Land Action Plan:
for the climate and nature emergencies

Produced by The Mersey Forest on behalf of Cheshire West and Chester Council

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Contents

Executive Summary

Climate change is the greatest threat to our social wellbeing and economic future. As such, a climate emergency has been declared at international and national levels, as well as by Cheshire West and Chester Council. Urgent action is needed now to drastically reduce greenhouse gas emissions, capture and store residual emissions, and adapt to inevitable changes such as increased flooding, heatwaves, and droughts. Compounding this, we are also in the midst of a nature emergency. Nature is in long term decline and urgent action is needed to reverse this, with a thriving natural environment essential to a healthy and prosperous society. The climate and nature emergencies are intrinsically linked and should be tackled together. Climate change will further drive nature's decline, whilst restoring nature can help to tackle the climate crisis.

Cheshire West and Chester Council's Climate Emergency Response Plan sets out actions across six themes: energy and industry; transport; housing; business premises and engagement; land use, adaptation, climate repair; and waste and recycling. This 'Land Action Plan: for the climate and nature emergencies' expands upon the land use, adaptation, and climate repair theme. It sets out a range of actions which will support the delivery of the target, in the Climate Emergency Response Plan, of a 10 per cent reduction in emissions from land use by 2025 (from the baseline of 340 $ktCO_2e$ per annum). Its focus is on nature based, green infrastructure, natural capital, and land use solutions to help mitigate and adapt to climate change. These will also deliver a wider range of ecosystem services and social, environmental and economic benefits, which cut across agendas such as development and regeneration, transport, health, recreation, tourism, and biodiversity.

Agriculture and land use accounts for around eight per cent of emissions within west Cheshire, with livestock responsible for most of this. The adoption of low carbon farming practices, coupled with shifts towards more plant-based diets which frees up land for other purposes, can help to bring down these emissions. The amount of carbon sequestered and stored in the landscape can also be increased, through

better management of peatlands, increased tree and woodland establishment, the creation of other habitats, and improved farming practices. This is needed to mitigate any residual or hard-to-eliminate emissions but can also provide a better-connected landscape for wildlife and reduce flooding, and trees in urban areas can help to manage overheating. In addition, the local production of feedstock for bioenergy with carbon capture and storage plants in the borough can play a significant role in mitigating climate change.

This Action Plan sets out a vision for land use in west Cheshire, alongside 64 actions to achieve this. Its success depends on Council teams taking ownership of the actions, and working with the Council's Climate Change team and other partners to embed it into policy and delivery across their teams. In some cases, the Council may be able to deliver actions directly, for example through its own policies or on its own land holdings. In many cases it will need to work with a broad range of organisations and professions, and at a range of levels from national to neighbourhood, to bring about change. This includes working with public agencies and service providers, neighbouring local authorities, environmental, community, voluntary-sector and nongovernmental organisations, and with professions including farmers, foresters, conservationists, tourism managers, planners, transport planners, investment decision makers, developers, urban designers, landscape architects, and engineers. Many of the actions will be delivered cumulatively by individual land owners and managers. This includes larger-scale, public sector, and easier to reach owners, as well as the harder to reach smaller-scale, private sector, businesses, and individuals. It will be important to work with organisations that engage with and provide grants to the latter group. In many cases, actions can be delivered with little extra cost, by changing how we do things; in some cases additional funding will need to be sought from external sources to deliver the action.

Much good work is already underway within west Cheshire, as well as elsewhere, and case studies throughout the Action Plan attempt to showcase some of this, but it is now imperative that this good work is mainstreamed, fast tracked and expanded upon.

The Vision

To act immediately so that, by 2045, all land in west Cheshire helps tackle the climate and nature emergencies. This will have wider social, economic and environmental benefits. Land use will be optimised to reduce greenhouse gas emissions, store residual emissions, and help us to adapt to inevitable changes.

To reduce emissions and store residual emissions, land needs to be used to:

- **Produce food** – ensuring food security through low carbon and regenerative farming and local food growing that restores soil health
- **Sequester and store carbon** – in soils and vegetation
- **Provide low carbon energy** – including bioenergy with carbon capture and storage, wind and solar
- **Provide low carbon materials** – replacing energy intensive materials with timber and other natural materials
- **Reduce the need for car travel** – high quality local recreation areas and green travel routes to encourage walking and cycling.

To help adapt to inevitable changes, land needs to be used to:

- **Support biodiversity** – recover, protect and maintain diverse habitats to ensure a connected landscape and natural resilience
- **Keep us cooler** – evaporative cooling and shading to ensure that during heatwaves urban areas remain attractive, comfortable and healthy places to live, work, visit and invest
- **Manage water in an integrated way** – natural flood management and managing water quantity and quality, to slow down peak flows, reduce runoff and associated soil erosion, store and re-use water, sustain river flows, catch sediment, and prevent pollutants from entering waterways
- **Provide a resilient outdoor recreation and visitor resource** – connecting people with nature and improving wellbeing, whilst managing visitor pressure on sensitive landscapes and wildlife.

The Case for Action

Climate change is the greatest threat to our social wellbeing and economic future[1]. A climate emergency has been declared internationally[2] and nationally[3], as well as by Cheshire West and Chester Council[4]. It is one of three global emergencies highlighted recently by the United Nations Environment Programme, alongside the nature and pollution emergencies[5]. Nature is in long term decline[6] and urgent action is needed to reverse this, with a thriving natural environment essential to a healthy and prosperous society[7]. The climate and nature emergencies are intrinsically linked and should be tackled together. Climate change will further drive nature's decline, whilst restoring nature can help to tackle the climate crisis.

In order to limit global warming to 1.5°C, as aspired to in the Paris Agreement, there is a need to reduce greenhouse gas emissions 45 per cent by 2030 (compared to 2010 levels), and to reach net zero emissions by 2050[8]. The UK Government has accepted recommendations of the UK's Climate Change Committee to go further than this, and cut greenhouse gas emissions 68 per cent by 2030 (compared to 1990 levels), and 78 per cent by 2035[9], reaching net zero by 2050[10]. Cheshire West and Chester Council has set its own ambitious targets to be carbon neutral as an organisation by 2030[11], and to support the borough to achieve carbon neutrality by 2045[12]. It's Council Plan has the climate emergency as the first of six priorities[13]. These longer-term targets are important and demonstrate intention, however, there is a finite carbon budget, which makes immediate action to reduce greenhouse gas

[1] Intergovernmental Panel on Climate Change (2018). Global warming of 1.5 °C.
[2] UNEP. Facts about the Climate Emergency.
[3] Committee Climate Change (2019). Local Authorities and the Sixth Carbon Budget.
[4] Cheshire West and Chester (2019). The Climate Emergency.
[5] United Nations Environment Programme (2021). Making peace with nature.
[6] State of Nature Partnership (2019). State of Nature.
[7] Dasgupta (2021). The Economics of Biodiversity: The Dasgupta Review.
[8] Intergovernmental Panel on Climate Change (2018). Summary for policymakers.
[9] UK Government (2021). UK enshrines new target in law to slash emissions by 78 per cent by 2035.
[10] Climate Change Committee. A legal duty to act.
[11] Cheshire West and Chester Council (2020). Carbon Management Plan.
[12] Cheshire West and Chester Council (2020). Cheshire West and Chester Climate Emergency Response Plan.
[13] Cheshire West and Chester Council. Cheshire West and Chester Council Plan 2020-2024.

emissions crucial[14]. In order to stay within its carbon budget, the borough needs to reduce emissions 92 per cent by 2030, compared to 2017 levels. This is the equivalent of only six years at current emission levels, and amounts to a reduction of 13 per cent each year[15].

West Cheshire emits 3,856 $ktCO_2e$ per year, the fifth largest of any local authority area[16]. The primary contributor to emissions is industrial and institutional buildings (52 per cent), followed by transport (24 per cent), residential buildings (14 per cent), commercial buildings and facilities (8 per cent) and public sector emissions (2 per cent)[17]. In addition to this, it has been estimated that greenhouse gas emissions (gross) from agriculture and land use are more than 340 $ktCO_2e$/year, approximately 8 per cent of all emissions[18]. Within this sector, the dominant source of emissions is from livestock (92 per cent); with dairy cows responsible for 55 per cent and non-dairy cows for 33 per cent. The other eight per cent is crop and grassland emissions which are largely for animal feed, typically the result of nitrous oxide emissions from fertilisers. Land can also act as a carbon sink, with vegetation and soils removing carbon from the atmosphere and storing it in the longer term.

There is a need for deep and urgent cuts in emissions across all sectors, as well as a clear need to adapt to climate change impacts that are already being felt, and will intensify. Indeed, the slower and less effective we are at reducing emissions, the greater the climate impacts will be[19]. In the UK, it is projected that climate change will lead to warmer and wetter winters, hotter and drier summers, sea level rises, and an increase in the frequency and intensity of extremes such as heatwaves, heavy rainfall, and droughts[20]. These changes have a range of impacts including heat stress and mortality, risks to critical infrastructure, transport disruption, risks to

[14] Intergovernmental Panel on Climate Change (2021). 6th Assessment Report.
[15] Anthesis (2019). Cheshire West and Chester – Climate Emergency.
[16] GOV.UK (2019). UK Local Authority and regional carbon dioxide emission national statistics.
[17] These figures do not consider emissions from agriculture, forestry and land use. Anthesis (2019) Cheshire West and Chester – Climate Emergency.
[18] Anthesis (2019). Cheshire West and Chester – Climate Emergency.
[19] Intergovernmental Panel on Climate Change (2021). 6th Assessment Report.
[20] Met Office (2019). UK Climate Projections: Headline Findings.

biodiversity, risks to food security, increased flood risk, reduced stream flows, water stress and reduced water quality[21].

Cheshire West and Chester Council's Climate Emergency Response Plan sets out actions across six themes: energy and industry; transport; housing; business premises and engagement; land use, adaptation, climate repair; and waste and recycling. This 'Land Action Plan: for the climate and nature emergencies' has been developed under action 8.10.9 of the land use, adaptation, and climate repair theme: "We will develop a detailed action plan that will support delivery of local action". It expands upon the other 22 actions set out under that theme. It sets out a range of actions which will support the delivery of the target, in the Climate Emergency Response Plan, of a 10 per cent reduction in emissions from land use by 2025 (from the baseline of 340 $ktCO_2e$ per annum). There are significant overlaps with the other themes which are highlighted in the Action Plan.

This Action Plan has a particular focus on nature based[22], green infrastructure[23], natural capital[24], and land use solutions to help mitigate and adapt to climate change whilst delivering a wider range of ecosystem services[25] and social, environmental and economic benefits. We will use these terms fairly interchangeably within the Action Plan. It sets out actions to reduce the greenhouse gas emissions associated with land use, but also to mitigate climate change further by using the natural environment to take up and store carbon in soils and vegetation. Whilst it is not possible for this to offset anything close to current overall emissions, nature-based solutions are needed to mitigate any residual and hard-to-eliminate emissions. It also

[21] UK Climate Risk (2021). Independent Assessment of UK Climate Risk (CCRA3).
UK Government (2017). Climate change risk assessment.

[22] Defined as "actions to protect, sustainably manage, and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits". IUCN REF

[23] Defined as "the network of open space, woodlands, wildlife habitat, parks and other natural areas that surround, pass through, and link cities, towns and villages sustaining clean air, water, and natural resources and enriching the lives of residents and visitors". www.cheshirewestandchester.gov.uk/residents/planning-and-building-control/total-environment/trees-and-hedges/green-infrastructure.aspx

[24] Ecosystems Knowledge Network. Natural capital is the concept of valuing the assets that nature provides to us.

[25] Ecosystem services are the benefits provided by ecosystems that contribute to making of human life. http://uknea.unep-wcmc.org/EcosystemAssessmentConcepts/EcosystemServices/tabid/103/Default.aspx

sets out nature based and green infrastructure solutions that can help us to adapt to projected changes in climate. Such solutions are especially attractive as many can deliver both mitigation and adaptation benefits, as well as having multiple other social, environmental and economic benefits such as enhancing biodiversity and human health and wellbeing[26].

This 'Land Action Plan: for the climate and nature emergencies', has drawn upon and updated a previous framework for action developed for the North West of England[27] , as part of the North West Climate Change Action Plan and EU Interreg IVC GRaBS (Green and Blue Space Adaptation for Urban Areas and Eco Towns) project[28].

[26] TCPA (2018). Planning for Climate Change.
Natural England (2021). Carbon Storage and Sequestration by Habitat.
Daspgupta (2021). The Economics of Biodiversity: The Dasgupta Review. Headline Messages.
[27] Community Forests Northwest (2011). Green Infrastructure to Combat Climate Change: A Framework for Action in Cheshire, Cumbria, Greater Manchester, Lancashire and Merseyside..
[28] Green Infrastructure to Combat Climate Change (2011).

The Actions

This section sets out 66 actions to help achieve the vision. These relate to land use, with a focus on nature-based and green infrastructure solutions, involving land management and change. It is divided into sub-sections; the first sets out overarching actions, followed by sub-sections for each role we want land to play (or climate change service) in turn. Mitigation services, those that reduce emissions or store emissions, are considered first. These are: produce food, sequester and store carbon, provide low carbon energy, provide low carbon materials, and reduce the need to travel by car. The adaptation services follow, and these are: support biodiversity, keep us cooler, manage water in an integrated way, and provide a resilient outdoor recreation and visitor resource.

Each sub-section includes an introduction to the service, a list of numbered actions to be taken by the council and partners, some case studies (these are intended to showcase good work that is already underway and for inspiration; we have not been able to fact check claims made by external organisations), and some mapping (which is also available through a mapping portal allowing users to scroll, zoom, and overlay map layers).

The actions are set out under specific climate change service for presentation purposes. However, many of the actions can deliver more than one climate service, and it is desirable that they do so. Indeed, with careful planning, design, and management, it may be possible to deliver an even wider range of services. In addition to tackling the climate and nature emergencies, delivering the actions adds value to a broad range of Council agendas, including the other five priorities in the Council Plan[29]: “growing our local economy and delivering good jobs with fair wages for our residents; supporting children and young people to get the best start in life and achieve their full potential; enabling more adults to live longer, healthier and happier lives; making our neighbourhoods even better places to call home; being an efficient and empowering council”.

[29] Cheshire West and Chester Council Cheshire West and Chester Council Plan 2020-2024

The actions need to be delivered by the Council, working with a broad range of partners, and using a number of different mechanisms. The Council's Climate Change team will be responsible for overseeing the delivery of this Action Plan. However, its success depends on a number of Council teams taking ownership of the actions, and working with the Climate Change team and other partners to embed it into policy and delivery across their teams. In addition to the Climate Change team, there are actions to be taken by the following Council teams: Cheshire Farms, Communications, Construction and Major Projects, Economic Growth, Ellesmere Port Regeneration Programme, Energy and carbon reduction within Qwest services, Environmental Commissioning, Finance, Highways, Localities, Planning, Procurement, Property, Regeneration Projects, Streetcare, Total Environment, Transport. In addition, some of the actions are listed as for all teams across the Council or for all land managing or building managing teams.

The Council will also need to work with a broad range of external partners, and at a range of levels from national to neighbourhood, to bring about change. We have identified over 100 potential partners. These partners are not set in stone but are a potential starting point for who the Council may need to engage with; it by no means commits the partners to taking action, and other partners can also be included. The partners include public agencies and service providers, neighbouring local authorities, environmental, community, voluntary-sector and nongovernmental organisations, and professions including farmers, foresters, conservationists, tourism managers, planners, transport planners, investment decision makers, developers, urban designers, landscape architects, engineers, and educators. Many of the actions will be delivered cumulatively by individual land owners and managers. This includes larger-scale, public sector, and easier to reach owners, as well as the harder to reach smaller-scale, private sector, businesses, and individuals.

List of potential partners

- Academic/Research Institutions
- Active Cheshire
- Active Travel Forum
- Adactus
- Agri-consultants

- Agriculture and Horticulture Development Board
- Association for Environment Conscious Building
- Association for Public Service Excellence
- Beavers Trust
- Brio Leisure
- British Institute of Agricultural Consultants (BIAC)
- Businesses
- Canal and River Trust
- Care Communities
- Catering companies
- Central Association of Agricultural Valuers (CAAVE)
- Centre for Alternative Technology Zero Carbon Britain Hub and Innovation Lab
- Centre for Innovation Excellence in Livestock
- Changing Lives Together
- Chartered Institute of Public Finance and Accountancy (CIPFA)
- Cheshire Association of Local Councils (ChALC)
- Cheshire Agricultural Society
- Cheshire and Merseyside Integrated Care System
- Cheshire and Warrington Low Carbon Communities Network
- Cheshire College - South and West
- Cheshire Community Action
- Cheshire Community Homes
- Cheshire East Council
- Cheshire Energy Hub
- Cheshire Heritage and Sustainability Enterprises (CHASE) CIC
- Cheshire Historic Buildings Preservation Trust
- Cheshire Constabulary
- Cheshire Permies
- Cheshire Resilience Forum
- Cheshire West and Chester Local Access Forum
- Cheshire West Communities Together
- Cheshire West Recycling
- Cheshire West Voluntary Action
- Cheshire Wildlife Trust
- Cheshire Young Farmers Clubs
- Chester Cycling Campaign
- Chester, Ellesmere Port and Neston Business Forum
- University of Chester
- Chester Community Energy
- Chester Zoo
- Cholmondeley Estates
- Community energy organisations
- Construction Industry Research and Information Association (CIRIA)
- Council companies
- Community and 'Friends of' Groups
- Community Land Trusts

- Community Supported Agriculture Network
- Confederation of Forest Industries (ConFor)
- Contractors
- Country Land and Business Association (CLA)
- CPRE, The Countryside Charity
- Cycling North Cheshire
- Dee Catchment Partnership
- Developers
- Department for Environment, Food and Rural Affairs (Defra)
- Department for Work and Pensions (DWP)
- Edsential
- Ellesmere Port Development Board
- Environment Agency
- Extinction Rebellion
- Faiths4Change
- Farm clusters
- Farmers
- Farming and Wildlife Advisory Group (FWAG)
- Forestry Commission
- ForHousing
- Flintshire County Council
- Friends of the Earth
- Garden Centres
- Garden Organic
- Garden Trusts
- Greenpeace
- Grosvenor Estate
- Groundwork Cheshire, Lancashire & Merseyside
- Halton Borough Council
- Healthbox CIC
- Health Sector
- High Streets Task Force
- Highways England
- Housing Associations
- HyNet
- Innovative Farmers
- Invest Net Zero Cheshire
- Keep Britain Tidy
- Land Owners and Managers
- Liverpool John Moores University
- Local Energy North West Hub
- Local Enterprise Partnership
- Local Government Association
- Local Nature Partnership
- Manchester Metropolitan University
- Peel Ports
- Mersey Dee Alliance
- Muir Group
- National Allotment Society
- National Farmers Union
- National Trust
- Natural England
- Neighbourhood Plan Groups
- Network Rail
- NHS Cheshire Clinical Commissioning Group

- NHS Cheshire and Wirral Partnership NHS Foundation Trust
- Parish Councils
- Peel NRE
- Plus Dane
- Probation Services
- Qwest
- Ramblers Association
- RECORD
- Reaseheath College
- Regional livestock membership groups
- River Weaver Navigation Society
- Royal Horticultural Society (RHS)
- Royal Institution of Chartered Surveyors (RICS)
- Royal Society for the Protection of Birds (RSPB)
- Royal Town Planning Institute (RTPI)
- Sanctuary Housing
- Schools
- Severn Trent (Hafren Dyfrdwy)
- Shropshire Council
- Soil Association
- Suppliers
- Sustrans
- Tatton Group
- Tenant Farmers Association
- The Conservation Volunteers (TCV)
- The Land Trust
- The Mersey Forest
- The Mersey Rivers Trust
- The Sandstone Ridge Trust
- Town and Country Planning Association (TCPA)
- Tourism Attractions
- Tourism Managers
- Town Councils
- Transition Network
- Transition Northwich
- Transition Town Initiatives
- Transport Planning Organisations
- United Utilities
- University of Liverpool
- University of Manchester, including Tyndall Centre for Climate Change Research
- U3A
- University of Nottingham – Division of Animal Sciences
- University of Salford Centre for Construction Innovation
- Vivo Care Choices
- Volunteering Matters
- Warrington Borough Council
- Waste Reduction Volunteers
- Weaver Gowy Catchment Partnership
- Weaver Vale Housing Trust
- Welsh Water
- Wirral Council
- Women’s Institute

- Woodland Trust
- Wrexham County Borough Council
- Wrexham Glyndŵr University

There are a number of mechanisms available to aid delivery of the actions. We have identified over 80 mechanisms. These are by no means definitive, but are a starting point for consideration. They are a mixture of existing and future strategies, policies, plans, and guidance, as well as programmes, projects, and potential funding sources. Many of the actions within the Plan can be delivered within existing resources through more innovative ways of working, and, where this is not possible, the Council will engage with Government and wider stakeholders to seek to secure funding to deliver its priorities. There are a number of more generic ways of funding green infrastructure delivery (e.g. Landfill Communities Fund, Heritage and Big Lottery Funds), and there is also a need to continue to be innovative in securing funding for delivery (e.g. through tax reforms, council tax precepts, use of byelaws for flooding issues, an infrastructure levy, natural capital bond, etc).

List of potential mechanisms

- Adaptation Reporting Power
- All Strategies, Policies, Plans, Programmes and Initiatives
- Anchor Institution Forum
- Accessible Natural Greenspace Standard (ANGSt)
- Asset Management Plan
- Biodiversity Action Reporting System
- BREEAM
- Britain in Bloom
- Building Regulations (Approved Document J)
- Business rates
- Capital Spend
- Catchment Flood Management Plans
- Catchment Sensitive Farming
- Community Infrastructure Levy, Section 106, Planning Conditions
- Cheshire Pension Fund
- Climate Emergency Fund
- Climate Emergency Governance Board
- Climate Emergency Taskforce
- Corporate Plans

- Council Sustainable Drainage System Guidance
- Countryside Stewardship
- Crowdfunding
- Dee River Basin Management Plan
- Developer Agreements
- Development Briefs
- Eco Schools
- Ecological Networks and Restoration Zones
- Ellesmere Port Industrial Area Master Plan and Action Plan
- Environmental Land Management Schemes (ELMS)
- Environmental Stewardship
- English Woodland Grant Scheme (EWGS)
- Fairtrade
- Farms Review
- Food Strategy
- Forest Parks
- Forest Schools
- Forest Stewardship Council (FSC)
- Forestry Commission guidance
- Green Flag Awards
- Green Infrastructure, Open Space and Tree Strategies/Plans
- Green Recovery Challenge Fund
- Green Social Prescribing
- Green Streets
- Landscape Projects
- Landscape Recovery
- Lease agreements
- Little Leigh Parish Council Active Travel Assessment
- Living Landscapes
- Local Biodiversity Action Plans
- Local Enterprise Partnership Policies
- Local Nature Recovery
- Local Plan
- Local Transport Plan
- Local Transport funding
- Local Walking and Cycling Infrastructure Plan
- Management Plans
- Masterplans
- Mersey Estuary Catchment Flood Management Plan
- MOREwoods
- National and Regional Procurement Frameworks (e.g. Bloom, Crown Commercial Service, TUCO)
- Natural Capital Audit and Investment Plan
- Natural Capital Investment models
- Natural Health Service
- Nature for Climate Peatland Grant Scheme
- Nature Recovery Networks
- Neighbourhood, Parish and Town Plans
- North West and North Wales Shoreline Management Plan

- North West River Basin District River Basin Management Plan
- Northern Forest
- Occupational Agreements
- One Public Estate
- Peat Action Plan
- Peatland Carbon Code
- Peatland Projects
- Procurement Policies
- Professional Networks
- Rural Development Programme for England (RDPE)
- Renewable Heat Incentive
- Royal Horticultural Society Schools Gardening Scheme
- Rights of Way Networks
- River Dee Catchment Management Plan
- Sustainable Catchment Management Programme (SCaMP)
- School Food Growing Programmes
- Social Value Policy
- Strategic Flood Risk Assessments
- Surface Water Management Plans
- Sustainable Community Strategies
- Sustainable Farming Incentive
- Integrated Sustainable Travel Taskforce
- Thrive
- Themes, Outcomes, Measures (TOMS) Portal
- Tourism Strategies
- Tree Preservation Orders
- Trees for Climate
- UK Renewable Energy and Biomass Targets
- Urban Tree Challenge
- Volunteering
- Wastewater Charges
- Water Framework Directive
- Weaver Gowy Catchment Flood Management Plan
- Weaver Gowy Catchment Management Plan
- Wildflower and Grasslands Strategy
- Woodland Access Standard
- Woodland Carbon Code
- Woodland Certification
- Woodland Trust's Woodland Carbon for businesses

A significant funding source will be through the Government's £640m Nature for Climate Fund, which aims to deliver nature-based solutions to climate change such

as tree planting, peatland restoration, and nature recovery[30]. As part of the Nature for Climate Fund, there is a £12.1 million[31] investment for the Trees for Climate programme, to establish over 500 hectares of trees across England's Community Forests (including The Mersey Forest, of which Cheshire West and Chester Council is part)[32]. Funding is not limited by traditional woodland planting but also novel approaches to urban forest creation[33]. The new Environmental Land Management Schemes (ELMS) programme will also be a major funding mechanism, as will Biodiversity Net Gain.

The Council's Climate Emergency funding, totalling £16.2 million between 2020-2024[34], will be an important mechanism. The funding is used to support a range of Council and community-led low carbon projects, and could be used to help deliver this Action Plan.

Much can also be achieved by ensuring that the actions are embedded into other plans, policies and strategies. In particular, the Local Plan will be a significant mechanism. This has recently been engaged upon via the Local Plan conversation[35,36]. In its current version, there are a number strategic objectives relevant to the climate emergency: SO13 states the need to "manage, expand and improve green infrastructure and waterways"; SO14 highlights the need to "mitigate and adapt to the effects of climate change"; SO15 is to "take action on climate change by promoting energy efficiency and energy generation from low carbon and renewable resources"; and SO16 promotes the need to "achieve sustainable waste management, using sustainable modes of transport and travel and the prudent use of our natural resources including water and mineral reserves"[37].

Within local planning, the Community Infrastructure Levy and Section 106 agreements are important mechanisms to secure planning obligations to mitigate the

[30] DEFRA (2020). New funding for tree planting as National Tree Week comes to a close.
[31] Community Forest Trust (2020). Trees for Climate.
[32] DEFRA (2020). 500-hectare planting boost for England's Community Forests.
[33] UK Government (2020). New funding for tree planting.
[34] Cheshire West and Chester Council (2020). Council Budget 2020-21 allocated to challenges.
[35] Cheshire West and Chester Council (2021). Local Plan Conversation.
[36] Cheshire West and Chester (2021). 87. Local Plan - Response to Overview and Scrutiny Committee Report.
[37] Cheshire West and Chester (2015). Adopted Local Plan (Part One) Strategic Policies.

impact of new developments, with local communities able to target spending on green and blue infrastructure, climate change, and nature-based solutions, where Neighbourhood Plans exist. There are currently 24 areas within west Cheshire with Neighbourhood Plans. As currently, the prioritisation of Section 106 and Community Infrastructure Levy will be undertaken by the Council's Capital and Investment Board in-line with existing governance processes.

However, the fate of the planning system at a national level is in flux. In August 2020, the Ministry for Housing, Communities and Local Government penned a White Paper, entitled Planning for the Future[38], which looked to reform the planning system. Some of the proposed reforms included significant changes to the way Local Plans are prepared, and what they should or should not cover, while others are relevant to Neighbourhood Planning, Community Infrastructure Levy, Section 106 and green infrastructure funding. In September 2021, the newly appointed housing secretary, Michael Gove, has ordered a pause on legislation and is reviewing the planning reforms.

[38] UK Government (2020). Planning for the future.

1. Cross-cutting Actions

The overarching actions set out here broadly relate to how the Council operates or its systems, land management or change, planning, communications, and reporting. They are cross-cutting actions, that help to combine the different services we want from land. Whilst we can take actions to provide a particular service, it is essential to exploit the multifunctionality of the land wherever possible, in order to optimise the climate services it provides, and to work in partnership and with local communities in order to achieve this. Green infrastructure should be seen as a critical infrastructure, like roads or waste disposal, and, as such should be well planned and maintained, and viewed as integral to new development[39]. Existing green infrastructure should be better managed for the range of services it provides.

List of Council and Partner Actions

1.1 Champion this 'Land Action Plan: for the climate and nature emergencies' and embed it in the broadest range of policies, strategies, plans, programmes, initiatives, decision making, and ongoing work across the Council and borough, not just those directly related to the environment.

1.2 Establish an ongoing dialogue and reporting between all Council teams, the climate change team and senior management on promoting and actioning the delivery of this Action Plan and the rest of the Climate Emergency Response Plan.

1.3 Identify and meet the skill gaps within the current and future workforce needed to deliver this Action Plan.

1.4 Review the Council's approach to business case development in order to take into account whole life costs, bringing together capital outlay, maintenance and carbon accounting.

1.5 Procurement of products and services must seek to minimise greenhouse gas emissions, store residual emissions (e.g. in timber products), ensure they are adapted to inevitable changes in climate, minimise nature depletion and contribute to

[39] Natural Economy Northwest (2010). Green Infrastructure Prospectus.; Commission for Architecture and the Built Environment (2010). Grey to Green: How we shift funding and skills to green our cities.

nature recovery, and be sustainable and free from deforestation throughout the supply chain. Imported commodities must come from certified sustainable sources.

1.6 Use strategic regeneration programmes in Ellesmere Port, Northwich and Winsford, and Chester to act as exemplars, showcasing partnership working and community engagement to deliver multifunctional green infrastructure, with optimised climate change services.

1.7 Work with the Local Enterprise Partnership to develop, finalise and launch a Natural Capital Audit, Investment and Implementation Plan for Cheshire and Warrington, and target strategic interventions using this.

1.8 Review the Council's land holdings, including its farm estate, to explore the case for this land to contribute to the Council's goal of becoming carbon neutral by 2030, as well as helping adapt to climate change and nature recovery, including the potential to introduce a biodiversity net-gain commitment on this land.

1.9 Engage with other public or public facing land holders to look at assets and how land is managed collectively to better tackle climate and nature emergencies. This could include health, defence, education, police, as well as Housing Associations, Parish and Town Councils, and large land holders.

1.10 Review the opportunity following the Local Plan Conversation to use updates to the Local Plan, if any, to strengthen existing green infrastructure, biodiversity net gain, and other policies in relation to this Action Plan; and ensure more expedient enforcement and implementation of policies.

1.11 Engage with and support the Planning Team to share best practice and support ambitious net-zero, nature recovery, and climate adapted policy making and enforcement.

1.12 Encourage and enable new or revised Neighbourhood Plans to incorporate climate change, nature recovery, and green infrastructure policies. This could include providing templates, exemplars, and other guidance or facilitation methods.

1.13 Review the Council's tree replacement policy and promote the value of urban trees to justify and secure resources for urban planting, taking into account the range of ecosystem services they provide across the borough.

1.14 Use nature based solutions to climate change where possible, in order to tackle the climate and nature emergencies together. Ensure that biodiversity is a consideration in the delivery of all actions. All interventions should also seek to: optimise other green infrastructure services through careful design and management, take into account other considerations (including landscape character, historic environment), make provisions for long term management, involve appropriate partners including local communities in decision making and delivery.

1.15 Proactively engage, communicate, and support the wider community and businesses to raise awareness, educate, elicit ideas and expertise, co-create, encourage and support delivery of actions, and in some cases explain why the actions taken are needed. This will include volunteering and community action (e.g. through Friends of Groups, community groups, and charities), meaningful engagement with disadvantaged and underrepresented sections of society, and the use of citizen science or participatory research where appropriate.

1.16 Collect and regularly update GIS data on urban and rural green infrastructure, including quantity, types, functions, and where it is needed for different socio-economic and environmental reasons.

1.17 Liaise nationally to ensure that GIS datasets relating to this agenda are freely or readily accessible by local authorities.

1.18 Monitor, review and report on delivery of actions and their effectiveness via the reporting mechanism of the Climate Emergency Response Plan, which provides an annual report to Council, and use this information to refine the Plan.

Case Studies

Cheshire West & Chester Food Strategy

Both green infrastructure and the need to reduce carbon emissions are embedded into the food strategy. The food strategy has been developed, in partnership with local people, in order to provide a more sustainable approach to food poverty issues. It covers all aspects of food education, such as food safety, cooking lessons, growing locally sourced food, and healthy accessible food. Encouraging local food growing initiatives and working with local food suppliers helps to reduce food miles

and combat food poverty. It also aims to work with local independent retailers to provide locally sourced food, with delivery piloted by an electric cargo bike known as the 'Greenway Grocer'. This will serve community groups, children's centres and schools along the greenway in Chester.

Tattenhall and District Neighbourhood Plan

This Neighbourhood Plan has supportive policies to act on climate change and green infrastructure, including reducing surface water runoff, the planting of individual, small groups of trees, and small woodlands on appropriate and available land. Across west Cheshire there are now 24 areas with an approved Neighbourhood Plan. Neighbourhood Plans can help draw down Community Infrastructure Levy and Section 106 funding which is available to the community to help deliver their objectives. This can also be matched with other available funds. Neighbourhoods such as Beeston, Tiverton and Tilstone, Fearnall, Tarvin, Kelsall and Willington, and Tarporley mention the importance of green infrastructure and general climate change polices.

Picton Tree Planting

Trees for Climate is a national woodland creation programme, part of the Government's £500m Nature for Climate Fund. It aims to at least treble planting rates in England by 2024. The Council, through The Mersey Forest, are playing a leading role as the legal accountable body for the programme, which is being delivered by England's 13 Community Forests. Across Cheshire and Merseyside, nearly 44 ha of new woodland has been created in the last year, in urban parks and green spaces and on private land and farmland. In west Cheshire, one of the sites was Council-owned land in rural Picton, near Chester, with views to the industrial area of Ellesmere Port. 6 ha of native broadleaved woodland were established here, with 12,366 trees and 305 metres of hedgerows planted. It is estimated that this will store 2,326 tonnes of carbon over 100 years. Planting included the endangered native black poplar, with trees provided by Chester Zoo as part of their species recovery programme. This tree was once widespread across the borough's floodplains, but now there are only around 7,000 left in the UK. It is of great wildlife value, with over 100 specialist insects associated with it. In addition to tree planting, areas of the site were left open to conserve historical features and for other habitats.

This included two newt ponds and 6 ha of species rich native wildflower meadows across the wetter part of the site, to recreate the traditional floodplain meadows that would have once existed, and compensating for habitat loss in other parts of the borough. It is planned to collect seed from the site to create similar meadows in other parts of the borough. The site is also on the 70 mile long North Cheshire Way national footpath, from the Wirral to the Peak District, and the funding helped improve the footpath and provide new infrastructure such as stiles and a footbridge.

London Plan Urban Greening Factor

The London Plan includes a policy G5 on urban greening. In order to meet this policy, developers can use the Urban Greening Factor tool to demonstrate the quality and quantity of green infrastructure in the new development. Required Urban Greening Factor Scores are set out in Local Plans, and in cases where they are not, scores of 0.4 for predominately residential and 0.3 for predominately commercial developments are applied. This is considered the minimum benchmark, but not the maximum required. The approach is adapted from Malmö's 'Green Space Factor', Berlin's 'Biotope Area Factor' (also used in other German cities), and Seattle's 'Green Factor'. A similar 'Green Infrastructure Score' was developed for North West England in 2011, as part of the Northwest Regional Development Agency's Sustainability Policy for the Built Environment. It assigned factors to different surface types, which are multiplied by the area they cover and summed; the total is divided by the site area to give the score, which must reach a target level.

2. Produce Food

West Cheshire has a large amount of agricultural land, largely used for dairy and non-dairy livestock, and crops that feed them. The Cheshire Plain is well known for its agricultural use, with almost 2,000 farms across Cheshire[40]. The largest land use across west Cheshire is pasture, accounting for 39,029 ha, followed by non-irrigated arable land which accounts for 33,647 ha. Most of the agricultural land is classed as Grade 3 (67,439 ha), with 9,732 ha of Grade 2 land[41]. The best and most versatile land is that in grades 1, 2, and 3a.

There are significant greenhouse gas emissions associated with livestock farming. Gross greenhouse gas emissions from agriculture and land use in west Cheshire currently account for more than 340 ktCO_2e/year, approximately 8 per cent of all emissions. The dominant source of emissions is from livestock (92 per cent); with dairy cows responsible for 55 per cent and non-dairy cows for 33 per cent. The other 8 per cent is crop and grassland emissions, typically the result of nitrous oxide emissions from fertilisers[42]; this crop and grassland is largely (but not exclusively) grown for animal feed. Alongside greenhouse gas emissions, agricultural production can also impact on soil erosion, water pollution, and wildlife.

Nationally, there are recommendations to reduce meat and dairy consumption, alongside reducing food waste, to both help reduce emissions, as well as to free up land to play a wider range of roles in tackling the climate and nature emergencies. The Climate Change Committee propose a 20 per cent reduction in meat and dairy consumption, whilst the National Food Strategy proposes a 30 per cent cut[43]. However, west Cheshire should continue to play an important part in ongoing meat and dairy production as, due to the nature of its climate and soils, it is one of the most efficient places in the world for dairy production. The soils here may also not be well suited to growing crops or bioenergy crops, and consideration would need to be given to the potential of increased soil erosion from any change in land use,

[40] Rural Business Research (2019). FBS Region Reports.
[41] Liverpool John Moores University (2021). Tables for west Cheshire maps.
[42] Cheshire West and Chester Council (2019). Anthesis Report.
[43] National Food Strategy (2020). Independent Review.

especially on slopes. Greenhouse gas emissions from UK agricultural produce are also around half of the global average, so care needs to be taken to ensure that any land use change does not lead to increased imports of products with a higher carbon footprint than those produced in west Cheshire.

The challenge and opportunity here is to work with farmers to adopt low carbon and regenerative farming practices across west Cheshire to reduce emissions and help store carbon in soils, maintaining the best quality agricultural land for food production to ensure food security into the future, whilst using less versatile and more marginal agricultural land for other uses such as woodland and habitat creation. Good farming practice can increase the amount of carbon stored in the soils, which in turn can improve crop yields. Urban food production and community food growing also has a role to play in reducing food miles, as well as helping with issues such as health and food poverty. This could be in allotments as well as other community spaces.

A high uptake of low-carbon farming practices could deliver 10 $MtCO_2e$ emissions savings in the UK by 2050[44]. Improving farming's productive efficiency, including through improved agricultural technology, has a big part to play in significantly reducing greenhouse gas emissions. This can enable farming to produce the same quantity of food, or more, with fewer but smarter inputs. The Climate Change Committee[45] and National Farmers Union[46] have highlighted a variety of measures to boost productivity and reduce emissions, and ongoing research will identify more. These include: the use of controlled release fertilisers and inhibitors to increase efficient use of nitrogen and reduce emissions; feed additives to reduce methane emissions from ruminant livestock (shown to reduce methane emissions by 30 per cent); improving health in cattle and sheep to reduce methane emissions and boost growth rates; precision farming for crops to deliver nutrients and crop protection more efficiently; loosening compacted soils and preventing soil compaction in cropland and pasture, reducing the need for cultivation and minimising nitrous oxide emissions; anaerobic digestion to convert animal manures, crops and crop by-products into renewable energy; a wide range of energy efficiency measures to

[44] Climate Change Committee (2020). Land use: Policies for a Net Zero UK.
[45] See for example table 9 in: SRUC (2020). Non-CO_2 abatement in the UK agricultural sector by 2050.
[46] NFU (2019). Achieving NET ZERO Farming's 2040 goal.

reduce usage of fuels and electricity; gene editing for disease resistance to improve health and productivity of crops and livestock and reduce emissions.

Cheshire West and Chester Council own 18 tenanted farms as part of its farms estate (although there are other agricultural/grazing land holdings), covering 838 ha, ranging from 15 to 76 ha in size[47]. There are a range of different agreements with the tenant farmers. The majority of these are non-dairy livestock farms on grade 3 land, with grassland the main land cover and some maize. There is little woodland on the estate, and some of the farms are on peaty soils. The Council have a Farms Policy, which has involved managed disposal of the estate contribute funds to the Council's capital programme. A review of the estate has recently been undertaken to consider how it can contribute to Council goals, including in relation to the climate emergency.

Cheshire West and Chester is working towards becoming a Sustainable Food Place, creating partnerships between local producers, people and stakeholder groups to ensure that the food system is healthy, sustainable and more equitable.

List of Council and Partner Actions

2.1 Encourage dietary change in line with national recommendations to free up land for habitat creation and other uses by reducing intake of carbon intensive foods such as beef, lamb and dairy. Encourage locally sourced (or British), seasonal agricultural produce, including meat and dairy, including through public procurement.

2.2 Safeguard the 'best and most versatile' agricultural land (grades 2 and 3a) for food production.

2.3 Keep up to date with advice and best practice and encourage low carbon/methane farming practices, regenerative farming, and agricultural practices adapted to a changing climate, and optimise the delivery of other services. According to the Climate Change Committee, cost effective mitigation measures include: biological nitrogen fixation with grass-legume mixtures, livestock breeding, increased

[47] Discussion with Cheshire Farms Service

milking frequency, high sugar content grasses, anaerobic digestion of manure, better health planning for livestock, precision feeding, high starch diet for dairy cattle, covering slurry with impermeable plastic, nitrate and 3NOP as feed additives, catch/cover crops. Adaptation practices include farm water management to reduce flooding and provide for droughts, changing crop types, field and hedgerow trees and copses to provide shade for livestock.

2.4 Advocate livestock are not fed on soy linked to rainforest destruction.

2.5 Review the Council's approach to supporting allotment and community growing.

2.6 Use new and re-development to encourage and incorporate urban food production, through the creation of allotments, community farms and gardens, inclusion of orchards, fruit trees and bushes into urban design, and including 'meanwhile' and temporary uses of land.

2.7 Encourage community and home food growing, through practical work and awareness raising programmes, including in schools, faith-based land, allotments, orchards, and parks.

Case Studies

Grosvenor Estate and Farms

Grosvenor Farms is a large commercial farm which manages 2,330 ha and houses 2,500 dairy cows and 1,200 dairy heifers. The farm also grows combinable crops on approximately 1,400 ha of land. Grosvenor Farms has reduced its carbon emissions by about 40 per cent across all their dairy activities since 2014. Its emissions from milk production are half the national average and soil carbon levels are almost twice as good as the UK cropland average. This has been achieved through the use of renewable energy from solar panels on their sheds, as well as through the use of integrated, circular, farming systems, such as recycling sand for bedding and manures as organic fertilisers to replenish soils, minimum tillage, and growing their own forage (more than 80 per cent of its animal feed is grown without the use of artificial fertilisers). 12 per cent of its land is dedicated to supporting greater biodiversity and improving habitats, which will help other species adapt to climate change and aid natural flood management. Grosvenor Farms is also in the initial

stages of utilising anaerobic digestion of manure to produce energy and link into carbon capture and storage infrastructure in west Cheshire. The farm and estate are using LIDAR to monitor increases in above ground biomass. In addition, this data is used to examine where to create habitats to slow flow of water into water courses, helping to reduce flooding and improve water quality. The Grosvenor Estate has installed a state of the art sawmill at its Eaton Estate near Chester. This will enable both estate and other local timber to be processed, particularly for use in construction. Its Hatton Heath Mill buildings have been constructed from estate grown timber. Waste from the sawmill will be used in the estate's biomass heating systems.

Agroforestry at Whitehall Farm, Cambridgeshire

In 2017, only 3 per cent of the UK's farmed area practised agroforestry. Whitehall Farm is Britain's largest agroforestry project. The 250 acres of land grows traditional crops such as wheat, barley, clover, and field scale vegetables in addition to growing apple trees with field scale crops growing in between. The benefits of agroforestry allow for the soil to recover and offset the carbon used by the farmland.

National Farmers Union advice and guidance

The National Farmers Union provides resources to help farmers adapt their practises in order to help achieve a net zero target by 2040. Their Net Zero Plan suggests that tackling climate change in UK agriculture requires a portfolio of different policies and practices focused on three key pillars: improving farming's productive efficiency to reduce greenhouse gas emissions (enabling farming to produce the same quantity of food, or more, with less inputs in smarter ways); farmland carbon storage in soils and vegetation (improving land management and changing land use to capture more carbon, through bigger hedgerows, more woodland, and especially more carbon-rich soil); boosting renewable energy and the bioeconomy to displace greenhouse gas emissions from fossil fuels and to create greenhouse gas removal through photosynthesis and carbon capture.

Whitby Park Community Garden and allotments, Ellesmere Port

Cheshire's Natural Health Service uses the natural environment to help tackle local health inequalities. In partnership with The Mersey Forest, Whitby Park Community

Garden and allotments helps to bring Gardening for All sessions to the local community who help with planting, maintaining and harvesting the crops[48]. The programme has been successful in producing and selling vegetables all year round.

Bridge Community Farm, Ellesmere Port

The Bridge Community Farm based in Ellesmere Port works with the local community to create long-term jobs through sustainable farming and the promoting and selling of veg boxes across Cheshire and Wirral. The charitable scheme helps the unemployed, those suffering mental health issues and learning disabilities at varying ages. The scheme has been successful in offering a local produce such as fruit, vegetables, salads and herbs to local residents and high-end restaurants[49]. New orchards have been added as part of the Trees for Climate programme, to provide community access to free fresh fruit.

For Futures homeless allotment project

In 2018, For Futures, a homeless support service from For Housing, wanted to establish a pilot food growing project as part of their programme of support for people who were homeless or at risk of becoming homeless. For Futures worked with the Council's Total Environment team to identify an unused plot at Brook Lane allotment site in Chester. Initially overgrown and unused for many years, For Futures and volunteers transformed the site into a productive food growing space, running weekly hands on sessions throughout the year. This project supported 19 clients, helping them to get back on their feet and learn new skills, encouraging them to adopt a healthy and balanced diet, as well as regaining confidence and developing social skills. Due to the success of this pilot scheme, the project has been recently been extended with For Futures securing a second site at the former TB hospital on Sealand Road. This second phase is currently in development but will enable For Futures to extend support for more homeless clients in a horticultural therapy-based activity.

[48] Natural Health Services (2016-2020). Cheshire's Natural Health Service Impact Report.
[49] We are UMI (2019). Bridge Community Farms in Ellesmere Port expands after acquiring the natural veg men delivered veg box business.

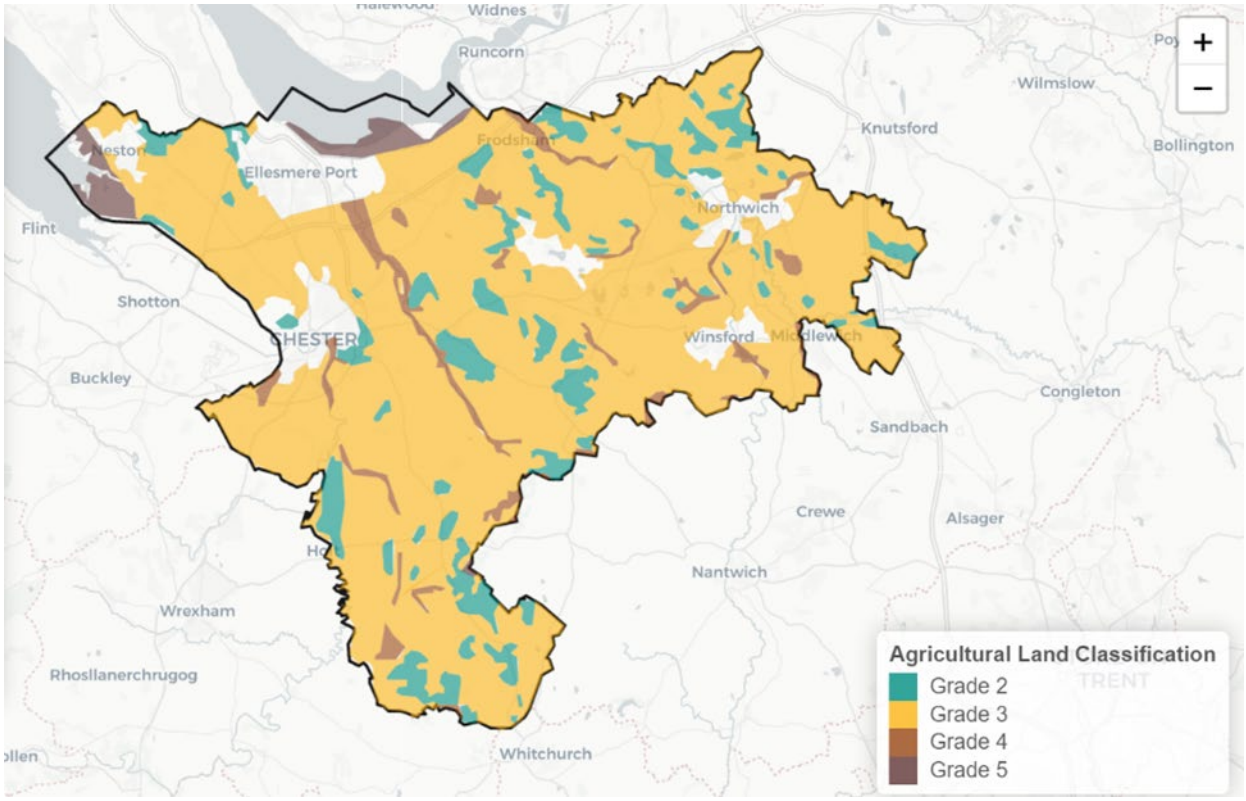
For other good practice see:

- The Sow the city programme encourages local growing to make sure Manchester is green and healthy. They include policy guidance to encourage urban food growing.
- The harvest-ometer tool helps people keep track of how much food they grow and how much money they save. It can also calculate carbon savings.
- Cheshire Wildlife Trust has a series of community food growing projects and volunteering.
- Defra's Future Farming website gives an overview of changes to farming in England. Farmers and land managers will be rewarded for doing even more to improve the environment whilst producing high quality food and other products.
- Innovative Farmers is a not for profit membership network, for all farmers and growers who are running on farm trials, on their own terms.
- The Department for Enviornment, Food and Rural Affairs advice on Best Farming Practices website gives case studies on protecting soil and water.

Supporting Maps

Map: Agricultural land classification in west Cheshire[50]. Grades 1, 2, and 3a are classed as the Best and Most Versatile agricultural land[51]. Interactive version of this map is available through the mapping portal.

Agricultural Land Classification: © Natural England copyright. Contains Ordnance Survey data © Crown copyright and database right 2021.



[50] Accessible description: This is a map which describes the agricultural land classification in west Cheshire. It is a map of the borough in which land is classified into grades 2 to 5, where the smaller numbers are the higher quality agricultural land.

[51] It should be noted that agricultural land classification may alter in a changed climate as climatic and soil conditions change, this map is based on current climate and land use data.

3. Sequester and Store Carbon

Soils and vegetation can act as a long-term store of carbon and can also actively sequester carbon, or remove it from the atmosphere. Thus, changes to land use and/or management can lead to increases or decreases in the amount of carbon stored and its ability to sequester carbon. Increasing sequestration and storage of carbon in both soils and vegetation is essential in order to remove any residual or hard to eliminate emissions, either from agriculture or other sectors.

It has been estimated that 9.6 MtC (or 35.2 $MtCO_2e$) is stored by the top 30cm of soil and vegetation in west Cheshire[52]. There are however, other approaches which have been used to estimate this figure. For example, Anthesis estimated that the top 15cm of soil stores 4.6 MtC (or 16.9 $MtCO_2e$), and then extrapolated from this to estimate that the top 100 cm of soil stores 10 MtC (or 35.6 $MtCO_2e$); they estimated vegetation to store 900,000 tC (or 3.4 $MtCO_2e$)[53]. It is difficult to gain an exact understanding of the carbon stored in the vegetation and soils, due to the difficulties in estimating the carbon stored in soils and competing methodologies. Many of the estimates of soil carbon are only for the top 15cm of soil, whereas soils are often much deeper than this. Cantarello et al (2011) suggest that Intergovernmental Panel on Climate Change guidance is to look at the top 30 cm (see Nabuurs et al., 2003; cited in Cantarello). Some soils, in particular peat, are much deeper than this.

[52] Calculation performed by Liverpool John Moore's University, as part of the Natural Capital Audit for Cheshire West and Chester Council. Carbon values are derived (and slightly adapted) from Cantarello et al (2011). "Potential effects of future land-use change on regional carbon stocks in the UK." Environmental Science & Policy 14.1. https://www.sciencedirect.com/science/article/pii/S146290111000122X?casa_token=e0cD6TkcKiAAAAAA:HWEg0nc-vYohkrYHhCfu7Y-DtFVnUQExwh3jLMUeHmU9YDAIbleu_Qdqbxs9eerWFY8_c1r2ma8. In this approach, a literature review was used to assign vegetation and soil carbon values to different land use classes. As such, the actual soil is not taken into account, but the typical soil carbon associated with the different land uses is.

[53] REF Anthesis. They used the freely available 'Countryside Survey Topsoil Carbon density' dataset from 2007 (http://mapapps2.bgs.ac.uk/ukso/home.html), which provides the soil carbon density on a 1km grid square to a depth of 15cm. It is not clear from their report how they extrapolated this to a depth of 100cm; a footnote to a table reads "Carbon in soils to 100cm is extrapolated from 15cm using ratios calculated from Natural England 2012", but these ratios are not explicit in this Natural England report (an updated version of this is also now available, for 2021). To estimate the vegetation carbon they used values from Natural England (2012) and applied them to the broad land-types within the Crop Map of England (this, they say "mainly uses satellite data to identify land-uses and crop types; it is a snap-shot at a point in time (summer 2018) and should be considered indicative only".

Taking 9.6 MtC as our estimate for now, the table below splits this according to different habitats. Improved grassland covers the largest area of west Cheshire (43,960 ha), and stores the highest total amount of carbon in vegetation and soils (5.5 MtC) due to its large area. However, broadleaved woodland has the highest carbon density at 270 tC/ha, and the three woodland categories together store a total of 1.5 MtC.

Table: Carbon stored in the vegetation and top 30cm of soil for a range of different habitats in west Cheshire[54].

Habitat	Area (ha)	Total carbon (tons)	Tons carbon / ha
Boundaries	1,233.14	162,774.6	132.00
Cultivated/disturbed land	21,148.77	1,714,904	81.09
Garden	5,302.28	528,213.6	99.62
Gardens/parks/brownfield	28.64	2,852.69	99.62
Grassland (improved)	43,960.94	5,455,553	124.10
Grassland (marshy)	173.44	26,265.53	151.44
Grassland (semi-natural)	1,038.79	124,485.4	119.84
Grassland (unknown)	210.12	20,932.57	99.62
Heathland	199.33	21,928.24	110.01
Intertidal	1,804.62	138,709.7	76.86
Mire	68.99	13,863.23	200.96
Scrub	173.66	17,907.01	103.10
Shingle	0.14	17.51	124.10
Swamp	54.05	818.53	151.44
Trees/parkland	300.58	30,989.82	103.10
Woodland (broadleaved)	3,752.71	1,012,643	269.84
Woodland (coniferous)	832.04	138,201.4	166.10
Woodland (mixed)	1,769.52	357,443.7	202.00

[54] Accessible description: The table shows the carbon stored in the vegetation and top 30cm of soil for 18 different habitats in west Cheshire (the habitats are: boundaries, cultivated/disturbed land, garden, gardens/parks/brownfield, grassland (improved), grassland (marshy), grassland (semi-natural), grassland (unknown), heathland, intertidal, mire, scrub, shingle, swamp, trees/parkland, woodland (broadleaved), woodland (coniferous), woodland (mixed). It sets out the area covered by each habitat (in ha), the total carbon stored in that habitat (in tC), and the carbon stored (in tC/ha).

Soils are a much larger store of carbon than vegetation. Soil organic matter is directly related to soil carbon, and increasing it can lead to higher crop yields for farmers, as well as making them more resilient to drought and flooding. Peaty soils in particular are especially important as a long term carbon store. They can also sequester carbon if they are in good condition. However, when degraded, they are a source of carbon emissions. Restoration of degraded peatlands can therefore help to reduce carbon emissions. It is estimated that only 3.3 per cent (or 3,067 ha) of west Cheshire is peat (see table below), and probably all counts as lowland peat. It is highly likely that it is degraded and therefore acts as a source of emissions; 60 per cent of the peat in west Cheshire is classified as wasted which is "deep peat that has been substantially degraded following years of drainage and cultivation so the peat is now more dominated by underlying mineral material". Further work should be undertaken to really understand this peat resource, how it is currently being managed, and its carbon store and emissions/sequestration. This could inform better management or restoration potential.

Table: Types of peat in west Cheshire[55].

Grade	Area (ha)	Cover (%)	Data source
Rich fens/reedbeds (wasted)	1841.68	1.96	Natural England Peatland Data
Rich fens/reedbeds (deep)	1080.07	1.15	Natural England Peatland Data
Lowland fens	116.89	0.12	Natural England Priority Habitat Inventory
Reedbeds	16.30	0.02	Natural England Priority Habitat Inventory
Lowland raised bog	9.48	0.01	Natural England Priority Habitat Inventory
No Data	1.40	0.00	Natural England Peatland Data
Raised bog	1.38	0.00	Natural England Peatland Data

Vegetation can also play a role here. Woodlands generally have significantly higher above-ground carbon stores than other vegetation[56], and can continuously sequester

[55] Accessible description: The table shows the types of peat in west Cheshire. These are: rich fens/reedbeds (wasted), rich fens/reedbeds (deep), lowland fens, reedbeds, lowland raised bog, no data, and raised bog. For each type of peat, the table sets out the area it covers in ha, as well as the percentage of west Cheshire that it covers. The data source for each type of peat is also listed.

[56] Broadmeadow and Matthews (2003). Forests, carbon and climate change: the UK contribution. Forestry Commission.

more carbon. For this reason, woodland establishment is promoted in particular for carbon sequestration and storage. In west Cheshire there are 5,866 ha of woodland, covering 6.2 per cent of the borough (according to the National Forest Inventory, 2018; which is the dataset used nationally for reporting on woodland cover). Another estimate, by Anthesis, put woodland cover at the vastly different 12,323 ha[57]. This higher figure is for "woodland including trees in hedgerows and fields", and is estimated from the Crop Map of England (Anthesis say that this "mainly uses satellite data to identify land-uses and crop types; it is a snap-shot at a point in time (summer 2018) and should be considered indicative only". It could be that the 6,547 ha difference in woodland cover between Anthesis' estimate and the National Forest Inventory figure is highlighting both small forests and "trees outside of woodlands", which are not picked up by the National Forest Inventory and can be a significant amount. However, further analysis is needed to establish robust figures for trees outside of woodlands. Forest Research should soon have a new national dataset on "trees outside of woodlands", which would be useful to use in order to have nationally comparable data that is regularly updated to see change.

There are some constraints to woodland creation. For example, new woodland should not be planted on peat soils, due to the release of carbon from the soils. In some instances, it may even be desirable to remove established woodland from peat soils, especially where these are classed as low-productivity. Any new woodland creation establishment should follow the UK Forest Standards to take a range of factors into consideration, including landscape and historic character, biodiversity, and retaining high quality agricultural land for food production. As such, although they may not be as effective at sequestration and/or storage as woodland or peatland, other habitats do also play a role in managing carbon. Natural England have recently reported on the carbon storage and sequestration of a range of different habitats[58]. Hedgerows can also act as a large carbon sink if managed

Natural England (2021). Carbon storage and sequestration by habitat: a review of the evidence (second edition).

[57] Anthesis (2019) https://info.anthesisgroup.com/hubfs/CW&C%20Final%20Report.pdf?hsLang=en

[58] Natural England (2021). Carbon storage and sequestration by habitat: a review of the evidence (second edition).

correctly, and there are incentives for farmers to do this with a proposed Hedgerow Carbon Code similar to the Woodland Carbon Code[59].

Private finance will probably play a part in investing in carbon capture projects and is a significant opportunity for farmers. This is in early stages of development, and the model to be used needs to be clarified, simplified, and a robust carbon market created for the outputs of the investment.

List of Council and Partner Actions

3.1 Manage land to optimise the carbon stored in soils and vegetation (e.g. agricultural practices to increase soil carbon stores, regenerative farming, increased tree and woodland establishment, hedgerows, agroforestry (both silvoarable and silvopastural), wetland, peatland and woodland management).

3.2 At least double the cover of woodland, as well as trees outside of woodlands, across the borough by 2045, through natural regeneration and planting, as appropriate. Planting will be a mix of broadleaf and conifer, to provide a range of services and benefits, adhering to UK Forestry Standards and a "right tree, right place" approach.

3.3 To continue to be the accountable body, programme managers, funding recipient and distributor for the Trees for Climate national programme, ensuring the effective management of this nationwide programme.

3.4 Support the ongoing delivery of The Mersey Forest Plan.

3.5 Review the existing peat habitats and soils within west Cheshire, in order to develop appropriate retention and restoration targets. This could be in line with national recommendations by the Climate Change Committee to restore at least 25 per cent of lowland peat by 2050 (or 50 per cent under a higher level of ambition), while allowing food production to continue on the most productive land.

[59] Game and Wildlife Trust (2021). Proposed Hedgerow Carbon Code could unlock more than £60m income for farmers, as development project receives £81k funding.

3.6 Review procurement processes to confirm that contracts are peat-free, and take corrective action where necessary.

Case Studies

Lost Mosses Project

Cheshire Wildlife Trust's Lost Mosses project at Delamere has created new spaces for nature, restoring 120 ha of meres and mosses in Delamere in partnership with the Forestry Commission.

Winmarleigh carbon farm, Lancashire

The creation of the Winmarleigh carbon farm has seen the agricultural land surrounding the Winmarleigh and Cockerham Moss site of special scientific interest turned back into peatland, with sphagnum moss planted as a carbon capture method. As a result the site helps to protect the site of special scientific interest by acting as a buffer zone to the main bog site from the surrounding drainage. Further opportunity for carbon farms can be formed through carbon offsetting schemes such as government subsidies for carbon farming as part of the new Environmental Land Management Schemes (ELMS).

Rindle Moss restoration peatland and wet farming trial

As part of the Wildlife corridor to connect Greater Manchester's mosslands. Historically 99 per cent of Chat Moss has been lost to development and agriculture after the draining of the mossland. This has resulted in large amounts of carbon being released into the atmosphere. The scheme forms part of the wetter-farming trial, and acts to reclaim some of the original land through rewetting programme which will re-wet the field to natural levels, increasing the water table and ensuring the halting of carbon release and ultimately ensuring the future storing of carbon. www.carbonlandscape.org.uk/ - unsure where to link this?

Woodland carbon code, Picton

The woodland carbon code is a voluntary scheme for the creation of new woodland. Picton, part of Cheshire West and Chester's farms estate, is one of the sites being

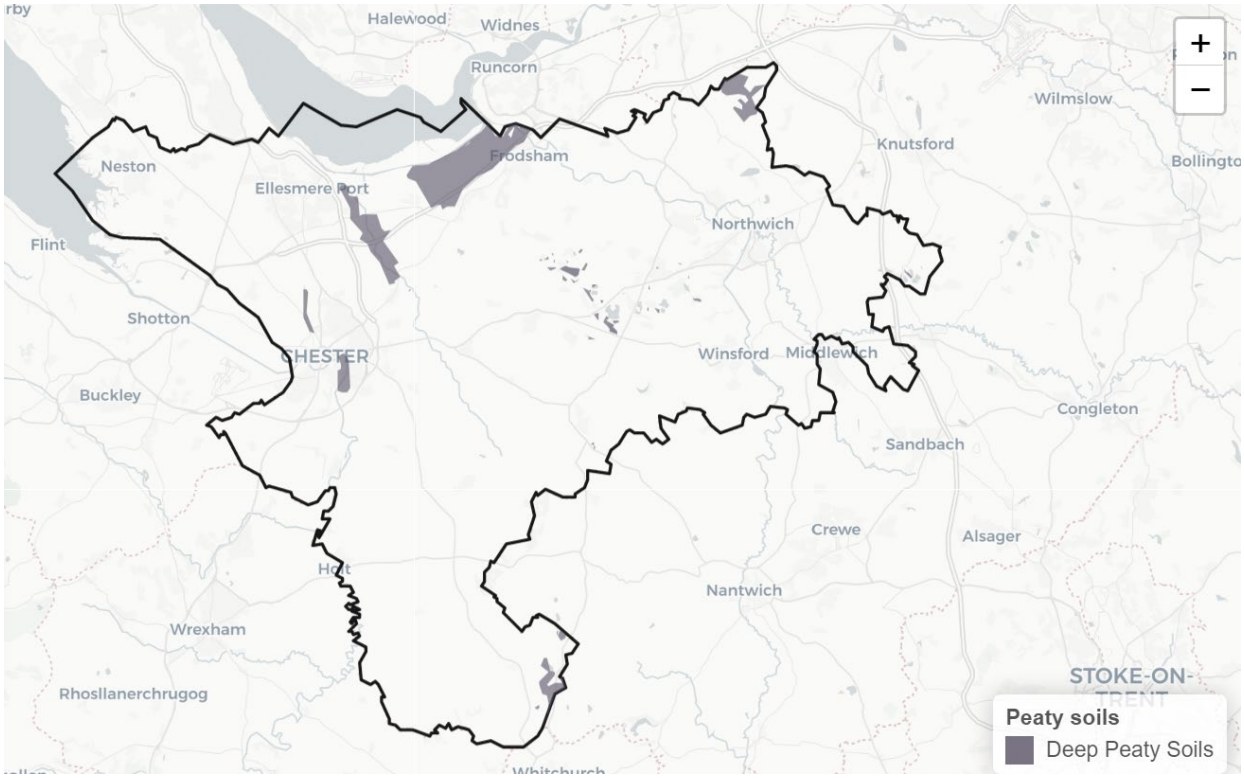
entered into the carbon code this year. The site is predicted to sequester 2,352 tonnes of carbon over 100 years and this will be verified five years after validation. The carbon code allows for the sequestered units of carbon to be used as an offset against a company's emissions. The scheme follows four key principles as regulated by the UK government and international standards.
https://woodlandcarboncode.org.uk/

Supporting Maps

Also see woodland map in section 4.

Map: Peat soils in west Cheshire[60]. Interactive version of this map is available through the mapping portal.

Peaty Soil Location: Derived from 1:50 000 scale BGS Digital Data under Licence 2006/072 British Geological Survey. © NERC. National Soils map © Cranfield University (NSRI) © Crown Copyright and database rights 2021. © Natural England copyright 2021, reproduced with the permission of Natural England, https://www.gov.uk/help/terms-conditions © Crown Copyright and database right 2021. Ordnance Survey licence number 100022021.



[60] Accessible description: This is a map which shows the location of deep peaty soils in west Cheshire. It is a map of the borough showing the presence or absence of these soils.

Map: Carbon storage by vegetation and the top 30cm of soils in west Cheshire[61]. Interactive version of this map is available through the mapping portal.

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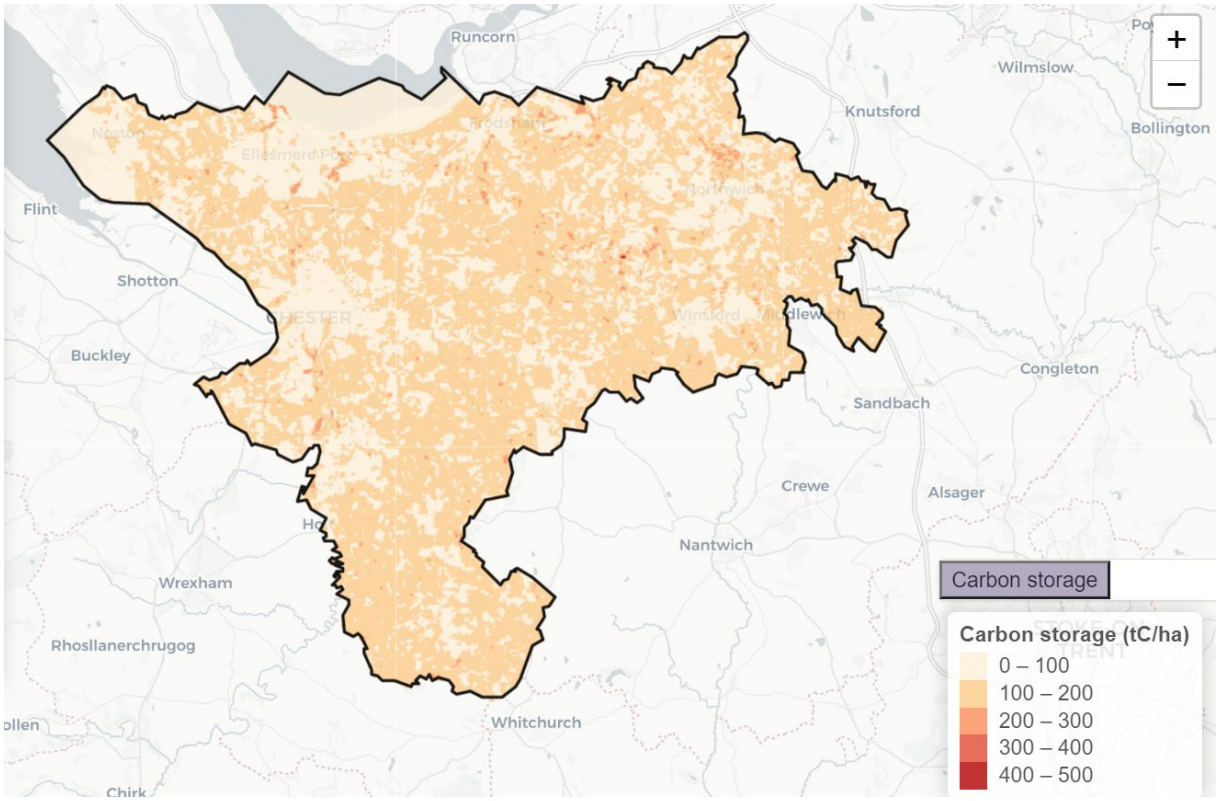


[61] Accessible description: This is a map which describes the carbon stored in the vegetation and top 30cm of soils in west Cheshire. It is a map of the borough which splits the amount of carbon stored over the whole area into 5 categories: 0-100 tC/ha, 100-200 tC/ha, 200-300 tC/ha, 300-400 tC/ha, 400-500 tC/ha.

4. Provide Low Carbon Energy

Replacing fossil fuels with lower carbon alternatives will help to mitigate climate change and contribute to meeting the UK's renewable energy targets. The 'energy and industry' and 'waste and recycling' strands of the Council's Climate Emergency Response Plan will largely deal with this topic. There are also cross overs with the other strands which are energy users: 'transport', 'housing', and 'business premises and engagement'. However, there are actions which relate more specifically to land use which we will cover here. The planning and location of any energy and waste uses discussed here would need to comply with policies and allocations in the Local Plan.

Land within west Cheshire has clear potential to help provide low carbon energy, although this may be in certain, limited locations. This could be through sensitive siting of small-scale solar photovoltaics (with potential for livestock grazing under solar farms, providing shade for animals in high temperatures) and windfarms.

There are also opportunities for biomass. According to the Climate Change Committee, during this decade, Government policies should assist the transition towards the use of biomass (including energy crops) as a fuel with carbon capture and storage, but away from their use for heating buildings and generating power without carbon capture and storage[62]. Sustainably harvested biomass plays a significant role in reaching net zero, as long as it is prioritised for the most valuable end-uses. The Climate Change Committee scenarios propose planting around 0.7 million ha of miscanthus, short rotation coppice and short-rotation forestry by 2050 (around 23,000 ha/yr)[63]. This highlights the importance of scaling up from only 10,000 ha of land in England currently growing miscanthus and short rotation coppice, and no short rotation forestry for bioenergy[64].

[62] Climate Change Committee land use report.
[63] "Further Ambition" scenario. The more ambitious "Speculative" scenario increases this to 1.2 million ha.
[64] Climate Change Committee land use

Bioenergy crops with carbon capture and storage is a net negative technology[65]. West Cheshire has a unique opportunity to capitalise on it due to its significant industrial infrastructure, a proposed Ince Bio Power bioenergy with carbon capture and storage plant in the Ellesmere Port area[66], and identified opportunities for a long term underground carbon store at Liverpool Bay. In order to make this a sustainable operation, a local supply of the bioenergy feed will be essential in reducing emissions associated with transportation. As such, opportunities should be sought across west Cheshire to grow bioenergy crops to feed the plant, whilst also seeking to provide a range of other benefits we want from the land, such as for wildlife and recreation. Bioenergy crops could include: woodland management and establishment for these purposes, planting short rotation coppice (in particular willow coppice) or miscanthus. Planting of bioenergy crops will need consideration in order to not increase soil erosion, especially on slopes. There may be opportunities to grow miscanthus in wetter areas of the Cheshire Plains, currently under water for 3-4 months per year, and used for silage and summer grazing.

The borough is also well placed to capitalise on another net negative technology. There are significant opportunities for the anaerobic digestion of manure with carbon capture and storage, as Cheshire has the a high density of cattle. The slurry from cattle provides a lower yield of material compared to that of energy crops, however the greatest benefit to slurry anaerobic digestion is the low to zero cost. The availability of input material on any given farm will dictate the size and type of anaerobic digestion plant, and slurry will be unavailable as an anaerobic digestion input when cattle are out grazing. Therefore, it is essential to identify farms within west Cheshire that are likely to have available slurry for digestion[67] and to explore opportunities for a coordinated and cooperative approach to slurry to allow small and medium sized farms to employ anaerobic digestion.

There are further opportunities that need to be explored, in combination with the ‘energy and industry’ and ‘waste and recycling’ strands of the Council’s Climate

[65] Climate Change Committee (2020). The Sixth Carbon Budget: Agriculture and land use, land use change and forestry.
[66] Protos (2021). News: Ince Biomass Plant Chosen as Site for Innovative Carbon Capture Technology Project.
[67] Reaseheath Enterprise Delivery Hub (2010). Economic Viability of Farm Scale AD Biogas Production across Cheshire and Warrington.

Emergency Response Plan, for creating a net negative land and waste economic sector. This includes anaerobic digestion with carbon capture and storage of general waste, maize, food waste, and mixed waste, bio synthetic natural gas, landfill gas capture (instead of flaring) to biomethane with carbon capture and storage, biomass to hydrogen, biodiesel, and jet fuel.

List of Council and Partner Actions

4.1 Review potential to expand growing of bioenergy crops (e.g. short rotation coppice, miscanthus, or other crops) for use with carbon capture and storage in appropriate locations, including on temporary/meanwhile land to provide some income. Encourage bioenergy with carbon capture and storage facilities in the borough to source their feedstock from within west Cheshire.

4.2 Encourage low-carbon energy production from anaerobic digestion of livestock manure. Support the development of the bioenergy with carbon capture and storage sector in partnership with the Local Enterprise Partnership.

4.3 Support other renewable energy generation from the land, e.g. photovoltaics, wind.

4.4 Keep up to date with potential new ways of generating energy, such as the potential for ground source and water source renewable heat generation in urban green spaces.

Case Studies

Frodsham Wind Farm

One of England's largest onshore generating stations, and the largest in the Cheshire region, with an installed capacity of more than 50 MW.

HyNet

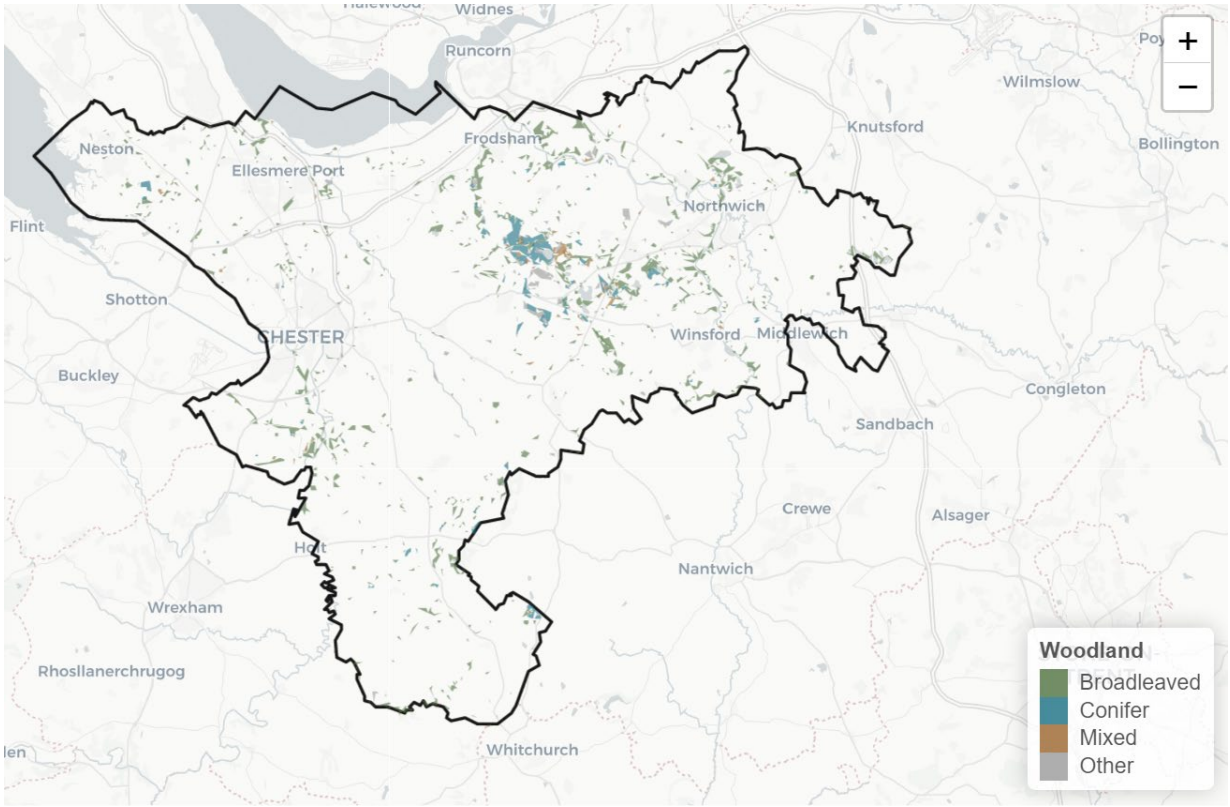
Off Gas Grid Study, Cheshire

This study identified companies in Cheshire and Warrington that are off the gas grid and contacted them to raise awareness of alternative lower carbon heating technologies, the Renewable Heat Incentive, and opportunities around this in terms of saving costs on heating and generating an income. Businesses that are part of the rural fuel or energy supply chain were also contacted. The study found that the Renewable Heat Incentive makes installing biomass boilers more attractive, however, there are no accredited ‘Microgeneration Certification Scheme’ (an internationally recognised quality assurance scheme) biomass installers in the North West of England. The study highlights supply chain issues and provides recommendations to enhance biomass uptake.

Supporting Maps

Map: Woodland in west Cheshire[68]. Interactive version of this map is available through the mapping portal.

National Forest Inventory: Contains, or is based on, information supplied by the Forestry Commission. © Crown copyright and database right 2021 Ordnance Survey 100021242.



[68] Accessible description: This is a map which describes woodland in west Cheshire. It is a map of the borough showing the location of woodland, which is classified as broadleaved, conifer, mixed, or other.

5. Provide Low Carbon Materials

The “housing” and “business premises and engagement” themes from the Council’s Climate Emergency Response Plan cross-over with this topic, as it relates to the materials used in construction.

The production and manufacture of materials, particularly those used in construction, is associated with high greenhouse gas emissions. Embodied energy is an estimate of the total energy required to produce an individual material (including transportation, the mining of raw material and primary processing)[69]. A study into the life cycle energy consumption of buildings revealed windows, drywall, bricks and concrete to be the largest contributors of embodied energy (between 60 – 70 per cent contribution)[70].

The Climate Change Committee makes the case for an increase in sustainably managed woodland for the purpose of construction, alongside its other benefits such as carbon storage[71]. Increasing the quantity of wood used in construction presents an opportunity to reduce greenhouse emissions, as timber has a low embodied energy than materials such as concrete and steel. In addition to using less energy to manufacture, the use of wood products also means that the carbon contained in them is stored in the buildings in the longer term. Locally grown and sourced products can help to reduce transport emissions and to protect the world’s rainforests[72]. There is huge potential for timber in the non-residential sector, which currently sees very low levels of timber in larger builds[73]. Any new build would need to be in accordance with the latest fire safety regulations. Other natural and renewable materials can also be incorporated into new builds, such as wood fibre, hemp, lignin and sheep’s wool.

[69] Leary, M (2011). Fundamentals of Aluminium Metallurgy.
[70] Azari, R (2019). Sustainable Construction Technologies.
[71] Climate Change Committee (2020). Land Use: Policies for a Net zero UK.
[72] For example, see www.rainforest-alliance.org
[73] Climate Change Committee (2019). Wood in Construction in the UK: An Analysis of Carbon Abatement Potential.

Woodland cover in west Cheshire is 6.2 per cent (compared to 10 per cent in England)[74]. Cheshire West and Chester Council manages over 500ha of woodland, as well as 28,000 trees outside of woodlands. These are situated across the borough, in both urban and rural areas[75]. Whilst the Council owned woodlands are currently not harvested for timber, some of the woodlands in the borough are, including by the Forestry Commission at Delamere, National Trust at Peckforton Hill, and Woodland Trust at Frodsham Hill, as well as by some of the larger estates such as Grosvenor, Cholmondeley, and Bostock. Processing of timber has taken place outside of west Cheshire, for example in North Wales and Cumbria, although the Eaton Estate near Chester (part of the Grosvenor Estate) is in the process of installing a state of the art sawmill (to be operational late 2021) both estate and other local timber to be processed, particularly for use in construction (see case study in section 2).

List of Council and Partner Actions

5.1 Bring under and unmanaged rural and urban trees and woodlands into management for the range of services they can provide, and to retain these for longer term.

5.2 Review the potential to make use of timber and natural materials in construction, including in public buildings, and ensure that green infrastructure (e.g. trees, green roofs, and Sustainable Drainage Systems where appropriate) is incorporated to make it well adapted to projected climate change.

5.3 Develop public procurement policies, as well as Council Funds, Grants and Capital programmes, that enhance market opportunities for local sustainable materials.

5.4 Support innovation and entrepreneurship in developing new products and market opportunities from timber and other natural low carbon alternatives to energy intensive materials, ensuring that any value added processing is carried out locally.

[74] From the National Forest Inventory (2018). Anthesis gave a different estimate, discussed in the carbon section.

[75] Cheshire West and Chester Council tree-and-woodland-strategy (cheshirewestandchester.gov.uk)

Case Studies

Forestry Scotland, the use of timber in construction

A research report into sourcing and using local timber products. Timber is almost carbon neutral, has low embodied energy and can store carbon in the fabric of the building.

Woodland Management, Frodsham

Woodland management from the production of timber in order to gain multiple benefits such as the harvesting of wood whilst also ensuring an increased awareness of wildlife conservation, public access and leisure provision. Material is used for construction, fencing and biomass with saw mills across North of Wales.

Woodland Management, Sefton Coast

Sefton's woodlands are managed by the Council's Coast and Countryside Service. Trees felled as part of management works are used in the 'Pinewood workshop' to manufacture wood products (e.g. engraved signs, benches, way-markers, gates, picnic benches, bird feeders, boardwalks, access barriers, and nest boxes) for use in the borough. The workshop also provides training for adults with learning disabilities. This reduces the amount of tree surgery waste going to landfill, reduces carbon emissions from transportation, and recycles the timber into a product of benefit to residents and visitors. All wood products are branded with the Forest Stewardship Council logo, certifying that it is from a sustainably managed source. Sefton was the first local authority in the North West of England to achieve this.

- For other good practice see Association for Environment Conscious Building.

Supporting Maps

See woodland map in section 4.

6. Reduce the Need for Car Travel

The “transport” theme from the Climate Emergency Response Plan crosses over with this topic, as well as the “housing” and “business premises and engagement” themes. In this Action Plan we do not focus on reducing emissions from transport in its entirety, but rather on the contribution to this agenda that greener settings can provide.

Across the UK, road traffic has significantly increased, from 255 billion miles travelled in 1990 to 328 billion miles in 2018[76]. It is responsible for 21 per cent of the total UK greenhouse gas emissions (2017)[77]. The 2009, integrated transport report for Cheshire West and Chester Council identified that road transport emissions were 3.3 tCO_2/capita within the borough, compared to an average of 2.2 tCO_2/capita in the UK[78]. In 2019, heavy good vehicles made up 160 million miles of traffic, whilst cars made up 2,164 million miles[79]. Car ownership is also on the rise within west Cheshire. In 2011, 81 per cent of households had access to at least one car, with an average of 1.3 cars per household[80]. Residents from disadvantaged communities are less likely to own and have access to a car[81].

The Council has a Local Walking and Cycling Infrastructure Plan (2020-2030), which provides a strategic approach identifying where cycling and walking improvements are required at a local level over a 10 year period[82]. It suggests that there are approximately 348 km of cycleways in the borough as well as 155 km of additional traffic free routes including canal towpaths, and a further 1,261 km of Public Rights of Way. 13 per cent of residents walk or cycle to work, compared to 74 per cent who travel by car and 5 per cent by bus.

[76] ONS (2019). Road transport and air emissions.
[77] ONS (2019). Road transport and air emissions.
[78] Cheshire West and Chester Council (2009). Integrated Transport Strategy.
[79] Department for Transport (2020). TRA8902: Motor vehicle traffic (vehicle miles) by local authority and selected vehicle type in Great Britain.
[80] Cheshire West and Chester Council (2016). Cheshire West and Chester Parking Study.
[81] Transport Scotland (2019.) Scottish Transport Statistics, No 37, 2018 Edition.
[82] Cheshire West and Chester Council (2020). ‘Walk. Ride. Thrive’ Draft Local Cycling and Walking Infrastructure Plan 2020 – 2030.

The provision of green, attractive and safe travel routes could encourage people to walk and cycle more, helping to reduce carbon emissions associated with transport as well as improving local air quality and health and wellbeing. These factors are essential in supporting the Council and the wider Cheshire and Merseyside sub-region's aspiration to become a Marmot Community, one in which sectors work in a joined up way to promote population health and wellbeing. In addition, the provision of high quality local recreation areas could reduce the desire to travel further distances, potentially by car, for recreation. Improving the quality of outdoor spaces with trees can increase physical activity such as walking and cycling[83]. Greener neighbourhoods can also result in a 30 per cent increase in retail sales as people look to shop closer to their homes[84]. Tree lined streets can also help improve road safety, with better judgements of distance reported[85]. Ongoing engagement and co—production via forums such as the Integrated Sustainable Travel Taskforce will be central to reducing the need for car travel.

List of Council and Partner Actions

6.1 Create and green active travel routes to make them more accessible, safe, attractive and comfortable for walking, cycling and wheeling. Existing green corridors can be used (e.g. rivers, canals, disused railway lines, public rights of way) as well as tree lined streets.

6.2 Explore and remove barriers to the use of public green spaces, both physical and non-physical.

[83] Woodland Trust (2019). Residential developments and trees.
[84] Living Streets (2018). The pedestrian pound.
[85] Trees and Design Action Group (2014). Trees in Hard Landscapes A Guide for Delivery.

Case Studies

Northwich Woodlands

Provision of locally accessible recreational resources close to urban areas reduce the need to travel by car, can help to disperse visitors more widely and hence reduce pressure on key locations, and improve health and wellbeing.

Princes Avenue, Liverpool

A green cycle route into the city centre along a historic boulevard. Completed as part of the UrbanGreenUp project.

Green Net, Graz, Austria

The green network of Graz consists of the city's green spaces and the green routes which connect them. It aims to provide a healthy and safe way to travel around the city. As well as providing travel routes, these green links also offer an opportunity for recreation, improved air circulation, shade, habitats and a better quality of place. The green routes are categorised as city wide, district level, or local streets; the higher the route is in this hierarchy the more versatile and multifunctional the infrastructure should be. The green net helps to inform planning policy in the city; it highlights strengths and weaknesses in the green network, allowing planners to identify where to safeguard and where to invest in green space to enhance connectivity.

7. Support Biodiversity

We are in the middle of an ecological crisis. Almost half of all UK wildlife is in long term decline and 15 per cent of species are at risk of extinction[86]. The climate emergency is only hastening this destruction of the natural environment, damaging habitats and disrupting ecosystems. Yet it is these very habitats that have the potential to lock up carbon and fight back against rising global temperatures. It is essential that we not only protect these spaces, but let them thrive – for the benefit of people, planet and nature.

The recent Dasgupta review into The Economics of Biodiversity, commissioned by Her Majesty's Treasury, highlighted that humanity does not exist in isolation from nature but sits within it. Nature is our most precious asset, upon which our economies, livelihoods and well-being all depend. With biodiversity declining faster than at any time in human history, we are undermining the productivity, resilience and adaptability that nature lends our society. Our demands on it far exceed its capacity to supply us with the goods and services we all rely on[87]. As we recover from the Covid-19 crisis, the need for nature-rich green spaces where we live and work is clearer than ever and will help health, education and the economy build back stronger. Action must be taken now to remedy this and to put nature into recovery at a local level, in support of regional, national and international work to do the same.

There is an urgent need to set aside more space for nature in order to halt species and habitat losses, and accelerate nature's recovery; through rewilding, habitat creation and management, and the better management of all land. The UK Government has committed to ensuring 30 per cent of the UK is protected by 2030, and this is reflected in the Council's Wildflower and Grasslands Strategy[88]. Rewilding Britain has called for: the creation of core rewilding areas across at least 5 per cent of Britain, and the establishment of 'natural dispersal corridors' across at least 25 per cent of Britain that embed core rewilding areas within broader mosaics of nature-

[86] State of Nature Partnership (2019). State of Nature.
[87] Dasgupta (2021). The Economics of Biodiversity: The Dasgupta Review.
[88] Cheshire West and Chester Council (2020). Wildflower and Grasslands Strategy.

friendly land and marine uses which enhance nature's recovery. These corridors should substantially expand habitat quality and connectivity in a way that allows species to disperse and migrate as climate zones move[89].

As the climate changes, the range of species is shifting northwards and to higher altitudes. It has been estimated that climate zones in Britain are moving northwards at up to 5km a year[90]. A number of factors will limit species ability to move, including their dispersal abilities and the nature of the landscape (i.e. the fragmentation of habitats and the permeability of the landscape in between). Our wildlife is already severely depleted and not in a good state to withstand the added pressures of climate change. Nature reserves are small and fragmented, and the surrounding landscapes are generally not managed in order to allow for species movement. The 2010 Lawton review stated "we need a step-change in our approach to wildlife conservation, from trying to hang on to what we have, to one of large-scale habitat restoration and recreation, under-pinned by the re-establishment of ecological processes and ecosystem services, for the benefits of both people and wildlife"[91].

Within west Cheshire, 108.6 km^2 (or 11.5 per cent of the borough) is currently designated for nature[92]. Whilst Area of Outstanding Natural Beauty is a landscape designation, rather than a designation for nature as such, if the proposed Sandstone Ridge Area of Outstanding Natural Beauty goes ahead this would bring the total designated area (for nature and landscape) to 430 km^2, or 30 per cent of west Cheshire. Cheshire West and Chester Council's Ecological Network offers an opportunity to link areas of biodiversity at a broad landscape scale. In addition, the Council has adopted the Environmental Management Strategy. This includes a Wildflower and Grasslands Strategy, which aims to improve biodiversity on Council-managed land. It also considers the importance of planning policy/development

[89] Rewilding Britain (2020). Adapting to Climate Heating: How rewilding can help save Britain's wildlife from extinction during the climate emergency.
[90] Rewilding Britain (2020). Adapting to Climate Heating: How rewilding can help save Britain's wildlife from extinction during the climate emergency.
[91] Lawton et al (2010). Making Space for Nature: a review of England's wildlife sites and ecological network. Report to Defra.
[92] This includes land designated as Local Wildlife Sites (LWS), SSSIs, Ramsars, SPA, SAC, ASNW, LNR; with all designations except for LWS taken from www.data.gov.uk.

management in contributing to the aims of the Strategy, as well as the management of private gardens.

Table: Landscape and nature designations in west Cheshire[93]. It should be noted that designations in the table do overlap.

Designation	Area (km^2)	Cover (per cent)
Local Wildlife Site (LWS)	56.6	6.0
Site of Special Scientific Interest (SSSI)	51.1	5.4
Ramsar	39.7	4.2
Special Protection Area (SPA)	38.4	4.1
Special Area of Conservation (SAC)	17.3	1.8
Ancient Semi-Natural Woodland (ASNW)	5.6	0.6
Local Nature Reserve (LNR)	1	0.1
Area of Outstanding Natural Beauty (AONB; Sandstone Ridge - proposed)	220.4	23.4

List of Council and Partner Actions

7.1 Protect 30 per cent of land in west Cheshire for nature by 2030 (in line with national and international commitments), including the Council's own land holdings, in-line with the Wildflower and Grasslands Strategy. As well as more land for nature, we also need to increase the size of habitats where possible, improve their management so that they are in more favourable conditions and take into account climate change impacts, and link these sites with nature-enhancing land uses into a more coherent Nature Recovery Network.

7.2 We will work with the Local Nature Partnership and other partners to develop a Nature Recovery Strategy for Cheshire, to aid recovery of key habitats and species.

[93] Accessible description: The table shows the landscape and nature designations in west Cheshire. These are: Local Wildlife Sites (LWS), Sites of Special Scientific Interest (SSSI), Ramsars, Special Protection Areas (SPA), Special Areas of Conservation (SAC), Ancient Semi-Natural Woodland (ASNW), Local Nature Reserves (LNR), and a proposed Area of Outstanding Natural Beauty (AONB) for the Sandstone Ridge. The table sets out the area covered by each designation in both km^2 and as a percentage of west Cheshire. It should be noted that designations in the table do overlap.

7.3 Identify where there may be substantial barriers to species dispersal, such as major roads, and explore the potential to create green bridges to allow for species migration.

7.4 Planning should continue to identify and protect ecological networks, including internationally important sites, sites of special scientific interest, Local Wildlife Sites, ancient woodlands, other priority habitats and features, and areas for restoration.

7.5 Invest in Council skills and ability to act as lead for Biodiversity Net Gain investment.

7.6 Reduce the frequency of mowing, collect cuttings, and reduce use of pesticides and weedkillers on Council owned land, in line with the Wildflower and Grasslands Strategy.

7.7 Encourage all land to be managed to create a more permeable landscape and reduce pressure on wildlife.

7.8 Encourage low carbon and wildlife friendly gardening practices, that take into consideration potential impacts of climate change.

Case Studies

Living Landscapes

Cheshire Wildlife Trust are working to ensure natural connections of 4,700 ha of land. The aim is to ensure an established county-wide wildlife network in Cheshire, linking and enhancing wildlife habitat. The Gowy and Mersey Washlands is an example of a Living Landscapes project.

No or Reduced Mowing

A growing number of local authorities, for example Cardiff, are now opting for management regimes which involve reduced mowing, in order to create wildflower meadows beneficial for pollinators and other wildlife, whilst at the same time saving on expenses and carbon associated with more intensive management regimes. Plantlife has a "No Mow May" campaign to encourage better management of lawns for wildlife. Cheshire Wildlife Trust are also campaigning for a change in management policies.

Green bridge over A556, Cheshire East

The green bridge over the A556, located to the west of Mere, provides both farm access and a wildlife corridor to maintain connectivity between habitats over the dual carriageway. It was planned by Highways England in order to limit the impact of the new road on badgers, bats and great crested newts, which were known to be in the vicinity. The bridge contains a mixture of hedging and plants which together provides a safe passage across the road for badgers, voles and other small animals, insects and birds. A remote sensing camera has shown that the bridge is being used by badgers. This was the first green bridge created specifically for wildlife by Highways England, although another had been undertaken for landscape purposes. They are now being more regularly committed to as part of road developments where there is a recognised need in the Environmental Statement, however they are not yet part of the formal standard and have not been retrofitted to existing road bridges.

Wildlife gardening

There are lots of resources available online to support more wildlife friendly gardening practices. Some examples are included below.

www.cheshirewildlifetrust.org.uk/take-action//wild-garden-award

www.nationaltrust.org.uk/features/nine-ways-to-build-a-wildlife-friendly-garden

www.greenroofers.co.uk/green-roofing-guides/ultimate-guide-eco-friendly-gardening/

www.woodlandtrust.org.uk/blog/2018/01/environmentally-friendly-gardening-10-top-tips/

www.chesterzoo.org/what-you-can-do/campaigns/wildlife-connections/

Green Roof Policy, Basel, Switzerland

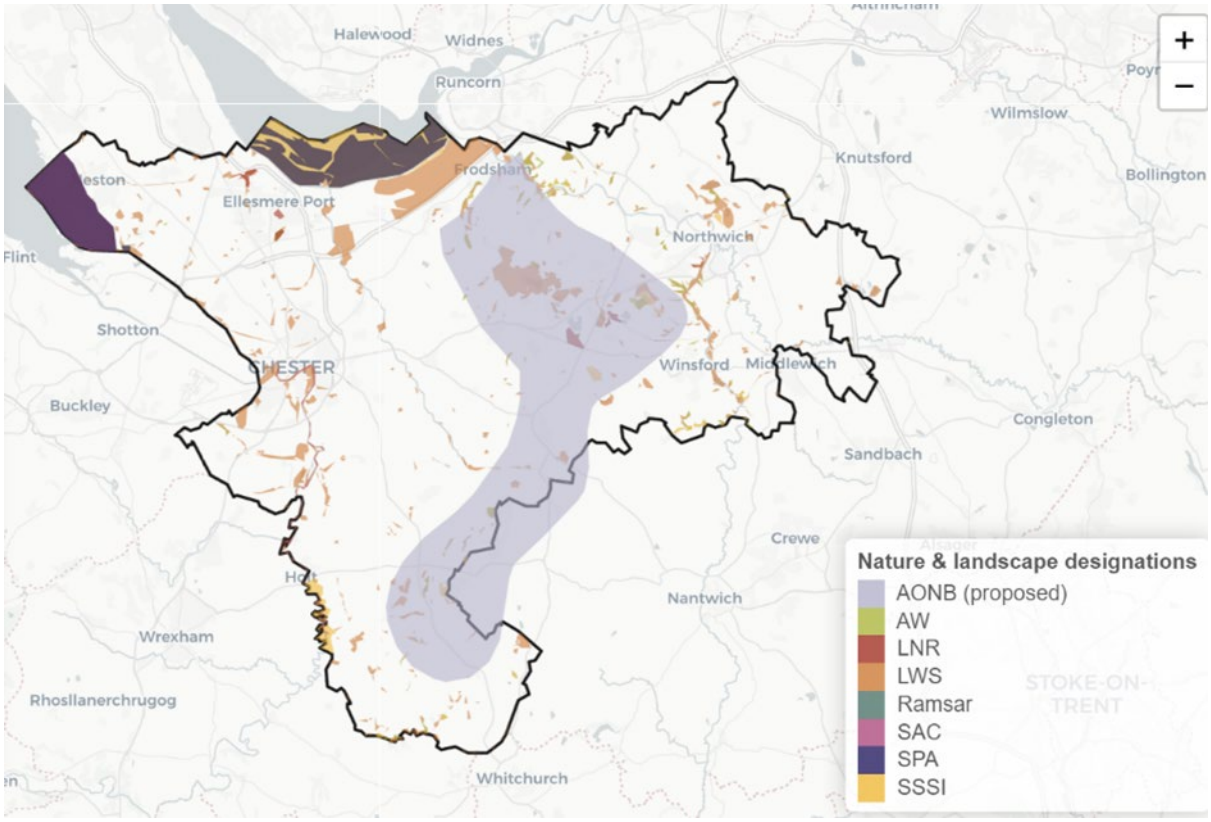
Basel has the highest density of green roofs in the world, covering 23 per cent of its flat roof area. Following subsidies in the 1990s, the Building and Planning Act was amended in 2002 so that all new buildings with flat roofs must have green roofs. On roofs over 500m^2, the substrate must be native soils and of varying depth. Basel Exhibition Centre's green roof shows the value of different substrate depths for biodiversity; it also has solar panels which provide shade for species, and are more efficient as they are kept cooler by the green roof.

Pollinator Planting schemes within west Cheshire

There are some recent examples of where Cheshire West and Chester Council has undertaken pollinator planting schemes within open spaces. These include new bee friendly borders and bespoke bug hotels at Alexandra Park, and a bee friendly planting scheme at Water Tower Garden Park in Chester, working with Friends of the Earth.

Supporting Maps

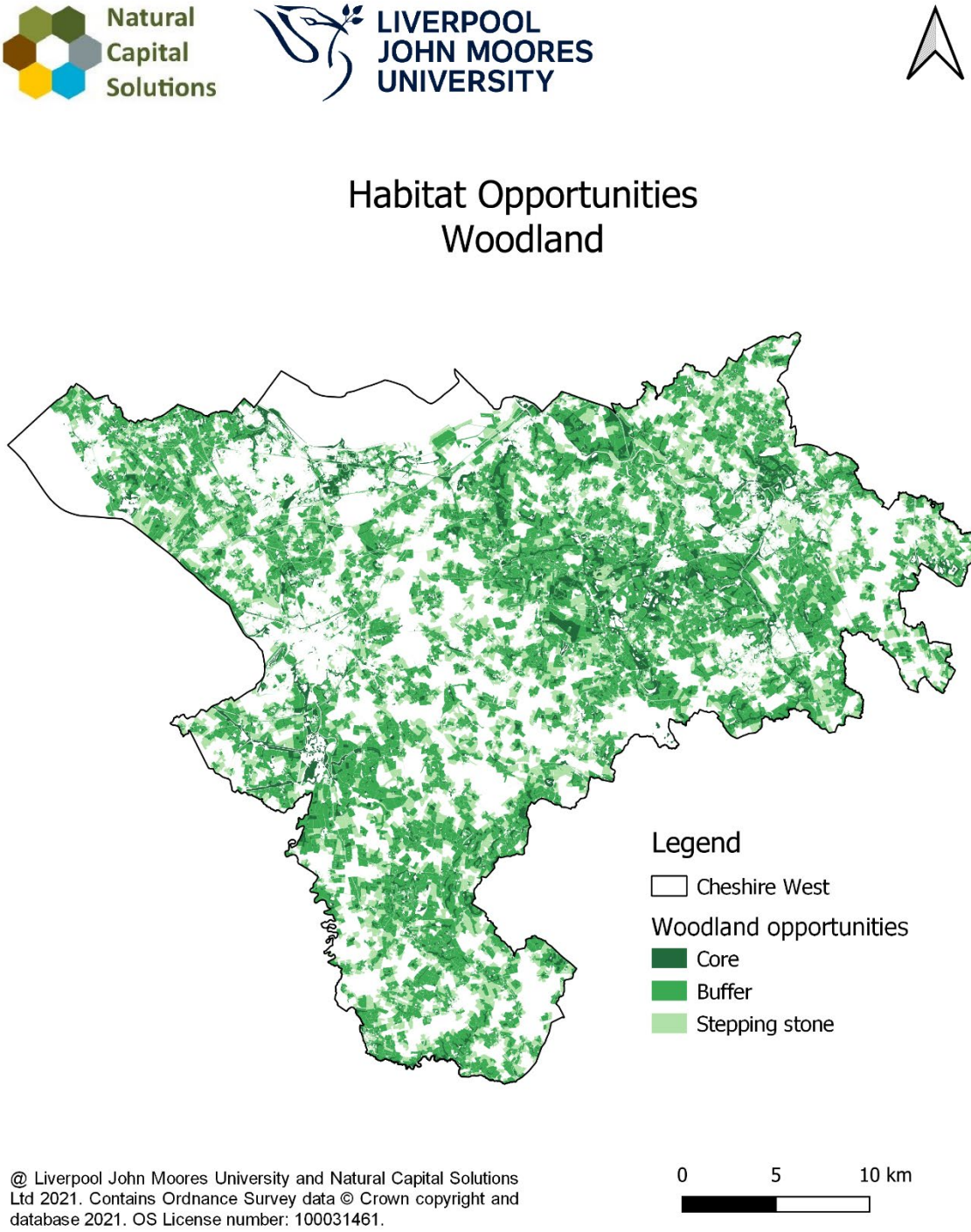
Map: Nature and landscape designations in west Cheshire[94]. The various designations overlap. Interactive version of this map is available through the mapping portal.



[94] Accessible description: This is a map which describes the nature and landscape designations in west Cheshire. It is a map of the borough showing the location of a proposed Area of Outstanding Natural Beauty (AONB), as well as ancient woodland (AW), Local Nature Reserves (LNR), Local Wildlife Sites (LWS), Ramsars, Special Areas of Conservation (SAC), Special Protection Areas (SPA), and Sites of Special Scientific Interest (SSSI).

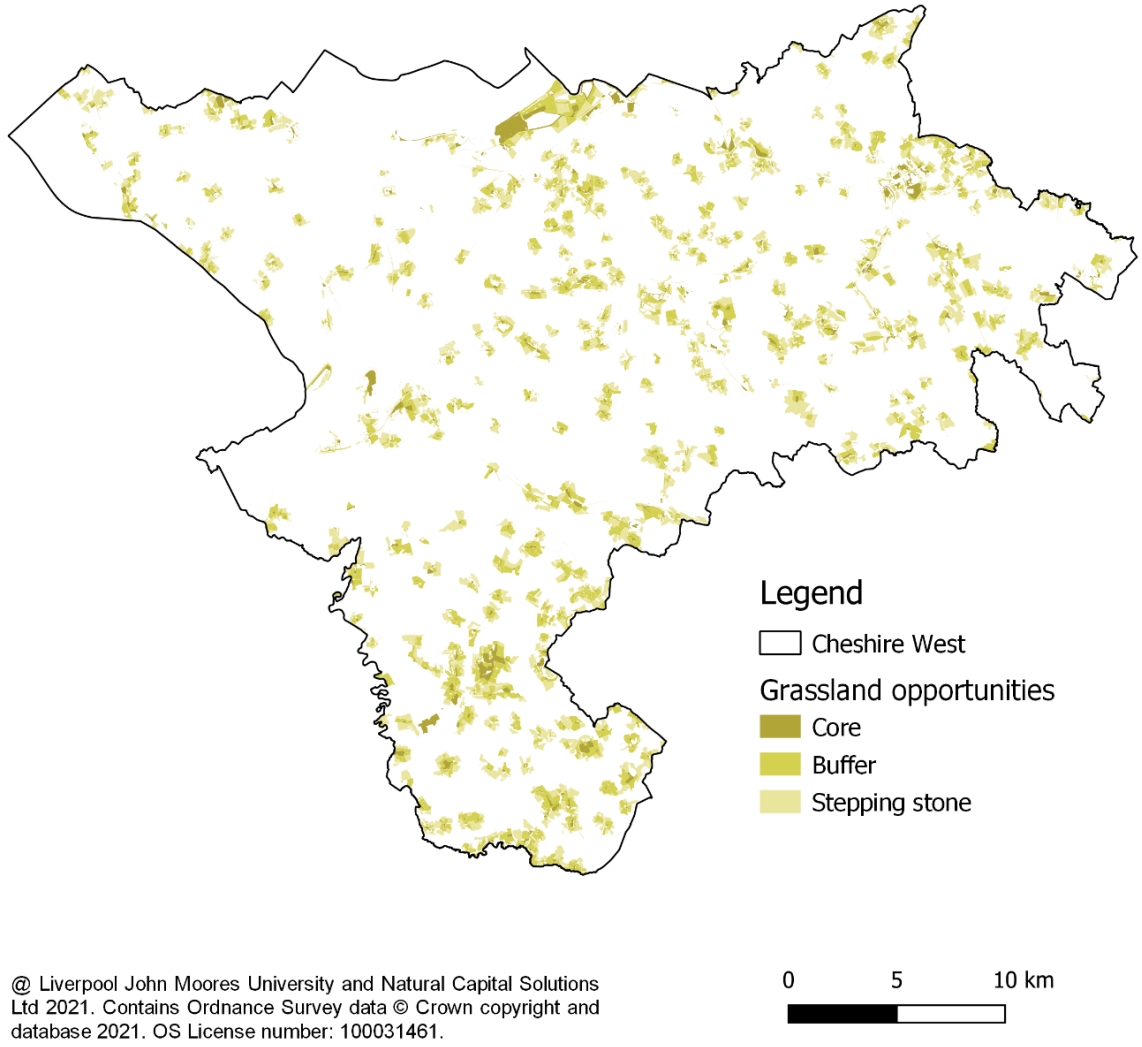
A number of ecological network maps have been produced. The first 4 below have been produced by Natural Capital Solutions, to show opportunities for woodland, grassland, mire, and wetland habitats. The fifth map is using data from Natural England's Natural Course project to show the wetland and woodland ecological networks. Cheshire West and Chester Council have an ecological network map from 2016 and is used as part of the Local Plan. These need to be compared and assessed thoroughly as part of delivering action 7.2.

Map: Woodland habitat opportunities in west Cheshire[95]. Interactive version of this map is available through the mapping portal.



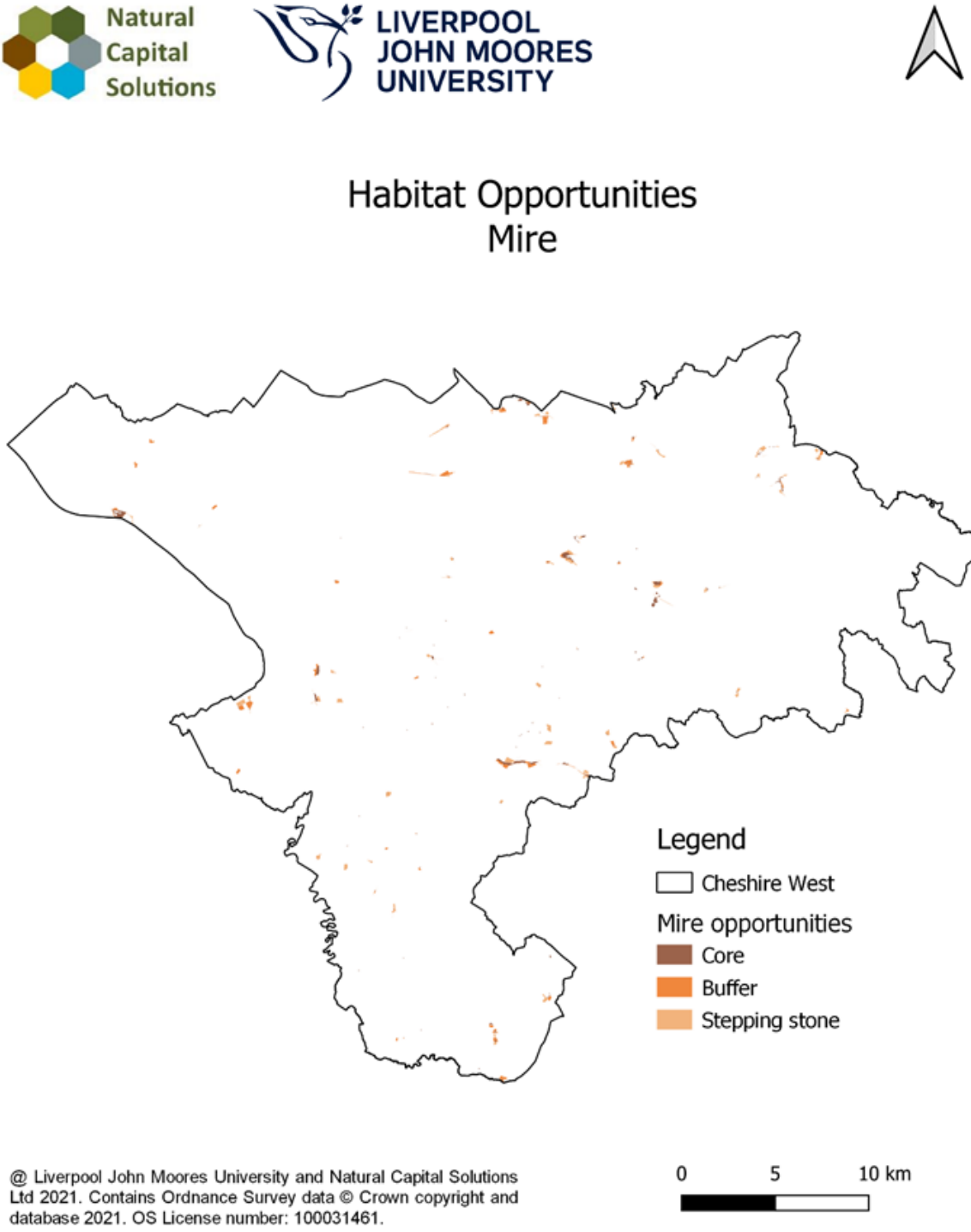
[95] Accessible description: This is a map which describes the woodland habitat opportunities in west Cheshire. It is a map of the borough showing the location of core woodland habitats, as well as buffers of these, and steeping stones to connect them.

Map: Grassland habitat opportunities in west Cheshire[96]. Interactive version of this map is available through the mapping portal.



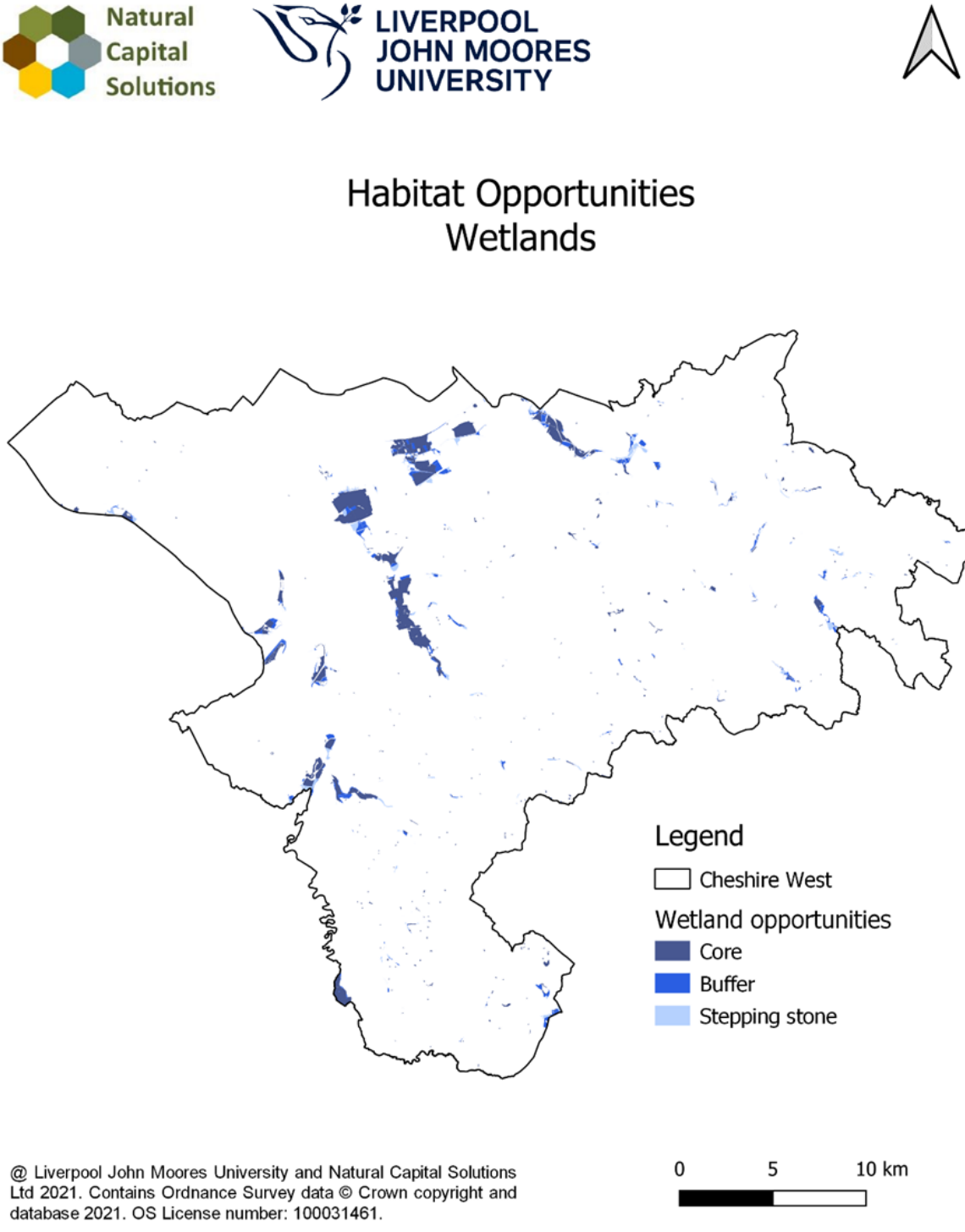
[96] Accessible description: This is a map which describes the grassland habitat opportunities in west Cheshire. It is a map of the borough showing the location of core grassland habitats, as well as buffers of these, and steeping stones to connect them.

Map: Mire habitat opportunities in west Cheshire[97]. Interactive version of this map is available at through the mapping portal.



[97] Accessible description: This is a map which describes the mire habitat opportunities in west Cheshire. It is a map of the borough showing the location of core mire habitats, as well as buffers of these, and steeping stones to connect them.

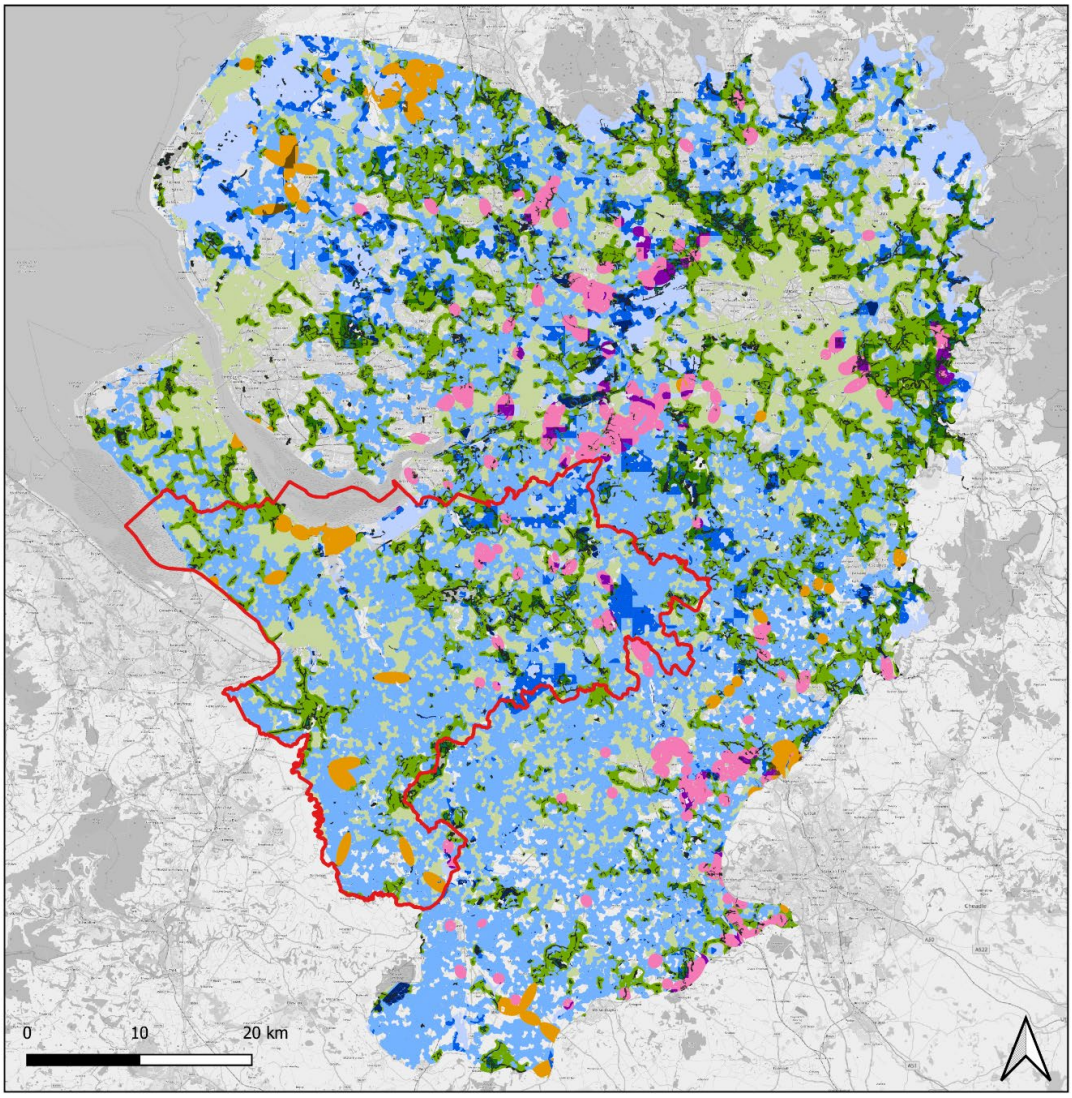
Map: Wetland habitat opportunities in west Cheshire[98]. Interactive version of this map is available through the mapping portal.



[98] Accessible description: This is a map which describes the wetland habitat opportunities in west Cheshire. It is a map of the borough showing the location of core mire habitats, as well as buffers of these, and steeping stones to connect them.

Map: Ecological network model for Cheshire to Lancashire[99]. Interactive version of this map is available through the mapping portal.

Data source: Natural England's Natural Course project.



Legend

- Primary Wetland Habitat, Better
- Primary Woodland Habitat, Better
- Priority Wetland Creation Zone, Connect
- Priority Woodland Creation Zone, Connect
- Wetland Buffer Zone 1, Bigger
- Wetland Buffer Zone 2, Bigger
- Wetland Creation Zone, Connect
- Wetland Network Expansion Zone, More
- Woodland Buffer Zone 1, Bigger
- Woodland Buffer Zone 2, Bigger
- Woodland Creation Zone, Connect
- Woodland Network Expansion Zone, More
- CWAC boundary

LIVERPOOL JOHN MOORES UNIVERSITY

[99] Accessible description: This is a map which describes an ecological network model for Cheshire to Lancashire. The boundary of west Cheshire is shown in red. The map shows wetland and woodland habitat. For each habitat type it shows the primary habitat (where the focus would be on making these better), creation zones (to connect up the primary habitats), buffer zones (to make habitats larger), and expansion zones (to create more habitats).

8. Keep Us Cooler

Climate change is projected to increase the frequency and intensity of heatwaves[100]. Due to the urban heat island effect, the impact of such heatwaves will be felt most within urban areas, with consequences for health and well-being, and for the economic vitality of town and city centres. For example, in 2020 there were three heatwaves in June, July and August which resulted in 253 extra deaths in the North West of England[101]. Among the most vulnerable are those located in urban centres, the elderly, people with severe illnesses, and those who cannot adapt their behaviour to keep cool (e.g. young children)[102]. About 250,000 people live in the urban areas of west Cheshire, notably in Chester, Ellesmere Port, Northwich and Winsford.

The Public Health England, Heatwave Plan promotes the greening of the built environment to combat overheating[103]. Green infrastructure can help manage temperatures by providing evaporative cooling, shading, and allowing air to flow into urban areas. It can also help reduce future demand for air conditioning, which would result in increased emissions as well as waste heat further warming urban areas. Large green spaces play an important cooling role, but it is also important to have green areas where people live, work and gather. Trees, green walls and green roofs can help to increase green cover in more built up environments. Trees will be particularly important for the shade they provide, and, in particular, large canopied trees[104].

Whilst overheating is less of a concern in the rural locality of the borough (population 89,111), adequate tree shade is still desirable[105]. It can also be beneficial to provide shade for livestock and water courses.

[100] Joseph Rowntree Foundation (2011). Climate change, justice and vulnerability.
[101] GOV.UK (2020). Heatwave mortality monitoring report.
[102] Joseph Rowntree Foundation (2011). Climate change, justice and vulnerability.
[103] Public Health England (2019). Heatwave plan for England.
[104] Wang et al (2021). Tree species richness and diversity predicts the magnitude of urban heat island mitigation effects of greenspaces.

List of Council and Partner Actions

8.1 Review the potential to target areas to protect existing and create new green infrastructure, and increase tree cover (including trees which will have large mature canopies) to provide shade and cooling.

8.2 Explore the potential to use green space and building alignment to incorporate cool air flows into new developments, and the wider settlement.

Case Studies

Green Streets, Ellesmere Port

The community greening project increased urban tree cover for a variety of reasons including urban cooling. It included street tree planting, creating green alleyways and walls, and installing water butts to collect water for the trees. Much of the work was in high density and deprived urban areas. Sixty-two street trees were planted in four locations across Ellesmere Port in 2009.

Manchester Mayfield Regeneration Strategy Framework

The proposed massing of the new regeneration area considers the potential impact of local wind directions and the microclimate within and around the site, and to inform the proposed layout and future landscaping. The proposal considers the scale and massing of each building within the site ensuring the direction of the sun enables light throughout the development. This has been planned through analysis and computer modelling.

Digital Environmental Atlas, Berlin, Germany

This online atlas presents maps and information on a range of environmental topics, and aids urban planning and landscape development. A 'climate function' map defines spaces according to the climatic impact they have on other areas and an evaluation of the impact of any structural change on this. It combines a green and open space inventory, settlement areas, traffic related air pollution, and information on air exchanges. This is then translated into a 'planning advice' map, guiding protection and development in order to improve the climate and air quality (e.g. link

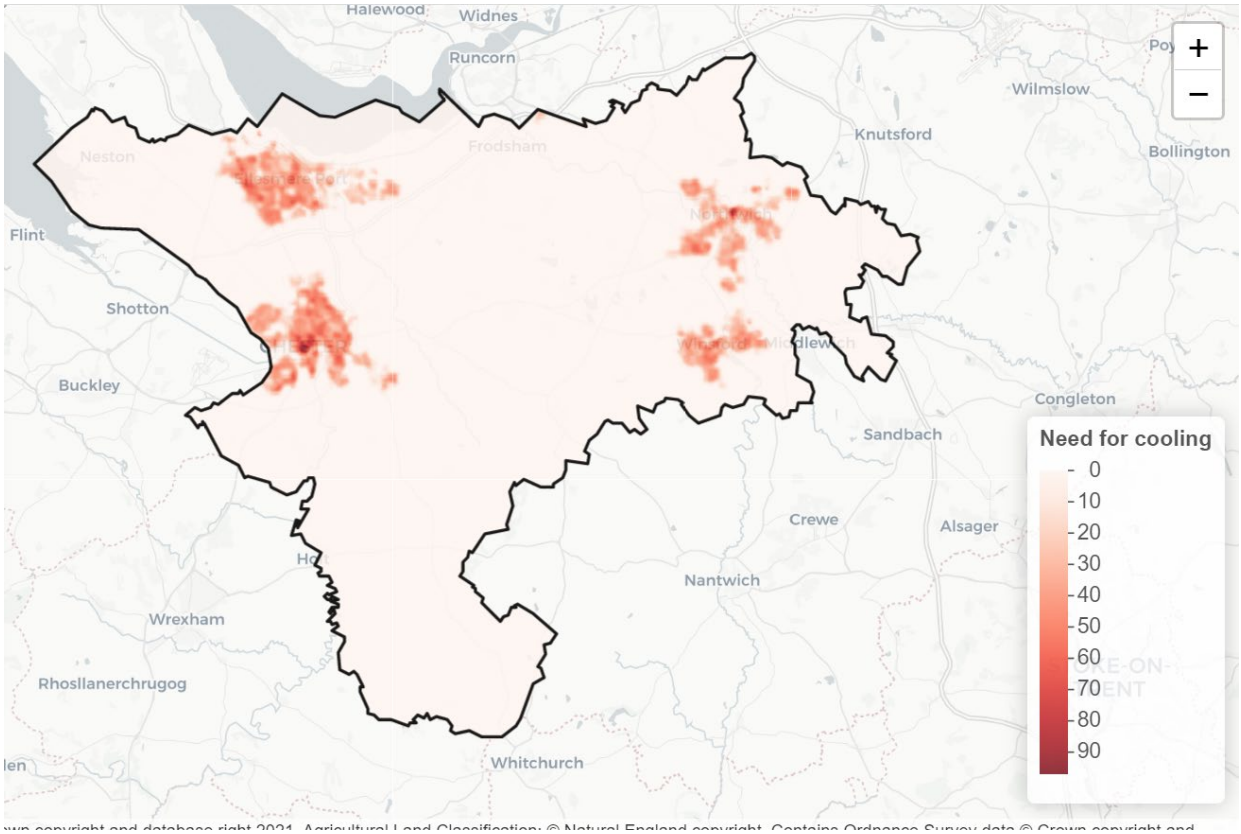
open spaces, increase vegetation for ventilation, align new development with wind channels).

For other good practice see:

- The Cool walks tool is an app to find the most shaded route along a given journey within Barcelona.

Supporting Maps

Map: Need for cooling in west Cheshire[106]. This map estimates societal and environmental demand for ecosystems that can regulate local temperatures and reduce the urban heat island effect. It is based on three indicators: the locations of areas suffering from the urban heat effect (i.e. proportion of sealed surfaces), population density, and proportion of the population in the highest risk age categories (i.e. over 65 years). The latter two indicators show the societal need for local climate amendment. Interactive version of this map is available through the mapping portal.



[106] Accessible description: This is a map which describes the need for cooling in west Cheshire. It is a map of the borough showing the need for cooling on a scale from 0 to 100, where the higher numbers indicate areas with a greater need for cooling.

9. Manage Water in an Integrated Way

Climate change projections include a shift in the seasonality of rainfall; drier summers and wetter winters, with more extreme events such as heavy rainfall which can lead to flooding, and drought with implications for the quantity and quality of water, with important consequences for both human consumption and wildlife that relies on aquatic ecosystems. Land use and management also impacts on water; on the speed of runoff over surfaces, soil erosion, pollutants entering water courses, and on demand for water, including abstraction. We must plan for water in an integrated way, to be able to reduce flooding and the impacts of drought, and maintain water resources.

The more extreme rainfall events anticipated with climate change will result in increased flooding from a range of sources including surface water, rivers and tidal. Urbanisation also increases flood risk, with impermeable paved surfaces replacing permeable vegetated surfaces. This results in a faster rate and a greater volume of runoff into drains, and an increased risk of these being overwhelmed and flooding. It also results in a more frequent occurrence of combined sewer overflows polluting watercourses. Flooding has severe negative impacts: affecting health and wellbeing, having significant economic costs, damaging property, reducing crop yields and hence food security (see section 2), increasing soil erosion and thereby reducing its health for both food storage and carbon sequestration and storage (see section 3), as well as decreasing water quality. Lower income households are particularly vulnerable to flooding, as they are less able to prepare, respond and recover from it. There is a significant cross over between vulnerability to flooding and overheating (section 8), with almost two-thirds of places vulnerable to flooding, also being extremely heat-vulnerable[107].

The 2016 Strategic Flood Risk Assessment sets out the latest information on flooding in the borough[108], whilst the Local Flood Risk Management Strategy guides the Council and partners such as the Environment Agency, Welsh Water, and United

[107] Joseph Rowntree Foundation (2011). Climate change, justice and vulnerability.
[108] Cheshire West and Chester (2016). Strategic Flood Risk Assessment.

Utilities in working together to protect homes, businesses and other infrastructure across west Cheshire[109]. United Utilities, Welsh Water and Severn Trent (Hafren Dyfrdwy) are the water companies operating in the borough[110].

The majority of west Cheshire is relatively flat and is split by high land in the south and north to Frodsham[111]. The borough sits largely within the Weaver Gowy catchment (with the Gowy to the west and Weaver to the east). Its western fringe, including Chester, is covered by the River Dee catchment, that extends into Wales. West Cheshire includes parts of two estuaries: the Dee by Neston and the Mersey between Ellesmere Port and Frodsham[112]. Land use in these areas is estuary, intertidal flats, and salt marsh, backed largely by industrial units, urban areas, and some arable land and pastures[113]. The salt marsh habitat in particular, which covers 2,316ha, could be important for coastal flood protection (see section 3 for its role in carbon sequestration and storage, and section 7 for supporting biodiversity).

The River Dee's tidal range extends inland to Chester, causing flood risk in the area and on low lying floodplains, whilst the Mersey effects land to the north of the M56[114] Flood risk across Ellesmere Port and Neston is isolated to smaller but historic locations, including small watercourses and drainage infrastructure. Elsewhere in the borough, there is a major flood risk area in Northwich where the River Dane converges with the River Weaver. Surface water flooding is less likely to occur in the central area of the borough which tends to be on higher ground, but has greater prevalence across the flatter ground, with residential properties most at risk. The Environment Agency suggests that up to 28,900 properties in west Cheshire could be at risk from surface water flooding, from a rainfall event expected once every 200 years[115].

[109] Cheshire West and Chester (2016). Local Flood Risk Management Strategy.
[110] Cheshire West and Chester Council (2015). Cheshire West and Chester Local Plan (Part One) Strategic Policies.
[111] Cheshire West and Chester (2016). Strategic Flood Risk Assessment.
[112] Cheshire West and Chester Council (2015). Cheshire West and Chester Local Plan (Part One) Strategic Policies.
[113] Copernicus (2021). CORINE Land Cover 2018.
[114] Cheshire West and Chester (2016). Level 1 Strategic Flood Risk Assessment.
[115] Cheshire West and Chester (2016). Level 1 Strategic Flood Risk Assessment.

Whilst flooding cannot be wholly prevented, its impacts can be reduced. Natural Flood Management solutions have a part to play in managing flooding, alongside other solutions such as hard engineering and community resilience. They help to protect, restore and emulate the natural functions of catchments, floodplains, rivers and the coast. They can take many forms that can be applied in urban and rural areas, and on rivers, estuaries and coasts. They reduce the maximum water volume and slow down peak flows, by increasing storage, catchment and channel roughness, and infiltrating water to the soil in appropriate locations. They can also help to manage water resources, maintaining base flows during dry periods and filtering water to catch sediment and remove pollutants. Depending on the technique and location, they can provide a range of other benefits including sequestering and storing carbon, supporting biodiversity, and keeping us cooler.

Techniques used include establishing trees, hedgerows and woodlands, restoring river meanders, leaky dams, temporary storage areas and ponds, functioning floodplains, agricultural practices to improve soil structure, green infrastructure, and sustainable drainage systems[116]. Cover crops planted after harvest, rather than leaving the soil bare over the winter, can help to stabilise soils and reduce runoff, increasing organic matter and the amount of carbon stored, as well as improving soil structure. Riparian buffer strips, or woody interventions, where overland flows meet watercourses can be carefully planned using LIDAR technology to determine the size and shape of the intervention. Once established they will increase carbon stored and sequestered, provide biomass for use with carbon capture and storage, increase habitat, and improve water quality. The Climate Change Committee also suggest that agro-forestry can improve the quality of soil[117] and can help to reduce soil erosion at the source and protect river banks from erosion[118].

[116] Catchment Based Approach. What is natural flood management; Thomas and Nisbet (2006). An assessment of the impact of floodplain woodland on flood flows. Forest Research. Water and Environment Journal. 21, 114–126; Handley and Gill (2009). Woodlands helping society to adapt. In Read et al (2009). Combating climate change: a role for UK forests. ; Broadmeadow and Nisbet (2010). Opportunity Mapping for Woodland to Reduce Flooding in the River Derwent, Cumbria. Forest Research. ; Woodland Trust (2008). Woodland actions for biodiversity and their role in water management.

[117] Climate Change Committee (2019). Land use policies for a net zero UK.

[118] Nisbet et al (2004). A Guide to Using Woodland for Sediment Control. Forest Research.

Sustainable Drainage Systems (SuDS) and green infrastructure have a substantial role to play in water management as part of the built environment, providing other climate services and wider benefits[119]. The SuDS philosophy gives equal consideration to water quantity, water quality, amenity and biodiversity. In addition, features can also be incorporated to capture and store rainwater, enabling it to be reused during droughts to irrigate the green infrastructure, allowing it to continue to provide evaporative cooling and thereby help keep towns and cities cool (section 8) without adding extra pressure to water resources.

Cheshire West and Chester Council has its own Sustainable Drainage System design and technical guide, which includes examples of different Sustainable Drainage System techniques such as detention basins, ponds and wetlands[120].

List of Council and Partner Actions

9.1 Implement the Local Plan policies requiring Sustainable Drainage Systems (for water quantity, quality, amenity, and biodiversity), where appropriate, in new developments and restructuring.

9.2 Target areas to retrofit Sustainable Drainage Systems (for water quantity, quality, amenity, and biodiversity), using existing or creating new green infrastructure, subject to funding.

9.3 Divert rainwater falling on properties (including roofs, drives, patios, yards etc) away from public sewers using Sustainable Drainage System techniques such as soakaways, or diverting it to water courses where possible (prior permission required from the Environment Agency or Canal and River Trust).

9.4 In line with Local Plan policy, avoid new developments in areas at risk of flooding, using these areas as open space, with provision for temporary water storage.

[119] Ellis, J.B. (2013). Sustainable surface water management and green infrastructure in UK urban catchment planning.
[120] Cheshire West and Chester (2020). Sustainable Drainage Systems Guidance.

9.5 We will identify where natural flood management approaches can be used through an opportunity mapping exercise.

9.6 Encourage and use natural flood management within river catchments to help manage riverine flooding and soil erosion.

9.7 Identify and prioritise river stretches for rehabilitation and restoration (e.g. reconnecting rivers to their floodplains).

9.8 Ensure a sustainable water supply for vegetation in times of water stress in order to maintain its evaporative cooling function.

Case Studies

Cheshire West and Chester Sustainable Drainage Systems Guidance Volume 1: Design and Technical Guide

Together with Local Plan (Part Two) policy DM 41, this guide provides the policy support in order to gain a coherent approach and standardised requirements to the design and implementation of Sustainable Drainage Systems. The Council is encouraging Sustainable Drainage System design for developments of all sizes, including new development and redevelopment.

Natural Flood Management and Sustainable Drainage Systems Opportunities Map

Mapping across the Calder Valley as part of the Slow the Flow scheme ensures support for individual and collaborative action for flood mitigation. The mapping identifies realistic locations where residents, businesses, and organisations in Mytholmroyd can contribute to flood alleviation through natural and sustainable interventions. The tool also gives indications as to what interventions might be appropriate in those locations.

London Green Roofs

Strong planning policy embedded into Local Plans to support green roofs can be seen in urban centres such as London, Cambridge, and Milton Keynes[121]. London,

[121] MKA Ecology (2021). Green Roofs and Biodiversity: What you need to know.

for example, has a supporting planning policy in the form of the 'Living Roofs and Walls' technical report which encourages and highlights the benefits of green infrastructure within major schemes.

Mill Brook Natural Flood Management, Tattenhall

The Mill Brook scheme has been created as a temporary flood water storage installation with seepage barriers. The flood management programme aims to hold back flood water at times of peak flow overspill from the Mill Brook further upstream at China Meadow.

River Alt and Croxteth Brook Restoration Project, Liverpool

The scheme manages habitat creation through the planting of wetland plants and the opening of the to improve conditions for river invertebrates. The scheme provides strong community engagement and offers a place to improve the quality of local people's lives and create educational and recreational opportunities.

Natural Flood Management opportunity mapping

Maps have been produced for four Defra Pioneer Catchments which quantify both the opportunity and the benefit of natural flood management, taking a catchment based approach. The report shows that large-scale Natural Flood Management could have made a significant difference to flood risk in Storm Desmond.

Slowing the Flow, Pickering, North Yorkshire

This project is exploring flood management which works with nature to store more water in the landscape and slow its passage downstream. It is expected to reduce the frequency of floods, and deliver benefits to the local environment and community. Landscape management measures employed throughout the catchment include constructing low level bunds, planting trees (especially along streams and in the floodplain), and restoring woody debris dams and wetlands.

River Quaggy, London

This river was de-culverted as part of a flood management scheme. This has created a natural, meandering, wildlife-rich feature in Sutcliffe Park, Greenwich which can be temporarily flooded (and closed to the public). This reduces the downstream flood

risk to Lewisham town centre. Since restoration visits to the park have increased by 73 per cent. Downstream, in a denser urban area, the river banks have been re-naturalised at Chinbrook Meadows, which helps to protect a new housing development from flooding. www.environment-agency.gov.uk/static/documents/Business/casestudyrecreation_1514776.pdf

Chavasse Park, Liverpool

Chavasse Park is a 2.2 hectare green space which is part of the Liverpool One development. The park is on top of a retail and car parking area. In order to reduce flood risk, the park has been designed to attenuate rainwater onsite through a large water containment tank, and a series of ponds and fountains. In addition to reducing flooding, the captured rainwater is also used to irrigate the green space, providing a sustainable source of water. This will ensure that, even in times of drought, the green space will continue to evapotranspire and provide cooling when it is most needed. Chavasse Park was highly commended as an urban green space by the Landscape Institute at the 2009 Landscape Awards.

Opportunity Mapping for Woodland Creation to Reduce Diffuse Sediment and Phosphate Pollution, Cumbria

This study assesses opportunities for woodland creation to help manage sediment and diffuse phosphate pollution within the Lake District by identifying the main sources and pathways of delivery to watercourses. It builds on a previous study of Bassenthwaite Lake. It identifies opportunities for woodland creation on land with a high risk of soil erosion, river lengths with high and moderate risks of bank erosion, and in floodplains. It recommends that stakeholders use the maps to help target future woodland creation to aid diffuse pollution management.

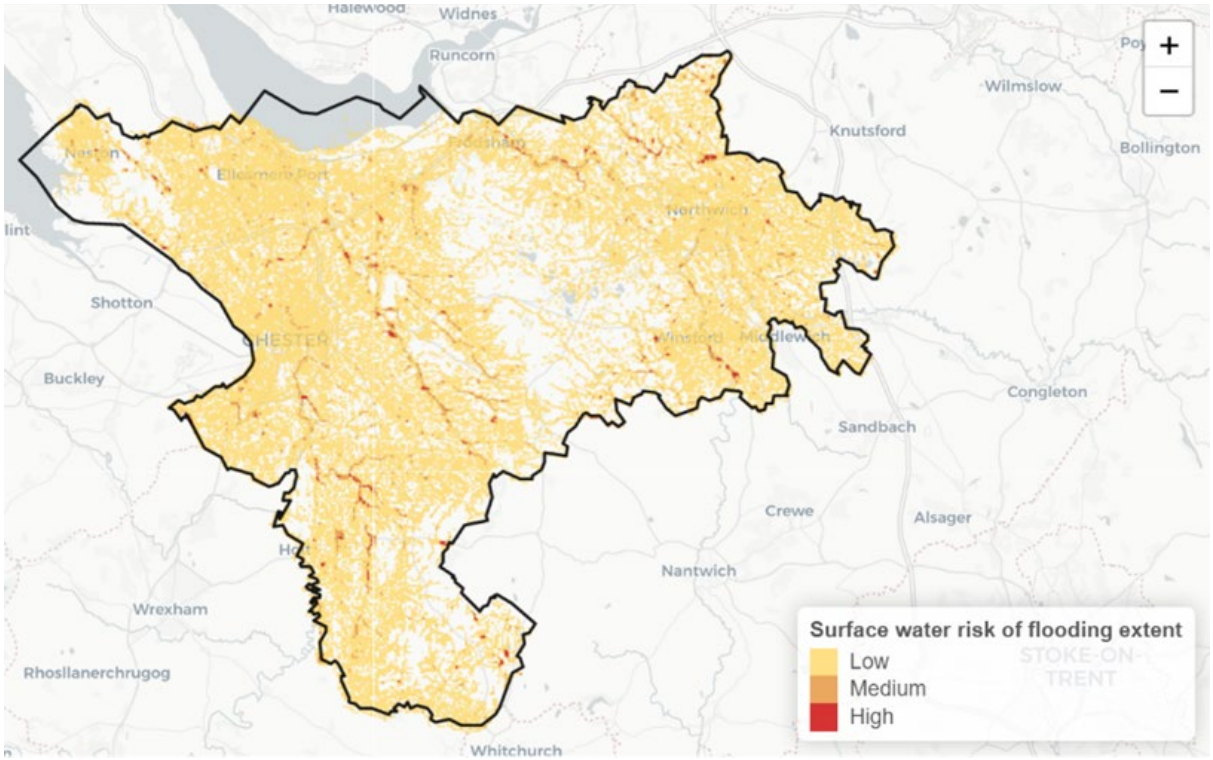
For other good practice see:

- The Green Streets project in Northwood, Knowsley is providing free water butts to accompany new street trees planted in the area http://northwoodgreenstreets.blogspot.com

Supporting Maps

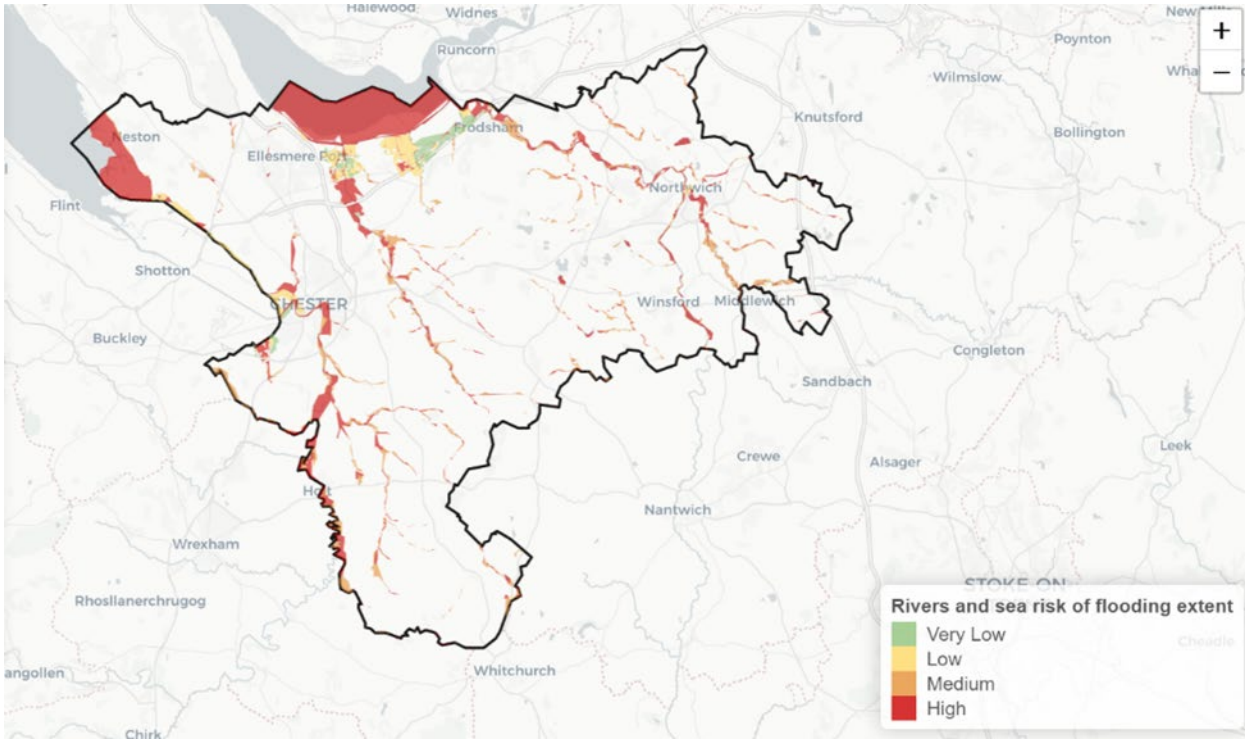
Map: Surface water risk of flooding extent in west Cheshire[122]. Interactive version of this map is available through the mapping portal.

Risk of Flooding from Surface Water: © Environment Agency copyright and/or database right 2015. All rights reserved. Some features of this information are based on digital spatial data licensed from the Centre for Ecology & Hydrology © NERC (CEH). Defra, Met Office and DARD Rivers Agency © Crown copyright. © Cranfield University. © James Hutton Institute. Contains OS data © Crown copyright and database right 2015. Land & Property Services © Crown copyright and database right.



[122] Accessible description: This is a map which describes the extent of surface water flood risk in west Cheshire. It is a map of the borough showing areas at a low, medium, and high risk of surface water flooding.

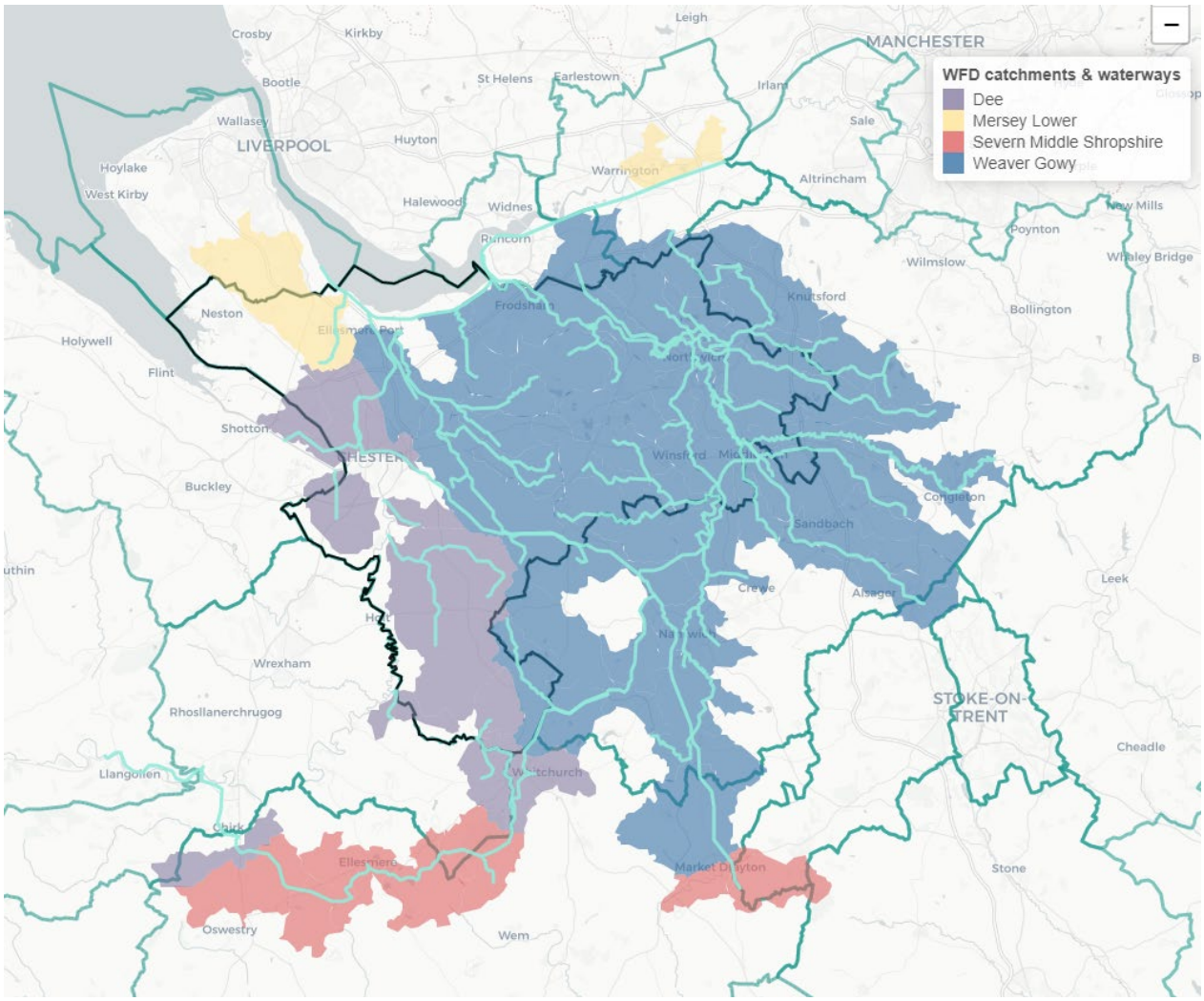
Map: Rivers and sea risk of flooding extent in west Cheshire[123]. Interactive version of this map is available through the mapping portal.



[123] Accessible description: This is a map which describes the extent of river and sea flood risk in west Cheshire. It is a map of the borough showing areas at a low, medium, and high risk of river and sea flooding.

Map: Water Framework Directive river catchments and waterways in west Cheshire, including neighbouring Local Authority boundaries[124]. Interactive version of this map is available through the mapping portal.

Water Framework Directive River Water Body Catchments and River, Canal and Surface Water Transfer Water Bodies Cycle 2: Environment Agency copyright and/or database right 2015. All rights reserved., Contains OS data © Crown copyright and database right 2021.



[124][124] Accessible description: This is a map which describes Water Framework Directive catchments and waterways, in west Cheshire and surrounding local authorities. It is a map of the borough and surrounding local authorities showing the following river catchments: Dee, Mersey Lower, Severn Middle Shropshire, Weaver Gowy. It also shows water courses that flow through west Cheshire. Surrounding local authority boundaries are marked on the map.

10. Provide a Resilient Outdoor Recreation and Visitor Resource

The hotter summer temperatures anticipated with climate change may result in a shift towards more outdoor oriented recreation and tourism in west Cheshire. This could place increasing pressure on landscapes and wildlife, which may also be under direct pressure from climate change. Trampling as a result of higher visitor numbers could also increase erosion. It is crucial to manage the outdoor visitor resource for these increasing pressures. There may be a need to divert visitors from more vulnerable landscapes, towards ones that are able to accommodate a greater number of visitors. This will include providing alternative outdoor attractions, such as woodlands, which may be more resilient to changes[125]. West Cheshire had 36.4 million tourists visits in 2018, an increase of 45 per cent since 2009.

List of Council and Partner Actions

10.1 To embed an understanding of the interactions between climate change, visitor behaviour and environmental capacity into any tourism-oriented policy.

10.2 Carefully manage adverse impacts of climate change and visitor pressure on valuable landscapes.

10.3 Create outdoor tourism resources in areas with a high capacity to accommodate visitors, linking in to public right of way network.

10.4 Promote natural visitor destinations.

10.5 Encourage sustainable travel to and around natural tourism resources.

10.6 Explore the use of innovative funding measures, such as visitor payback schemes, in order to increase investment in landscape management.

10.7 In areas where there is high visitor pressure, ensure that footpaths and public rights of way are maintained to reduce erosion. Tourism policy should recognise the reliance that the visitor economy has on key landscapes and ensure that their use as a visitor resource is sustainable.

[125] McEvoy et al (2006). Climate Change and the Visitor Economy: the challenges and opportunities for England's Northwest.

Case Studies

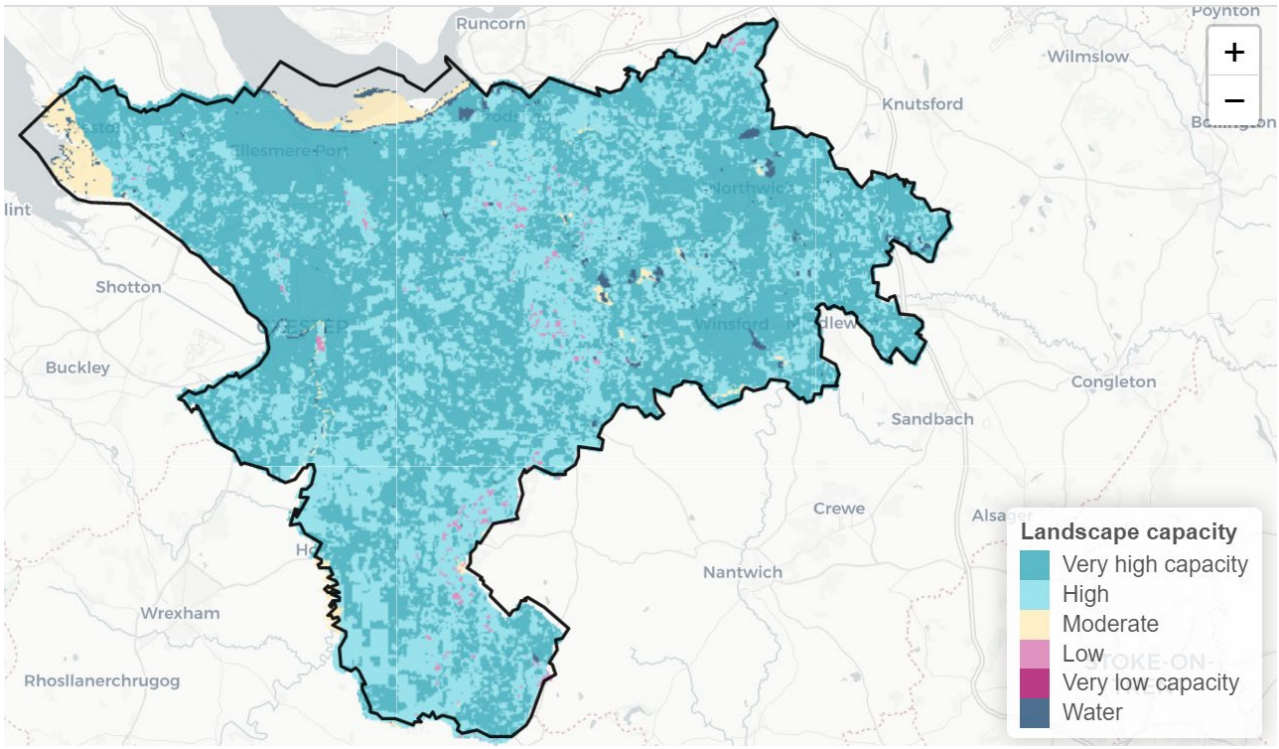
Northwich Woodlands

Northwich woodlands, along with the forest parks at Delamere and Marbury, are good examples of a resilient visitor attraction within the borough. Not only promoting sustainable travel through its accessibility and location near to urban settlements, but as a way to reduce pressure on key locations, and improve health and wellbeing.

Supporting Maps

Map: Capacity of the landscape to accommodate use by walkers in west Cheshire[126,127]. Interactive version of this map is available through the mapping portal.

Visitor capacity: Data courtesy of Gina Cavan, University of Manchester, now at Manchester Metropolitan University

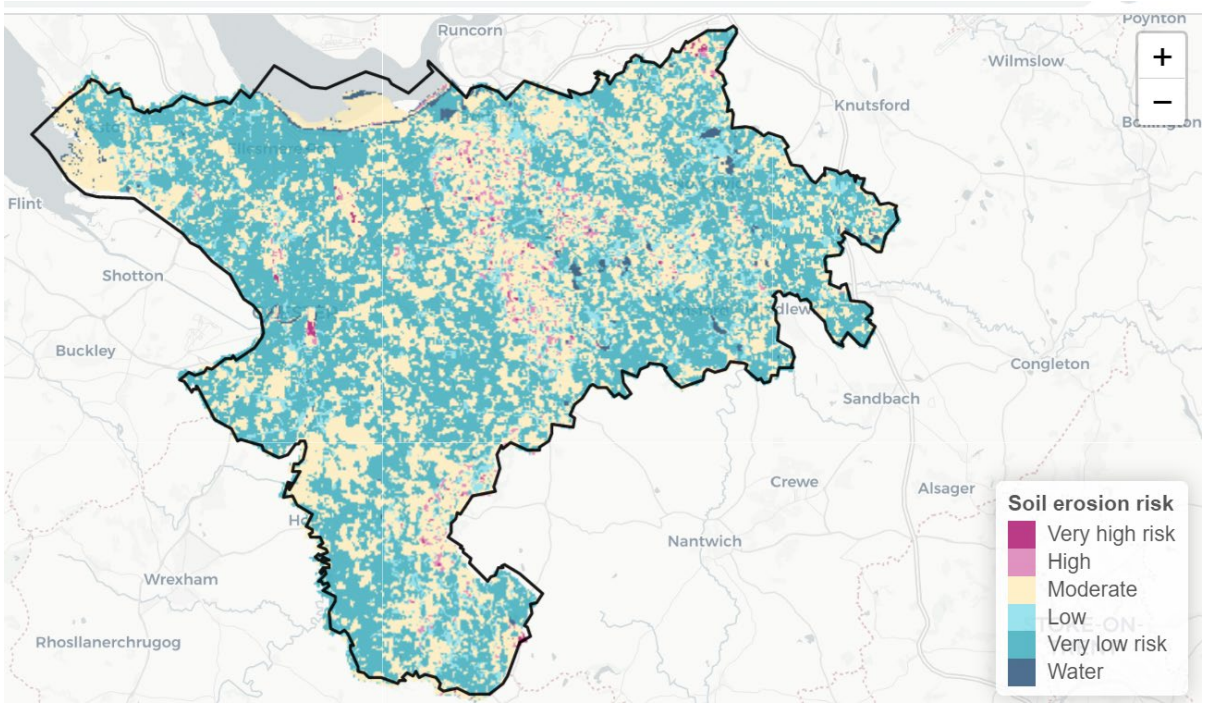


[126] This map combines: landscape character sensitivity (using soil erosion vulnerability), visual sensitivity (using tranquillity), and landscape value (using designated sites). It does not take into account rights of way and access. See presentation by Cavan et al "Climate change, tourism and landscape impacts: a regional analysis".

[127] Accessible description: This is a map which describes the capacity of the land to accommodate use by walkers in west Cheshire. It is a map of the borough showing areas where the landscape has a very high, high, moderate, low, and very low capacity to accommodate use by walkers. It also shows areas that are water.

Map: Soil erosion risk in west Cheshire[128,129]. Interactive version of this map is available through the mapping portal.

Erosion risk: Data courtesy of Gina Cavan, University of Manchester, now at Manchester Metropolitan University



[128] Soil erosion risk here combines soil erodability (taking into account soil texture and slope), soil erosivity (taking into account precipitation and temperature) and land cover vulnerability. See presentation by Cavan et al "Climate change, tourism and landscape impacts: a regional analysis".

[129] Accessible description: This is a map which describes the soil erosion risk in west Cheshire. It is a map of the borough showing areas where the soil erosion risk is very high, high, moderate, low, and very low. It also shows areas that are water.

Legislative and Policy Context

This section contains a broad review of legislation, policy and guidance relevant to this agenda. This is presented for international, European Union, UK, pan-authority, Cheshire West and Chester Council, and neighbourhood levels, in turn.

International

Intergovernmental Panel on Climate Change. Provides scientific assessments on climate change, enabling policymakers to understand the risks for the future and gaining insight into potential adaption and mitigation methods. A few relevant report include: the latest synthesis report; the sixth synthesis report will be available in 2022; a special report into Climate Change and Land; An special report on the impacts of global warming of 1.5°C.

United Nations Framework Convention on Climate Change. From 1994, the objective of the Convention is to stabilise greenhouse gas concentrations "at a level that would prevent dangerous anthropogenic (human induced) interference with the climate system". The focus is on developed nations to lead the way on climate change action.

Paris Climate Change Agreement (2015). The central aim is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5°C.

G7 Cornwall summit. The G7 summit brings together the leaders of seven nations and of the EU commission. It committed to net zero carbon emissions no later than 2050 and to halve collective emissions by 2030. There was also a commitment to conserve or protect at least 30 per cent of land and oceans by 2030. Ensure additional and stepped up action on climate change and renewed a pledge to raise $100bn a year to help poor countries cut emissions.

COP 26. The November 2021 summit will accelerate action towards the goals of the Paris Agreement and UN Framework Convention on Climate Change.

European Union

European Green Deal (2020). This is to boost the efficient use of resources by moving to a clean, circular economy and restore biodiversity and cut pollution. Cut greenhouse gas emissions by at least 55 per cent by 2030. Sets Europe on a responsible path to becoming climate neutral by 2050.

A framework for Community action in the field of water policy Directive (2000) https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32007L0060

Assessment and management of flood risks directive (2007) https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32007L0060

Common Agriculture Policy. Pillar One - farmers must adhere to additional standards for animal health and welfare, plant health and the environment if in receipt of the direct subsidy. Pillar Two: additional co-funding by the EU and each member state is provided by the Rural Development Programmes for farmers, land managers, woodland owners, and foresters.

Regulation on the governance of the energy union and climate action (2018). entered into force on 24 December 2018 as part of the Clean energy for all Europeans package.

Renewables Energy Directive (2018). The revised Renewable Energy Directive (EU) 2018/2001 establishes a binding EU target of at least 32 per cent for 2030 with a review for increasing this figure in 2023.

The Energy Performance Of Buildings Directive (2019). EU Member States will now need to prepare national policy measures to achieve new objectives.

The EU Strategy on adaptation to climate change (2013). Sets out a framework for adaptation measures and policies to increase resilience. Partly updated 2018.

United Kingdom

The Environment Act (2021). The Act brings into UK law environmental protections and recovery. Focusing on cleaner air, restoration of natural habitats and increased biodiversity.

25 Year Environment Plan (2018). £40 million additional investment into the government's Green Recovery Challenge Fund will go towards creating and retaining thousands of jobs, with funding being awarded to environmental charities and partners across England to restore the natural environment and help make progress on the UK's ongoing work to address the twin challenges of biodiversity loss and climate change, as part of our green recovery from Covid-19.

Peatland Grant. £10 million grant being shared across four projects to restore over 6,000 hectares of lowland and upland peat in England, delivering an estimated annual saving of 23,000 tCO_2e.

UKCP18. UKs updated climate projections, which has built on UKCP09 to provide greater regional data and provide more analysis of potential extremes and impacts of climate change.

England's Woodland Carbon Fund. Launched in 2016 is providing £19 million for woodland planting and on-going maintenance.

Woodland Carbon Code (2018). A voluntary scheme for new woodland creation projects with funding for carbon sequestered.

Environmental land management scheme (ELMS). DEFRA scheme means farmers and other land managers may be paid for delivering a number of public goods.

Green Industrial Revolution (2020). 10-point plan of action to achieve a net zero emission future. Including a section on Nature: Protecting and restoring our natural environment, planting 30,000 hectares of trees every year, whilst creating and retaining thousands of jobs.

The Peatland Code is a voluntary certification standard for UK peatland projects wishing to market the climate benefits of peatland restoration.

Localism Act (2011). Focuses on restructuring the relationship between central government and the community, including reform of the planning system.

Devolution/ levelling up White Paper. Planned sometime 2021 after being pushed back in 2020

National Infrastructure Strategy (2020). Plans to transform UK infrastructure in order to level up the country, strengthen the Union and achieve net zero emissions by 2050.

National Planning Policy Framework (2012). Consolidated planning policy statements, circulars, and guidance. Updated 2019.

Natural Capital Committee. Advisers the government on natural capital, such as forests, rivers, minerals and oceans.

Nature Recovery Networks. Forms part of the Government's 25 Year Environment Plan. By bringing together partners, legislation and funding, we can restore and enhance the natural environment.

Planning For The Future (2020). Government draft white paper on the streamlining of the planning process, helping to form the local plan into 3 categories: renewal, growth and protection. Particular focus on design and sustainability within housing and communities. Development which doesn't fit within the outlined local plan for these categories will be determined through the NPPF.

Science and innovation strategy for forestry in Great Britain (2020). Trees, forests and woodlands can meet the challenges of providing a healthy future for the economy, society and the environment.

Clean Growth Strategy Leading the way to a low carbon future (2017). UK paper on key policies for a clean future.

Climate Change Committee. An independent statutory body established under the Climate Change Act 2008. Includes advice on UK agricultural and land use policies (2020), including increased tree planting, low-carbon farming practices, peatland restoration, bioenergy crops, reduce food waste and consumption of carbon-intensive foods.

National Adaptation Programme and the Third Strategy for Climate Adaptation Reporting (2018). Making the country resilient to climate change.

Trees for Climate (2020). Funds to help deliver against goals in the government's 25 Year Environment Plan and support Nature Recovery Networks across England.

England Tree Strategy (2021).

Climate Change Act (2008). Set a target for the reduction of greenhouse gas emissions. Amended in 2019 to include targets for 2050.

Agriculture Act (2020). Replaces the EU Common Agricultural Policy.

Protecting our Water, Soil and Air: A Code of Good Agricultural Practice for farmers, growers and land managers (2009). This practical guide sets out actions to protect and enhance water, soil and air quality. Updated 2018.

The Path to Sustainable Farming 2021-2024 (2021). Sets out the changes that are going to be made to agricultural policy in England.

National Farmers Union. Net zero plan talks about bioenergy with carbon capture and storage and anaerobic digestion.

Farming for Change: mapping a route to 2030 (2021). 'Land use in the UK must be dramatically transformed by the end of the decade if the UK is to meet its 2050 net-zero target, with space re-allocated from livestock to vegetables, meadows and hedges, resulting in all of us eating less meat and more plant-based foods'.

Catchment Sensitive Farming: reduce water and air pollution (2014). Support for farmers and land managers to reduce water and air pollution from agriculture. Last updated 2020.

Energy white paper: Powering our net zero future (2020).

Energy Act (2008). Sets powers to introduce feed-in tariffs and a Renewable Heat Incentive scheme aimed at driving an increase in renewable energy generating capacity.

The Place Alliance. Recommends that when designing neighbourhoods, the aspiration should be for everyone to live within a five-minute walk of 'significant' green space and 'never be more than 10 minutes' from basic facilities.

State of the Nation, Transport planning for a sustainable future. Reviews travel trends and behaviours, current government policy, regional transport planning, spending and investment and transport taxes and charges to enable the Transport Planning Society to make clear recommendations to government and the sector.

Planning for less car use.

Cycle infrastructure design.

Rewilding Britain.

National Parks and Access to the Countryside Act (1949). Provides power to declare Local Nature Reserves.

Wildlife and Countryside Act (1981). The main legislation relating to nature conservation in Great Britain. This provides detail on a range of protection and offences relating to wild birds, other animals, and plants and other legislation.

UK Biodiversity Action Plan (1994). This was the UK Government's response to the 1992 Rio Convention on Biological Diversity. The UK was the first country to produce a national Biodiversity Action Plan providing detailed plans for the conservation of the most threatened species and habitats, alongside national progress reports.

Countryside and Rights of Way Act (2000). Provides support for access and nature conservation

Natural Environment and Rural Communities Act (2006). Imposes a duty to conserve biodiversity and applies to all local authorities and extends beyond just conserving what is already there to carrying out, supporting and requiring actions that may also restore or enhance biodiversity. The Secretary of State is required to publish a list of habitats and species that are of principal importance for the conservation of biodiversity in England.

Biodiversity Strategy for England – Biodiversity 2020: A Strategy for England's Wildlife and Ecosystem Services.

Natural Environment White Paper – The Natural Choice (2014).
Securing the value of nature.

Heatwave Plan for England (2019). Sets out what needs to be done to raise awareness of the risks relating to severe hot weather and preparations to reduce these. Includes long term planning issues, such as the use of trees and green space for cooling.

National Flood Emergency Framework for England (2014)

Flood and Water Management Act (2010). To address flooding and water scarcity, both of which are predicted to increase with climate change.

Future Water, the Water Strategy for England (2008). Sets out the long-term vision for water policy and management; covers demand, supply, quality, drainage, flooding.

Putting the water into waterways 2015-2020 Plan (Canal and River Trust).

Floods and water regulation (2019). A framework for the assessment and management of flood risks, aiming at reducing the adverse consequences for human health, the environment, cultural heritage and economic activity associated with floods.

Flood Risk Regulations (2009). Require Lead Local Flood Authorities to identify areas which are at risk of flooding from surface water flooding, groundwater flooding, ordinary watercourse flooding and flooding from canals with significant consequences, and to produce a Preliminary Flood Risk Assessment based on those areas.

Water for Life (2011). DEFRA paper on water and the natural environment and the green economy.

Surface Water Management An Action Plan (2018).

UK - Water Framework Directive (2017). Requires targets to be set to improve water bodies, and River Basin Management Plans to be created and implemented, taking into account water quality, resources, physical habitat, and flooding.

Working with natural processes to reduce flood risk (2017): Natural Flood Management evidence base for working with natural processes to reduce flood risk.

Government Tourism Policy (2011).

Safeguarding our Soils: A Strategy for England (2009). Sets out the vision that by 2030, all England's soils will be managed sustainably and degradation threats tackled successfully. This will improve the quality of soils and safeguard their ability to provide essential services for future generations.

Policy examples to help soil.

The state of the environment: soil.

Meeting our future water needs: a national framework for water resources.

UK Government water resources.

Pan-Authority

Cheshire Natural Capital Audit and Investment Plan. Strategic Economic Plan which sets out the sub-region's growth ambitions to 2040.

Lower Mersey and Alt abstraction licensing strategy (2013). Strategy to manage water resources sustainably.

River Weaver Gowy management plan (2019). The Weaver Gowy catchment is part of the North West River Basin District. Cheshire, through Nantwich and onto Winsford where it become impounded and navigable, joining the Manchester Ship Canal at Runcorn. The operational catchments are the Dane, Gowy, Lower and Upper Weaver.

Weaver Gowy Catchment Flood Management Plan.

Cheshire West and Chester Council

Anthesis Climate Emergency Strategy Support (2019). To provide an evidence base to inform the Council's planning in response to the Climate Emergency Declaration

Strategic Flood Risk Assessment (2016). Flood risk information together with the most current flood risk and planning policy.

Carbon Management Plan (2020). Sets out the actions the Council needs to take to be carbon neutral by 2030.

Climate Emergency Response Plan (2020). Actions to be carbon neutral as a borough by 2045.

Local Plan (Part One) strategic policies (2015) and (Part Two) Land Allocations and Detailed Policies (2019). Includes ENV 3 Green Infrastructure: The Local Plan will support the creation, enhancement, protection and management of a network of high quality multi-functional Green Infrastructure. 8.22 Green Infrastructure is the network of green spaces, water bodies, biodiversity habitats, and other natural elements that surround, pass through, and link the settlements and landscapes, connecting the cities, towns and villages in the borough.

Council Plan 2020-2025. Climate emergency is the top priority.

Green infrastructure framework (2011).

Tree and Woodland Strategy.

Cycling Strategy.

Neighbourhood

The Localism Act (2011). Introduced new rights and powers to allow local communities to shape development by preparing neighbourhood plans, setting out the vision, policies and proposals for an area. Once made, the neighbourhood plan forms part of the statutory development plan for the borough and is used in making decisions on planning applications within the neighbourhood.

Parish Councils. Town and parish councils are the first level of local government. They provide communities with a democratic voice and a structure for taking community action.

Neighbourhood Plans. West Cheshire has 24 areas with an approved neighbourhood plan: Ashton Hayes and Horton-cum-Peel; Beeston, Tiverton and Tilstone Fearnall; Broxton; Central Gowy (South); Clotton Hoofield; Cuddington Parish; Darnhall Parish; Davenham and Whatcroft; Farndon; Hartford; Helsby; Kelsall and Willington; Malpas and Overton; Moulton; Neston; No Mans Heath; Norley; Northwich; Tarporley; Tarvin; Tattenhall and District; Utkinton and Cotebrook; Whitegate and Marton; Winsford. There are a further 15 designated neighbourhood areas, currently with no plan: Antrobus Neighbourhood Area 1; Barrow; Burwardsley; Coddington and District; Comberbach; Delamare and Oakmere; Frodsham; Guilden Sutton Parish; Handbridge; Ince; Kingsley; Lower Peover; Marston and Wincham; Mickle Trafford and District; Upton-by-Chester and district.