a natural space** in the last 14 days, compared to **68%** of adults in the **least deprived areas** (*Armstrong et al., 2021*)

Our findings and research from Natural England (*2020*) show that urban greenspaces such as parks, fields or playgrounds are the most frequently visited of all green and natural spaces. However, not everyone has equal access to greenspaces which could benefit their personal wellbeing. Research showed that socio-economic factors play an important role in who is visiting natural spaces, with adults on lower incomes, with lower education, the unemployed and those living in the most deprived areas making fewer visits. Figure 92 shows urban greenspaces in LCR.

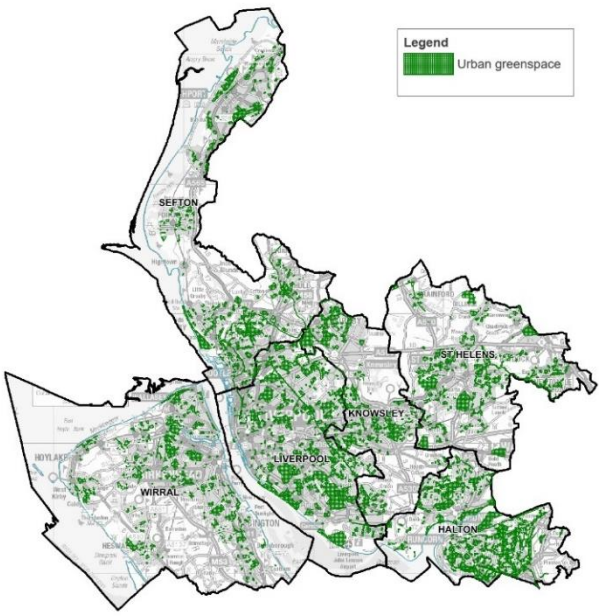


Figure 92: Urban greenspaces in the Liverpool City Region.

Liverpool is one of the most economically deprived regions in the UK. The English Index of Multiple Deprivation (IMD) 2015 shows that LCR is the most deprived Local Enterprise Partnership (LEP) area nationally. The level of deprivation varies between local authorities in the city region, with Knowsley and Liverpool being the most deprived and Wirral and Sefton the least. The most disadvantaged neighbourhoods are found in north Liverpool, south Sefton, east Wirral, north and central Knowsley, central St.Helens and east-central Halton (*State of Liverpool City Region, 2016).* However, more research is needed to identify gaps in greenspace provision, quality and accessibility in the LCR.

N7: Invasive species

Headlines

- A high proportion of GB Invasive non-native species (INNS) have been detected within the LCR.
- The number of INNS occurring in the LCR is increasing in our terrestrial, marine and freshwater environments.
- There is currently little coordinated control which could lead to costly remediation in the future.
- Some sensitive habitats are being increasingly degraded by INNS and native species.
- Opportunities for Citizen Science monitoring to deliver joined up and collaborative, targeted control.
- Climate change is likely to continue to increase opportunities for new INNS.
- The diverse nature of the marine, freshwater, terrestrial interfaces in the LCR present particular challenges and opportunities in the tackling of INNS.

Why consider invasive non-native species?

Invasive non-native species (INNS) include species that have arrived in the UK by accident or introduction and have escaped into the wild where they have or are likely to become established. These are a subset of non-native species, many of which are present in the UK but are not known to be damaging to native ecology. INNS species can have devastating impacts on native species and associated ecosystems which in turn can un-balance natural functions and become significant cost burdens on the local and national economy both through direct and indirect damage and through necessary control.

"The cost of INNS in GB is at least £1.7 billion per year. Much of this cost is borne by the agriculture and horticulture sector, but many other sectors, including transport, construction, aquaculture, recreation and utilities, are also affected. Japanese knotweed alone is estimated to cost the British economy around £166 million per year."

INNS can occur in all habitats within the UK and have been arriving in the country for hundreds of years. However, due to climate change, increases in global trade and weakened native ecosystems these species are more readily able to both arrive in, establish and colonise (*Gaertner, et al., 2017; Ricotta, et al., 2009; Thompson and McCarthy, 2008*).

Long established and current invasive species include the likes of Feral Cat (*Felis catus*), Brown Rat (*Rattus norvegicus*) and Grey Squirrel (*Sciurus carolinensis*) all of which have well evidenced large-scale impact on native species. While more recent arrivals such as the Harlequin Ladybird (*Harmonia axyridis*) have shown that such threats remain a current concern.

This section aligns to the national UK Biodiversity Indicator B6 pressure from invasive species.

How have we assessed this indicator?

This indicator was assessed using the species outlined in the national indicator. Data were provided from a range of sources largely comprising records from Merseyside BioBank and Cheshire rECOrd. Records were mapped at a 1km resolution to produce a 'richness' heatmap showing the highest densities and therefore pressures of invasive species on the natural environment. Species were then broken down and assessed by broad environment and colonisation rates inferred using occurrence in the region. The review of mapped richness was carried out alongside a literature review of existing subject material available. Data were not considered sufficient to attempt to apply the multi-species statistical analysis in the case of this indicator.

National Outlook

"The prompt eradication of the extremely invasive water primrose in Great Britain, for example, is estimated to provide a cost saving of approximately £240m compared to late stage eradication."

The UK 25 Year Environment Plan underpins the need for action as part of a wider remit for enhancing biosecurity, enhancing the natural environment and protecting the economy (*HM Government, 2018*).

To deliver action on INNS in Great Britain the 'Great Britain Invasive Non-Native Species Strategy' exist to monitor arrivals and their impact; improve awareness and understanding of the impact of INNS; develop a strong collaborative approach based on shared responsibility between national and local stakeholders and provide guidance for the effective control and eradication measures. Currently there are 3,248 assessed non-native species present in the UK (*UKCEH, 2021*) with over 10 new arrivals each year. 10% of non-native species arriving in the UK are thought to have damaging ecological and economic impacts (*GBINNSS, 2015*) and their control has been shown to be effective at preserving native communities (*Bradley et al., 2019*).

INNS occurring along 10% or more of Britain's land or coastline have increased over the period 1960-2020 likely increasing pressure on native species and ecosystems. The terrestrial, marine and freshwater native groups have been assessed as deteriorating over the long-term (*Defra, 2021*).

Liverpool City Region Outlook

Of the 194 ecologically damaging invasive and non-native species listed under the UK biodiversity indicator (B6) a significant amount; 91 (84%) terrestrial, 21 (45%) freshwater and 12 (31%) marine have been observed as present within the LCR.

These include a wide range of species some of which are long term established and widespread others more recent arrivals. Freshwater and marine INNS are likely to be under represented in the data due to substantially less recording effort, difficulty in recording those habitats and a higher level of skill required for their identification.

Based on available data the highest number concentrations of invasive species are seen to occur in and around urban centres with particularly high concentrations in South Liverpool, central St.Helens, North West Wirral, Runcorn and Formby (Figure 93).

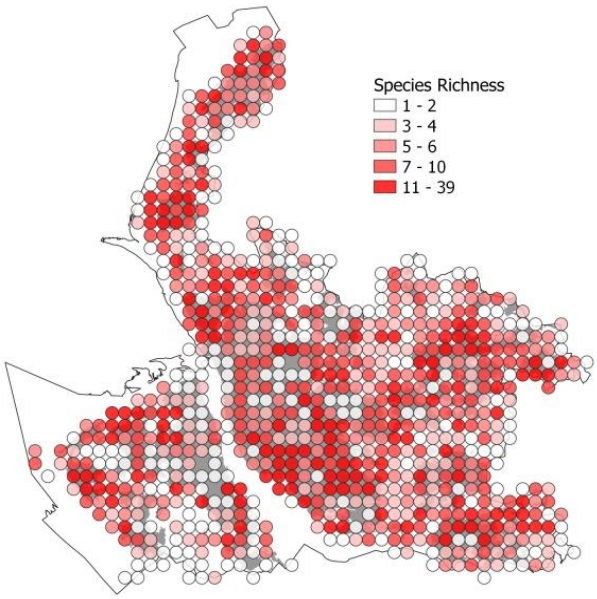


Figure 93: 1km distribution of invasive non-native species richness and by extension the greatest pressures on native ecosystem.

It is perhaps unsurprising that these urban/nature interfaces should be the front line of invasive non-native species incursions as many of these species are the results of escapes, deliberate release or poor biosecurity measures.

Urban heat effects are also likely to provide opportunities for non-native species to successfully colonise ahead of an already warming climate. At the same time natural ecosystems may be weakened by urban pollution, recreational pressure and other human effects meaning species are less able to resist or recover from the arrival of these more competitive Intruders.

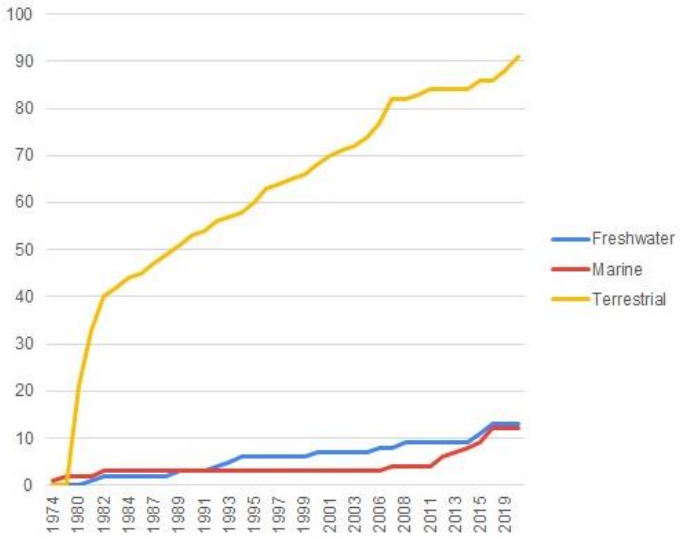


Figure 94: Arrival of INNS in the LCR by generic group. Shows cumulative arrival without local loss. Pre-1980 not included for terrestrial.

Terrestrial

The long term and widespread presence of some of these species continue to have negative impacts on native species ecosystems and cause economic damage (e.g. Grey Squirrel) (*UNEP-WCMC, 2010*). Other species found locally are perhaps more readily recognised as economically and ecologically damaging such as Japanese Knotweed (*Fallopia japonica*), dangers to human health Giant Hogweed (*Heracleum mantegazzianum*) or damaging to biodiversity Harlequin Ladybird.

Within the LCR some species can be considered particularly invasive where they occur within sensitive ecosystems such as the Sefton Coast. Sea Buckthorn (*Hippophaes rhamnoides*) is not listed as INNS under national legislation however, it's is having an enormous negative impact on coastal dunes, flora and fauna. Similarly, Japanese Rose (*Rosa rugosa*) is widely sold and planted but results in stabilisation of the coastal dunes and loss of specialist species diversity. Sensitive habitat such as dune systems are particularly vulnerable with recent recording detecting 24 INNS and an additional 14 native species demonstrating invasive characteristics (*Smith, 2020*).

This is despite legislation and guidance being produced by government and the Non-Native Species Secretariat (NNSS) regarding the negative impacts of these species and the importance of effective control measures. Most species remain largely if not entirely uncontrolled in the natural environment.

Figure 95: The INNS Austrominus modestus not detected in Liverpool marina but found extensively in the wider marine environment.

Marine

Marine INNS are a concern for the LCR as a point of international marine trade. The ports and docks of Liverpool and the Wirral have the potential to provide points of arrival for species which can be transported on the hulls of ships or in ballast, gaining footholds in these areas or being distributed along the coastline by tidal forces (Figure 95; *Austrominius modestus* found at Crosby Coastal Park, 2021). In recent years there has been increasing awareness of the potential impacts of marine invasive and improved control measures established.

The North West has comparatively low established marine invasive species detected within sampled docks and while Liverpool was found to support a range of INNS these were not encountered at the levels elsewhere (e.g. Fleetwood). Notable fouling INNS included *Tricellaria inopinata* which is known to have a negative impact on native marine ecosystems as well as fouling marine equipment (*CABI, 2021*). However, due to ongoing trade and transport and a warming climate (*Stachowicz, 2002*) it is likely that these species will continue to colonise and an overall 17% increase in occupancy has previously been detected between 2015 and 2016 with other more damaging

socioeconomic INNS already having spread elsewhere in NW England (*NWWT, 2016*). It is also worth observing that while the rapid assessment of North West marinas did not detect some INNS they have otherwise been observed outside operational areas.

Relevant to the LCR are the previous NW IFCA Biosecurity plan 2014-2019 (*Temple, 2014*) and the NW Marine Plan (2021) which details the risks posted by marine INNS and up to date guidance for their control (*MMO, 2020*).

Freshwater

There is poor data on INNS for waterways in the LCR despite the region having significant freshwater resource in the form of canals, rivers and open reservoirs. However, due to the artificial nature and historic use of many of these resources (e.g. shipping, transport and industry) the establishment of INNS is likely. A study of the highly invasive Demon Shrimp (*Dikerogammarus haemobaphes*) found in the Leeds-Liverpool Canal demonstrate the ability of this species to rapidly colonise linked freshwater networks such as canal and river systems (*Johns T. et al., 2018*). This species has been shown to cause "measureable ecological impact" over the last 6 years of a national study into its spread and establishment (*Environment Agency, 2021*). Anecdotally, Zebra Mussel (*Dreissena polymorpha*) has been observed on several sections of the Leeds-Liverpool Canal at Bootle (*MEAS, per comms, 2021*).

The Environment Agency (*2021*) has also demonstrated that freshwater INNS occurrence coincides with negative condition assessments of all habitats (Table 11).

Table 11. Percentage of all water bodies in England with significant INNS presence (*Environment Agency, 2021*).

	River	Lake	Transitional	Coastal	Total
High	0%	n/a	n/a	0%	0%
Good	13%	24%	15%	42%	17%
Moderate	28%	23%	55%	59%	28%
Poor	31%	48%	100%	100%	33%
Bad	32%	20%	50%	n/a	32%
Within all water bodies	27%	26%	48%	52%	27%
Within water bodies at less than good	29%	26%	55%	60%	29%

Less than 1% of LCR main rivers are in good ecological status and 25% are in poor/bad ecological status (see indicator N1) suggesting that they are vulnerable to the establishment of INNS.

To address the lack of information relating to INNS in the freshwater environment there are opportunities to develop innovative monitoring techniques such as the use of eDNA. An approach supported by the Environment Agency (2021) and already being tested and used as an approach in the region (Mersey Gateway Environment Trust; Mersey Rivers Trust).

Conclusion

This inaugural State of Nature report for the Liverpool City Region (LCR), has for the first time, brought together data about the state of our natural environment. This State of Nature report seeks to provide an environmental baseline for the LCR to inform the Spatial Development Strategy (SDS) and an ambitious strategic policy approach to shape local nature recovery for future generations.

The State of Nature report is evidence and data led and has assembled primary and secondary data derived from a wider range of sources. Where data have allowed we have produced trend analysis to facilitate assessment of changes in protected sites, habitats and species as well as public engagement in the nature and ecosystem service provision. **The trends however, are clear, they show that biodiversity within the LCR is in a state of decline and urgent action is required**. The report makes a number of recommendations (Part II) to halt this decline through local nature recovery and to inform SDS policy, which we request the LCR Combined Authority consider and adopt.

It is intended that this State of Nature report is the first of many reports for the LCR as a robust approach to measuring nature recovery within the LCR. This is essential as we progress towards reversing the climate and ecological emergency.


Photo credit: Anya Coffey

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Appendix 1: Data, Methods and Limitations

The State of Nature (SoN) report is evidence and data led. In following an approach reliant heavily on manipulation and analysis of national and local secondary data it is important that data used, limitations and methods are transparent and replicable. Methods follow best practice and draw upon local expert knowledge and publications wherever possible. Species data has been sourced from Local Record Centres (LRCs), Merseyside Biobank and Cheshire rECOrd to ensure coverage of the Liverpool City Region (LCR).

This technical appendix builds upon information provided in the indicator section of the SoN report. Full detail of data, methods and limitations are set out below by SoN report indicator N1 to N7. Note: methods relating to species indicators N3, N4 and N7 are similar therefore are discussed together to avoid duplication. A **reference list** is also provided setting out sources of information used in Part I.

N1 Habitat extent and status

Data and Limitations

Indicator N1 relates to **quantity**, **quality** and **connectivity** of habitats. In this section we draw heavily upon local habitat data. Whilst National Vegetation Classification (NVC) survey data is available and, in some cases, more recent than Phase 1 Habitat Survey; coverage is generally site or coast-based e.g. Sefton Coast with limited continuous classification of terrestrial areas. Given the strategic nature of the SoN report, the decision was taken at an early stage to use Phase 1 Habitat Survey data as the baseline as this provides more complete and higher level coverage of the LCR. However, NVC survey has been used, notably in the 'Sefton' section of indicator N1 and future iterations of the report may seek to draw on this data further to facilitate trend analysis.

Table 1: Age of Phase 1 Baseline

District	Date	Method
Halton	2006	Field/Desktop
Knowsley	1996-98	Field
Liverpool	2000 and 2006	Field/Desktop
Sefton	1999-00	Field
St. Helens	1999-00	Field
Wirral	c.1981	Field

Phase 1 Habitat Survey data in the LCR is imperfect. Limitations are associated primarily with agedness of survey, coverage of coastal/intertidal areas and inconsistencies between survey across districts e.g. recording of linear habitats. However, these datasets are derived from field-based habitat survey methods, and despite limitations, are considered best available data for the purpose of quantifying extent and change of habitats in the LCR.

Habitat loss is measured against a baseline derived from district level Phase 1 Habitat Survey data (c.1981-2006) see Table 1. Historic habitat trends i.e. pre-1980 are not quantified as no data is available.

Phase 1 Habitat Survey undertaken in the 1980s for all districts (excluding Halton) is available as scanned maps. Merseyside Environment Advisory Service (MEAS) and Merseyside BioBank as part of the data collation phase for the SoN report digitised a significant part of this survey to facilitate habitat trend analysis. This was a substantial task. However, due to inconsistencies between the survey coverage and scope, meaningful habitat change could not be readily identified at an LCR or district level. Therefore, alternative methods were adopted. Nonetheless, this habitat data provides a useful snapshot in time and future iterations of the SoN report may benefit from this resource which is held at Merseyside BioBank.

Alternative sources of habitat information such as the LCR Natural Baseline habitat asset register were also considered. This data is largely based on OS MasterMap Greenspace data which has a high level of spatial accuracy. However, this is topological survey and aside from woodland which is typically well recorded, habitat classifications for wetland, heathland and grassland are generalised, patchy and do not follow habitat survey methods (e.g. Phase 1 Habitat Survey, NVC or UKHab). Therefore, given the natural environment remit of the SoN report and indicator N1, it was determined that Phase 1 Habitat Survey data provides the best available habitat baseline at this time.

It should be noted that direct comparison between habitat areas (measured in ha) of LCR Natural Baseline habitat asset register and Phase 1 Habitat Survey baseline is not possible. This is due to differences in geographic coverage and survey methods. Table 2 of indicator N1 section however does account for this to a degree, by providing percentage coverage figures for the LCR area by broad habitat type.

To maintain a strategic approach and be comparable with national trends, data is typically presented at broad habitat type level. However, case studies and discussion does consider individual habitats where appropriate. Table 2 below show the Phase 1 habitat type codes included in each broad habitat type category.

Table 2: Broad Habitat Types Defined

Broad Habitat Type	Phase 1 code
Arable	J1.1
Improved Grassland	B4
Grassland (unimproved, semi-improved & marshy)	B1, B2, B3 and B5 (including sub codes)
Heathland	D1 to D6 (including sub codes)
Wetland	E1 to E4, F1, F2, G1 and G2 (including sub codes)
Woodland	A1 to A4 (including sub codes)

Broad habitat types comprising highest distinctiveness habitat are discussed. Arable and amenity grassland are also included as they form a significant area of the LCR, provide habitat for farmland species (arable) and suitable alternative natural greenspaces (amenity grassland).

Remaining habitats of lower nature conservation value or those which have inconsistent coverage in the baseline habitat data (e.g. coastal/intertidal) have been omitted from broad habitat type analysis. It should be recognised therefore analysis is of broad habitat type only and not all land cover in the LCR is included due to data limitations.

Methods

Using Geographic Information Systems (GIS) and built area data taken from Ordnance Survey MasterMap (2020) an area and percentage loss has been calculated for broad habitat types found in the LCR. As noted above, some coastal, urban and all intertidal

habitats are omitted due to data coverage inconsistencies in the Phase 1 Habitat Survey baseline. This includes the Sefton Coast and the 4 estuaries: Ribble, Alt, Mersey and Dee which is a notable limitation.

In order to calculate area, point and line data including target notes and linear habitats was omitted. Analysis of hedgerow and watercourses is considered separately (district summaries) under indicator N1 where data allows. Phase 1 habitat polygons for each district were extracted and their areas summed by broad habitat type.

Then using MapInfo Professional (v15.0.3) 'erase' tool, habitat was removed from the Phase 1 habitat data where polygons overlapped the following OS MasterMap built area data:

- Buildings_poly; and
- Other_poly. This layer was subject to SQL query 'make' = 'manmade' which queried out sealed surfaces such as car parks from areas of natural greenspace.

The area of the polygons 'lost' i.e. overlapping the above built area data layers (see Figure 1 below) was then recalculated using SQL area (ha) function and summed.

This approach enabled a percentage and area loss figure to be calculated for each district and broad habitat type as presented in Table 2 of the SoN report.

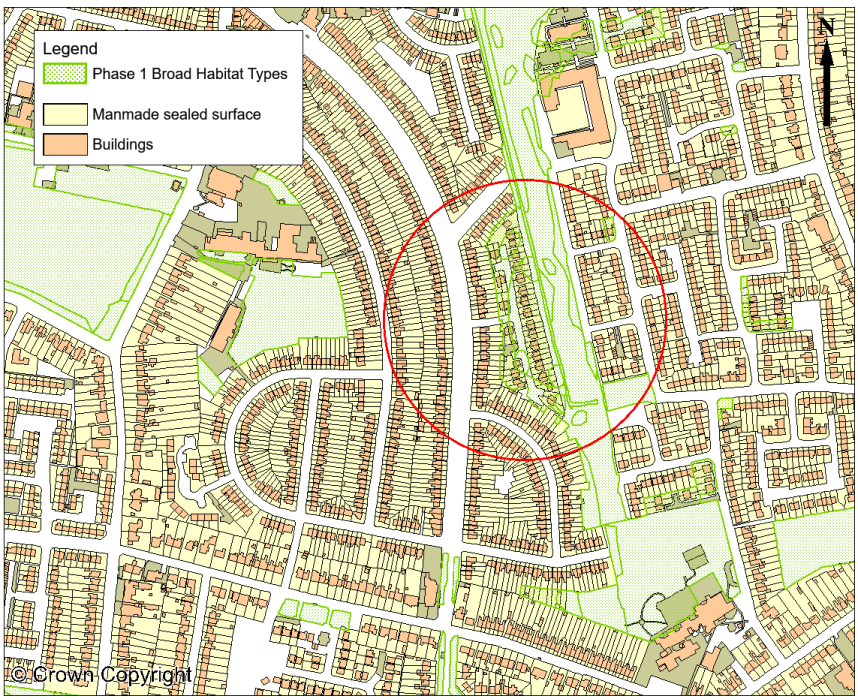


Figure 1: Habitat change mapping

This development-led approach to habitat change mapping was taken as loss or gain (see Figure 1) can be readily quantified and measured. Habitat changes as a result of non-development impacts e.g. climate change and invasive species are more difficult to measure due to gaps in data.

However, non-development impacts are considered under indicator N1 and other indicators e.g. N2 and N3 in the SoN report through interpretation of secondary data and case study information. Therefore, this is not considered to be a significant limitation.

Habitat Creation

The above method does not account for habitat creation, management or condition. Habitat creation data is very limited at an LCR level except for woodland plantation data collated by the Mersey Forest (TMF). Data provided by TMF for hectares of woodland planted in the LCR between 1990 to 2021 was subtracted from the woodland area loss in Table 2 of indicator N1 section to give an area gain value (ha) since the baseline year. Percentage change was then calculated.

Habitat Quality

Data on habitat quality is very limited and typically recorded at designated site level. Therefore, whilst we have data on condition of sites (see indicator N2), no data is available at a habitat level.

For this indicator it has only been possible to report on river quality within the LCR (see Table 3 and 4 of the SON report). This section includes data on ecological status of main rivers derived from Water Framework Directive monitoring obligations. This data can be accessed and extracted from the Environment Agency's online Catchment Data Explorer. Data currency for LCR waterbodies is available for 2015 and 2019. From this using the total number of waterbodies (includes main rivers and canals) in each catchment the percentage in good, moderate, poor and bad ecological status was calculated.

Habitat Connectivity

Analysis of habitat connectivity and species movements through the landscape at an LCR level is limited. The LCR Ecological Network and Nature Improvement Area, approved by Local Planning Authorities in November 2015 is used as a proxy for habitat connectivity for the purposes of indicator N1. It is acknowledged that further refinement of this is needed e.g. modelling of species movements and this is expected to come through the Local Nature Recovery Strategy process.

The LCR Natural Capital Baseline (*Holt et al., 2021*) led by Liverpool John Moores University has recently produced opportunity mapping for woodland and other broad habitat types. This data and method is undergoing verification therefore it was considered premature to use these outputs for the SoN report. We anticipate these opportunity maps will however be used as part of a suite of evidence to inform a Local Nature Recovery Network for the LCR.

N2: Designated Sites

This indicator relates to **extent** of designated sites on land, water and at sea and **condition** of those designated sites.

To assess this indicator, data has been collated from national and local sources.

Methods, data and limitations

Extent of Designated sites

Data on the extent of nationally and internationally designated sites (SPAs, Ramsars, SACs, SSSIs, NNRs) has been collated from mapped data available online from Natural England open data sources.

Local Wildlife Site (LWS) extent and boundary data is available locally and held by MEAS, Merseyside BioBank, Wirral Council, Halton Council and Cheshire rECOrd. This information has been collated to enable mapping and recording of LWS extent for this report.

Local and nationally designated sites have been mapped and displayed within the report. Total extent as well as percentage of the total LCR area has been calculated and presented.

Extent of all designated sites have been provided. However, trends in extent of designated sites over time have not been assessed within this report for the LCR. As this is the first SoN report, the extent of designated sites sets the baseline for future monitoring.

Condition of Designated Sites

Condition of designated sites has been provided where data is available. Complete condition data is available for SSSIs only. Nationally all SSSIs are subject to condition monitoring through the 'Common Standard Monitoring' which is undertaken and reported by Natural England and available online (*Natural England, 2021*). Condition monitoring data from this website was collated for the LCR to allow reporting within this SoN report.

Condition monitoring for SPAs, Ramsars and SACs is not available. However, as these sites are all also covered by SSSI designations, SSSI condition monitoring also provides information on condition of these internationally designated sites.

Trends in condition have only been possible for a sample of LWSs in LCR. LWS monitoring over the last ten years has been patchy across the LCR. Therefore a complete LWS dataset for all years and all sites is not available. No LWS monitoring

data is available for Halton and only partial LWS monitoring data is available for North Merseyside. Only Wirral complete regular monitoring and this is undertaken by volunteers and co-ordinated by Wirral Wildlife who themselves are a voluntary organisation.

Whilst, Wirral monitoring is regularly completed, Wirral LWS monitoring data is not collated together and therefore a complete Wirral LWS monitoring dataset was not available to allow trend analysis. Therefore, reporting on LWS condition trend relates to North Merseyside only.

Monitoring within North Merseyside was restarted in 2020 and collated into an annual monitoring report for the period April 2020 to March 2021 (*MEAS, 2021*). This annual monitoring was used to inform the SoN report. In addition, sites monitored in 2020 and 2021 were compared with previous monitoring data, were available. This allowed a comparison of site status over time. There was approximately 10 years between monitoring survey allowing for trend analysis of change to be undertaken albeit on a relatively small sample of site.

Data on the percentage of LWSs in positive conservation management was obtained through Defra Single Data list 160-00 reporting (*Defra, 2020*) . Local Authority data for the LCR was extracted and trends plotted within charts and presented within the N2 section of the report.

N3: Abundance of widespread species

N4: Protected/Priority species status

N7: Distribution of invasive non-native species, plant pests and diseases

Methods relating to species indicators N3, N4 and N7 are similar therefore are discussed together below.

N3 Abundance of Widespread species

Indicator N3 of the SoN report incorporates a summary of those species included within sections C5, C6, C7 and C8 of the UK Biodiversity Indicators. The UK indicators separate these sections by taxonomic group, whereas the SoN report has focused on taxon related by ecological sensitivity in the fashion of the UK State of Nature Report and other DEFRA analysis.

N4 Protected /Priority species status

This section broadly aligns with UK Biodiversity Indicators C3b (Status of UK species of European Importance) and C4b (Status of UK priority species – distribution).

N7 Distribution of invasive non-native species, plant pests and diseases

This section relates to UK Biodiversity Indicator B6 Pressure from invasive species and follows the same sub divisions covering Freshwater, Marine (coastal) and terrestrial species.

Data

Information used has been drawn from a range of sources. The majority of the analysis and review has been based on evidence drawn from literature review and the findings of prior publications (see 'method' below for more information on sources) or presented directly as case or species studies where appropriate.

In addition, there has been select implementation of modelling of multi-species indicators using the method applied in the UK Biodiversity Indicator method (see Multi-Species Indicator Modelling below). These species observations data have been gathered largely from the two Local Environmental Records Centres (LERCs), namely Merseyside BioBank and Cheshire rECOrd, and augmented with data from national schemes and societies where this was not already available (E.g. Amphibian and Reptile Conservation, Botanical Society of Britain and Ireland, Butterfly Conservation, Bat Conservation Trust).

Limitations

Access to Evidence

The primary limitation for this work was time available to collate, analyse and then interpret information. Particularly, as the focus of the work has been on a literature review. Accessing both raw species observation data and published literature involved an extensive trawl with limited time for additional stakeholder input. As such there are sources of information that have not been included. However, their addition would be unlikely to impact on the high-level recommendations of the report and indeed the difficulty in accessing these sources has resulted in recommendations around centralisation and better signposting for biodiversity evidence for the LCR.

Data were also collated from the Royal Society for Protection of Birds (RSPB) and British Trust for Ornithology (BTO) but following stakeholder feedback it was decided that local trend analysis of Birds was not useful.

Modelling

A core consideration in the formation of the report was that indicators should be as repeatable as possible. With regards to the species sections N3, N4 and N7 it was decided to employ the same statistical methods used in UK monitoring. Baysian

modelling to produce a multi-species occurrence index is scalable and the Biological Records Centre (BRC) statistical package is designed to handle the same types of opportunistic species observation data primarily available in the LCR via the LERCs. The innovative method is well structured and so would be easily repeatable.

However, application of the multi-species indicator (MSI) method was constrained by several factors; primarily time and expertise. While, the process itself is straightforward, understanding of the data and outputs requires an understanding of complex statistics and how they interact with the data. Furthermore, as a novel approach it required detailed explanation to stakeholders. Ultimately, this meant that following feedback on outputs for Birds which suggested trend analysis was not representative or considered in some cases misleading we decided to remove those outputs. Modelling outputs for plants however were considered representative and therefore have been retained.

Multi-species indicator modelling remains an area of active development and several organisations including statutory conservation advisors, national schemes and research bodies are currently working on methods to encourage and deliver local implementation in the next few years. By including this method in some early analysis here we are enabling future compatibility, comparison and potentially compliance as guidance in this area evolves.

Methods

Species selection

The focus of the analysis and trends is on species associated with a broad habitat type in order to align with the national methods and analysis undertaken for indicator N1. As such a sub-set of species were selected for trend analysis related to each broad habitat type. The UK Biodiversity Indicator species selection is undertaken by the appropriate national taxonomic expert group (e.g. Butterfly Conservation (BC) for butterflies; National Plant Monitoring Scheme (NPMS) for plants) with support from UK Centre for Ecology and Hydrology (UKCEH), DEFRA and the Joint Nature Conservation Committee (JNCC). These lists were used for each section to both ensure consistency with the national indicator sets and apply expert knowledge to the selection of species-ecosystem associations.

The list ultimately used within the Liverpool City Region analyses is a self-selecting subset of the national list. Any species not observed in our area would not appear on the list at all (though may appear in future iterations where range change occurs). Furthermore, where the species list was used to model trends the multi-species indicator pipeline removed species where there was insufficient data to detect a trend. This includes low numbers of site samples (poor spatial distribution of data) and exclusion of species that have poor temporal coverage (either scattered within the timeframe or only occurring in a few discrete years).

Literature review

The literature review has comprised the most informative aspect of the work on assessing broad species indicators for the LCR. The literature review accessed a range of publications including research papers, reports and analyses commissioned by statutory agencies and publications by local natural history organisations, notably including the Lancashire & Cheshire Fauna Society (see reference list). These sources include peer-reviewed expert opinions often based on primary data capture and analysis. These findings form a robust and critical component of the evidence brought together in these sections.

Through the use of species and case studies select species have been used where possible to illustrate trends relating to each indicator have been used as indicative key species. These illustrations have typically been provided by authors from local expert groups or individuals.

For example, while we lack meaningful Bat species observations for trend analysis an expert from the Merseyside & West Lancashire Bat Group (MWLBG) has been able to provide their own long-term structured surveys and analysis from hibernacula and site monitoring. Similarly, the Lancashire Wildlife Trust (LWT) authored a study of Red Squirrel populations and the Mersey WeBS group kindly provided extensive input on analysis and interpretation of Estuarine bird count data.

Trend analysis

Multi-species trend analysis is a powerful tool for conservation and monitoring and over the last decades the BRC and UKCEH have taken enormous strides adapting methods so they might be applied to opportunistically collected or mixed source biological records collected in the UK. These methods are now regularly applied at national scales by government and national recording schemes and societies and have been fundamental to the production of the national ‘State of Nature’ reports.

Such methods can be applied at any scale. However, there must be an understanding of the species and data being fed into the model as these selections will dictate how the output can be interpreted and used. For there to be confidence in the outputs there must also be a broad understanding and agreement of their application within the stakeholder community. This is the first application of these methods within the Liverpool City Region and as a novel approach the necessary support and engagement with the broad and diverse network of local natural history organisations was not available in the time available. As a result, modelling was applied in a very limited way on select indicators.

Where used the multi-species indicator was applied using RStudio (1.4) using the UKCEH developed R package ‘BRC indicators’ and associated workflow (*August, T. 2021*). For the LCR; data was clipped to the temporal range 1980 – 2019 as earlier data was far sparser while more recent information was incomplete. As above, species

lists from national indicators were used as these had already been informed by the national schemes and societies.

Given the timeframes available visualised individual species trends within the MSI have not been provided however these were produced as part of the MSI modelling pipeline and may in future be provided in greater detail once the method has been more comprehensively tested and greater feedback on its application received.

Mapping

A number of species and multi-species distribution maps have been included in the species sections. Technically these have been produced using fundamentally similar methods. Species observation data held in comma separated value files has been read into a QGIS (version 3.16) using the Field Studies Council (FSC) Tomorrow's Biodiversity project plugin (tom.bio productivity tools).

The plugin expedites the reading in of structured biological records and mapping at various scales. For the purposes of the report this was to either 1km or 2km grids. These atlas layers are then styled within QGIS to produce a choropleth map to visually aid in the interpretation of data (e.g. species density). Once mapped the newly generated GIS layer is presented within the QGIS software alongside contextualisation layers (urban background and administrative boundaries) as appropriate.

N5: Ecosystem functions of habitats and species

This indicator broadly aligns with national indicators:

- B6 Natural functions of water and wetland ecosystems;
- D7 Species supporting ecosystem functions.

The LCR Nature Capital Baseline tool provides a strong basis for ecosystem service assessment in LCR and underpins analysis of ecosystem function capacity in the SoN report.

The baseline has been developed by Liverpool John Moores University (LJMU) and will ensure the Liverpool City Region Combined Authority is well placed to embed a natural capital approach in policy and decision making.

Methods, Data and Limitations

Indicator N6 presents interpretation of various ecosystem service capacity maps and information prepared by LJMU and informed by *Holt et al. (2020)* and *Angers Blondin et. al* (*2021*). Full methods are available by request from LJMU who have undertaken the primary data analysis and modelling.

Mapping and interpretation of the following ecosystem services is included:

- accessible nature;
- air purification;
- carbon storage;
- carbon sequestration;
- local climate;
- noise regulation;
- water flow; and
- water quality.

As discussed under indicator N1 earlier, the baseline comprises a habitat asset register data derived principally from Ordnance Survey (OS) MasterMap Greenspace and Natural England Priority Habitat Inventory (PHI) data. OS data is topological survey which is spatially accurate. However, this does not follow habitat survey methods and generalises habitat classifications, notably for grassland, wetland and more complex mosaic / transitional habitats. The PHI data also has limited use at a site level due to generalisations of habitat classification.

The species section broadly aligns with UK Biodiversity Indicator D1c and includes a review of select Bees and Hoverflies.

N6 Social action for the natural environment

This indicator has two components: (a) people's engagement in the natural environment and (b) peoples social action for the environment. This indicator aligns with two national indicators (G4) Peoples engagement in nature, and (G5) people's engagement in social action.

By measuring these two indicators it is possible to assess **levels of engagement** in the **natural environment** across the LCR but also how this translates into social action for the natural environment.

Methods, Data and Limitations

To assess this indicator data has been collated from three sources:

- Engagement in Nature Liverpool City Region questionnaire.
- Sample volunteer hours from five environmental organisations; and
- A review of the 2019 Year of the Environment

Engagement in Nature questionnaire

Firstly, to understand people's social action and engagement with the natural environment in the LCR, a questionnaire was created using Google Form, a survey

administration software. The online questionnaire was entitled, 'Engagement in Nature Liverpool City Region'. It comprised of 15 questions, ranging from demographic to environmental focused.

The questions were adapted from the national 'People in Nature Survey' which gathers evidence and trend data through an online survey relating to people's enjoyment, access, understanding of and attitudes to the natural environment, and it's contributions to wellbeing. The online questionnaire was circulated through the LCR Combined Authority's general 'citizen' contact group and was shared through social media. The questionnaire was anonymised and in accordance with GDPR Regulations 2018.

The questionnaire received 270 responses between 13th August and 31st October 2021. The results were analysed in Microsoft Excel and pie charts produced. The main results from the questionnaire were included in the SoN report, and all results and outputs can be found in Appendix 2.

However, there are limitations with this method. The online questionnaire was shared by means of social media accounts. Social media accounts were restricted to permission granted by the authors of the report. This included Merseyside BioBank Twitter, Facebook and LinkedIn accounts and Liverpool City Region Year of Environment 2019 Twitter account, which combined have over 2000 followers. Sharing the 'Engagement in Nature Liverpool City Region' survey via these accounts to a predominately environmental audience may have produced bias in regards of the questionnaire's participants. However, this will have been limited by the majority of the questionnaire's participants coming from Combined Authority's general 'citizen' contact group.

Sample volunteer effort from environmental organisations

To obtain a sample of volunteer effort from national environmental organisations in the LCR, three organisations were consulted. Given the restricted timeframe available to collect data to support this indicator, only a limited number of environmental organisations could be consulted to provide data on volunteer effort.

These organisations were British Trust for Ornithology (BTO), The Conservation Volunteers (TCV) and the National Trust (NT). The NT provided data on number of volunteers and hours during the financial year 2019/20 at NT places within the LCR. The figures represent volunteering activity in conservation and environmental roles at Formby, Speke Hall and at our countryside places on the Wirral including Thurstaston Common, Heswall Fields, Caldy Hill and Harrock Wood.

TCV shared data on number of volunteers and hours contributed to environmental volunteering projects across the LCR in financial year 2019/20. Additionally, BTO provided data on participants of 'Big Garden Bird Watch' within Liverpool Local Authority area. The results of this BTO survey feed into national monitoring of bird species.

Furthermore, to obtain a sample of volunteer effort from local environmental organisations in the LCR, two organisations were consulted, including Lancashire Wildlife Trust (LWT) and Merseyside BioBank. LWT provided volunteer numbers and hours from 2017 to 2021 (until 31st August 2021) for different environmental and conservation projects across the LCR. These projects included Red Squirrel Project, Lunt Meadows Groups, Seaforth, Freshfield Dune Heath, Liverpool Wednesday Group and Individual volunteers. Merseyside BioBank provided data on total number of biological records held and number of volunteer observers who have submitted those records. Additionally, annual office-based volunteer hours were calculated for projects such as biological record harvesting and Phase 1 habitat mapping.

A review of Year of the Environment 2019

Finally, a review of the Year of Environment (YOE) 2019 was conducted. The YOE 2019 was a year of green action across Liverpool City Region where people from all backgrounds had the opportunity to get involved in projects which aimed to improve the environment. The highlights were taken from Year of Environment 2019: Year in Review (*MEAS, 2020*). These included number of events, environmental pledges and people engaging with YOE.

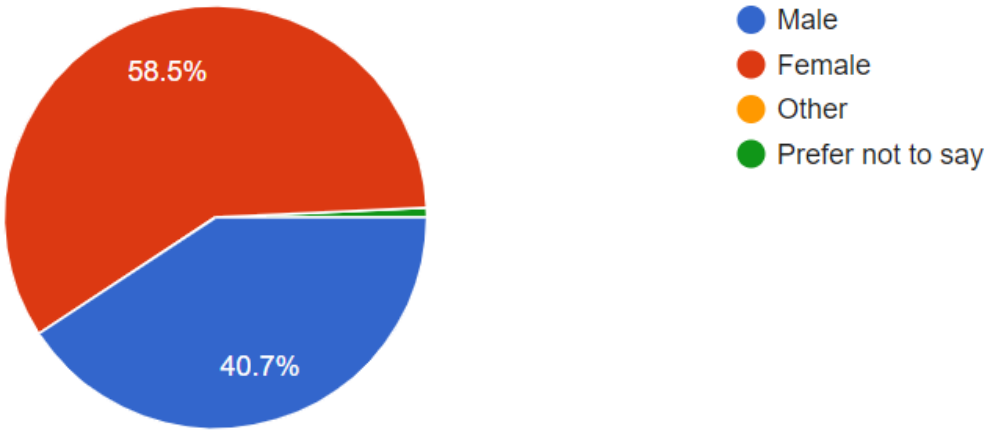
MEAS and Merseyside BioBank have endeavoured to follow best practice and present results in a transparent way. However, if you have any queries regarding data and methods used in this SoN report please contact us via: http://www.meas.org.uk/1314

Appendix 2: Engagement in Nature Liverpool City Region Questionnaire

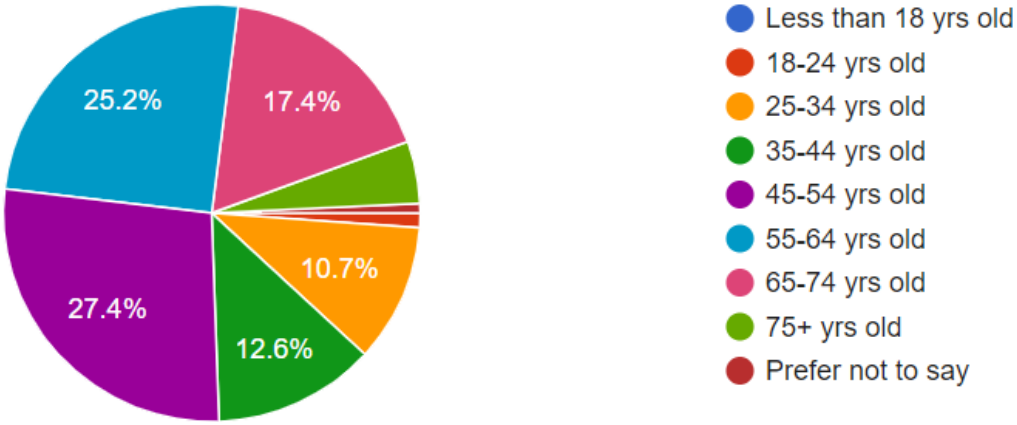
This technical appendix includes summary results of data collected to inform indicator 'N6: People's engagement in nature and social action for the environment'.

The online questionnaire, 'Engagement in Nature Liverpool City Region' comprised of 15 questions. A summary of 270 responses to each question are presented below:

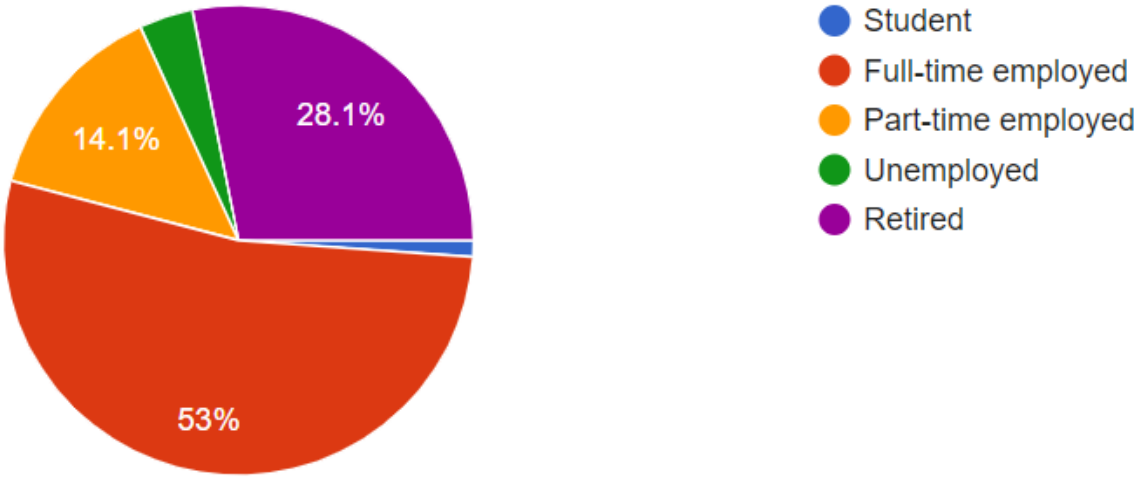
Question 1: What gender do you identify as?



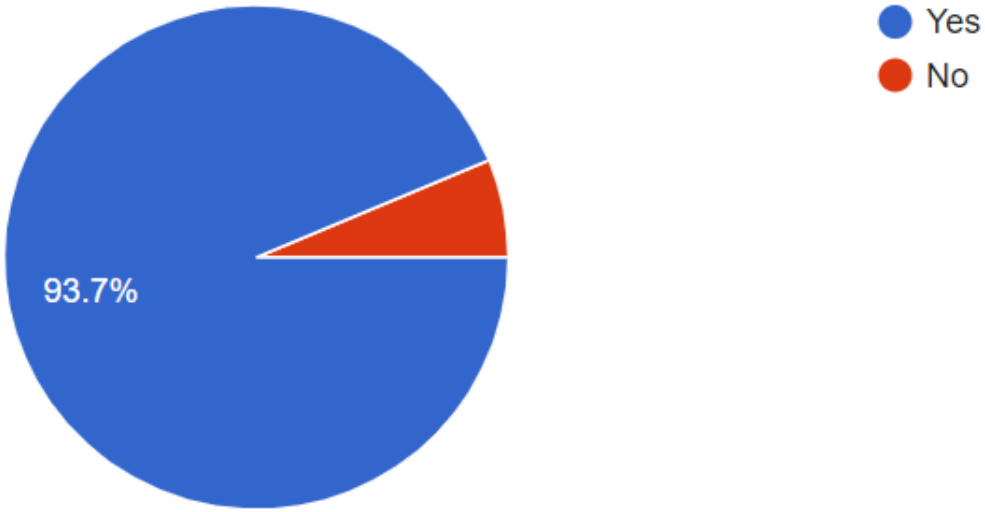
Question 2: How old are you?



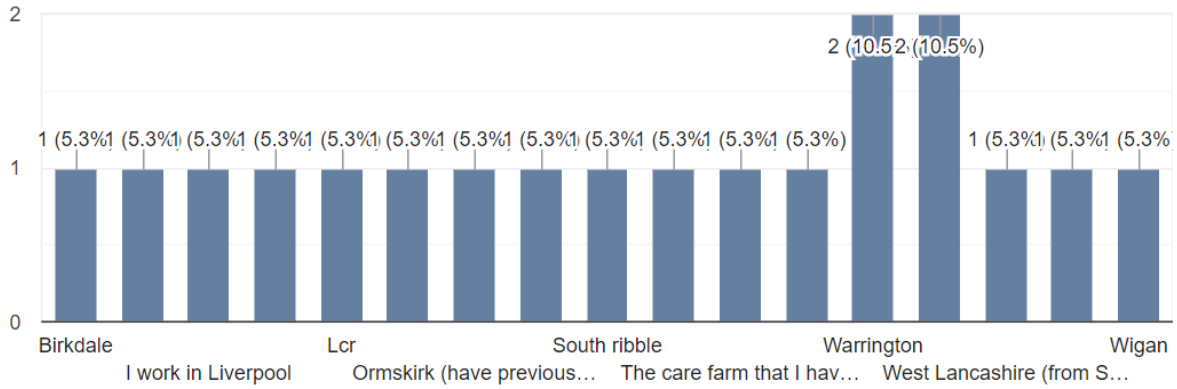
Question 3: What is your current employment status?



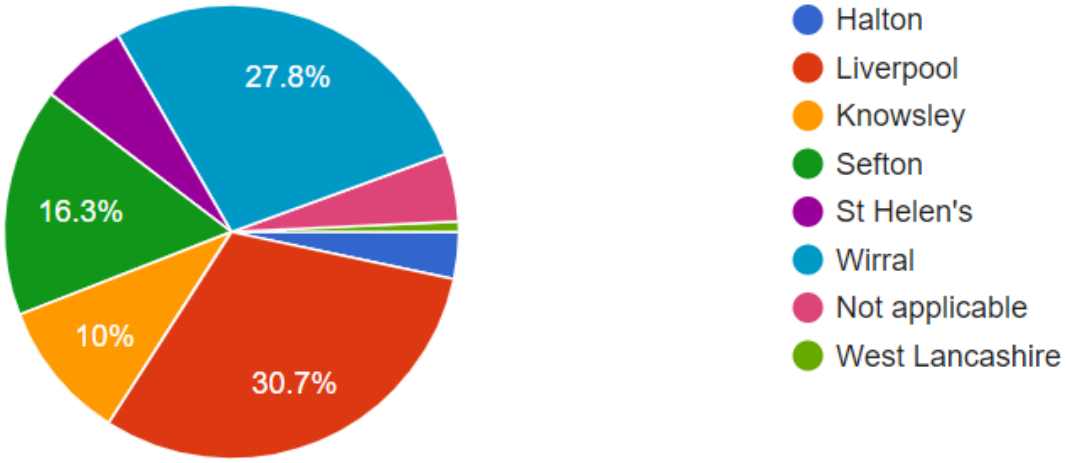
Question 4(a): Do you live in the Liverpool City Region (LCR)? The LCR comprises of Halton, Liverpool, Knowsley, Sefton, St Helen's and Wirral.



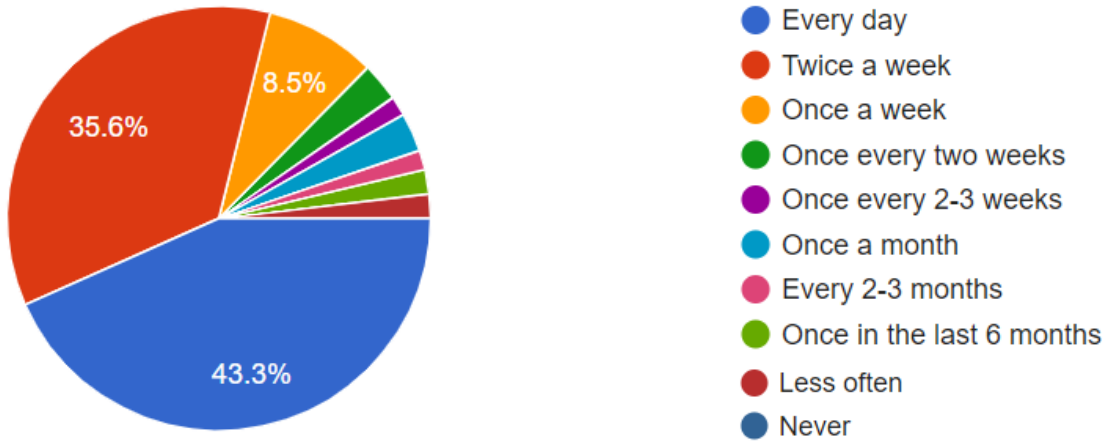
Question 4(b): If no, please specify below:



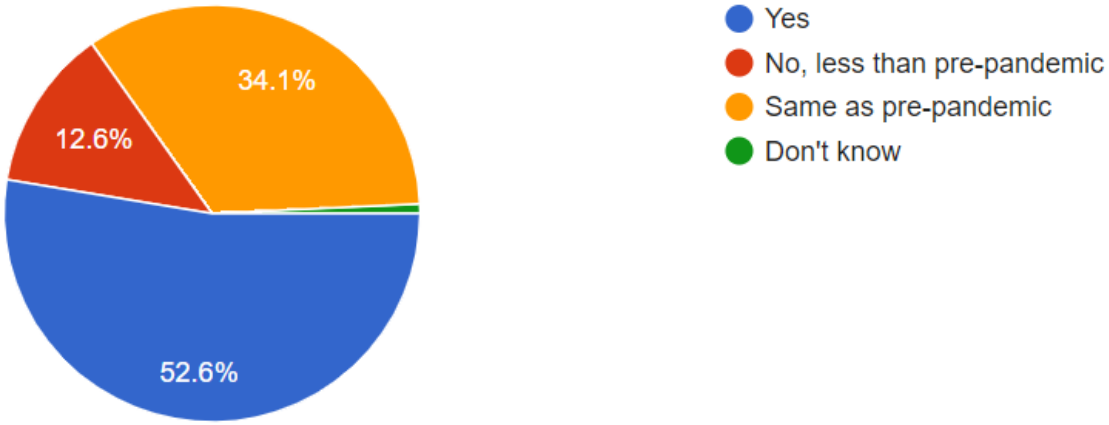
Question 4(c): If yes, which district do you live in?



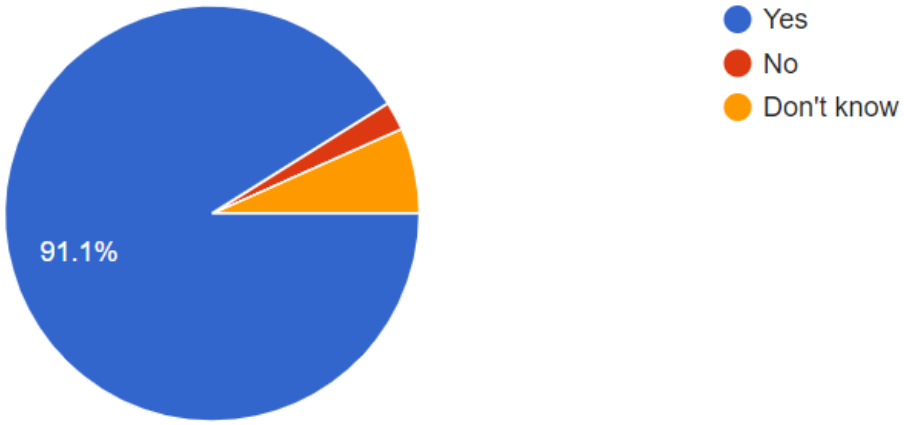
Question 5: On average how often have you spent free time outside in greenspaces?



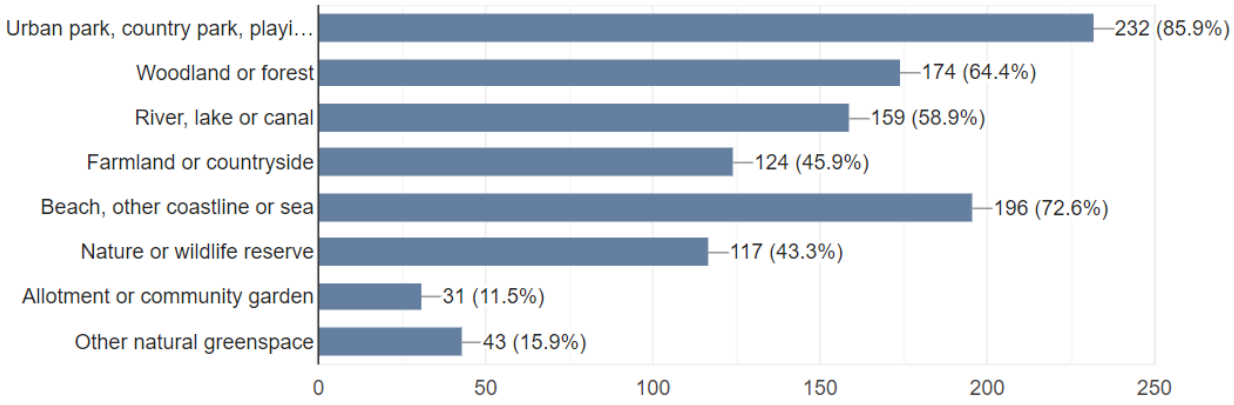
Question 6: Has the amount of time you have spent visiting greenspaces increased since the coronavirus pandemic?



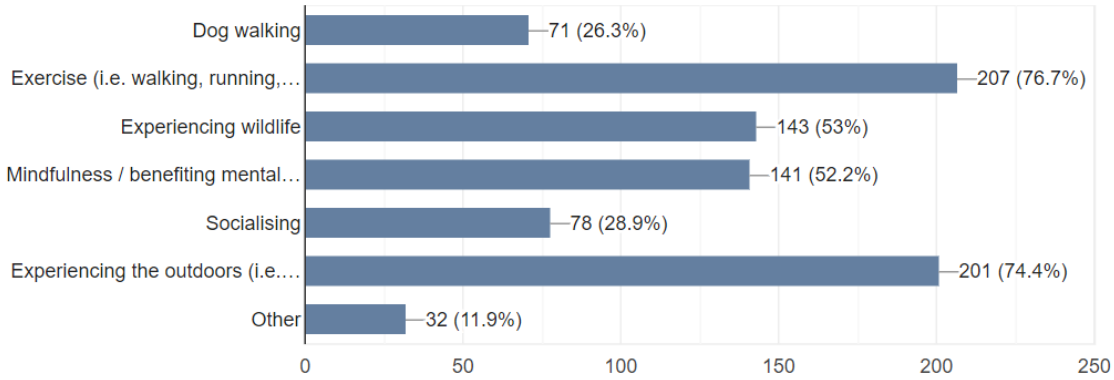
Question 7: Do you believe you will continue to visit greenspaces more often in the future?



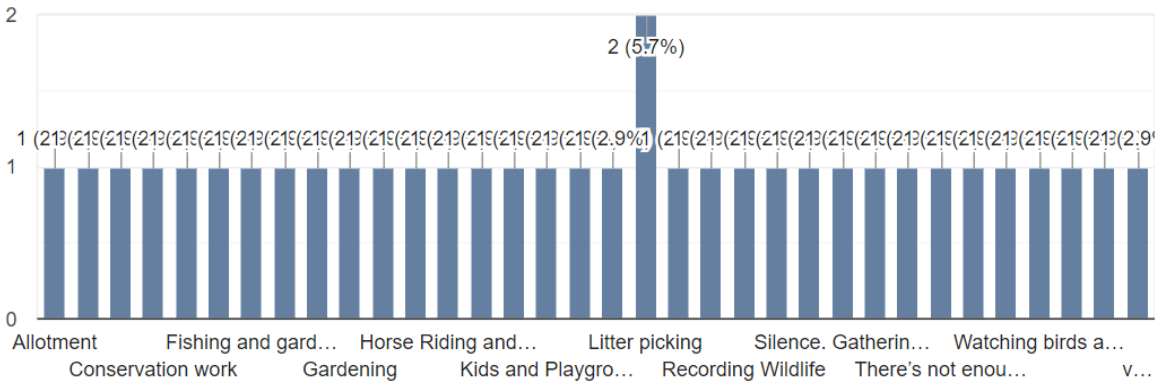
Question 8: Which of the following type(s) of greenspaces do you visit?



Question 9(a): Which of the following are your main reason(s) for visiting greenspaces?

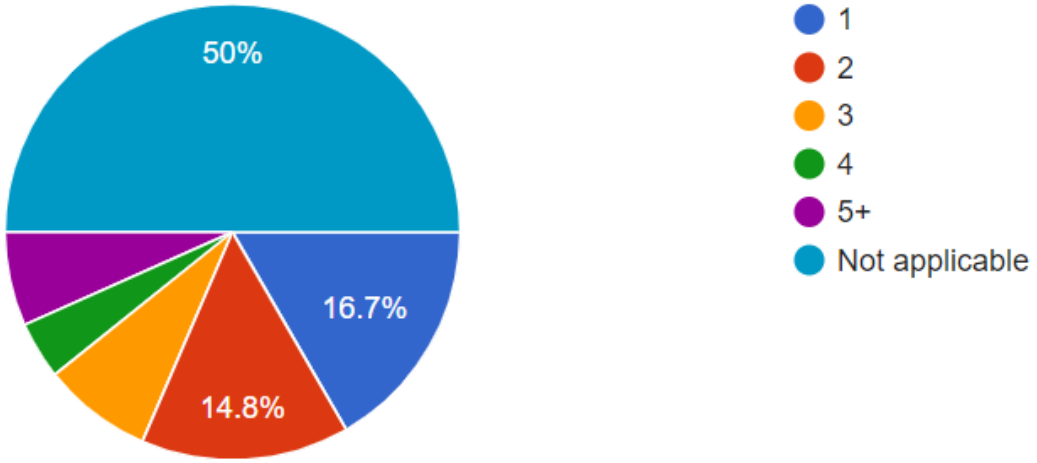


Question 9(b): If other, please specify:

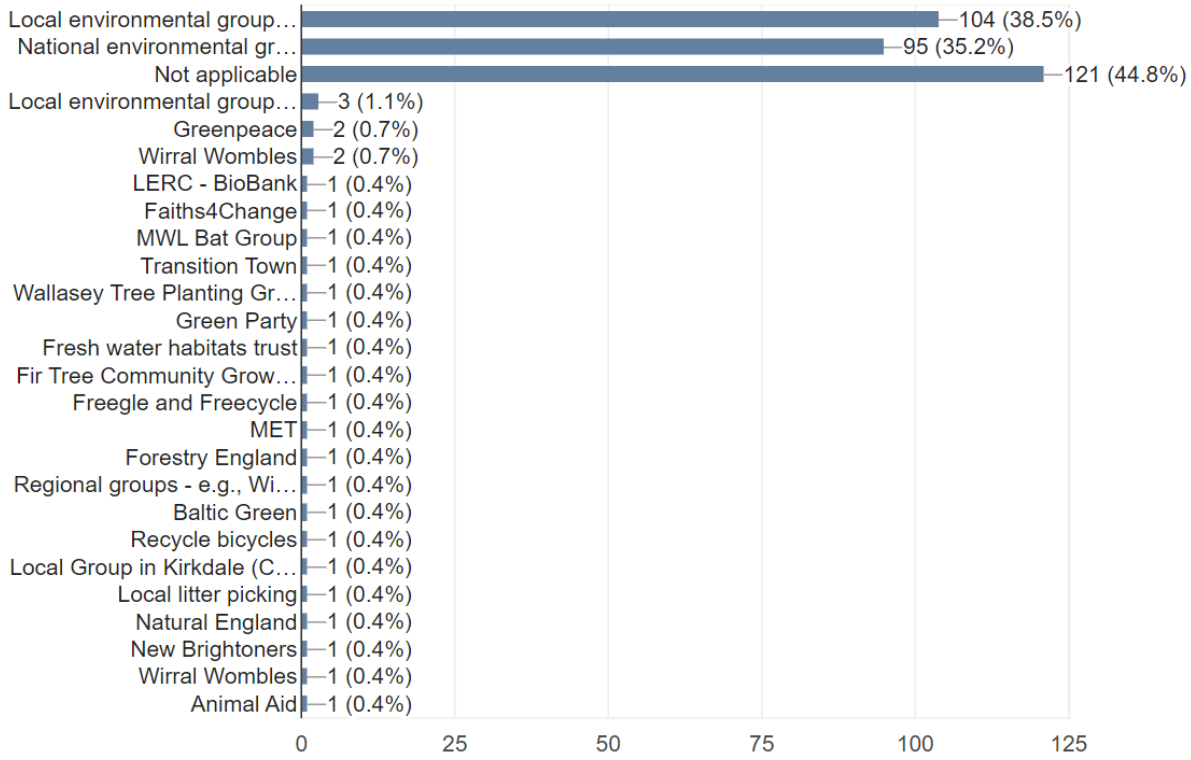


Question 10(a): Do you actively engage with an environmental group (s)?

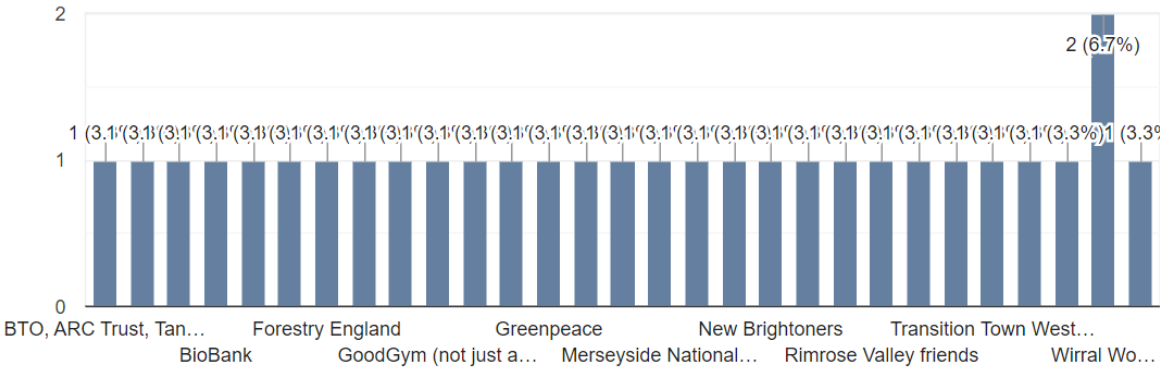
Question 10(b): If 'Yes', how many environmental group(s) do you actively engage with?



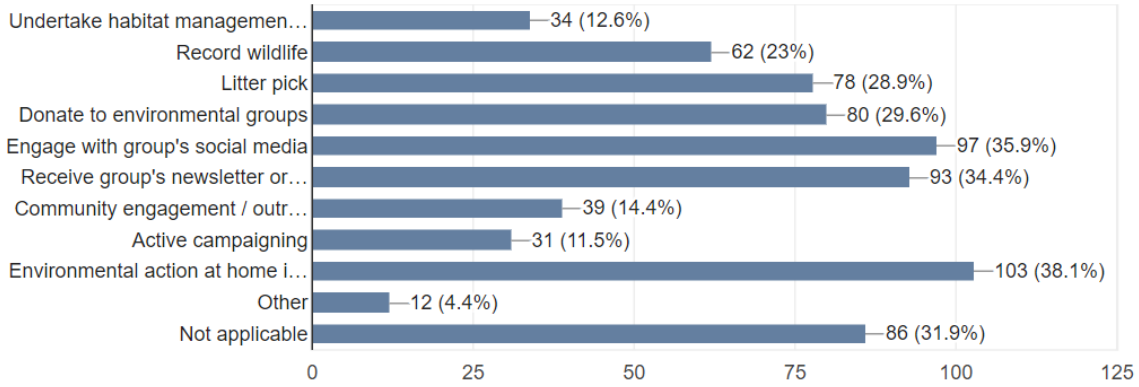
Question 11(a): What environmental group(s) do you engage with?



Question 11(b): If other, please specify which environmental group you actively engage with:



Question 12(a): How do you engage with environmental group(s) or take action on an individual level?

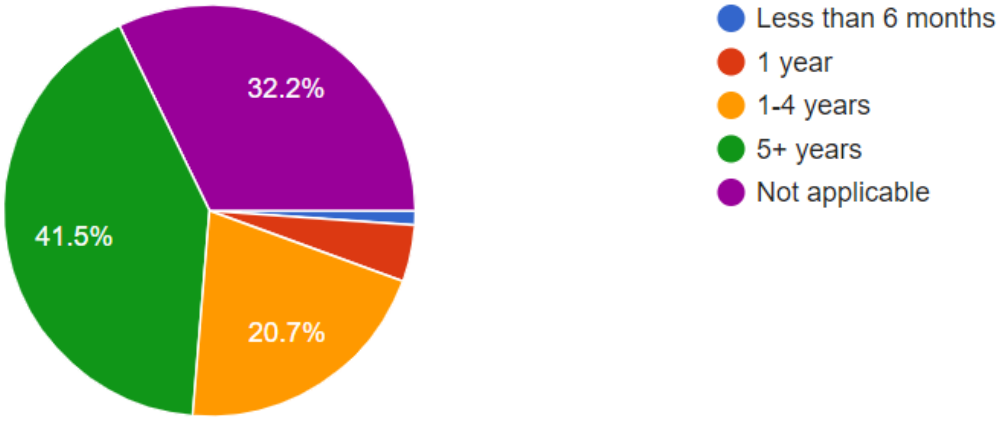


Question 12(b): If other, please specify how you engage with the environmental group or take action on an individual level:

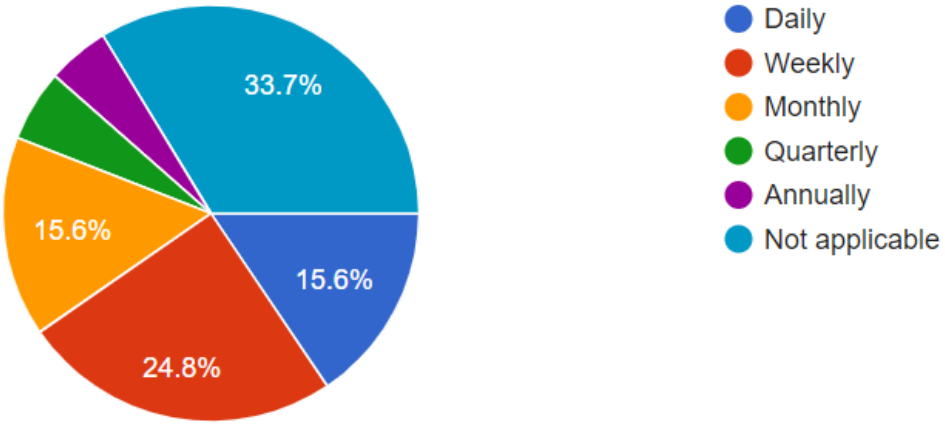
Examples responses:

- Webinars, Talks & Meetings. Learning courses;
- Creating a wildlife garden, composting;
- Chair of trustees Faiths4Change;
- Run activities and perform at events;
- Growing food for Liverpool Organic Direct;
- Online petitions & email campaigns for environmental issues;
- I don't drive due to environmental reasons;
- A member of The New Brighteners Facebook Admin and Management;
- Area coordinator for British Divers Marine Life Rescue; and
- Environmental Awareness training, community garden, recycling projects.

Question 13: How regularly do you engage with the environmental group (s) or take action on an individual level?



Question 14: How long have you been engaging with environmental group (s) or taking environmental action on an individual level?



Question 15: Please choose one or more of the following options for why you engage with an environmental group (s) or take action on an individual level?