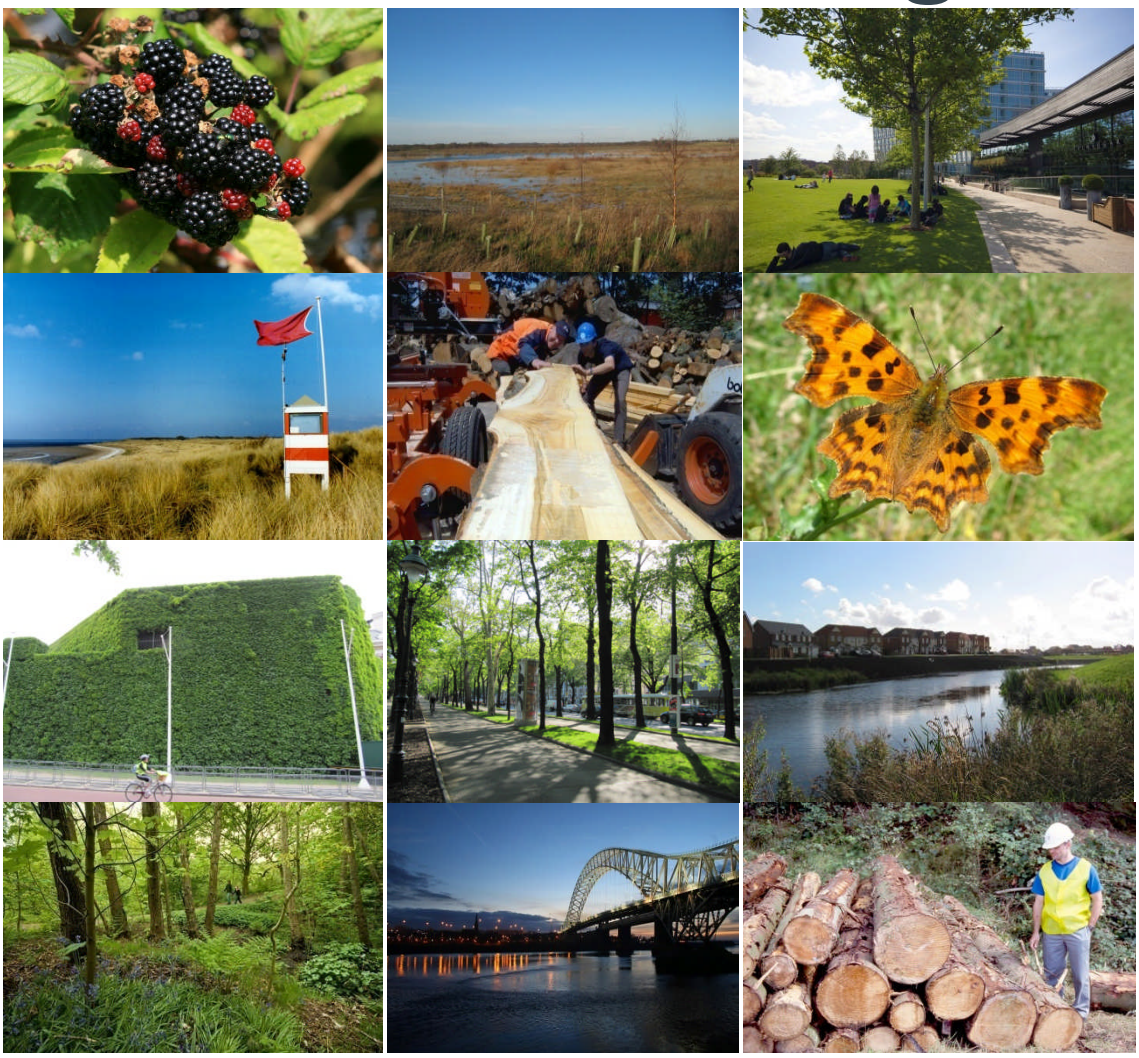
Green Infrastructure to Combat Climate Change



A Consultation Draft Action Plan for Cheshire, Cumbria, Greater Manchester, Lancashire, and Merseyside

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Contents

Acronyms

The following abbreviations appear in the Action Plan.

AAP	Area Action Plan
ASCCUE	Adaptation Strategies for Climate Change in the Urban Environment
BTCV	British Trusts for Conservation Volunteers
CABE	Commission for Architecture and the Built Environment
CAMS	Catchment Abstraction Management Strategies
CCAP	Climate Change Action Plan
CCI	Community Contracting Initiative
CCVE	Climate Change and the Visitor Economy
CFMP	Catchment Flood Management Plan
CFNW	Community Forests Northwest
CIL	Community Infrastructure Levy
CIRIA	Construction Industry Research & Information Association
CLASP	Climate Change Local Area Support Programme
CURE	Centre for Urban and Regional Ecology
DARA	Department of Agriculture and Rural Development
DCLG	Department of Communities and Local Government
DECC	Department of Energy and Climate Change
DEFRA	Department of Food and Rural Affairs
DfT	Department for Transport
EA	Environment Agency
EU	European Union
FC	Forestry Commission
FR	Forest Research
FSC	Forest Stewardship Council
FWAG	Farming & Wildlife Advisory Group
GI	Green Infrastructure
GIS	Geographic Information System
GIU	Green Infrastructure Unit
GRaBS	Green & Blue Space Adaptation for Urban Areas & Ecotowns
LA	Local Authority
LBAP	Local Biodiversity Action Plan
LDA	London Development Agency
LDF	Local Development Framework
LSP	Local Strategic Partnership
LTP	Local Transport Plan
NE	Natural England
NENW	Natural Economy Northwest
NFU	National Farmers Union
NGO	Non-Government Organisation
NI	National Indicator
NW	Northwest
NWCCAP	Northwest Climate Change Action Plan
NWDA	Northwest Development Agency
RCEP	Royal Commission on Environmental Pollution
RFF	Regional Forestry Framework
RHI	Renewable Heat Incentive
RSL	Registered Social Landlord
RSPB	Royal Society for the Protection of Birds
RSS	Regional Spatial Strategy
RTPI	Royal Town Planning Institute
S106	Section 106 Agreement
SCAMP	Sustainable Catchment Management Programme
SFRA	Strategic Flood Risk Assessment
SMP	Shoreline Management Plan
SPD	Supplementary Planning Document
SUDS	Sustainable Urban Drainage Systems
SWMP	Surface Water Management Plan
TCPA	Town and Country Planning Association
TDAG	Trees and Design Action Group
TPO	Tree Preservation Order
UU	United Utilities
WFD	Water Framework Directive
WoT	Woodland Trust
WT	Wildlife Trusts

Introduction

The latest scientific evidence has reinforced the fact that climate change is the greatest threat to our social well being and economic future. We need to reduce greenhouse gas emissions (known as climate change mitigation) in order to limit the severity of climate change; the UK Climate Change Act sets targets for cuts of at least 80% by 2050 and 34% by 2020, compared to 1990.

We also need to make changes now to adapt to climate change impacts that are already being felt. Climate change projections anticipate warmer and wetter winters, hotter and drier summers, sea level rises, and more extreme events such as heatwaves, heavy rainfall, and droughts. In the North West of England, some headline changes by the 2080s (based on the central estimate of the medium emissions scenario) are[1]:

- 21% decrease in summer precipitation – leading to reduced stream flow and water quality, increased drought, subsidence, decreased crop yields, and serious water stress
- 16% increase in winter precipitation – leading to increased winter flooding, increased subsidence, risks to urban drainage, severe transport disruption, risks to critical infrastructure
- 3.7°C increase in summer temperatures – leading to increased heat stress, infrastructure risks, risks to biodiversity, heat related deaths, risks to food security
- 32cm rise in relative sea levels in Liverpool.

'Rising to the Challenge: A Climate Change Action Plan for England's Northwest 2010-2012' sets out key measures to mitigate and adapt to climate change[2] including a "regional assessment of the risks, opportunities and priorities for green infrastructure in adapting and mitigating for climate change". This has been undertaken as part of the 'Green and Blue Space Adaptation for Urban Areas and Eco-towns (GRaBS)' project[3] and has two key outputs to date[4]: (1) an online evidence base which holds a review of key research, policy and delivery relevant to how green infrastructure can help in climate change mitigation and adaptation; (2) a report 'Green Infrastructure: How and where can it help the Northwest mitigate and adapt to climate change?'. This Action Plan, 'Green Infrastructure to Combat Climate Change', has been developed from the evidence base and the report, and best practice study visits as part of the GRaBS project.

Green infrastructure has been defined as "the region's life support system – the network of natural environmental components and green and blue spaces that lie within and between our cities, towns and villages and provide multiple social, economic and environmental benefits"[5]. Building greater resilience to climate change is one of five key green infrastructure actions[6].

Green infrastructure provides a range of services that make a substantial contribution towards climate change adaptation and a limited but important contribution towards climate change mitigation. In addition to climate change mitigation and adaptation, green infrastructure also provides a range of other benefits[7] making it a desirable way to combat climate change.

This Action Plan sets out a number of green infrastructure actions that can be delivered by stakeholders within Cheshire, Cumbria, Greater Manchester, Lancashire, and Merseyside in order to help combat climate change. This will help to ensure the long term viability of communities in these areas, that they are adapting to future climate changes and taking action to reduce its severity.

[1] http://ukclimateprojections.defra.gov.uk/content/view/2220/499/
[2] NWDA *et al*. (2010) Rising to the challenge: A climate change action plan for England's Northwest 2010-2012. www.climatechangenorthwest.co.uk/assets/_files/documents/feb_10/cli__1265921054_NW_Climate_Change_Action_Plan.pdf
[3] www.grabs-eu.org
[4] www.ginw.co.uk/climatechange
[5] Northwest Green Infrastructure Think Tank (2006) Northwest Green Infrastructure Guide (version 1.1). www.ginw.co.uk
[6] NENW. Green Infrastructure Prospectus. www.ginw.co.uk/resources/Prospectus_V6.pdf
[7] NENW. The economic value of green infrastructure. www.nwda.co.uk/PDF/EconomicValueofGreenInfrastructure.pdf

Vision

Green infrastructure within Cheshire, Cumbria, Greater Manchester, Lancashire, and Merseyside is planned, designed, and managed by all relevant stakeholders to combat climate change, whilst delivering other benefits. All opportunities are taken to safeguard, create, enhance, and maintain green infrastructure in order to optimise the climate change adaptation and mitigation services it provides.

These include:

- **Managing surface water** – urban green infrastructure can help to manage surface water and sewer flooding by reducing the rate and volume of water runoff; it intercepts water, allows it to infiltrate into the ground, and provides permanent or temporary storage areas
- **Managing high temperatures** – particularly in urban areas, where evaporative cooling and shading provided by green infrastructure can ensure that towns and cities continue to be attractive and comfortable places to live, work, visit and invest
- **Carbon storage and sequestration** – storing carbon in soils and vegetation
- **Managing riverine flooding** – green infrastructure can provide water storage and retention areas, reducing and slowing down peak flows, and thereby helping to alleviate river flooding
- **Food production** – reducing food miles and altering agricultural practices (such as organic farming) to reduce carbon emissions
- **Material substitution** – replacing materials such as concrete and steel (which involve high fossil fuel consumption in their production) with sustainably managed wood (and other natural materials)
- **Fossil fuel substitution** – replacing fossil fuels with sustainably managed biofuels
- **Reducing the need to travel by car** – providing local recreation areas and green travel routes to encourage walking and cycling
- **Helping other species to adapt** – providing a more vegetated and permeable landscape through which species can move northwards to new 'climate spaces'
- **Managing visitor pressure** – providing a recreation and visitor resource for a more outdoors lifestyle, and helping to divert pressure from landscapes which are sensitive to climate change
- **Reducing soil erosion** – using vegetation to stabilise soils that many be vulnerable to increasing erosion
- **Managing water supply** – green infrastructure can provide places to store water for re-use, allows water to infiltrate into the ground sustaining aquifers and river flows, and can catch sediment and remove pollutants from the water, thereby ensuring that water supply and quality is maintained
- **Managing coastal flooding** – green infrastructure can provide water storage and retention areas, reducing and slowing tidal surges, and thereby helping to alleviate coastal flooding.

Actions

This Action Plan sets out green infrastructure actions that can be taken in order to help achieve the vision. Please refer to the online evidence base, report and mapping, which support these actions.

The first sub-section below covers overarching actions which relate to all climate change services. This is then followed by sub-sections of actions relating to each climate change service in turn, the order of which corresponds to an assessment of priority made in the recent report[8] which took into account the need for mitigation or adaptation (including probability and magnitude) and the potential for green infrastructure as a solution (including effectiveness and practicality).

A table of actions is set out in each sub-section. These include the following headings:

- Action – numbered and described, where the action is highlighted it indicates that it is considered a priority
- S – indicates that this action is relevant at a 'strategic' scale
- N – indicates that this action is relevant at a 'neighbourhood' scale
- P – indicates that this action is relevant at a 'plot' scale[9]
- Owner – indicates potential owners of the action
- Mechanism – indicates potential delivery mechanisms (please note that full references are listed at the end of this Action Plan)
- Supported in – indicates key documents which support this action (please note that full references are listed at the end of this Action Plan)
- Link to service – indicates the main other climate change services that could be achieved whilst delivering an action specific to one particular service[10].

[8] Refer to section 5.3 of: CFNW (2010) Green Infrastructure: How & where can it help Northwest England mitigate & adapt to climate change?. www.ginw.co.uk/climatechange/green-infrastructure-how-and-where-can-it-help-the-northwest-mitigate-and-adapt-to-climate-change.htm

[9] The strategic, neighbourhood and plot scales were modified from the conurbation/catchment, neighbourhood, and building scales in: Shaw *et al.* (2007) Climate change adaptation by design: a guide for sustainable communities. TCPA, London. www.tcpa.org.uk/data/files/bd_cca.pdf

[10] Also refer to figure 23 (compatibility of climate change related services) on page 53 of: CFNW (2010) Green Infrastructure: How & where can it help Northwest England mitigate & adapt to climate change?. www.ginw.co.uk/climatechange/green-infrastructure-how-and-where-can-it-help-the-northwest-mitigate-and-adapt-to-climate-change.htm

1. Overarching actions

Green infrastructure provides a number of services which can help us to mitigate and adapt to climate change. Whilst we can take actions to provide a particular service, it is essential to exploit the multifunctionality of green infrastructure wherever possible and to work in partnership across sectors and disciplines 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.

Green space between housing rows in Vauban, Freiburg

Case Study 1. Green infrastructure in new developments – Freiburg, Germany

The city has some exceptional examples of green infrastructure being incorporated into new development and restructuring. In the Vauban district, social and ecological concepts were integrated through the planning and development of what used to be the site of army barracks. Old rows of trees were preserved and new private and communal green spaces between the housing rows were created for amenity and to improve climatic conditions and allow air to flow into Freiburg. SUDS features are incorporated into the site and green roofs, which were a planning requirement, are used to store rainwater. Rieselfeld is another best practice development, incorporating green spaces, green roofs, water management, and climatic considerations.

www.fwtm.freiburg.de/servlet/PB/show/1199617_l2/GreenCity.pdf

Case Study 2. Green Space Factor – Malmö, Sweden

The green space factor was used in the Western Harbour development in Malmö in order to reach a certain level of green cover within the new courtyards and to minimise surface sealing. Greenery was desired for an attractive and healthy surrounding for people, to promote biodiversity, and to minimise stormwater runoff. The approach assigns factors to different surfaces including vegetation, open water, green roofs, green walls, trees, shrubs, permeable paving, and non-permeable paving. The factors are multiplied by the area of the site covered by each surface and added together. The total is then divided by the overall site area to give the green space factor, which has to reach a pre-determined level. The green space factor was developed from the 'Biotope Area Factor' used in Berlin and other major German cities, and has also been developed and used in Seattle. Initial work has been undertaken to develop the approach into a 'Green Infrastructure Target' for a UK context[11].

www.malmo.se/download/18.4a2cec6a10d0ba37c0b800012608/bo01_det_grona_bo01_eng.pdf

[11] Contact susannah.gill@merseyforest.org.uk for more information.

1. Overarching actions	S	N	P	Owner	Mechanism	Supported in
a. To champion this plan and seek to embed it in all relevant policies, strategies, plans, programmes and initiatives within Cheshire, Cumbria, Greater Manchester, Lancashire, and Merseyside.				Named champion for each sub-region? GIU		
b. Select an area of strategic importance subject to new development or restructuring in Cheshire, Cumbria, Greater Manchester, Lancashire and Merseyside in which to incorporate green infrastructure and optimise the climate change services it provides. To act as a pilot or exemplar.				Named champion for each sub-region? GIU Environmental bodies		
c. Target green infrastructure interventions to areas where the highest number of prioritised services (managing surface water, managing high temperatures, carbon storage and sequestration, managing riverine flooding, food production) are considered important (figure 25 on page 56 and appendix B of report).				Environmental bodies Land owners Land managers	Grant schemes Incentives	
d. Ensure that new development and restructuring incorporates green infrastructure, and optimises the climate change services it provides. Planners, designers, and developers should work together.				Planners Developers Landscape architects	(Case Study 1)	Climate Change Adaptation by Design (TCPA)
e. Opportunities should be taken by any green infrastructure intervention to maximise the other services. Seek out and engage the most relevant stakeholders in the process. Design interventions to optimise services. (Refer to figure 23 on page 53 of the report for compatibility of the services).				All interveners Landscape architects		
f. Make provisions for the long term maintenance of green infrastructure.				All interveners	Could be a requirement in a SPD	
g. Engage and involve local communities in any intervention to gain support and ownership.				All interveners Communities	Planning consultations Green Streets	
h. Incorporate the 'green infrastructure target' approach into planning policy.				Planners GIU	Malmo's Green Space Factor (Case Study 2)	
i. Ongoing stakeholder engagement in the plan, and training for professionals on the role of green infrastructure in combating climate change.				Named champion for each sub-region? CFNW Groundwork	Climate change adaptation and GI Training	Skills to Grow (CABE)
j. Training and awareness raising for members of the community on the role of green infrastructure in combating climate change.				CFNW Groundwork Local authorities Environmental bodies Schools	Community Adaptation Training (CLASP and GRaBS) Forest Schools	Skills to Grow (CABE)
k. To monitor and review actions within Cheshire, Cumbria, Greater Manchester, Lancashire, and Merseyside.				Named champion for each sub-region? GIU		

2. Managing surface water

Surface water and sewer flooding is becoming increasingly common as a result of increased urbanisation, surface sealing, and more extreme rainfall events with climate change. Hard surfaces increase both the volume and rate of surface water runoff, which can lead to overwhelmed drains and surface water flooding with significant economic, social and environmental costs. Green infrastructure, as part of a sustainable urban drainage system (SUDS), has a substantial role to play in reducing this risk. It reduces the rate and volume of water entering the drains by intercepting it, providing temporary and permanent storage areas, and allowing the water to infiltrate into the ground rather than being directed to drains.

Pond in communal green space as part of the SUDS features in Rieselfeld, Freiburg

Case Study 3. Sustainable Drainage: Design and Adoption Guide – Cambridge

This guide is intended for use by developers and their consultants where they are seeking adoption of SUDS by Cambridge City Council within the public open space of new developments. It sets out the design and adoption requirements that the City Council will be looking for, in order to ensure a smooth and satisfactory adoption process. It is also for use by all those involved in the design, construction and future maintenance of any adoptable SUDS. These include: developers, engineers, landscape designers, architects and urban designers, development control and other City Council officers and maintenance teams. The introductory sections cover the broader issues involved in designing a successful SUDS system, whilst the latter sections focus on individual SUDS features, describing them and highlighting issues and solutions, maintenance requirements and costs.

www.cambridge.gov.uk/public/docs/SUDS-Design-and-Adoption-Guide.pdf

2. Actions for managing surface water	S	N	P	Owner	Mechanism	Supported in	Link to services
a. Target areas (using figure 18 on page 43 of report, or better local information where it exists) in which to incorporate SUDS features into existing green infrastructure, and to create new green infrastructure for its role in surface water management. This could include retrofitting green roofs and increasing tree canopy coverage to intercept rainwater.				Local authorities – planners, parks, tree officers EA UU CFNW and urban forestry initiatives	SWMP Green Streets i-trees S106		Water supply
b. Provide stronger planning policy requiring new developments and restructuring to use SUDS. Putting in place a suitable train of SUDS techniques to manage surface water effectively on a given site so that it does not pass on flood risk to other areas.				Planners EA UU	LDF informed by SFRA and SWMP S106 Planning conditions	NW RSS Flood Risk Appraisal (4NW)	Water supply
c. Follow emerging best practice for the design and adoption of SUDS.				Planners Developers Landscape architects Architects	Use or production of a design and adoption guide (Case Study 3)		Water supply
d. Safeguard and create new green infrastructure where it occurs on soils with a high infiltration rate. Avoid development here where possible.				Planners Developers Landscape architects	LDF Green infrastructure plans	ASCCUE project (CURE)	Water supply
e. Refer to and make use of documentation on how to adapt the buildings, neighbourhoods and cities to climate change.				Planners Developers Architects Landscape architects		Adapting to the Impacts of Climate Change (Eclipse); Sustainable Cities (CABE); London Housing Design Guide (LDA)	Temps River flood Species Water supply Coastal flood

For other actions of importance for managing surface water please refer to: 1a-j, 3c, 10d, and 13b

3. Managing high temperatures

Climate change projections show that temperatures are likely to increase, which will exacerbate the urban heat island effect. During the 2006 heatwave there were approximately 60 excess deaths (or an increase of 15%) in North West England[12]. It is estimated that the 2003 summer heatwave claimed 35,000 lives across Europe, many in urban areas[13]. Modelling suggests that by the 2050s, such an event could be seen as normal, whereas by the end of the century it may be considered cool[14]. Green infrastructure can help to manage high temperatures[15] by providing evaporative cooling, shading, and allowing air to flow into urban areas. It can help to reduce heat stress and mortality among the most vulnerable communities; including older people, those with chronic and severe illness, and those who are unable to adapt their behaviour to keep cool (including young children).

Case Study 4. Green Streets – Greater Manchester and Merseyside

Green Streets is a community greening project of Red Rose Forest and The Mersey Forest, aimed at increasing urban tree cover. From planting street trees, to creating green alleyways and green walls, Green Streets works with communities to promote greening for a variety of reasons. Much of the work is in high density and deprived urban areas. Trees planted will provide shade for people using the street, and will evapotranspire and provide cooling in the surrounding area.
www.redroseforest.co.uk/web/content/view/43/143/
http://merseyforest.org.uk/pages/displayProjects.asp?iProjectID=31

Green Streets project in Ellesmere Port, Merseyside (copyright: McCoy Wynne)

Case Study 5. Digital Environmental Atlas – Berlin, Germany

This online atlas presents maps and information for the city on a range of environmental topics, including soil, water, air, climate, biotopes, land use, traffic, noise and energy. This resource aids urban planning and landscape development. The goal of the 'climate function' map is to define spaces according to their climatic effect on other areas, and to evaluate the climatic sensitivity to structural changes. It combines a green and open space inventory, settlement areas, traffic related air pollution, and air exchanges. This is translated into a 'planning advice' map which includes protection and development measures (such as linking open spaces, increased vegetation for ventilation, and aligning new development with wind channels) to improve the climate and air quality. This is considered important in adapting to climate change.
www.stadtentwicklung.berlin.de/umwelt/umweltatlas/edin_411.htm

[12] Department of Health (2010) Heatwave Plan for England.
www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/@ps/documents/digitalasset/dh_114423.pdf
[13] Larsen (2003) Record heat wave in Europe takes 35,000 lives. *Earth Policy Institute,* October 9th 2003. www.earth-policy.org/Updates/Update29.htm
[14] Stott *et al.* (2004) Human contribution to the European heatwave of 2003. *Nature,* 432 (7017), 610-614.
[15] Gill *et al*. (2007) Adapting cities for climate change: the role of the green infrastructure. *Built Environment*, 33 (1), 115-133.

3. Actions for managing high temperatures	S	N	P	Owner	Mechanism	Supported in	Link to services
a. Target areas (using figure 13 on page 35 of report, or better local information where it exists) to protect existing green infrastructure, create new accessible green infrastructure, and increase tree canopy coverage (including large trees) in streets and open spaces in order to provide shade and cooling. Target areas include the most vulnerable populations to heat stress and places where people gather (including town centres, transport hubs, etc).				Local authorities – planners, parks, tree officers CFNW and other urban forestry initiatives Housing Associations and RSLs	Green Streets (Case Study 4) i-trees S106		
b. Strengthen planning policy to ensure no net loss of green infrastructure, and to seek to increase it where possible. Potential to aim for a 10% increase in green infrastructure in the most built up areas in order to help keep surface temperatures at current levels until the end of the century. Also aim to increase tree cover and include large canopied trees in new developments.				Local authorities – planners, parks, tree officers	LDF S106 Planning conditions	ASCCUE (CURE)	
c. Maintain and manage existing large canopied trees, including through Tree Preservation Orders, for their provision of shade.				Local authority tree officers	Tree Strategies TPOs	No Trees, No Future (TDAG) Urban Environment Report (RCEP)	Surface water
d. Consider the direction of wind and air flows into urban areas, especially under conditions of temperature inversions. Open space could be planned accordingly to use wind to cool urban areas. This approach is widely used in continental Europe where historically there has been more of a need to plan for high temperatures.				Local authorities – planners Universities	Findings could be implemented through LDF and GI plans	Berlin Digital Environmental Atlas (Case Study 5)	Linear networks link to: River flood Species Travel
e. Ensure a sustainable water supply for vegetation in times of water stress in order to maintain its evaporative cooling function. This could be through the use of appropriate SUDS techniques (including water butts at a very local level), where rainwater could be collected, stored and re-used.				Local authorities Land owners Land managers UU	Land management plans Planning conditions Incentives for private land owners to install water butts (Case Study 16)	ASCCUE (CURE)	Water supply

For other actions of importance for managing high temperatures please refer to: 1a-j, 2e, 5a, 6f, 9b, 10d, 10f, and 11f

4. Carbon storage and sequestration

Carbon is stored in soils and vegetation. Changes to land use and/or management practices can lead to increases or decreases in the amount of carbon stored. Soils contain more carbon than vegetation[16], with peaty soils being especially important. Restoration of degraded peatlands could help to reduce carbon emissions. Forests generally have significantly higher above-ground carbon reservoirs than other vegetation types[17], making them especially appropriate for carbon storage and sequestration. In the North West of England, soils and vegetation store 2.5 MtC, with a mean density of 178 tC/ha.

(copyright: Mike Roberts)

Case Study 6. Sustainable Catchment Management Programme (SCaMP) – North West England

United Utilities' SCaMP project, developed in association with the RSPB, aims to apply an integrated approach to catchment management in two key areas of United Utilities land, Bowland and the Peak District area. This approach has benefits for water quality, biodiversity, agricultural tenants, and carbon storage. Work includes: restoring blanket bogs by blocking drainage ditches, restoring areas of eroded and exposed peat, restoring hay meadows, establishing clough woodland, restoring heather moorland, providing new farm buildings for indoor wintering of livestock and for lambing, providing new waste management facilities to reduce run-off pollution of water courses, fencing to keep livestock away from areas such as rivers and streams and from special habitats.

www.unitedutilities.com/scamp.aspx

[16] Milne & Brown (1997) Carbon in vegetation and soils of Great Britain. Journal of Environmental Management: 49, 413-433.

[17] Broadmeadow & Matthews (2003) Forests, carbon & climate change: the UK contribution. Forestry Commission Information Note 48. www.forestry.gov.uk/pdf/fcin048.pdf/$FILE/fcin048.pdf

4. Actions for carbon storage and sequestration	S	N	P	Owner	Mechanism	Supported in	Link to services
a. Avoid new development in areas with highest carbon densities (figure 7 on page 25 of the report). Embed within planning policy and decision making. Offset any carbon lost by increasing or managing carbon stores elsewhere.				Planners NE	LDF Development control S106 CIL		Species River flood Fuel material
b. Target areas for management to maintain existing significant carbon stores (figure 7 on page 25 of the report).				NE FC Land owners Land managers	Peatland projects RFF Grants Incentives	Cumbria High Fells (NE)	Species
c. Double woodland cover in the North West of England by 2050. This could be targeted to lower quality agricultural areas and has the potential to be multifunctional.				FC CFNW and woodland initiatives Land owners Land managers	RFF Manifesto Grants Incentives S106	RFF Manifesto	Fuel Material River flood Erosion Visitors Food
d. Aim for net removal of CO_2 from land use, land use change and forestry.				Local authorities NE FC	NI 186 RFF Grants		Fuel Material
e. Change agricultural practices to increase the amount of carbon stored.				Farmers NE FWAG	Low Carbon Farming Pilot Grants		Food
f. Carbon trading and credible carbon offset schemes should provide incentives for land management practices that deliver measurable savings in greenhouse gases.				NE FC	Foundation Woodland Carbon Code	Woodland Carbon Task Force Climate Change Policy (NE)	

For other actions of importance for carbon storage and sequestration please refer to: 1a-j, 5b, 6e, 7a-d, and 13a

5. Managing riverine flooding

Flooding from rivers can have severe negative impacts, damaging property and affecting peoples' health and well being, and having significant economic costs. With more extreme rainfall events anticipated with climate change we are likely to experience increased flooding. Whilst flooding cannot be wholly prevented, its impacts can be reduced[18]. Green infrastructure helps to manage river flooding by holding back water in the catchment thereby reducing the volume and delaying the timing of peak flows[19,20] and providing water storage areas within floodplains where flooding is allowed to take place without causing damage.

Case Study 7. Slowing the Flow – Pickering, North Yorkshire

This project is exploring a new approach to flood management which works with nature to try and store more water in the landscape and slow its passage downstream. It is expected to reduce the frequency of future floods in Pickering, as well as deliver a range of other benefits to the local environment and community. The approach relies on changing the way the landscape is managed, employing a range of measures throughout the catchment including: constructing low level bunds, planting more trees, especially along streamsides and in the floodplain, restoring woody debris dams, and restoring wetlands.
www.forestry.gov.uk/fr/INFD-7YML5R

Restoration of the River Quaggy in Sutcliffe Park, Greenwich

Case Study 8. River Quaggy – London

The River Quaggy, previously culverted through Bromley, Greenwich and Lewisham, was de-culverted in 2000 as part of the River Quaggy flood management scheme. This has created a natural, meandering, wildlife rich feature in the landscape. The river now flows through Sutcliffe Park and, when there is an excess of water in the river, the park is allowed to flood and is closed to the public. This reduces the flood risk to Lewisham town centre which is downstream. The careful design ensures that mechanical flood defences are not needed, although part of the original culvert has been retained for use during major floods. The improvements are also beneficial for recreation; since restoration, visits to the park have increased by 73%. In the more urban area downstream the river banks have also been re-naturalised as part of the flood defences at Chinbrook Meadows to protect a new housing development.
www.cabe.org.uk/case-studies/quaggy-river
www.environment-agency.gov.uk/static/documents/Business/casestudyrecreation_1514776.pdf

[18] DCLG (2006) Planning Policy Statement 25: Development and flood risk.
www.communities.gov.uk/documents/planningandbuilding/pdf/planningpolicystatement25.pdf
[19] Thomas & Nisbet (2006) An assessment of the impact of floodplain woodland on flood flows. Forest Research. Water and Environment Journal. 21, 114–126.
[20] Handley & Gill (2009) Woodlands helping society to adapt. In Read *et al.* (2009) Combating climate change: a role for UK forests. An assessment of the potential of the UK's trees & woodlands to mitigate & adapt to climate change. The Stationery Office.
www.tsoshop.co.uk/gempdf/Climate_Change_Main_Report.pdf

5. Actions for managing riverine flooding	S	N	P	Owner	Mechanism	Supported in	Link to services
a. Prevent inappropriate developments in areas at risk of flooding (figure 15 on page 39 of the report). Use this land for open space and make provision for temporary water storage to hold water during peak flows.				Planners EA Land owners	LDF SFRA CFMP	PPS25 (DCLG)	Linear networks link to: Species Travel Temps
b. Take opportunities to hold water upstream of flood risk areas through land management, wetland and woodland creation (figure 15 on page 39 of the report).				EA FC CFNW and woodland initiatives Local authorities Land owners	CFMP Development of projects similar to 'Slowing the Flow at Pickering' (Case Study 7)	CFMP policy unit 6 (EA)	Carbon Species Erosion Water supply
c. Take opportunities to de-culvert and re-naturalise rivers, including floodplain forestry.				EA FC Developers	Development of projects similar to the River Quaggy (Case Study 8)		Species

For other actions of importance for managing riverine flooding please refer to: 1a-j, 2e, 3d, 4a, 4c, 9b, 10f, 12b, 12c, and 13a

6. Food production

Food production is essential, yet it causes greenhouse gas emissions; arising from what is grown, how it is grown, processed, and transported. Using the best quality land for food production will ensure our food security into the future. In addition, increased production within urban areas has a part to play in reducing food miles. Altered farming methods can also help to reduce emissions associated with agriculture, including storing more carbon within soils.

Allotment in the new development at Rieselfeld, Freiburg

Case Study 9. Capital Growth – London

The Capital Growth project aims to help Londoners transform the capital by creating 2,012 new food growing spaces by the end of 2012. It gives advice and support to local communities and helps them to access land and create food growing spaces. Projects receive a London wide support network, access to funding and discounts, recognition, and access to expertise in food growing. At Charlton Manor Primary School in Greenwich, disused parts of the grounds have been transformed into vegetable and fruit gardens. These were designed by the children, and include willow tunnels, seating areas, a greenhouse and a beehive. Children are involved on a daily basis, in their lunch time gardening club, and as a part of lessons. Parents and staff help with planting, maintaining and harvesting the crops.

www.capitalgrowth.org/home

6. Actions for food production	S	N	P	Owner	Mechanism	Supported in	Link to services
a. Safeguard highest quality 'best and most versatile' agricultural land (figure 11 on page 31 of the report) from development and restructuring, and maintain for food production. Enhance quality of grade 3 land.				Planners NFU	LDF Grants Incentives		
b. Planning policies to support urban food production, including allotment creation, and community farms and gardens.				Planners	LDF Green infrastructure plans		
c. Take opportunities in new developments and restructuring to incorporate urban food production, through the creation of allotments, community farms and gardens, and inclusion of fruit trees and bushes into urban design.				Planners Developers Landscape architects	S106 CIL		
d. Encourage community and home food growing.				Local authorities Schools Groundwork BTCV	Forest Schools 'Friends of' groups (Case Study 9)		
e. Encourage agricultural practices which reduce greenhouse gas emissions (e.g. organic, low tillage, etc).				FWAG NFU	Grants		Carbon
f. Provision of tree shade for livestock within the hot summer months.				Farmers Land owners	Grants Incentives	Cumbria High Fells (NE)	Temps

For other actions of importance for food production please refer to: 1a-j, 4c, 4e, 10d, 12b, 12c, 14a, and 14b

7. Material substitution

The production and manufacture of materials, particularly those used in construction, is associated with high levels of greenhouse gas emissions. Forests, which form part of our green infrastructure, can be managed and harvested for timber and wood products. Such products can replace more energy intensive construction materials including concrete and steel, which can result in carbon savings in embodied energy and also increase the carbon storage in buildings.

Sefton Coastal Footpath signage made from local timber

Case Study 10. Woodland Management – Sefton Coast

Sefton's woodlands are managed by the Coast and Countryside Service. Any trees felled as part of management works within the Council's woodlands are used in the 'Pinewood workshop' to manufacture wood products for use in the borough. The workshop is manned by a support carpenter who provides training for adults with learning disabilities. The team at the workshop produce engraved signs, benches, way-markers, gates, picnic benches, bird feeders, boardwalks, access barriers and nest boxes. This not only reduces the amount of tree surgery waste going to landfill, but also reduces carbon emissions from its transportation, and recycles the timber into something that residents and visitors to the area can benefit from. All wood products created can be branded with the 'Woodmark' Logo (Forest Stewardship Council), certifying that it has come from a sustainably managed source. Sefton is the first local authority in the North West to achieve this.

http://consult.sefton.gov.uk/portal/planning/green_space/gsstrategy?pointId=1211531871004
www.sefton.gov.uk/pdf/LeisureServicesAR08-09.pdf
http://merseyforest.org.uk/files/inclusion.pdf

7. Actions for material substitution	S	N	P	Owner	Mechanism	Supported in	Link to services
a. Take opportunities to bring unmanaged or under managed trees and woodlands into management to achieve greater use of wood products and woodfuel, whilst enhancing carbon storage.				FC CFNW and woodland initiatives Envirolink Local authorities	Grants Incentives Woodland certification Woodland management plans (Case Study 10)	England's Trees Woods and Forests Delivery Plan (FC) Forests and Climate Change Guidelines (FC)	Carbon Fuel
b. Increase planting of sustainably managed woodland for timber and woodfuel production, but recognising the need for multifunctionality including increasing carbon storage.				FC CFNW and woodland initiatives	RFF Grants		Carbon Fuel
c. Raise awareness about the role of timber and woodfuel in climate change management. Highlighting, for example, that harvesting sustainably managed woodlands does not make climate change worse.				FC CFNW and woodland initiatives	RFF		Carbon Fuel
d. Help the development and promote the use of public procurement initiatives that will enhance market opportunities for local sustainable wood products and fuel.				FC CFNW and woodland initiatives Local authorities	RFF Woodland certification	England's Trees Woods and Forests Delivery Plan (FC)	Carbon Fuel
e. Support innovation and entrepreneurship in developing new products and market opportunities.				FC CFNW and woodland initiatives		Strategy for England's Trees Woods and Forests (DEFRA)	Fuel

For other actions of importance for material substitution please refer to: 1a-j, 4c, and 8b

8. Fossil fuel substitution

Replacing fossil fuels with sustainably managed wood fuel could significantly reduce carbon emissions. In the North West of England, under managed and unmanaged woodlands offer a significant resource. According to a recent assessment, "within the next five years sustainably-produced wood fuel has the potential to save the equivalent of approximately 7 $MtCO_2$ emissions per year by replacing fossil fuels in the UK"[21]. Whilst biomass cannot provide for all of our energy needs, due to the small land area of the UK, it does have an increasing contribution to make to meeting the UK's renewable energy targets and to carbon reduction.

Biomass pellets (copyright: McCoy Wynne)

Case Study 11. Off grid gas study – Cheshire

The off grid gas study aimed to identify companies in Cheshire and Warrington that were off the gas grid and highlight the opportunities available to them to use alternative lower carbon heating technologies. This included contacting the companies to raise awareness of the Renewable Heating Incentive (RHI) and opportunities around this in terms of saving costs on heating and generating an income for the business. Businesses that are part of the rural fuel or energy supply chain were also contacted. The study identified that the RHI is an attractive incentive to install biomass; however, the Northwest has no accredited 'Microgeneration Certification Scheme' (an internationally recognised quality assurance scheme) biomass installers. The study highlights issues in the supply chain, and provides recommendations to enhance biomass uptake in the North West.

www.cwea.org.uk/cheshire-warrington-gas-grid-study
www.microgenerationcertification.org/Home+and+Business+Owners/Microgeneration+Installers/Biomass/North+West+Region

[21] Read *et al.* (eds.) (2009) Combating climate change: a role for UK forests. An assessment of the potential of the UK's trees and woodlands to mitigate and adapt to climate change. The Synthesis Report. The Stationery Office. www.tsoshop.co.uk/gempdf/Climate_Change_Synthesis_Report.pdf

8. Actions for fossil fuel substitution	S	N	P	Owner	Mechanism	Supported in	Link to services
a. Create supply chains to make adoption of biomass boilers more feasible for a larger number of people.				FC Envirolink CFNW and woodland initiatives	RFF Off grid gas project (Case Study 11)		
b. Work with public and private sector partners to develop a sustainable biofuels industry with a focus on utilisation of material in currently under-managed woodlands.				FC CFNW and woodland initiatives Local authorities – tree officers	RFF Tree and Woodland Management Plans	Strategy for England's Trees Woods and Forests (DEFRA)	Material
c. Ensure that planners and developers are aware of the support mechanisms (Envirolink, Biomass Energy Centre, and the planning portal where developers can access resources such as 'Approved Document J - Combustion Appliances and Fuel Storage Systems').				Envirolink Local authority – planners, carbon reduction officers			
d. Encourage biomass planting where there are no other constraints (figure 8 on page 27 of the report could be used in conjunction with other information).				FC CFNW and woodland initiatives	Grants		
e. Cultivate attitudinal conditions under which biofuels can develop as a viable and self sufficient energy source.				Envirolink Developers	Off grid gas project RFF	NW Biomass Strategy (RFF)	
f. Use biomass as a contribution to local authority carbon targets.				Local authority – carbon reduction officers	NI 186 Carbon management plans		

For other actions of importance for fossil fuel substitution please refer to: 1a-j, 4a, 4c, 4d, and 7a-e,

9. Reducing the need to travel by car

Road traffic is responsible for a substantial amount of the UK's carbon emissions. In 2004, the transport sector was responsible for around 27% of total UK CO_2 emissions[22]; of this, private motor transport generated nearly 43%[23]. Encouraging people to walk and cycle can help to reduce carbon emissions from transport. The provision of local recreation areas and green travel routes could encourage walking and cycling. Research in the Netherlands and Japan has suggested that people are more likely to walk or cycle to work if streets are lined with trees[24].

Walking and cycling route through functional green infrastructure that incorporates a swale to collect and convey surface water as part of the SUDS system in Rieselfeld, Freiburg

Case Study 12. Green Net – Graz, Austria

The green network of Graz consists of the city's green spaces, such as parks and play areas, and the green routes which connect them. The green net aims to provide a healthy and safe way to travel in Graz; between areas that people want to travel to and from. By creating these green links, other functions besides green travel will be provided such as recreation, improved air circulation, provision of shade, habitats and improved urban design. The green routes are categorised as "corridor" or city wide routes, "way" or district level routes, and "link" or local streets. The higher the route is in this hierarchy the more versatile and multifunctional the infrastructure should be. The green net was developed using GIS, making it easy to find out if part of it is affected by planning in the city. It shows qualities and deficits in the green network, allowing planners to identify where in the city to safeguard and where to invest in green space to enhance connectivity.
http://gis.graz.at/cms/ziel/1515118/DE/

[22] Steer Davies Gleave (2006) Driving up carbon dioxide emissions from road transport: an analysis of current government projections. A report for Transport 2000. www.foe.co.uk/resource/briefings/driving_up_co2_emissions.pdf
[23] Sustrans (2008) Annual Review. www.sustrans.org.uk/assets/files/Publications/sustrans_annual_review_08.pdf
[24] Cited by Woodland Trust (2010) Greening the Concrete Jungle: Policy brief. www.woodlandtrust.org.uk/en/plant-your-own-wood/Documents/MTMG%20-%20urban%20trees%20report.pdf

9. Actions for reducing the need to travel by car	S	N	P	Owner	Mechanism	Supported in	Link to services
a. Planning policy should safeguard high quality accessible green spaces (including woodlands) near to where people live and take opportunities to create new spaces and woodlands during development and restructuring.				Local authorities – planners, parks CFNW and woodland initiatives Woodland Trust	LDF S106	Woodland Trust Manifesto (WoT)	Visitor
b. Publicly accessible green space should be linked to form attractive walking and cycling routes. Linear green corridors, such as by rivers, should form a key part of this network. Opportunities should be taken to connect up these spaces, including through tree lined streets. These connections should be made between areas where people want to travel (e.g. home, work, schools, town and local centres, rural to urban areas, between rural areas, etc).				Local authorities – planners, parks, highways, transport planners, rights of way officers, tree officers Sustrans CFNW and urban forestry initiatives	LDF S106 LTP Rights of way networks Green Streets (Case Study 12)	Grey to Green (CABE)	Linear networks link to: River flood Species Temps
c. Provide signposts for people using these routes and publicise them to encourage their use for commuting and recreation.				Local authority rights of way officers			

For other actions of importance for reducing the need to travel by car please refer to: 1a-j, 3d, 5a, and 11d-f

10. Helping other species to adapt

As the climate changes, the range of species may shift northwards and upwards to higher altitudes as they seek new 'climate spaces'. A number of factors will limit their ability to do this, including their own dispersal ability and the nature of the landscape through which they are moving (i.e. the fragmentation of existing habitats and the permeability of the landscape between habitats). The management of linear features and corridors (e.g. river corridors, and road, railway and canal verges) for species movement may become increasingly important.

Green roof on the Basel Exhibition Centre, Switzerland. The image on the left, in comparison to that on the right, shows the increased biodiversity benefits of adding extra substrate depth. Solar panels can be seen in the image on the right.

Case Study 13. Green roof policy – Basel, Switzerland

Basel boasts the highest densities of green roofs in the world, covering approximately 23% of its flat roof area. This is the result of financial incentives and compulsory building regulations, and was driven by energy saving and biodiversity conservation goals. In the early nineties, 4% of customers' energy bills was put into a fund which was used to support energy saving projects, including providing subsidies for green roofs to reduce the energy consumption of buildings. Following on from the success of this and subsequent research into the biodiversity benefits of green roofs, the Building and Planning Act was amended in 2002. As a result, green roofs must be constructed on all new buildings with flat roofs. In addition, on roofs of over 500m^2, the substrates must be composed of appropriate native regional soils and be of varying depths in order to be of most value for biodiversity. The green roof on the Basel Exhibition Centre demonstrates the value of different substrate depths. It also includes solar panels which provide additional microclimates for species. In turn, the panels are kept cooler by the presence of the green roof and thus operate more efficiently.

www.urbanhabitats.org/v04n01/wildlife_full.html

www.greenroofs.org/grtok/policy_browse.php?id=63&what=view

10. Actions for helping other species to adapt	S	N	P	Owner	Mechanism	Supported in	Link to services
a. Implement the guiding principles (and associated actions) set out in 'Conserving Biodiversity in a Changing Climate' (Defra, 2007).				Conservation agencies and NGOs Local authorities – planners, parks, highways, tree, biodiversity officers Land owners Land managers	Range of mechanisms set out including: LDF LBAPs Management Plans	Biodiversity in a Changing Climate (DEFRA)	
b. Safeguard existing nature conservation, protected sites and areas of high quality habitat.				Planners Conservation agencies and NGOs Land managers	LDF and Planning Policy Framework Wildlife legislation NI 197	Biodiversity in a Changing Climate (DEFRA)	
c. Manage all green infrastructure, including agricultural land, to create a more permeable landscape for wildlife (case study 13). This may be especially important in Character Areas classified as having a moderate vulnerability to climate change (figure 20 on page 47 of report).				Land owners WT	Management plans Biodiversity Benchmark Scheme (WT) Grants	Biodiversity in a Changing Climate (DEFRA)	
d. Planning policy to require green roofs in all new developments where buildings have flat roofs. Require design to be suitable for biodiversity and, where possible, to provide other services.				Planners	LDF Case Study 13		Surface water Temp Food Water supply
e. Take opportunities to create buffers of semi-natural vegetation around existing sites. This will include opportunities presented by new development and restructuring.				Planners Conservation agencies and NGOs Land managers	Targeted site acquisition Management agreements Agri-environment	Biodiversity in a Changing Climate (DEFRA)	
f. Take opportunities to connect existing sites to form networks. It is especially important that these are oriented north-south, and from low to high altitudes, to facilitate species movement. This will include opportunities presented by new development and restructuring.				Planners Conservation agencies and NGOs Land managers	Targeted site acquisition Management agreements Agri-environment schemes	Biodiversity in a Changing Climate (DEFRA) Draft Environment PPS (DCLG)	Linear networks link to: River flood Travel Temps

For other actions of importance for helping other species to adapt please refer to: 1a-j, 2e, 3d, 4a, 4b, 5a-c, 9b, 11b, 13a, 13e, and 14a-c

11. Managing visitor pressure

The hotter summer temperatures anticipated with climate change may result in a shift towards a more outdoor oriented recreation and tourism in the North West of England. This could place increasing pressure on our landscapes, including the rural uplands and the coast, which may also be under direct pressure from climate change. It is crucial to manage the outdoor visitor resource for these increasing pressures. This will include providing alternative outdoor attractions, such as woodlands, which may be more resilient to changes.

Dream sculpture at Sutton Manor (copyright: McCoy Wynne)

Case Study 14. South St Helens Forest Park

Over the last fifteen years, the area to the south St Helens has been transformed from an unsightly collection of brownfield land surrounding a failing coal mine into a budding Forest Park. There are a number of sites which make up the Forest Park. Together, they already form a highly attractive gateway to Merseyside (straddling the M62) and a valuable natural resource for the local population. It is estimated that 298,000 people live within a 15 minute drive, 661,000 within a 20 minute drive, and just over 2 million within a 30 minute drive of the area. In addition, St Helens, Warrington and Halton have been announced as growth point areas, with significant numbers of new homes planned. As the woodlands mature and the sites are developed the area could become an outdoor visitor destination, perhaps with an extreme sports focus. One of the sites, Sutton Manor, has the giant 'Dream' sculpture erected on its peak.

www.discoverthemerseyforest.co.uk/Outandabout.aspx?region=2&name=South%20St%20Helens%20Forest%20Park

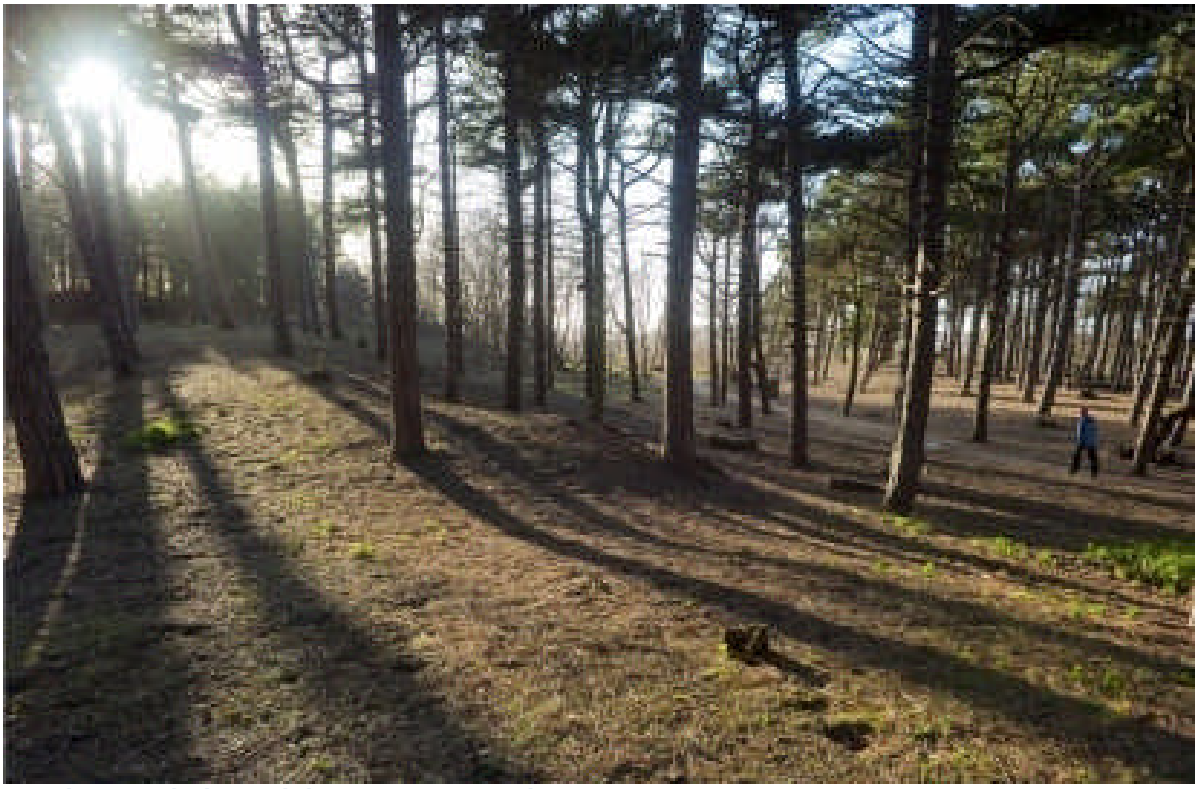
www.merseyforest.org.uk/files/St%20Helens%20Forest%20Park%20Final%20Draft%20July09.pdf

11. Actions for managing visitor pressure	S	N	P	Owner	Mechanism	Supported in	Link to services
a. Implement recommendations in the Climate Change and Visitor Economy report.						CCVE (McEvoy *et al*.)	
b. Sensitive management will be needed in areas where the landscape has a lower capacity to cope with increased visitors in a changing climate (figure 21 on page 49 of the report).				Tourism managers National Parks Authorities	Management plans	CCVE (McEvoy *et al*.)	Erosion Species
c. Outdoor tourism resources should be created in landscapes which have a high capacity to accommodate increased visitor pressure in a changing climate (figure 21 on page 49 of the report). This would be especially important in and near urban areas to reduce the need to travel long distances.				Tourism managers FC CFNW and forestry initiatives	Forest parks (Case Study 14)	CCVE (McEvoy *et al*.) Weaver Valley CCAP	Erosion Travel
d. Methods of travel to natural tourism resources should be considered and sustainable methods actively encouraged.				Tourism managers		CCVE (McEvoy *et al*.) Climate Change Policy (NE)	Travel
e. Natural visitor resources should be promoted, especially those which have a high capacity to accommodate visitors in a changing climate and that can be reached by sustainable methods of travel.				National Parks Authority Tourism managers		Strategy for England's Trees, Woods and Forests (DEFRA)	Travel
f. Green infrastructure within urban areas, including parks, street trees, and water courses and features, should be safeguarded and created in order to ensure that towns and cities are comfortable and attractive visitor destinations.				Local authorities CFNW and urban forestry initiatives	Green Streets		Temps Travel

For other actions of importance for managing visitor pressure please refer to: 1a-j, 4c, 9a, 12d, and 14d

12. Reducing soil erosion

Climate change could increase soil erosion as a result of more intense rainfall. In addition, if the climate is more favourable for outdoor recreation and tourism, trampling as a result of higher visitor numbers could also increase erosion. Careful management of land and changes to land cover can help to stabilise vulnerable soils. For example, woodland planting can help to reduce soil erosion at source and protect river banks from erosion[25]. This will also help to maintain water quality.



Formby Woods (copyright: McCoy Wynne)

Case Study 15. Woodland for Sediment Control – Cumbria

A study in the Bassenthwaite catchment in the Lake District used GIS based analysis to identify where new woodland could best aid sediment control. The opportunities occurred on land below 450m and included woodland creation on areas with high or medium vulnerability to erosion, riparian woodland creation on river banks with high and medium vulnerability to bank erosion, and floodplain woodland creation. A more recent study in the Derwent catchment[26] has used a similar approach to identify where there is potential to create or expand floodplain and riparian woodland to reduce downstream flood risk and to also improve soil structure and reduce erosion. www.forestresearch.gov.uk/pdf/englandwoodlandforsedimentcontroljune04.pdf/$FILE/englandwoodlandforsedimentcontroljune04.pdf

[25] Nisbet *et al*. (2004) A Guide to Using Woodland for Sediment Control. Forest Research. www.forestresearch.gov.uk/pdf/englandwoodlandforsedimentcontroljune04.pdf/$FILE/englandwoodlandforsedimentcontroljune04.pdf

[26] Broadmeadow & Nisbet (2010) Opportunity mapping for woodland to reduce flooding in the River Derwent, Cumbria. Forest Research.

12. Actions for reducing soil erosion	S	N	P	Owner	Mechanism	Supported in	Link to services
a. Encourage appropriate land use and management in areas where there is a high or very high risk of soil erosion.				NE FC Land owners	Grants		
b. Plant trees and woodlands to help reduce erosion and sedimentation. This could be targeted to riverbanks and floodplains, bare and eroding soils, and field margins.				FC and FR EA CFNW and other woodland initiatives Land owners	Grants EU WFD Proposed EU Soils Directive CFMP	Strategy for England's Trees, Woods and Forests (DEFRA) Woodlands for Sediment Control (FC) (Case Study 15)	River flood Water supply Food
c. Encourage appropriate agricultural practices to help reduce the adverse impacts of agriculture on the water environment. This will include managing soil erosion and runoff, particularly in areas where there is a high or very high risk of erosion (figure 18 on page 45 of the report).				NE Land owners Farmers FWAG NFU	Agri-environment schemes Soil management plans	Future Water (DEFRA) Climate Change & Agriculture in NW England (ADAS)	Food River flood Water supply
d. In areas where there is high visitor pressure, ensure that footpaths are maintained in order to reduce erosion. Tourism policy should recognise the reliance that the visitor economy has and puts on key landscapes and work to ensure that their use as a visitor resource is sustainable.				National Park Authorities Tourism managers	Tourism strategies Management plans	CCVE (McEvoy *et al*.)	Visitor

For other actions of importance for reducing soil erosion please refer to: 1a-j, 4c, 5b, 11b, 11c, and 13a

13. Managing water supply

Climate change projections show a shift in the seasonality of rainfall, with an increase in winter and a decrease in summer. Low flows in summer will impact on both water quality and quantity, with important consequences for human consumption. Safeguarding green infrastructure resources can help to recharge aquifers and maintain base flows. As part of a sustainable urban drainage system, it can remove pollutants from water and thereby improve its quality and can provide water storage areas. During droughts, this stored water could then also be used to irrigate the green infrastructure, allowing it to continue to provide evaporative cooling, and thereby manage high temperatures and keep towns and cities cool.

Chavasse Park, Liverpool where the green space is irrigated from collected rainwater

Case Study 16. Chavasse Park – Liverpool

Chavasse Park is a 2.2ha 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.

www.hortweek.com/news/search/863002/Waterfront-reinvention---Liverpool-ONE/

13. Actions for managing water supply	S	N	P	Owner	Mechanism	Supported in	Link to services
a. Manage the upper catchment of rivers to maintain base flows in rivers. This will include peatland restoration and potentially woodland creation projects.				NE FC UU National Parks Moors for the Future Peatscapes Land owners	SCaMP Management plans	Climate Change Policy (NE)	Carbon River flood Erosion Species
b. Use SUDS techniques to treat and improve water quality. This is important in areas where pollution is likely to occur (e.g. alongside roads, etc).				Local authorities Highways Agency		SUDS Manual (CIRIA)	Surface water
c. Safeguard green infrastructure in areas where it is considered important for recharging aquifers.				UU EA Local authorities			
d. Ensure that new woodland creation does not impact on aquifer recharge.				UU EA FC		Climate Change and Forestry (Read)	
e. Take appropriate action to deal with abstractions that are adversely impacting designated nature conservation sites.				EA WT Nature conservation bodies	CAMS (EA)	Future Water (DEFRA)	Species

For other actions of importance for managing water supply please refer to: 1a-j, 2a-e, 3e, 5b, 10d, 12b, and 12c

14. Managing coastal flooding

Coastal flooding occurs when storm surges reach the shore. Under current climate projections sea levels are likely to rise, potentially causing an increase in coastal flooding. Just as natural floodplains, which allow rivers to over-bank and flood their land temporarily, help to manage riverine flooding, naturally occurring green infrastructure along the coast provides a service that helps to manage coastal flooding. Dune systems, wetlands and salt marshes are important natural habitats.

Hesketh Out Marsh (copyright: Mike Watson)

Case Study 17. Hesketh Out Marsh – Lancashire (Lancashire, UK)

Hesketh Out Marsh is a new saltmarsh reserve on the Ribble Estuary where the RSPB and the Environment Agency have worked together to create stronger sea defences and new saltmarsh habitat through the process of managed realignment. It is one of the largest examples of this in the UK. In 1980, a sea wall was built which effectively took this land out of the estuary and allowed it to be used to grow crops. This wall was never going to last forever, especially with climate change and sea level rise. Now, the seawater has been let back in to flood some of the land, creating saltmarsh which is important for wildlife and also acts like a sponge, soaking up some of the energy of the sea before it reaches the strong, new sea defences. Furthermore, the Environment Agency has previously estimated that an 80m strip of saltmarsh can reduce maintenance costs of sea defences behind it by about £3000/km.

www.rspb.org.uk/reserves/guide/h/heskethoutmarsh/index.aspx
www.rspb.org.uk/Images/seasofchange_tcm9-132925.pdf

14. Actions for managing coastal flooding	S	N	P	Owner	Mechanism	Supported in	Link to services
a. Use planning policy to safeguard and ensure no loss of coastal habitats including wetlands, saltmarsh, and dune systems (figure 17 on page 41 of the report). Ensure coordination between the wide range of plans, strategies, and schemes which apply to the coastal zone.				Local authority planners NE EA RSPB National Trust NW Coastal Forum	LDF SMP LSP NI 189	SMP2	Species Food
b. Manage existing coastal habitat appropriately to ensure their continued functionality and create new areas of wetlands and other habitats.				NE EA RSPB National Trust NW Coastal Forum Land owners and managers	SMP Management plans (Case Study 17)	SMP2	Species Food
c. Protect the functional integrity of bays, estuaries and the inter-tidal areas immediately offshore.				NE EA	SMP	NW RSS (GONW)	Species
d. Plan and manage for a potential increase in visitor pressure in coastal areas to ensure that these habitats continue to help to manage coastal flooding.				Local authorities Tourist bodies NW Coastal Forum Land managers		NW Coastal Strategy (NW Coastal Forum) CCVE (McEvoy *et al*.)	Visitor

For other actions of importance for coastal flooding please refer to: 1a-j, and 2e

Delivering the plan

This Action Plan is being championed by (INSERT KEY CHESHIRE, CUMBRIA, GREATER MANCHESTER, LANCASHIRE, and MERSEYSIDE CHAMPIONS IF CONSIDERED APPROPRIATE). They will seek to embed the actions as appropriate within all relevant policies, strategies, plans, programmes and initiatives within Cheshire, Cumbria, Greater Manchester, Lancashire, and Merseyside, and to monitor and review their delivery.

The success of the Action Plan will depend upon all stakeholders taking responsibility and working in partnership to deliver actions that are relevant to them. Some of the actions may already be being delivered, whilst others will be more challenging.

The Green Infrastructure Unit will provide ongoing support in the delivery of this Action Plan, as appropriate. It is not possible to indicate a formal governance diagram for the Action Plan as this will be different in Cheshire, Cumbria, Greater Manchester, Lancashire, and Merseyside. However, the following organisations have indicated that they have an interest in working to deliver the Action Plan.

ADD LOGOS AS APPROPRIATE

communityforestsnorthwest
supporting the mersey, red rose and pennine edge forests

Consultation

Please send any comments by **Friday 29th October 2010** to susannah.gill@merseyforest.org.uk.

We welcome all comments on the Action Plan. Please indicate in your response whether your comments apply to Cheshire, Cumbria, Greater Manchester, Lancashire, or Merseyside; or whether they apply to all.

We are conscious that this Action Plan is not resourced and that, given the current political and structural changes, it may not be a short term priority in terms of work planning. That said, we believe that this Action Plan, and the evidence that has been gathered to back it up, will continue to be important into the future – climate change is not going to go away, and green infrastructure provides a crucial response that delivers multiple other benefits. We are therefore keen that this Action Plan is embedded within the new structures, and strategic and local planning and policies, as they emerge. Consequently, we are especially interested in any comments that can help us to develop and tailor an Action Plan that will work within and be relevant to Cheshire, Cumbria, Greater Manchester, Lancashire, and Merseyside.

In responding to this consultation, please consider the following points for Cheshire, Cumbria, Greater Manchester, Lancashire, or Merseyside:

1. Suggestions for a site of strategic importance for action 1b, where combined efforts could be prioritised in the short term.
2. Rank the priority order of the 13 services.
3. Are you happy with the current prioritisation given to the actions (within each service), or would you prioritise different actions?
4. Relating to organisations
    a. Is your organisation is happy to be a named action 'owner', and against which actions in particular?
    b. Are there any other organisations we have missed from the list of action 'owners'? Please be as specific as you can be.
    c. Is your organisation is happy to be a named 'champion'; including against actions 1a, b, i and k?
    d. Is your organisation happy to have its logo included in the "Delivering the plan" section, to demonstrate an interest in working to deliver the Action Plan?
5. Are there any other mechanisms by which the actions can be delivered? These can relate to strategies/policy/plans/guidance, or to delivery programmes. They can also be existing or potential future mechanisms (please let us know which they are). Given the current changes, we think we need to be flexible with the mechanisms, so the more we can suggest the better, especially any which are resourced.
6. Are there any other actions we should seek to include?

Action Table References

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